BALESTIER HILL SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2016
SECONDARY 4 NORMAL ACADEMIC

MATHEMATICS
Paper 1

4045/01

Tuesday 2 Aug 2016 **2 hours**

Additional Materials:
Nil

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.
You are expected to use a scientific calculator to evaluate explicit numerical expressions.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place. For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 80.

For Examiner's use:

/80

This question paper consists of <u>16</u> printed pages (including this page).

[Turn over

Mathematical Formulae

Compound interest

$$\text{Total amount} = P(1+\frac{r}{100})^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2}ab\sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

1   (a)   Express the ratio 35 seconds : 3 minutes 15 seconds in its simplest
          form.
    (b)   Express 44% as a fraction in its lowest terms.

                                    Answer   *(a)*   ………..........………………....   [1]

                                            (b)   ………..........……………….....   [1]

2   Mike has a bag containing 7 yellow balls and 5 blue balls. He picks two balls
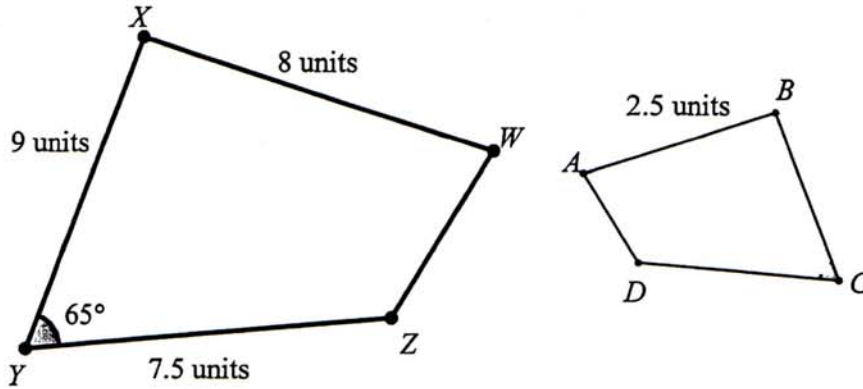   at random. What is the probability that Mike picks two balls of the same
    colour?

                                    Answer   ………..........………………....   [3]

3   Four numbers are represented on a number line as shown below.
    All the numbers are equidistant from each other. Find the value of x and of y.

    0.5 x y 1.4

                                    Answer $x = $ ………..........………………....   [1]

                                            $y = $ ………..........……………….....   [1]

4

Quadrilateral *ABCD* is a reduction of quadrilateral *WXYZ*. Find
(a) the scale factor,
(b) *BC*,
(c) the reflex angle *BCD*.

Answer (a) …………...………………….... [1]

(b) …………...……………………units [1]

(c) …………...……………….……° [1]

5 (a) Given that $y = 4 - 2x^2$, find the values of x when $y = 2$.

(b) Make p the subject of the formula $2m = \sqrt{\dfrac{6+4p}{3n}}$.

Answer (a) x = …………… or …………… [2]

(b) p = ………………………… [2]

6   (a)   Simplify $5x - 2x(-1 + 3x)$.

Answer   (a)   ………..………………….... [2]

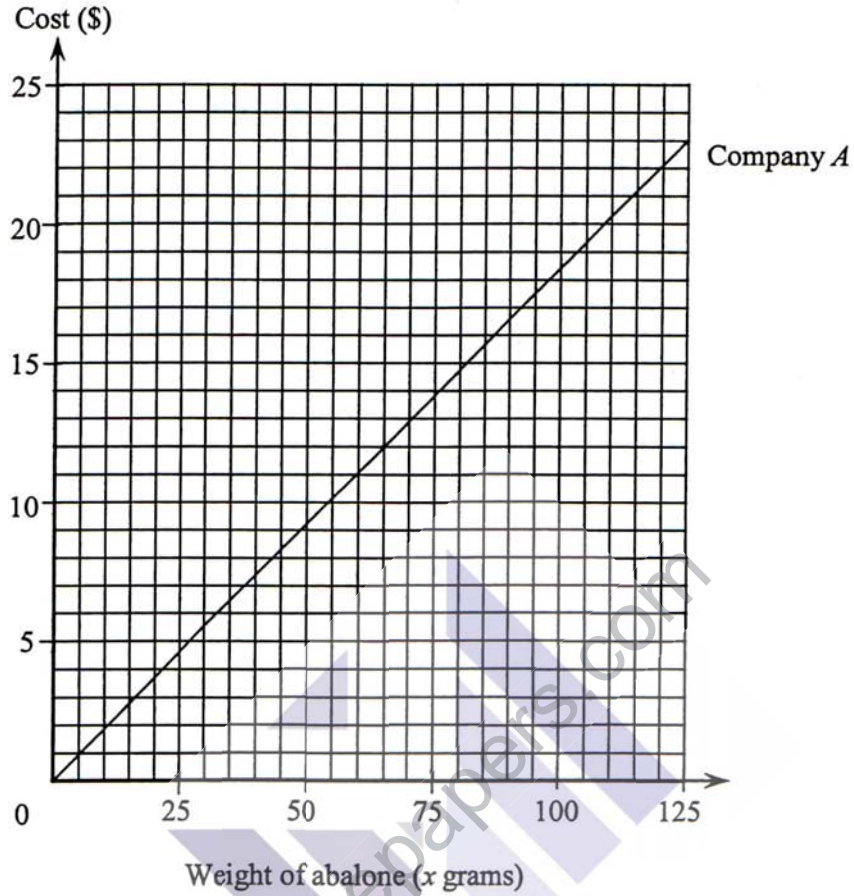(b)   Solve $\dfrac{5 + x}{3} = \dfrac{2}{3}$.

Answer   (b) $x =$ …………………………. [2]

7   (a)   Find the highest common factor of 12, 9 and 24.

(b)   The lowest common multiple for 6, 8 and x is 30. Find the smallest possible value of x.

Answer   (a)   ………..………………….... [1]

(b) $x =$ …………..……………. [1]

8 The graph below shows the price of abalone per gram sold by company A.

(a) Find the total weight of abalone in grams when the cost is $12.

(b) A Company B sells abalone at a minimum of 40 grams priced at $5 and additional abalone at 30 cents per gram.
    (i) Draw the graph on the grid to represent the charge made by Company B.

    (ii) Use the graph to estimate the weight when the price is the same for both companies.

Answer   **(a)** .... grams   [1]

       (b) (ii) .... grams   [1]

9   **(a)**   Find x if $9^{x-3} = 3$.

Answer   *(a)* $x =$ ….........……………..…   [2]

(b)   Simplify $\dfrac{2x}{3} \times \dfrac{15y}{x^{-1}} \times \left(\dfrac{6y}{z}\right)^0$ leaving your answer in positive indices..

Answer   *(b)*   ……...........………………..…   [2]

10   The storage capacity of a particular handphone is 1 gigabyte. A low resolution picture is 510 kilobytes and a high resolution picture is 2.8 megabytes.

A student takes only low resolution pictures using one handphone and only high resolution pictures on another identical handphone. How many more low resolution pictures can be stored in the handphone compared to high resolution pictures?

Answer   ……….........………………….…   [2]

11 Solve the simultaneous equations.

$$2x + y = 9$$
$$5x - y = 5$$

Answer $x =$ ....

$y =$ .... [3]

12 A river is 8 km long. It is represented by a distance of 5 cm on a map.
(a) Find the scale of the map in the form 1:n.

Answer (a) 1 : .... [1]

(b) A city covers an area of 400 km². Find in cm², the area representing the city on the map.

Answer (b) ....cm² [2]

13 **(a)** Factorise completely $18-8x^2$.

Answer *(a)* ………....……………..….. [2]

(b) Solve $x^2+2x=15$.

Answer *(b)* $x=$ …….....…. or …….......…. [2]

14 A regular polygon has n sides. The size of one interior angle is 5 times the size of one exterior angle. Calculate the value of n.

Answer $n=$ …….....………….... [3]

15 A man buys 30 identical watches for $600. He plans to sell all of them at $30 each. Find

(a) the profit he would have made for each watch,

Answer *(a)* $ .... [2]

(b) the discounted price if he gives a discount of 10% off the selling price.

Answer *(b)* .... [2]

16   In the diagram below, the points B, C, D, E lie on a circle with centre O. BD is the diameter of the circle, AF is tangent to the circle at B, ACD is a straight line and angle $CED = 36°$.
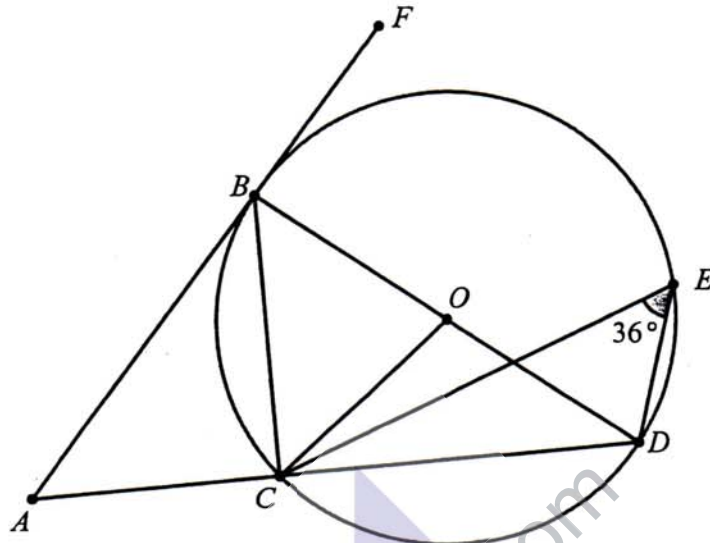
[1]

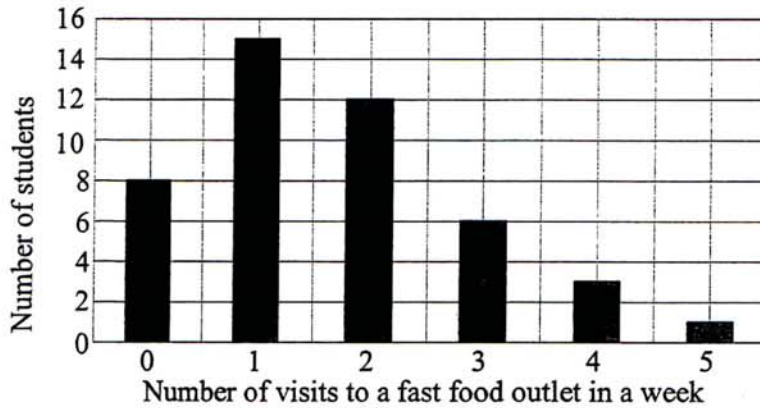Find
(a)   angle COD,
(b)   angle CBD,
(c)   angle BDC,
(d)   angle DAB.
(e)   If angle CGD is 144° and point G is on the circle, label on the diagram a possible point G.

Answer   *(a)*   ……..............……………°   [1]

(b)   ……..............……………°   [1]

(c)   ……..............……………°   [2]

(d)   ……..............……………°   [2]

17 The bar chart below shows the results of a survey on the number of visits to a fast food outlet in a week for secondary school students.


Number of visits to a fast food outlet in a week

(a) Find the mode of the distribution.

(b) Find the number of students who visits fast food outlets at least three times in a week.

(c) Jack suggested that the calculation to find the mean number of students visiting a fast food outlet is $\dfrac{8\times0+15\times1+12\times2+6\times3+3\times4+1\times5}{0+1+2+3+4+5}$.

Explain whether Jack is right.

Answer   (a) …………………………… [1]

(b) …………………………… [1]

(c) ……………………………………………………………

………………………………………………………………

………………………………………………………………

……………………………………………………………… [2]

18 In the diagram, $AB = 15$ cm, $BC = 8$ cm and $AC = 17$ cm.
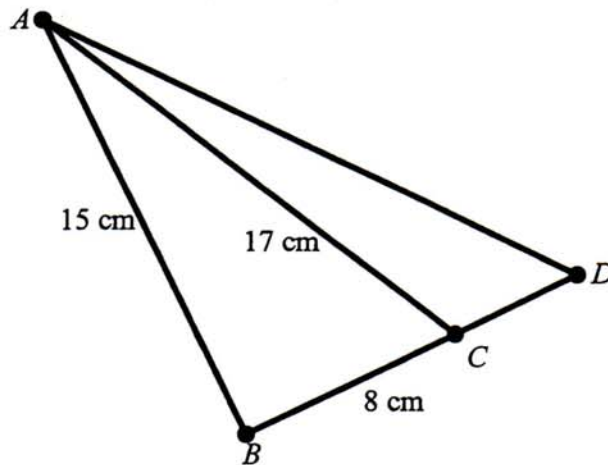
(a) Show that angle ABC is a right angle.

Answer (a)...

....

.... [2]

(b) Write down in fraction, the value of
(i) tan $\angle ACB$,
(ii) cos $\angle ACD$.

Answer (b)(i) .... [1]

(b)(ii) .... [1]

19 A car is traveling at a constant speed of 105 km/h.
(a) Find how many minutes the car takes to travel 196 kilometers.

Answer (a) .... mins [2]

(b) Calculate the speed of the car in meters per second.

Answer (b) ....m/s [2]

20 The diagram shows a square pyramid with base *PQRS* inscribed in a hemisphere. The height of the pyramid is 12 cm and the radius of the hemisphere is 10 cm.
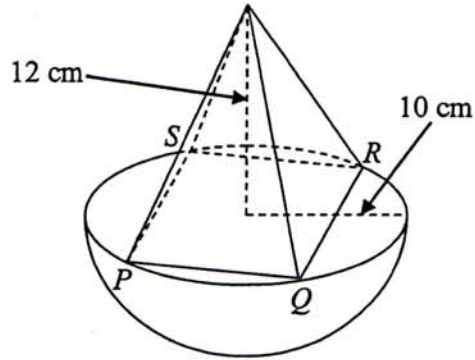
(a) Show that the length of *PQ* is approximately 14.1 cm.

Answer (a) ....

....

....

.... [2]

(b) Calculate the total volume of the figure.

Answer (b) ....cm³ [3]

21   The first four terms of a sequence are 3, 10, 17, 24.

(a)   Write the next three terms of the sequence.

Answer (a)   ……....……..…...……..........……………….……............…   [2]

(b)   Find the nth term of the sequence.

Answer   (b)   ……….......……………….…   [1]

(c)   Find the 20th term.

Answer   (c)   ……….……...……………….…   [1]

(d)   The kth term in the sequence is 353. Find k.

Answer   (d)   ………......……………….…   [1]

22   (a)   Construct parallelogram *PQRS* in the space given below where
             angle *PQR* = 120° and *PS* = 7.5 cm.   [2]

       (b)   On the same diagram, construct
              (i)   the angle bisector of angle *SPQ*,   [1]
              (ii)   the perpendicular bisector of *QR*.   [1]

       (c)   The bisector of angle *SPQ* meets the perpendicular bisector of *QR* at
              the point *X*. Measure and write down the length of *SX*.

P ———————————————————————————————— *Q*

Answer   *(c)*   ……….............…………… cm   [1]

- End of Paper-

BHSS 4NA Math Prelim 2016 P1 solution
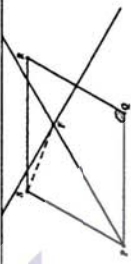
Qn	Solution	Marks	Remarks/ Alt soln
1(a)	$\dfrac{7}{39}$		
1(b)	$\dfrac{11}{25}$		
2	$\dfrac{7}{12}\times\dfrac{6}{11}+\dfrac{5}{12}\times\dfrac{4}{11}$ $=\dfrac{31}{66}$	M1, M1 / A1	
3	$x = 0.8,\ y = 1.1$	B1, B1	
4(a)	$\dfrac{5}{16}$ or 0.3125	B1	
4(b)	2.8125	B1	
4(c)	$295°$		
5(a)	± 1	B1,B1	
5(b)	$12m^2n = 6+4p$ $p = \dfrac{6m^2n-3}{2}$ or $p = 3m^2n - \dfrac{3}{2}$	M1 / A1	
6(a)	$5x+2x-6x^2$ $7x-6x^2$	M1 / A1	
6(b)	$5+x=2$ $x=-3$	M1 / A1	
7(a)	3	B1	
7(b)	5	B1	
8(a)	65	B1	

1

Qn	Solution	Marks	Remarks/ Alt soln
8(b)(i)	Cost ($) vs Weight of abalone ($x$ grams) graph — Company A line	B1	Must cut the point (85,20)
(b)(ii)	$60 \le answer \le 65$		
9(a)	$2x-6 = 1$ $x = 3.5$	M1 / A1	
9(b)	$\dfrac{2x}{3}\times\dfrac{15xy}{1}\times 1$ $10x^2y$	M1 / A1	
10	Low resolution $\dfrac{1000}{0.51} = 1960$ High resolution $\dfrac{1000}{2.8} = 357$ Difference – 1600 (3 sf)	M1 for both working / A1	Accept if given 1gb = 1024mb , 1mb = 1024 kb Low – 2056, high – 366 Difference = 1690 (3sf)
11	Either sub or elimination method $x = 2,\ y = 5$	M1 / A1,A1	
12(a)	5cm : 8km 5:800000 1:160000	B1	
12(b)	1cm: 1.6km $1cm^2 : 2.56km^2$	M1	

2

19(b)	$\frac{105km}{1hr} = \frac{105 \times 1000m}{1 \times 60 \times 60s}$	M1	
	29.2 m/s	A1	
20(a)	Let half of $PQ = x$		
	$x^2 + x^2 = 10^2$		
	$x = \sqrt{50}$		
	$PQ = 2x = 14.1$ (shown)	M1	
20(b)	Vol of hemisphere $= \frac{2}{3}\pi(10)^3$	M1	
	Vol of pyramid $= \frac{1}{3} \times (2\sqrt{50})^2 \times 12$	M1	
	Total volume = 2890	A1	Accept 2920 ($PQ = 14.1$)
21(a)	31, 38, 45	B2	Minus 1 mark for each mistake
21(b)	7n-4	B1	
21(c)	136	B1	
21(d)	51		
22		B1 / B1	(a) parallel correct length
		B1 / B1	(b)(i) (b)(ii)
22(c)	4.7 to 4.9 cm	B1	

	156.25cm²	A1	
13(a)	$2(9-4x^2)$	M1	
	$2(3-2x)(3+2x)$	A1	
13(b)	x = -5 or 3	M1, A1	M1 (any method), A1(both ans)
14	1 int angle = 5 ext angle	M1	
	1 int + 1 ext = 180°		
	6 ext angles = 180°	M1	
	1 ext angle = 30°	A1	Alt – find 1 int angle
	$\frac{360}{30} = 12$		
15(a)	$\frac{600}{30} = $20 cost price	M1	
	30 – 20	A1	
	= $10 profit	M1	
15(b)	$\frac{90}{100} \times 30$	A1	
	= $27		
16(a)	72	B1	
16(b)	36	B1	
16(c)	180-90-36	M1	
	=54	A1	
16(d)	180-90-54	M1	
	36	A1	
16(e)	Anywhere on the minor arc CD.	B1	
17(a)	1	B1	
17(b)	10	B1	
17(c)	No. calculation should be	M1	Accept if description is used instead of numbers.
	$\frac{8 \times 0+15 \times 1+12 \times 2+6 \times 3+3 \times 4+1 \times 5}{8+15+12+6+3+1}$	A1	
18(a)	$AB^2 + BC^2 = 15^2 + 8^2 = 289$	M1	
	$AC^2 = 17^2 = 289$		
	$AB^2 + BC^2 = AC^2$	A1	
	Therefore angle ABC is a 90°.	B1	
18(b) (i)	$\frac{15}{8}$	B1	
18(b) (ii)	$-\frac{8}{17}$		
19(a)	$\frac{60}{105} \times 196$	M1	
	112 Mins	A1	

Mathematical Formulae

Compound interest

Total amount $= P\left(1 + \dfrac{r}{100}\right)^n$

Mensuration

Curved surface area of a cone $= \pi r l$

Surface area of a sphere $= 4\pi r^2$

Volume of a cone $= \dfrac{1}{3}\pi r^2 h$

Volume of a sphere $= \dfrac{4}{3}\pi r^3$

Area of triangle $ABC = \dfrac{1}{2}ab\sin C$

Arc length $= r\theta$, where θ is in radians

Sector area $= \dfrac{1}{2}r^2\theta$, where θ is in radians

Trigonometry

$\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

$a^2 = b^2 + c^2 - 2bc\cos A$

Statistics

Mean $= \dfrac{\Sigma fx}{\Sigma f}$

Standard deviation $= \sqrt{\dfrac{\Sigma fx^2}{\Sigma f} - \left(\dfrac{\Sigma fx}{\Sigma f}\right)^2}$

Candidate's Name		Class	Register Number

BALESTIER HILL SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2016
SECONDARY 4 NORMAL ACADEMIC

MATHEMATICS
Paper 2   4045/02

Thursday   11 Aug 2016   2 hours

Additional Materials:
Writing paper (4 sheets)
Graph paper (1 sheet)

READ THESE INSTRUCTIONS FIRST

Write your answers and working on the separate writing paper provided.

Write your name, class and register number on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer all questions.

Section B
Answer one question.

If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
Calculators should be used where appropriate.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give
the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in
terms of π.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 60.

For Examiner's use:

/60

This paper consists of 8 printed pages (including this cover page).

[Turn over

Section A [53 marks]

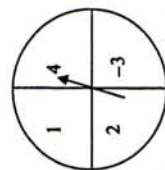Answer all the questions in this section.

1 Calculate

(a) $5.25 + 6.34 \times 2.17$, [1]

(b) $\dfrac{4.25 + 8.36}{5.25 \times 7.25}$. [1]

2

A spinner shown above is spun twice and the product of the two numbers is noted.

(a) Copy and complete the possibility diagram below. [2]

×	1	2	-3	4
1				
2				
-3				
4				

(b) Find the probability that

(i) the product is 9, [1]

(ii) the product is not 16. [1]

3 A sum of money is divided into the ratio of 3 : 4. The smaller portion is then divided into 3 parts in the ratio of $\frac{1}{2} : \frac{1}{3} : \frac{1}{4}$. If the smallest share of the 3 parts is $18, find the original sum of money. [3]

4 Sam wanted to buy a laptop that costs $1200. She was offered two options to pay for the laptop. The first is a full cash payment and the other is a 20% deposit with monthly installments of $50 for two years.

(a) Calculate the total amount she has to pay if she chooses the second option. [3]

(b) What is the percentage difference she has to pay if she opts for the second option? [2]

5 The equation of a line l_1 is $2x - 5y = 4$. Find

(a) the gradient of the line l_1, [2]

(b) the value of n if the point $(n, n+1)$ is on the line l_1, [2]

(c) the equation of another line l_2 if the line passes through the origin and the point $(n, n+1)$. [2]

6 (a) y is inversely proportional to $\sqrt{x}$. When $x=16$, $y = 3$. Find

(i) an equation connecting x and y, [2]

(ii) the value of y when $x = 25$. [1]

(b) 9 men can complete a job in 15 days. Calculate how long it will take 5 men to complete the same job if they work at the same rate? [2]

7 A rectangle has length $(x + 4)$ cm and breadth is $(2x-1)$ cm. The area of the rectangle is 238 cm².

(a) Form an equation in x and show that $2x^2 + 7x - 242 = 0$. [2]

(b) Solve the equation $2x^2 + 7x - 242 = 0$. [3]

(c) Find the perimeter of the rectangle. [2]

8 (a) Factorise completely $2xy - 3y - 6z + 4xz$. [2]

(b) Simplify the following expressions.

(i) $\dfrac{2x-1}{x+1} - \dfrac{4}{2+2x}$, [2]

(ii) $\dfrac{2x}{3} + \dfrac{8x^2}{27}$. [3]

5

9 Answer the whole of this question on a sheet of graph paper.

The variables x and y are connected by the equation $y = x^3 + 2$.
Some corresponding values of x and y are given in the following table.

x	-3	-2	-1	0	1	2	3
y	-25	p	1	2	3	10	29

(a) Calculate the value of p. [1]

(b) Using a scale of 2 cm to represent 1 unit on the horizontal axis and a scale of 2 cm to represent 5 units on the vertical axis, draw the graph of $y = x^3 + 2$ for $-3 \le x \le 3$. [3]

(c) Use your graph to find the value of y when $x = 2.5$. [1]

(d) By drawing a tangent, find the gradient of the curve $y = x^3 + 2$ at the point where $x = 1$. [2]

10 In the diagram, ABC represents a triangular plot of land. It is given that $AB = 9.3$ m, $BC = 5.6$ cm and $\angle BAC = 28°$. D is a point on AC such that $AD = 4.1$ m.
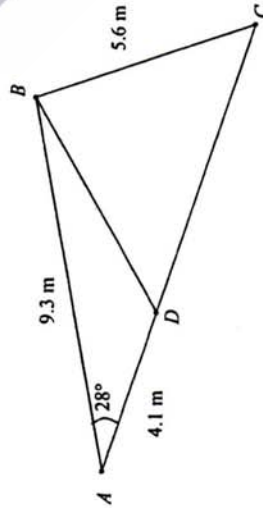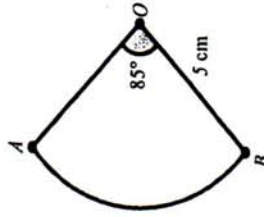

Calculate
(a) angle BCD, [2]
(b) length BD, [3]
(c) the area of triangle ADB. [2]
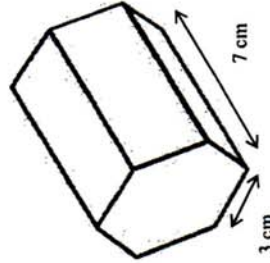
6

Section B [7 marks]

Answer one question from this section. One question carries 7 marks.

11 (a)

A and B are 2 points on a circle with centre O of radius 5 cm. Angle AOB is 85°.

(i) Convert 85° to radians. [1]

(ii) Calculate the area of the sector AOB. [2]

(iii) Calculate the perimeter of the sector AOB. [2]

(b)

A regular hexagonal prism has sides 3 cm and length of 7cm. Calculate the volume of the hexagonal prism. [2]

12 The following diagram shows a box-and-whisker plot of the marks for a class test.

Marks: 16 18 20 22 24 26 28 30 32
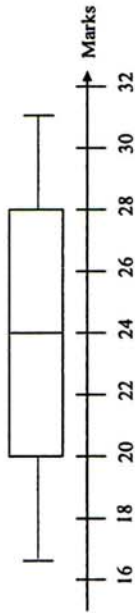
(a) State the median and interquartile range of the marks. [2]

(b) The table below shows the distribution of weight of some children admitted to Hospital A.

Hospital A:

Weight (x)	Frequency
$0 \leq x \leq 6$	2
$6 < x \leq 12$	7
$12 < x \leq 18$	12
$18 < x \leq 24$	1

Hospital B:

Mean = 12.2
Standard Deviation = 4.6

(i) Calculate the mean and standard deviation for Hospital A. [3]

(ii) Compare briefly, the weights of the children in both hospitals. [2]

- End of Paper -

Qn	Solutions	Marks	Remarks
1(a)	19.0078	B1	
1(b)	0.331	B1	
2(a)	(see table below)	B2	Minus 1 mark for each mistake

x	1	2	-3	4
1	1	2	-3	4
2	2	4	-6	8
-3	-3	-6	9	-12
4	4	8	-12	16

Qn	Solutions	Marks	Remarks
(b)(i)	$\dfrac{1}{16}$	B1	
(b)(ii)	$\dfrac{15}{16}$	B1	
3	$\dfrac{1}{2}:\dfrac{1}{3}:\dfrac{1}{4}$ is the same as $6:4:3$	M1	
	3 units ----- \$18	M1	
	13 units ----- \$78	A1	
	3 units ------- \$78	M1	
	7 units ----- \$182	A1	
4(a)	$0.2\times1200 = 240$	M1	
	$50\times12\times2 = 1200$	M1	
	$1200 + 240 = 1440$	A1	
(b)	$\dfrac{1440-1200}{1200}\times100\%$	M1	
	$= 20\%$	A1	
5(a)	$2x-5y = 4$	M1	
	$y = \dfrac{2}{5}x - \dfrac{4}{5}$	B1	Or B2
(b)	Gradient $= \dfrac{2}{5}$	M1	
	$2n - 5(n+1) = 4$		
	$2n - 5n - 5 - 4 = 0$	A1	
	$n = -3$		
(c)	$y = mx$	M1	
	$-2 = m(-3)$		
	$m = \dfrac{2}{3}$	A1	Or B2
	$y = \dfrac{2}{3}x$		

Qn	Solutions	Marks
6(a)(i)	$y = \dfrac{k}{\sqrt{x}}$	M1
	$3 = \dfrac{k}{\sqrt{16}}$	
	$k = 12$	A1
(ii)	$y = \dfrac{12}{\sqrt{x}}$	B1
	$\dfrac{12}{25}$	
(b)	9 men ---- 15 days	
	1 man ---- 135 days	M1
	5 men ---- $\dfrac{135}{5}$ days	
	27 days	A1
7(a)	$(x+4)(2x-1) = 238$	M1
	$2x^2 - x + 8x - 4 = 238$	
	$2x^2 + 7x - 242 = 0$ (shown)	A1
(b)	$\dfrac{-7\pm\sqrt{7^2 - 4(2)(-242)}}{2(2)}$	M1 M1
	$x = 9.39$ or -12.9	A1, A1
(c)	$2(9.3882 + 4) + 2[2(9.3882)-1]$	M1
	$= 62.3$	A1
8(a)	$2x(y+2z) - 3(y+2z)$	M1
	$(y+2z)(2x-3)$	A1
(b)(i)	$\dfrac{2x-1}{x+1} - \dfrac{4}{2(x+1)}$	M1
	$\dfrac{2(2x-1)-4}{2+2x}$	M1
	$\dfrac{4x-6}{2+2x}$	A1
(b)(ii)	$\dfrac{2x}{3}\times\dfrac{27}{8x^2}$	M1
	$\dfrac{9}{4x}$	A1

Remarks: Any other method with working clearly shown

			B1
			B1
			B1
(ii)	Both hospitals recorded same mean weight. However, the weight in hospital B is more spread out as SD is larger.		

4

9(a)	-6	B1	
(b)		C1	
		P1	
		A1	
(c)	17.6 ±0.25	B1	
(d)	Draw tangent at point $x = 1$	M1	
	5 ±1	A1	
10(a)	$\dfrac{\sin 28}{5.56} = \dfrac{\sin BCD}{9.3}$	M1	
	51.7°	A1	
(b)	$BD^2 = 9.3^2 + 4.1^2 - 2(4.1)(9.3)\cos 28$	M1, M1	1m for correct formula, 1m for correct substitution
	6.00 m	A1	
(c)	$\frac{1}{2} \times 9.3 \times 4.1 \times \sin 28$	M1	
	=8.95 m2	A1	
11(a)(i)	1.48 rad	B1	
(ii)	$\frac{1}{2} \times 5^2 \times 1.48$	M1	
	18.5	A1	
(iii)	$5(1.4835) + 5 + 5$	M1	
	17.4	A1	
(b)	The regular hexagon can be divided into 6 congruent triangles with lengths of 3cm.	M1	SOI
	Area of the hexagon $= (\frac{1}{2} \times 3 \times 3 \times \sin 60°) \times 6 = 23.38$	M1	
	23.38×7	M1	
	164cm³	A1	
12(a)	Median = 24, IQR = 8	B1, B1	
(b)(i)	$\text{Mean } \bar{x} = \dfrac{(3 \times 2) + (9 \times 7) + (15 \times 12) + (21 \times 1)}{22}$	M1	
	$= 12.2$	A1	
	Standard deviation $= 4.32$	B1	

4

3

24

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GCE 'N' LEVEL PRELIMINARY EXAMINATION 2016

Name	Reg.No.	Class

MATHEMATICS SYLLABUS A   4045/01

PAPER 1   **Date: 22 July 2016**

Sec Four Normal Academic   **2 hours**

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class register number and class on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.

If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is 80.

The use of an approved scientific calculator is expected, where appropriate.
If the degree of accuracy is not specified in the question and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

For Examiner's Use

80

Setter: Mr Alvin Ho and Mdm Wong CL

This document consists of **19** printed pages.

Mathematical Formulae

Compound Interest

$$\text{Total amount} = P\left(1 + \frac{r}{100}\right)^n$$

Mensuration

$$\text{Curved Surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2}ab\sin c$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f}$$

$$\text{Standard deviation} = \sqrt{\frac{\Sigma fx^2}{\Sigma f} - \left(\frac{\Sigma fx}{\Sigma f}\right)^2}$$
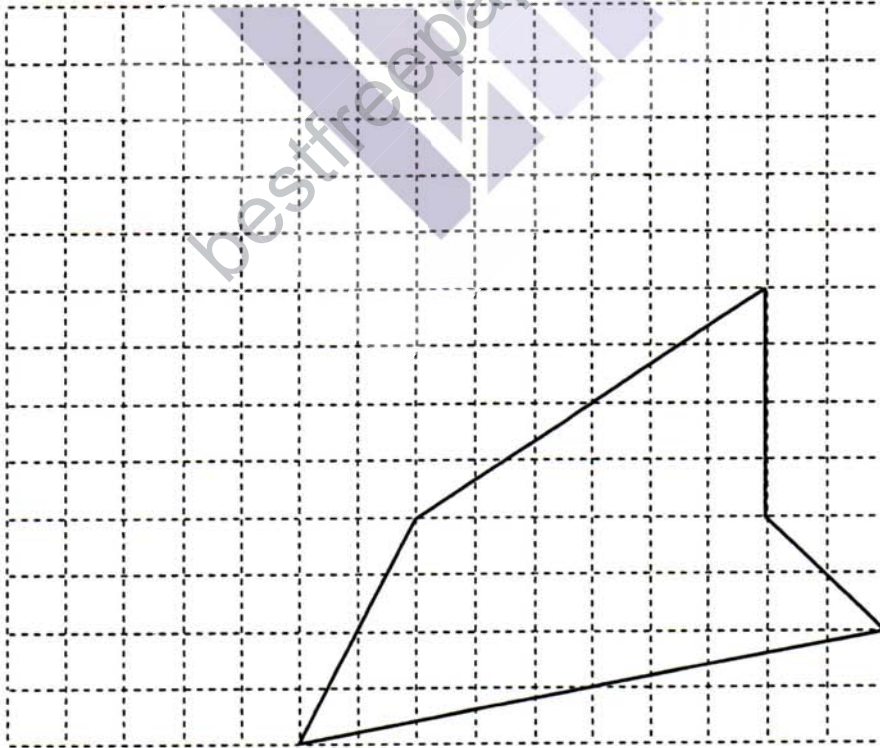
1

(a) Find $\sqrt[3]{5 \times 12}$. Write down all the figures on your calculator display.

Answer (a) .... [1]

(b) Write your answer to part (a), correct to 1 significant figure.

Answer (b) .... [1]

2 Draw on the grid an enlargement, scale factor 0.5, of the figure below.

[1]

3 (a) Calculate $\dfrac{1234.567 + 8.9^2}{3^3 + \sqrt{0.5}}$.

Answer (a) .... [1]

(b) Write 0.25% as a fraction in its lowest terms

Answer (b) .... [1]

4 The pictogram below shows the number of marks scored by a class of students for a Mathematics test.

Number of marks scored by students	
2 marks	☺ ☺
4 marks	☺ ☺ ☺ ☺
6 marks	☺ ☺ ☺ ☺ ☺ (
8 marks	☺ ☺ ☺ (
10 marks	☺ (

Key: Each ☺ represents 2 students

(a) Find the fraction of the students who scored at most 8 marks.

Answer (a) .... [1]

(b) Given that the passing mark is 6 marks, find the percentage of students who passed the test.

Answer (b) .... [1]

5   A wire 64 cm in length is cut into two pieces in the ratio 5 : 11.

(a) Find the length of the shorter piece.

Answer (a) ....cm [1]

(b) If the longer piece is bent to form a circle, find its radius.

Answer (b) ....cm [2]

6

> **Oreo Milkshake Recipe**
> 480 *ml*   Chocolate Syrup
> 64   Oreo Cookies
> 2000 *ml* Milk
> 16 cups Vanilla Ice-cream
>
> *Makes 8 Milkshakes*

Joe wants to make 35 Milkshakes for his class gathering.

How much milk will he use? Give your answer in litres.

Answer .... *l*   [1]

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29

7   (a) Convert 5.4 km/h to m/s.

Answer (a) ....m/s   [1]

(b) After school, a boy decided to walk home, covering a total of 2250 m. He travelled at an average speed of 3 km/h for his return journey. Calculate the time he reached home, if he left school at 1625 hours.

Answer (c) ....hours   [2]

8   A polygon has *n* sides. Three of its exterior angles are 70°, 25° and 15° while each of the remaining exterior angles is 50°. Find

(a) the value of *n*,

Answer (a) n = ...   [1]

(b) the largest interior angle

Answer (b) .... °   [1]

9   (a) Shelly, Joe and Russell are having a discussion over the *similar* properties of both a Rhombus and a Parallelogram. Below are the statements made by each of them:

   Shelly: For both quadrilaterals, they have opposite sides which are parallel, and the diagonals bisect each other at 90°.

   Joe: For both quadrilaterals, diagonally opposite angles are equal, and opposite sides are of equal length.

   Russell: For both quadrilaterals, the diagonals bisect each other, and the sides are of equal lengths.

   Whose statement is correct?

                                                        Answer .... [1]

   (b) Some properties of a Rectangle are different from those of a Parallelogram.

   Write down one such property.

        Answer .... [1]

10 (a) Factorise completely $18a^2 - 98$.

                                                        Answer (a) .... [2]

   (b) Simplify $\dfrac{(2x)^3}{4y} \div \dfrac{12x}{30y^3}$

                                                        Answer (b) .... [2]

11   There are 5 red balls, 4 blue balls and m green balls inside a bag.

   (a) Amirah picks a ball at random. Given that the probability of picking a green ball is 0.4, find the value of m.

Answer *(a) m =* .... [2]

  (b) If Amirah picks two balls at random, without replacement, find the probability of picking a red ball and a blue ball.

Answer *(b)* .... [1]

12

  (a) Solve $12(\frac{1}{2}x - 3) = 60$

Answer *(a)* .... [1]

  (b) Find the smallest integer that satisfies $5 \le 2(x-3)$.

Answer *(b)* .... [2]

13   (a) Given that $49^h = 7^4 \times 7^{12}$, find the value of h.

Answer *(a)* $h =$ .... [1]

(b) Given that $\dfrac{1}{2^{-k}} = \dfrac{2^{18}}{2^{\frac{5}{2}}}$, find the value of k.

Answer *(b)* $k =$ .... [1]

14 A line *AB* is drawn below,

    (a) Construct a triangle *ABC* such that *AC* = 10 cm and *BC* = 11 cm,   [1]

    (b) Construct the perpendicular bisector of *AB*,   [1]

    (c) Construct the angle bisector of angle *BAC*,   [1]

    (d) The point *P* is on the bisector of angle *BAC* and is the same distance from *A* as it is from *B*. Mark and label the position of *P*.   [1]

A   *B*

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34

15   (a)   Express 756 as the product of its prime factors.

<div align="right">

Answer   *(a)*   .... [1]

</div>

(b)   Given that $\dfrac{756k}{2}$ is a perfect square, write down the smallest possible integer value of

     k.

<div align="right">

Answer   *(b)*   *k* = ... [1]

</div>

16   (a)   Expand and simplify $2 - (2 - x)^2$

<div align="right">

Answer   *(a)*   .... [1]

</div>

(b)   Solve $\dfrac{3}{x^2 - 16} - \dfrac{7}{x + 4} = 1$

<div align="right">

Answer   *(b)*   .... [3]

</div>

17
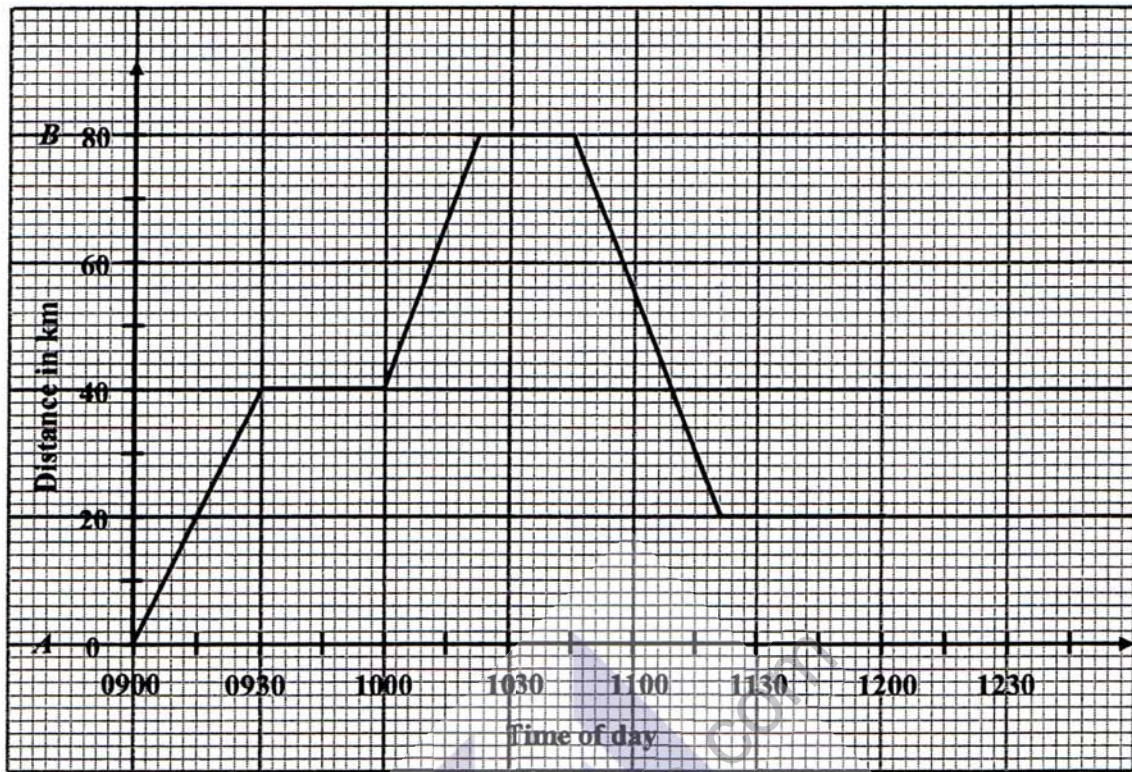
The diagram is a distance-time graph for the journey of a vehicle from point A to point B and its journey back to A during a period of 3.5 hours.

(a) Find the distance the vehicle had travelled by 09 50.

Answer (a) ....km [1]

(b) Calculate the speed that the vehicle must travel during the last part of its journey in order to return to its starting point by 12 30.

Answer (b) ....km/h [1]

(c) What is the average speed, in km/h, of the vehicle for the whole journey if it returns to the starting point at 12 30?

Answer (c) ....km/h [1]

(d) A second vehicle leaves B for A at 09 30. It travelled at a constant speed of 80 km/h.
By adding a straight line on the graph, state an estimate of the time at which the two vehicles first met, giving your answers to the nearest minute.

Answer (d) .... [2]

18   $x^2 + 6x - 11$ can be expressed in the form $(x + p)^2 + q$.

(a) Find the value of p and q.

Answer *(a)* $p =$ ....

$q =$ .... [2]

(b) Hence, solve $x^2 + 6x - 11 = 0$, correct your answers to two decimal places.

Answer *(b)* $x =$ .... or .... [2]

37

19 Mr Teo, a shoe shop owner makes a profit of 20% for every pair of shoes that was sold.

(a) Find the selling price of a pair of shoe if its cost price is $150.

Answer *(a)* $ .... [1]

(b) A pair of Nike shoes is sold for $360. Find the cost price of the Nike shoes.

Answer *(b)* $ .... [1]

During the End of Year Sale, there is a discount of 15%.

(c) Find the amount the customer has to pay for the same pair of Nike shoes now.

Answer *(c)* $ .... [1]

(d) Find the new percentage profit of the pair of Nike shoes.

Answer *(d)* .... [1]

20
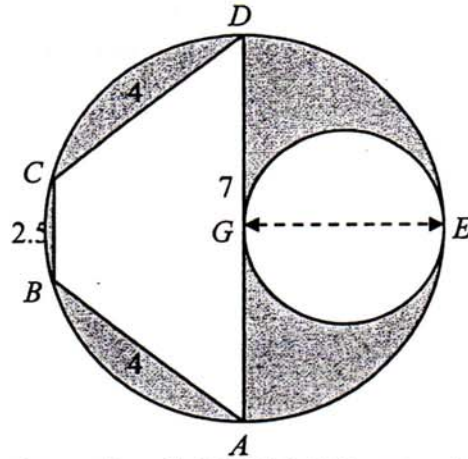
The diagram shows a circular cardboard *ABCDE* of diameter *AD*. A trapezium *ABCD* and a circle of diameter, *GE*, are removed from the cardboard. It is given that *BC* = 2.5 m, *AD* = 7 m and *AB* = *CD* = 4 m.

Calculate

(a)   the height of the trapezium,

Answer *(a)* .... m [1]

(b)   the area of the shaded region,

Answer *(b)* ....m² [2]

(c)   the perimeter of the shaded region.

Answer *(c)* .... m [2]

21
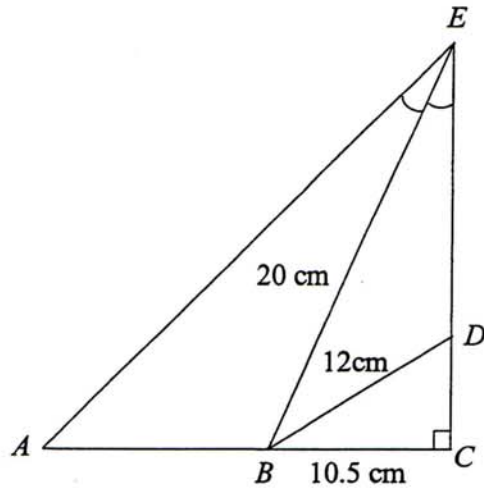
In the figure, triangle *ACE* is a right-angle triangle. *B* and *D* are points on *AC* and *CE* respectively such that *BC* = 10.5 cm, *BE* = 20 cm and *BD* = 12 cm. The line *BE* bisects the angle *AEC*.

Find

(a) angle *BEC*,

Answer (a) ∠*BEC* = ...° [1]

(b) the length of *AE*,

Answer (b) .... cm [2]

(c) sin ∠*BDE*, giving your answer as a fraction in the simplest form.

Answer (c) sin ∠*BDE* = ... [1]

22 (a) The table below shows the distribution of Mathematics test marks of a class of students.

Marks	$40 \le x \le 50$	$50 \le x \le 60$	$60 \le x \le 70$	$70 \le x \le 80$	$80 \le x \le 90$
No. of students	4	12	p	8	6

(i) If $p = 10$, find the mean mark.

Answer *(a)(i)* ....marks [2]

(ii) If the modal mark is 55, state the greatest value of p.

Answer *(a)(ii)* $p =$ .... [1]

(iii) If the median mark is 65, state the least value of p.

Answer *(a)(iii)* $p =$ .... [1]

(b) The stem and leaf diagram shows the time taken to serve customers at a fast food restaurant.

Time Taken to Serve a Customer

```
1 | 1  4
2 | 2  3  5  7  7  7
3 | 1  2  2  4  5  5  6  7  8
4 | 2  3
```

Key
3 | 1 means 3.1 minutes

(i) What was the median time taken to serve a customer?

Answer *(b)(i)* .... min [1]

(ii) The fast food restaurant claims that the average time taken to serve a customer is 2.7 minutes. Is the claim true? Explain your reasoning.

Answer *(b)(ii)* ....

.... [1]

23
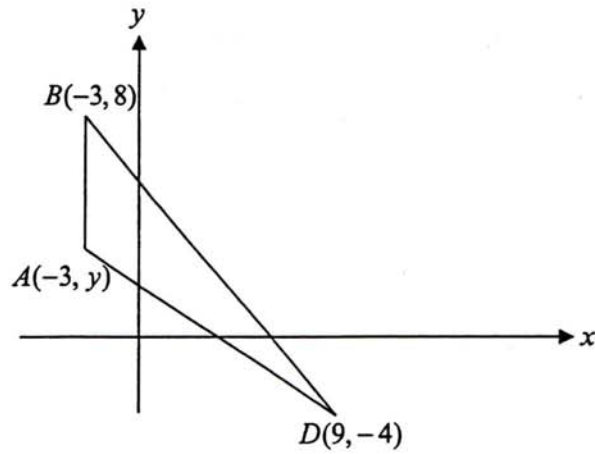
(a) Calculate the gradient of the line *BD*.

Answer (a) .... [1]

(b) Calculate the length of *BD*.

Answer (b) .... units [1]

(c) The point *A* is $(-3, y)$. If the gradient of the line *AD* is $-\dfrac{2}{3}$, show that the value of $y = 4$.

Answer

[1]

(d) Hence, find the equation of the line through *A* which is parallel to *BD*.

Answer (d) .... [2]

(e) Calculate the area of $\triangle ABD$.

Answer (e) .... units² [1]

42

24 Mr Lee consumed x bars of chocolates and drank y cans of coke in every month. In a particular month, when a bar of chocolate cost \$5.50 and a six-pack cans of coke cost \$4.50. His total expenditure was \$105.

(a) Form a equation in x and y and show that it reduces to $22x + 3y = 420$.

Answer

[1]

Due to the revision in food prices, the cost of a bar of chocolate was increased by \$0.70 and the cost of a six-pack cans of coke was increased by \$0.60. He calculated that his monthly expenditure on chocolates and coke would increase by \$13.50.

(b) Form another equation in x and y to represent the increase in expenditure and show that it reduces to $7x + y = 135$.

Answer

[1]

(c) (i) Solve these equations to find the number of bars of chocolates and the number of cans of coke Mr Lee consumed in a month.

Answer (c)(i) .... bars

.... cans [3]
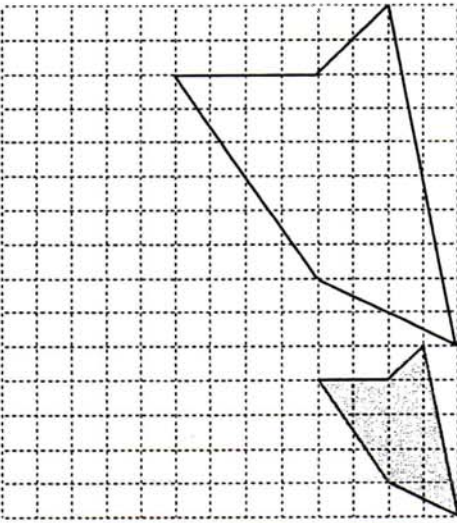
(ii) Find the total number of **six-pack cans** of coke Mr Lee drank in one year.

Answer (c)(ii) .... six-pack cans [1]

End of Paper
Please CHECK your WORK
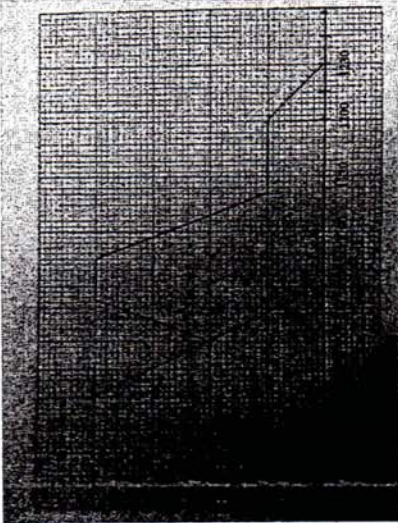
2016 BNSS 4NA Preliminary Examinations Mathematics Paper 1 (4045/01)
MARKING SCHEME

Qn	Suggested Solutions	Marks
1(a)	3.914867641	B1
1(b)	4 (1 s.f.)	B1
2		B1
3(a)	47.416607 =47.4 (3 s.f.)	B1
3(b)	$0.25\% = \dfrac{25}{10000}$ $= \dfrac{1}{400}$	B1
4(a)	$\dfrac{6}{7}$	B1
4(b)	% passed $= \dfrac{21}{33} \times 100\%$ $= 63\dfrac{7}{11}\%$ or 63.63% $=63.6\%\,(3\text{ s.f.})$	B1
5(a)	Length of shorter piece $= \dfrac{5}{5+11} \times 64$ $= 20\text{cm}$	B1

Qn	Suggested Solutions	Marks
5(b)	Length of longer piece $=64 - 20$ $=44$ cm $2\pi = 44$ $r = 7.001909612$ $r \approx 7.00\text{cm}\,(3\text{ s.f.})$	M1 A1
6	$2000\ ml = 2\ l$ 35 milkshakes require $= \dfrac{2}{8} \times 35$ $= 8\dfrac{3}{4}\ l$ or $8.75\ l$ of milk	B1
7(a)	5.4 km/h $= \dfrac{5.4 \times 1000 m}{1 \times 3600 s}$ $= 1.5$ m/s	M1 A1
7(b)	Time taken $= \dfrac{2.25 km}{3 km/h}$ $=0.75$ h $=45$ mins $1625\text{h} + 45\text{ mins} = 1710\text{h}$	B1
8(a)	$70° + 25° + 15° + 50°(n-3) = 360°$ $n - 3 = \dfrac{360° - 70° - 25° - 15°}{50°} = 50°$ $n = 8$	B1
8(b)	Largest interior angle $= 180° - 15°$ $= 165°$	B1
9(a)	Joe is correct.	B1
9(b)	There are 4 right angles. OR The two diagonals are equal in length.	B1
10(a)	$18a^2 - 98$ $= 2(9a^2 - 49)$ $= 2(3a + 7)(3a - 7)$	B1
10(b)	$\dfrac{8x^3}{4y} \times \dfrac{30y^3}{12x}$ $= 5x^2 y^2$	M1 A1

44

Page 4

Qn	Suggested Solutions	Marks
14		**B4** -Subtract 1 mark for lack of labelling (sides/vertices) -Subtract 1 mark for lack of working lines
15(a)	$756 = 2^2 \times 3^3 \times 7$	B1
15(b)	$\frac{756k}{2} = 2 \times 3^3 \times 7k$ $k = 2 \times 3 \times 7$ $= 42$	B1
16(a)	$2 - (2-x)^2$ $= 2 - (4 - 4x + x^2)$ $= -x^2 + 4x - 2$	B1
16(b)	$\frac{3}{x^2-16} - \frac{7}{x+4} = 1$ $\frac{3}{(x-4)(x+4)} - \frac{7}{x+4} = 1$ $\frac{3-7(x-4)}{(x+4)(x-4)} = 1$ $-7x+31 = x^2-16$ $x^2 + 7x - 47 = 0$ $x = 4.1974021$ or -11.1974021 $x = 4.20(3s.f)$ or $-11.2(3s.f)$	M1 M1 A1

Page 3

Qn	Suggested Solutions	Marks
11(a)	$P(green)$: $\frac{m}{5+4+m} = 0.4$ $m = 0.4(9+m)$ $m = 3.6 + 0.4m$ $m = 6$	M1 A1
11(b)	$P(\text{1 red and 1 blue}) = 2\left(\frac{5}{15} \times \frac{4}{14}\right)$ $= \frac{4}{21}$	B1 B1
12(a)	$12\left(\frac{1}{2}x - 3\right) = 60$ $\left(\frac{1}{2}x - 3\right) = 5$ $\frac{1}{2}x = 8$ $x = 16$	B1
12(b)	$5 \leq 2(x-3)$ $5 \leq 2x - 6$ $11 \leq 2x$ $5.5 \leq x$ Ans: 6	M1 A1
13(a)	$49^h = 7^4 \times 7^{12}$ $(7^2)^h = 7^{4+12}$ $\therefore 2h = 16$ $h = 8$	B1
13(b)	$\frac{1}{2^{-4}} = \frac{2^{\frac{5}{2}}}{2^2}$ $2^4 = 2^{18-\frac{5}{2}}$ $2^4 = 2^{15\frac{1}{2}}$ $\therefore k = 15\frac{1}{2}$	B1

Qn	Suggested Solutions	Marks
18(b)	$x^2 + 6x - 11 = 0$	
	$(x+3)^2 - 20 = 0$	
	$(x+3)^2 = 20$	M1
	$x+3 = \pm\sqrt{20}$	
	$x = \sqrt{20} - 3$ or $-\sqrt{20} - 3$	
	$= 1.47213$ or -7.47213	
	$= 1.47$ or -7.47 (2 decimal places)	A1
19(a)	Selling price of the pair of shoe $= 120\% \times \$150$ $= \dfrac{120}{100} \times \$150$ $= \$180$	B1
19(b)	Cost Price of Nike shoes $= \dfrac{100}{120} \times \$360$ $= \$300$	B1
19(c)	Amount the customer has to pay $= 85\% \times \$360$ $= \$306$	B1
19(d)	% profit $= \dfrac{\$306 - \$300}{\$300} \times 100\%$ $= 2\%$	B1
20(a)	Height of trapezium $= \sqrt{CD^2 - \left(\dfrac{AD - BC}{2}\right)^2}$ $= \sqrt{4^2 - 2.25^2}$ $= \sqrt{16 - 5.0625}$ $= 3.31\,\text{m}$	B1

Qn	Suggested Solutions	Marks
17(a)	Distance travelled = 40 km	B1
17(b)	speed $= \dfrac{\text{distance}}{\text{time}}$ $= \dfrac{20}{0.5}$ $= 40$ km/h	B1
17(c)	Average speed $= \dfrac{160}{3.5}$ $= 45\dfrac{5}{7}$ km/h (accept 45.7 km/h)	B1
17(d)		B1
	Time at which the 2 vehicles first met is 10 00.	B1
18(a)	$x^2 + 6x - 11 = (x+3)^2 - 3^2 - 11$ $= (x+3)^2 - 9 - 11$ $= (x+3)^2 - 20$	M1
	$\therefore p = 3, q = -20$	A1 for both correct.

| Qn	Suggested Solutions	Marks
21(b)	$CE = \sqrt{20^2 - 10.5^2}$ $= \sqrt{289.75}$ $\angle AEC = 2(31.6682°)$ $= 63.3365°$ $\cos 63.3365° = \dfrac{\sqrt{289.75}}{AE}$ $AE = 37.932$ ≈ 37.9 cm	M1 A1
21(c)	$\sin \angle BDE = \dfrac{10.5}{12}$ $= \dfrac{7}{8}$	B1
22(a)(i)	If $p = 10$, Mean $= \dfrac{4 \times 45 + 12 \times 55 + 10 \times 65 + 8 \times 75 + 6 \times 85}{4 + 12 + 10 + 8 + 6}$ $= 65$	M1 A1
22(a)(ii)	greatest value of $p = 11$	B1
22(a)(iii)	least value of $p = 3$	B1
22(b)(i)	The median is the number in the $\left(\dfrac{n+1}{2}\right)^{th}$ position, which is $\dfrac{19+1}{2} = 10$ th position. Median $= 3.2$ min	B1
22(b)(ii)	The claim is not true because the restaurant used the mode. A more accurate time would be the mean or median.	B1
23(a)	Gradient $= \dfrac{8 - (-4)}{(-3) - (9)}$ $= -1$	B1
23(b)	Length of $BD = \sqrt{[8-(-4)]^2 + (-3-9)^2}$ $= \sqrt{(12)^2 + (-12)^2}$ $= \sqrt{288}$ $= 16.9706$ ≈ 17.0 units	B1

Qn	Suggested Solutions	Marks
20(b)	Area of trapezium $= \dfrac{BC + AD}{2} \times$ height $= 4.75 \times 3.307$ $= 15.708$ m² Area of circle $ABCDE = \pi \times 3.5^2$ $= 38.4895$ m² Area of circle $GE = \pi \times 1.75^2$ $= 9.622375$ m² Shaded area $= 38.4895 - 9.622375 - 15.708$ $= 13.159125$ $= 13.2$ m² (3 sig. fig.)	M1 for either area of trapezium or the 2 circles. A1
20(c)	Circumference of circle GE $= 2\pi \times 1.75$ $= 11.00$ m Circumference of circle $AFDE$ $= 2\pi \times 3.5$ $= 22.00$ m Perimeter of trapezium $= 2.5 + 4 + 4 + 7$ $= 17.5$ m Perimeter of shaded region $= 17.5 + 22 + 11$ $= 50.5$ m (3 sig. fig.)	M1 for either perimeter of trapezium or circumference of the 2 circles. A1
21(a)	$\sin \angle BEC = \dfrac{10.5}{20}$ $\angle BEC = 31.6682°$ $\approx 31.7°$	B1

Qn	Suggested Solutions	Marks
23(c)	$\dfrac{y-(-4)}{(-3)-(9)} = \dfrac{2}{-3}$ $\dfrac{y+4}{12} = \dfrac{2}{3}$ $y+4 = 8$ $y = 4$ (shown)	B1
23(d)	$y = mx + c$ $4 = -1(-3) + c$ $c = 1$ $\therefore y = -x+1$ Or $y - 4 = -1[x-(-3)]$ $y-4 = -x-3$ $y = -x+1$	M1 A1 M1 A1
23(e)	Area of $\triangle MBD = \dfrac{1}{2} \times 4 \times 12$ $= 24$ units²	B1
24(a)	$5.50x + \dfrac{4.50}{6}y = 105$ $550x + 75y = 10500$ $22x + 3y = 420$ (Shown)	B1
24(b)	$0.7x + \dfrac{0.60}{6}y = 13.50$ $7x + y = 135$ (Shown)	B1

Qn	Suggested Solutions	Marks
24(c)(i)	$22x + 3y = 420$ — (1) $7x + y = 135$ — (2) From (2), $y = 135 - 7x$ — (3) Sub. (3) into (1), $22x + 3(135-7x) = 420$ $22x + 405 - 21x = 420$ $x = 15$ $y = 135 - 7(15)$ $= 30$ Or $(2) \times 3,\ 21x + 3y = 405$ — (3) $(1) - (3),\ x = 15$ $y = 135 - 7(15)$ $= 30$ No. of chocolate bars consumed in a month = 15 No. of cans of coke drank in a month = 30	M1 A1 A1 M1 A1 A1
24(c)(ii)	No. of six-pack cans of coke drank in a year $= (30 \times 12) \div 6$ $= 60$	B1
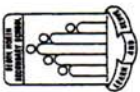
2

Mathematical Formulae

Compound Interest

Total amount $= P\left(1 + \dfrac{r}{100}\right)^n$

Mensuration

Curved Surface area of a cone $= \pi r l$

Surface area of a sphere $= 4\pi r^2$

Volume of a cone $= \dfrac{1}{3}\pi r^2 h$

Volume of a sphere $= \dfrac{4}{3}\pi r^3$

Area of triangle $ABC = \dfrac{1}{2}ab\sin c$

Arc length $= r\theta$, where θ is in radians

Sector area $= \dfrac{1}{2}r^2\theta$, where θ is in radians

Trigonometry

$$\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \dfrac{\Sigma fx}{\Sigma f}$$

$$\text{Standard deviation} = \sqrt{\dfrac{\Sigma fx^2}{\Sigma f} - \left(\dfrac{\Sigma fx}{\Sigma f}\right)^2}$$

BEDOK NORTH SECONDARY SCHOOL

Vision : Leaders for the future ; Creative lifelong learners ; Morally upright, caring and loyal

Mission : To develop our students holistically through quality programmes within a nurturing environment.

GCE 'N' LEVEL PRELIMINARY EXAMINATION 2016

Name	Reg.No.	Class

MATHEMATICS SYLLABUS A   4045/02

PAPER 2   Date: 12 August 2016

Sec Four Normal Academic   2 hours

Additional Materials: Answer Paper
Graph Paper (1 sheet)

READ THESE INSTRUCTIONS FIRST

Write your answers and working on the separate Answer Paper provided.
Write your name, class register number and class on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Section A
Answer all questions.

Section B
Answer one question.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 60.

The use of an approved scientific calculator is expected, where appropriate.
If the degree of accuracy is not specified in the question and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

At the end of the examination, fasten all your work securely together.

Setter: Mdm Lam CP and Mrs Jan Yap

This document consists of **11** printed pages.

49

Section A (52 marks)

Answer all the questions in this section.

1 The thickness of a sheet of cardboard is 9.2×10^{-3} cm. Calculate the thickness of three cardboard sheets, giving your answer in standard form. [2]

2 (a) During winter, the temperature in one particular week is

$2.1°C$, $-1.5°C$, $-4.3°C$, $5.5°C$, $-5.5°C$, $-5.6°C$ and $1.7°C$.

What is the difference between the lowest and highest temperature? [1]

(b) Find the fraction which is exactly halfway between $\frac{2}{7}$ and $\frac{5}{7}$. [1]

3 In the diagram, AB is parallel to CD.
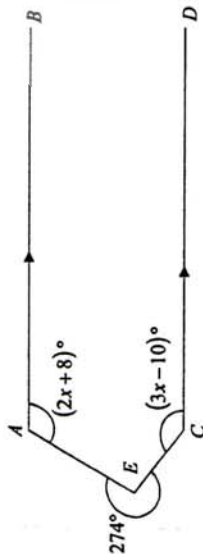
Calculate the value of x in the diagram. [3]

4 (a) Rachel bought an antique painting for $1 850.
After 2 years, she sold it at a profit of 40%.

Find the selling price of the painting. [1]

(b) Rachel invested some money into an account which pays 20% per year compound interest.

If she had a total of $1 468.80 in her account after 3 years, calculate the sum of money she invested. [2]

(c) Rachel is going to United States of America to visit her sister. On a certain day, the rate of exchange between United States dollars (US$) and Singapore dollars (S$) was US$1 = S$1.32. She changed S$1 468.80 into United States dollar.

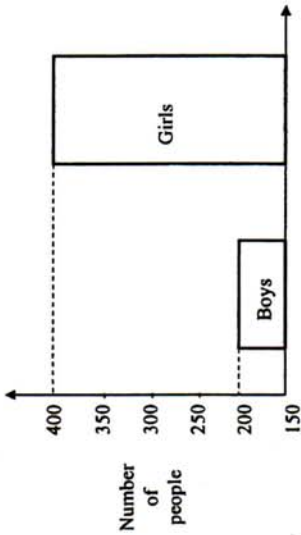How many United States dollars did she receive? Give your answer to the nearest dollar. [2]

---

5 In the quadrilateral $BXDC$ shown below, angle $XBC = 94°$, angle $BCD = 86°$ and angle $CDX = a°$.

E is a point on XD and A is a point on XB such that angle $BAE = 94°$ and angle $AED = a°$.

Diagram NOT drawn to scale
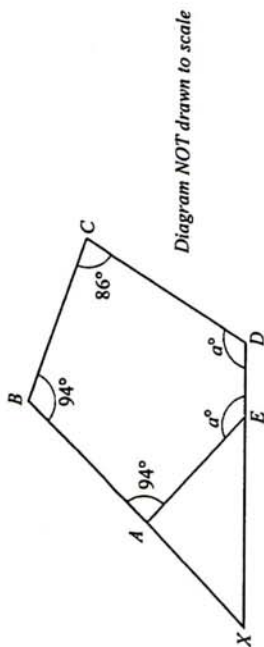
(a) Give a reason why AB is parallel to DC. [1]

(b) Calculate the value of a. [1]

(c) (i) Show that triangle AXE is an isosceles triangle. [1]

(ii) Given $AE = 7cm$, calculate the area of triangle AXE. [2]

6 (a) Factorise completely
(i) $3ax - 9ay - 4bx + 12by$ [2]

(ii) $6x^2 - 28x - 10$ [3]

(b) Rearrange this equation to make v the subject.
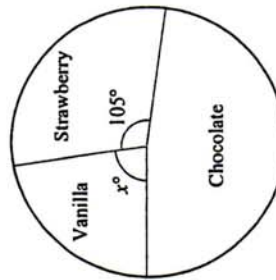
$$p = a + \frac{bv^2}{k}$$ [2]

8   The diagram below show a sequence of patterns consisting of circles and stars join by straight lines.

The first three patterns are shown below :

Pattern 1   Pattern 2   Pattern 3

(a)   Copy and complete this table

Number of stars	1	2	3	4	5	......	n
Number of circles	4	6	8			......	
Number of straight lines	4	7	10			......	

[4]

(b)   Is it possible to have a pattern in this sequence made from 103 circles? Show your working. [2]

---

7   (a)

In a particular kindergarten in a town, it is found that there are twice as many girls as boys.

Explain why the bar chart above, which illustrates the findings, might be considered misleading. [1]

(b)   A survey was conducted on 6 000 students in the same town to find their preferred ice-cream flavours; strawberry, vanilla or chocolate.

The pie chart illustrates the results of the survey.

(i)   Given that 1 400 students preferred vanilla, find the value of x. [1]

(ii)   Find the number of students who preferred chocolate. [2]

(iii) If 974 more girls than boys preferred chocolate, how many boys preferred chocolate? [2]

9 The diagram below shows an **open** rectangular box, made of thin metal.

It has a square base of sides x m and a height of $\frac{3.5}{x^2}$ m.
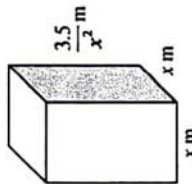
(a) Show that the total surface area of the open rectangular box can be expressed as

$$A = x^2 + \frac{14}{x}.$$ [3]

(b) The table shows the area, correct to 2 decimal places, for some values of x.

x	0.5	1	1.5	2	2.5	3	3.5	4
A	28.25	15.00	11.58	11.00	m	13.67	16.25	19.50

(i) Calculate the value of m. [1]

(ii) On a sheet of graph paper draw an x-axis, for values of x from 0 to 4, using a scale of 4 cm to 1 unit, and a y-axis, for values of y from 0 to 30, using a scale of 2 cm to 5 units.

Draw the graph of $A = x^2 + \frac{14}{x}$ for $0 \le x \le 4$. [3]

(iii) By drawing a tangent, find the gradient of the graph at the point where $x = 1.2$. [2]

(iv) Use your graph to find the length of the square base of the box for which the least amount of metal is used. [1]

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10 A shop is having a promotion on its candles.

(a) Cleo wants to buy a candle for her room and plans to place it on her bookshelf. The bookshelf has a height of 35 cm.
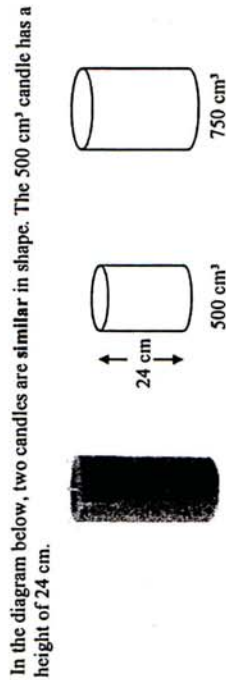
In the diagram below, two candles are **similar** in shape. The 500 cm³ candle has a height of 24 cm.

Cleo would like to buy the 750 cm³ candle.
Determine if the 750 cm³ candle can fit into her bookshelf. Show your working. [3]

(b) The shop owner needs to export some candles to his customers in Korea by airfreight. He has to pack the candles into the cartons. In order to lower the airfreight cost, he has to minimise the empty space left in the carton after packing the candles.

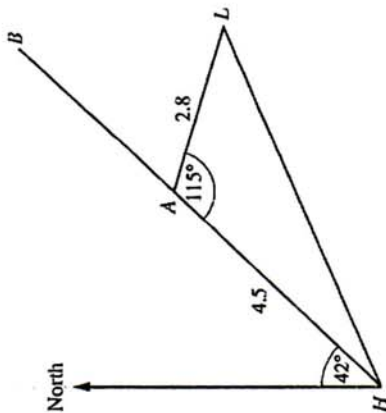The diagram shows the two types of packing, Type *A* and Type *B*.

Sample of candle to be packed
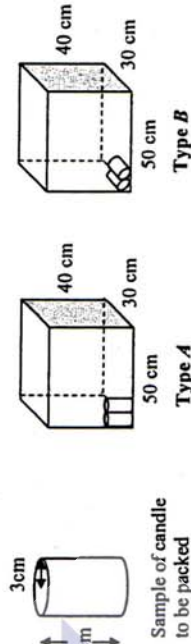
The table shows the dimensions of the carton and candle, as well as the packing requirements.

Carton dimensions	Length 50 cm, Width 30 cm, Height 40 cm.
Candle dimensions	Height 5 cm, Radius 3 cm.
Type *A* packing	Candles are placed <u>vertically</u> in the carton.
Type *B* packing	Candles are placed <u>horizontally</u> in the carton.
Assumptions	1) Candles can be packed in as many layers as possible. 2) Candles are to be packed in the same manner within the same carton in the respective type of packing.

(i) Which type of packing could minimise the empty space left in the carton after packing the candles? Show your working. [3]

(ii) Using your answer in part (i), calculate the volume of the empty space left in the carton after packing the candles in the carton. Leave your answer to the nearest whole number. [2]

12 Ernest and Ethan are two athletes who have training sessions together. In 80 sessions during 2015 they ran the same route, and their times were recorded.

(a) The cumulative frequency curve shows the distribution of Ernest's times.
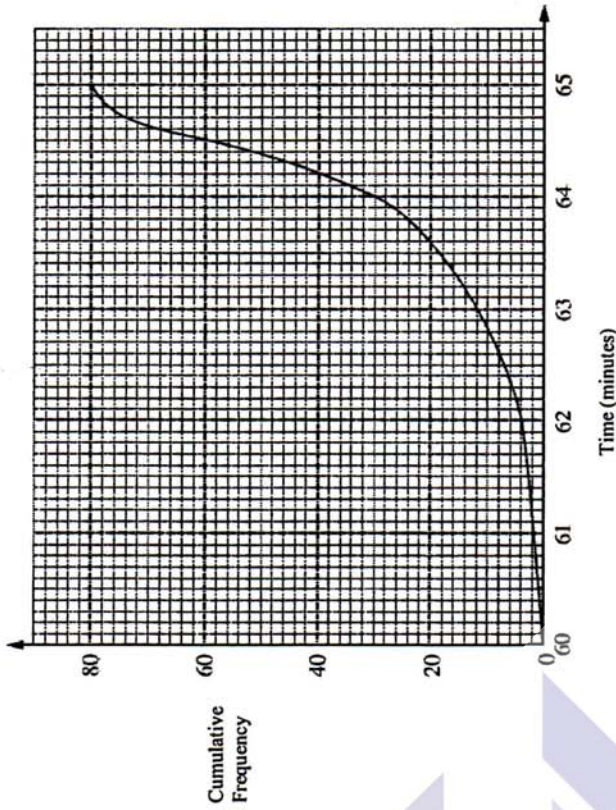
Using the above graph,

    (i) find the median time, [1]

    (ii) find the interquartile range of the times, [2]

    (iii)(a) A session with timing greater than 64 minutes is classed as unsatisfactory. How many of Ernest's training sessions are unsatisfactory? [1]

    (b) Which percentile of the distribution can be used to find the answer in (iii)(a)? [1]

(b) Ethan's times had a lower quartile of 62.5 minutes, a median of 63 minutes and an upper quartile of 64 minutes.
State which athlete was the more consistent runner, giving a reason for your answer. [1]

Section B (8 marks)

Answer **one** question from this section. Each question carries 8 marks.

11

The diagram shows the positions of a harbour, H, a lighthouse, L, and two buoys A and B.
HAB is a straight line.
The bearing of A from H is 042°.
$HA = 4.5$ km, $AL = 2.8$ km and angle $HAL = 115°$.

(a) Find the bearing of H from A. [1]

(b) Calculate

    (i) HL, [3]

    (ii) the area of triangle HAL. [2]

(c) A boat sailed from the harbour along the line HAB.

    (i) Calculate the shortest distance between the boat and the lighthouse. [1]

    (ii) The boat sailed at a constant speed of 3 m/s.
Given that the boat reached A at 07 15, calculate the time at which it left the harbour. [1]

11

12 (c) The probability that it will rain on any of the training sessions is p.

The probability that it does not rain on two consecutive days is $\dfrac{49}{100}$.
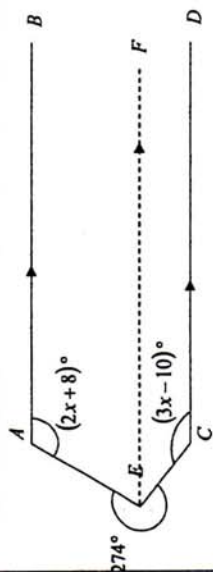
Calculate the value of p.

[2]

End of Paper
Please CHECK your WORK

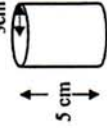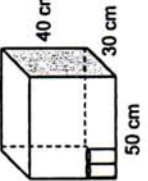## 2016 BNSS 4NA Prelim Exam Mathematics Paper 2 (4045/02)
MARKING SCHEME

Section A

Qn	Suggested Solutions	Marks
1	$3 \times 9.2 \times 10^{-3}$ $= 27.6 \times 10^{-3}$ $= 2.76 \times 10^{-3+1}$ $= 2.76 \times 10^{-2}$ cm	M1 A1
2(a)	Highest temperature is $5.5°C$. Lowest temperature is $-5.6°C$. Difference between the lowest and highest temperature is $5.5°C - (-5.6)°C$ $= 11.1°C$.	B1
2(b)	$\frac{2}{7} + \frac{5}{7} = \frac{7}{7}$ $\frac{7}{7} \div 2$ $= \frac{1}{2}$	B1
3	$274°$ A B $(2x+8)°$ E F $(3x-10)°$ C D Construct a line EF such that $EF//AB//CD$. $\angle AEC = 360° - 274°$ ($\angle s$ at a point) $= 86°$ $\angle BAE + \angle FEA = 180°$ (int $\angle s$ $AB//EF$) $\angle FEC + \angle DCE = 180°$ (int $\angle s$ $EF//CD$) $\therefore (2x+8)° + (3x-10)° + 86° = 360°$ $5x° - 2° + 86° = 360°$ $5x° = 360° - 84°$ $= 276°$ $x = \frac{276}{5}$ $= 55.2$	M1 M1 A1

Qn	Suggested Solutions	Marks
4(a)	$100\% - - - - - \$1850$ $140\% - - - - - \frac{1850}{100} \times 140$ $= \$2\,590$	B1
4(b)	Let the sum of money Rachel invested be $\$P$. $r = 20\%$, $n = 3$, $A = \$1468.80$ $A = P\left(1 + \frac{r}{100}\right)^n$ $1468.80 = P\left(1 + \frac{20}{100}\right)^3$ $1468.80 = P\left(1 + \frac{20}{100}\right)^3$ $1468.80 = 1.728P$ $P = \$850$	M1 A1
4(c)	$S\$1.32 = US\$1$ $S\$1468.80 = \frac{1}{1.32} \times 1468.80$ $= US\$1\,112.727273$ $\approx \$1\,113$ (nearest dollar)	M1 A1
5(a)	$\angle ABC + \angle BCD = 94° + 86°$ $= 180°$ (int. $\angle s$, // lines) $\angle ABC$ and $\angle BCD$ are Interior angles, AB is parallel to DC	B1
5(b)	Sum of int angles of a 5-sided polygon $= (5-2) \times 180°$ $= 540°$ $94° + 94° + 86° + 2a = 540°$ $2a = 540° - 274°$ $2a = 266°$ $a = 133°$	B1

Qn	Suggested Solutions	Marks
7(a)	Accept any one of the following reasons and other reasonable explanation : The vertical axis does not start with '0'. The bar chart seems to illustrate that there are 5 times as many girls than boys.	B1 (either answer is acceptable)
7(bi)	$x = \dfrac{1400}{6000} \times 360°$ $= 84°$	B1
6(bii)	Angle of sector representing chocolate $= 360° - 105° - 84°$ ($\angle s$ at a point) $= 171°$ No. of students who preferred chocolate $= \dfrac{171°}{360°} \times 6000$ $= 2\,850$	M1 A1
6(biii)	No. of boys who preferred chocolate $= \dfrac{2850 - 974}{2}$ $= 938$	M1 A1
7(a)	(see table below)	Total 4 marks : B1: 10, 12 B1: 13, 16 B1: $2(n+1)$. Accept $2n + 2$. B1: $3n + 1$

	1	2	3	4	5	.....	n
No. of stars	1	2	3	4	5	.....	n
No. of circles	4	6	8	10	12	.....	$2(n+1)$
No. of straight lines	4	7	10	13	16		$3n+1$

Qn	Suggested Solutions	Marks
7(b)	$2(n+1) = 103$ $2n + 2 = 103$ $2n = 101$ $n = \dfrac{101}{2} = 50.5$ No, it is not possible to have a pattern in the sequence made from 103 circles because 101 is not divisible by 2.	M1 B1
9(a)	Total surface area $=$ Area of bottom $+$ area of 4 sides $= x^2 + 4 \times \left(x \times \dfrac{3.5}{x^2} \right)$ $= x^2 + 4 \times \left(\dfrac{3.5}{x} \right)$ $= x^2 + \dfrac{14}{x}$ cm² (shown)	M1 B1

Qn	Suggested Solutions	Marks
5(ci)	$\angle AEX = 180° - 133°$ ($\angle s$ on a str. line) $= 47°$ $\angle AXE = 94° - 47°$ (ext. $\angle$ of a Δ) $= 47°$ Since $\angle EAX = \angle AXE = 47°$, therefore ΔAXE is an isosceles Δ. (shown) **OR** $\angle EAX = 180° - 94°$ ($\angle s$ on a str. line) $= 86°$ $\angle AXE = 180° - 133°$ ($\angle s$ on a str. line) $= 47°$ $\angle AXE = 180° - 86° - 47°$ ($\angle$ sum of Δ) $= 47°$ Since $\angle EAX = \angle AXE = 47°$, therefore ΔAXE is an isosceles Δ. (shown)	B1
5(cii)	Area of ΔAXE $= \dfrac{1}{2} \times 7 \times 7 \times \sin(180° - 94°)$ $= 24.44031923$ $= 24.4$ cm²	M1 A1
6(ai)	$3ax - 9ay - 4bx + 12by$ $= 3a(x - 3y) - 4b(x - 3y)$ $= (3a - 4b)(x - 3y)$	M1 A1
6(aii)	$6x^2 - 28x - 10$ $= 2[3x^2 - 14x - 5]$ $= 2(3x + 1)(x - 5)$ *Minus 1 mark if not factorised completely Such as $(6x + 2)(x - 5)$ or $(3x + 1)(2x - 10)$ cross method: $3x +1 \mid +x$; $x -5 \mid -15x$; $3x^2 -5 \mid -14x$	M1 M1 (show cross method working) A1
6(b)	$p = a + \dfrac{bv^2}{k}$ $\dfrac{bv^2}{k} = p - a$ $bv^2 = k(p - a)$ $v^2 = \dfrac{k(p - a)}{b}$ $v = \pm\sqrt{\dfrac{k(p - a)}{b}}$ *Minus 1 mark if $\pm$ is omitted	M1 A1

Qn.	Suggested Solutions	Marks
10(bi)	Diameter = 6cm Height = 5 cm **Type A packing (vertical):** Length : $6cm \times 8 = 48cm$ Width : $6cm \times 5 = 30cm$ Height : $5cm \times 8 = 40cm$ Total no. of candles $= 8 \times 5 \times 8$ $= \underline{320 \text{ candles}}$ **Type B packing (horizontal):** Length : $6cm \times 8 = 48cm$ Width : $5cm \times 6 = 30cm$ Height : $6cm \times 6 = 36cm$ Total no. of candles $= 8 \times 6 \times 6$ $= \underline{288 \text{ candles}}$ Since Type A packing is able to pack 320 candles more than Type B packing with 288 candles, therefore, the shop owner should use <u>Type A packing</u> in order to minimise the empty space left in the carton.	M1 M1 A1
10(bii)	Volume of carton $= 50 \times 30 \times 40$ $= 60\ 000$ cm³ Volume of 320 candles $= \pi (3)^2 (5) \times 320$ $= 14\ 400\pi$ cm³ Volume of the empty space left in the carton after packing the candles in the carton $= 60\ 000 - 14\ 400\pi$ $= 14\ 761.06579$ $= 14\ 761$ cm³ (nearest whole number)	M1 : show both volume. A1
	Section B	
11(a)	Bearing of H from $A = 360° - (180° - 42°)$ $= 222°$	B1
11(bi)	Using cosine rule, $HL^2 = 4.5^2 + 2.8^2 - 2(4.5)(2.8)\cos 115°$ $HL = \sqrt{4.5^2 + 2.8^2 - 2(4.5)(2.8)\cos 115°}$ $HL = 6.224144937$ $HL = 6.22$ km (3 sig. fig.)	M1 M1 A1

Qn.	Suggested Solutions	Marks
9(bi)	$m = 11.85$	B1
9(bii)	See graph on the last page	**3 marks:** 1 mark : correct axes and scales drawn, graph labelled 1 mark: Correct shape of a smooth graph 1 mark: All 8 points plotted and joined by smooth curve
9(biii)	Gradient of the curve at the point $= -7.32 \ (\pm 0.5)$	**2 marks :** 1 mark: tangent correctly drawn at $x=1.2$. 1 mark: gradient allow ± 0.5
9(biv)	From minimum value of A, height of the box for which the least amount of metal is used = 1.9 m.	B1
10(a)	Use similar solids concept. Let the height of the 750 cm³ candle be h cm. $$\frac{V_2}{V_1} = \left(\frac{h_2}{h_1}\right)^3$$ $$\frac{750}{500} = \left(\frac{h}{24}\right)^3$$ $$\left(\frac{h}{24}\right)^3 = \frac{750}{500}$$ $$\frac{h}{24} = \sqrt[3]{\frac{750}{500}}$$ $$h = \sqrt[3]{\frac{750}{500}} \times 24$$ $= 27.473141$ $= 27.5$ cm (3 sig. fig) <u>less than 35 cm</u> (height of bookshelf) ∴ The 750 cm³ candle can fit into her shelf.	M1 M1 A1

Qn	Suggested Solutions	Marks
11(bii)	Area of triangle $HAL = \dfrac{1}{2}(4.5)(2.8)\sin 115°$ $= 5.709739058$ $= 5.71 \text{ km}^2$ (3 sig. fig.)	M1 A1
11(ci)	$\sin(180° - 115°) = \dfrac{\text{Shortest distance}}{2.8}$ Shortest distance $= 2.8\sin 65°$ $= 2.537661804$ $= 2.54 \text{ km}$ (3 sig. fig.)	B1
11(cii)	Time taken $= \dfrac{4.5 \times 1000}{3} = 1500$ seconds $= 25$ minutes The boat left the harbour at 0650.	B1
12(ai)	Median $= 64.2$	B1
12(aii)	Interquartile range (Ernest) $= 64.5 - 63.6$ $= 0.9$	M1 A1
12(aiii) (a)	Number of "unsatisfactory" sessions $= 80 - 30$ $= 50$	B1
12(aiii) (b)	Percentile $= \dfrac{50}{80} \times 100\% = 62.5\%$	B1
12(b)	Interquartile range (Ethan) $= 64 - 62.5 = 1.5$ <u>Ernest</u> is a more consistent runner with a <u>lower interquartile range of</u> <u>0.9 as compared with Ethan.</u>	B1 *Ethan's IQR must be calculated, show comparison of values, to be awarded B1
12(c)	Probability that it does not rain on any one day of the training sessions $= \sqrt{\dfrac{49}{100}} = \dfrac{7}{10}$ Probability that it will rain on any of the training sessions $= 1 - \dfrac{7}{10}$ $= \dfrac{3}{10}$ or 0.3 **OR** $(1-p)(1-p) = \dfrac{49}{100}$ $(1-p)^2 = \dfrac{49}{100}$ $1-p = \dfrac{7}{10}$ $p = 1 - \dfrac{7}{10} = \dfrac{3}{10}$	M1 A1
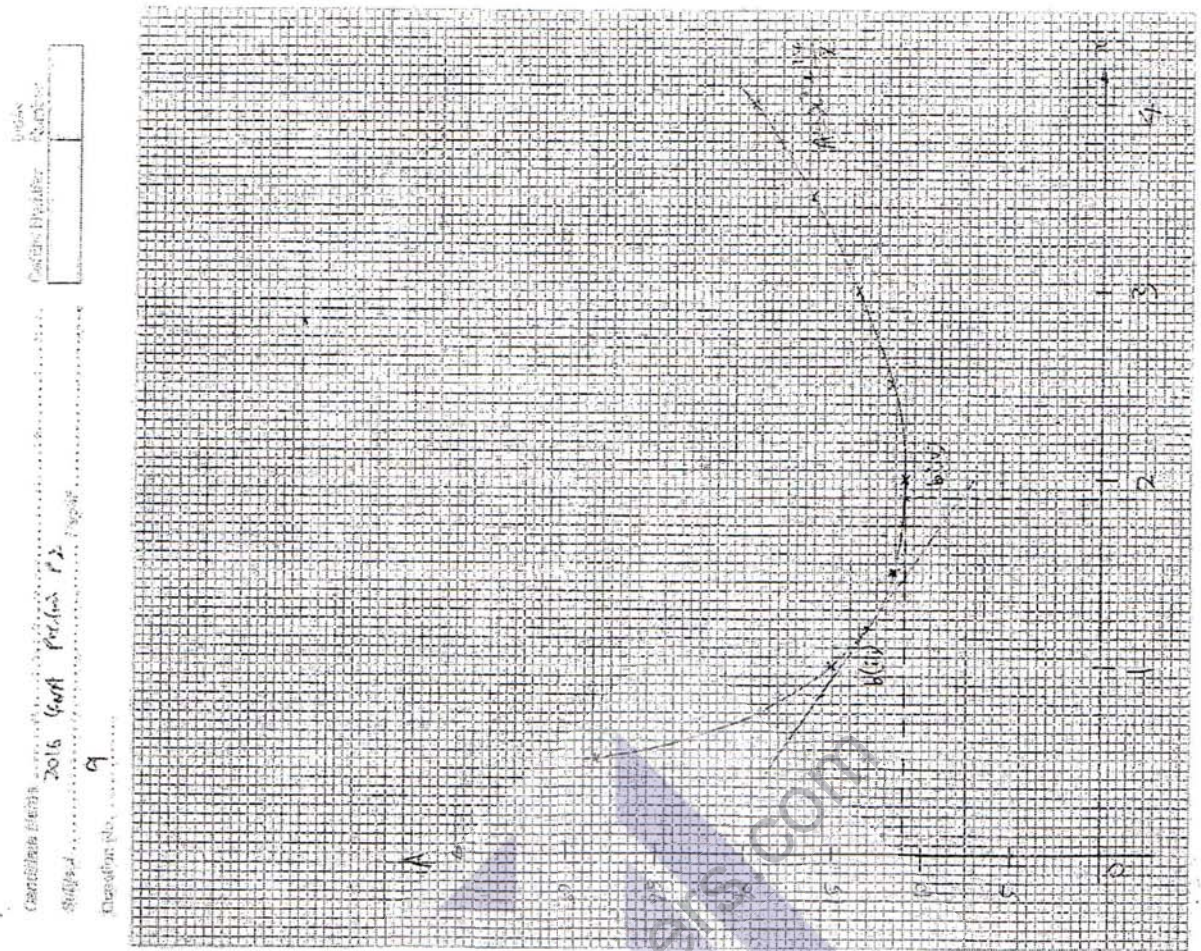
CANBERRA SECONDARY SCHOOL

2016 Preliminary Examination 1

Secondary Four Normal (Academic)

MATHEMATICS
Paper 1 (4045/01)

3rd August 2016
2 hours
0800 – 1000 h

Name: _____ ( )   Class: _____

READ THESE INSTRUCTIONS FIRST

Write your full name, class and index number on all work you hand in.

Write in dark blue or black pen on both sides of the paper.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** the questions.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

Calculators should be used where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 80.

FOR MARKER'S USE		
	Marks Awarded	Max Marks
Total		80

This question paper consists of **18** printed pages including the cover page.

Mathematical Formulae

Compound Interest

$$\text{Total amount} = P\left(1 + \frac{r}{100}\right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Area of a triangle } ABC = \frac{1}{2}ab\sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

Answer **all** the questions.

1 (a) Evaluate $\dfrac{34.8 - 4.3^2}{2.7 \times \sqrt{5}}$, giving your answer correct to 3 decimal places.

Answer (a) .... [1]

(b) The distance between Singapore and Hong Kong is 2581 km.
Write 2581 to the nearest hundred.

Answer (b) ....km [1]

2 (a) Written as a product of its prime factors, $660 = 2^2 \times 3 \times 5 \times 11$.
Write 198 as a product of its prime factors.

Answer (a) .... [1]

(b) The highest common factor of $198n$ and 660 is 132.

Find the smallest value of n.

Answer (b) .... [2]

3 (a) Express 83 billion in standard form.

Answer (a) ....…...…................... [1]

(b) By rounding each number to 1 significant figure, estimate the value of

$$\frac{54.13 \times 8.06}{2.95 + 7.09}$$

Answer (b) ….......................... [2]

4 An athlete is running at a speed of 10 m/s.
Find his speed in kilometres per hour.

Answer ....…..............km/h [2]

5 A map is drawn to a scale of 1 : 400 000.
(a)Two towns are joined by a 28 km expressway.
Find the length of the expressway, in cm, on the map.

Answer (a) ……………………..…….… cm [1]

(b) The area of a farm on the map is 3.5 cm².
Calculate the actual area of the farm in km².

Answer (b) …………………………….. km² [2]

6 Solve the equation $(3x-1)(4x-7)=10$, giving your answers correct to 2 decimal places.

Answer $x =$………... or ……………..…… [3]

Canberra Secondary School
Preliminary Examination 2 (2016)
Secondary Four Normal Academic
Mathematics Paper 1
[Turn Over

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7 Thomas and Sandra each have $15000 to invest for 3 years.

(a) Sandra invests it at 6.5% simple interest per year. Calculate the total interest that Sandra will earn at the end of 3 years.

Answer (a) $.............................. [1]

(b) Thomas invests it at 8% compound interest per year. Calculate the total interest that Thomas will earn at the end of 3 years.

Answer (b) $.............................. [2]

8 During a sale, Andy paid $360 for a camera which was originally priced at $500. Calculate the percentage discount he received.

Answer ....% [2]

9 Three bus services start operating at 5.30 am from Ang Mo Kio Bus Interchange. Service 145 leaves every 6 minutes, Service 159 leaves every 8 minutes and Service 232 leaves every 9 minutes.

Find the time when the three buses next leave the interchange together.

Answer .... [3]

10 In the diagram, PQ is a tangent to the circle at P. R and S lie on the circumference of the circle, centre O where RS is the diameter and RSQ is a straight line. Given that ∠SPQ = 32°, calculate
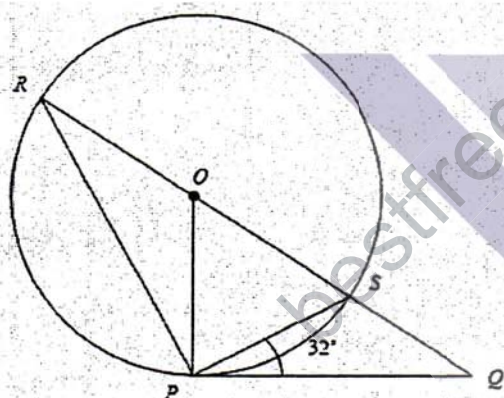
(a) ∠PRS

Answer (a) ∠PRS =.............................° [2]

(b) ∠PQR

(b) ∠PQR =.............................° [2]

11 Jack buys 5 pens and 8 erasers and total cost is $11.10. Joel buys 2 pens and 10 erasers and the total cost is $7.50.

Pens cost x cents each and erasers cost y cents each.

The cost of the Jack's stationaries is shown by the equation $5x + 8y = 1110$.

The cost of Joel's stationaries is shown by the equation $2x + 10y = 750$.

Solve the simultaneous equations to find the cost of each pen and each eraser.

$$5x + 8y = 1110$$
$$2x + 10y = 750$$

Answer x = ...

y = ... [3]

12 A pear producer weighs a sample of 100 pears from one of his trees (A).

The mean mass of pears from tree (A) is 117.8 g and the standard deviation is 6.32 g.

The producer also weighs a sample of pears from a second tree (B).
The mean mass is 115.6 g and the standard deviation is 6.42 g.

(a) Which tree has the lighter pears on average? Give a reason for your answer.

Answer (a)

....

....

....[2]

(b) Which tree has pears which are more consistent in mass? Give a reason for your answer.

Answer (b)

....

....

....[2]

Canberra Secondary School   Secondary Four Normal Academic
Preliminary Examination 2 (2016)   Mathematics Paper 1   **[Turn Over**

67

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13 Each figure in the sequence below consists of a number of diamonds.

Figure 1   **Figure 2**   **Figure 3**

(a) Complete the table below.

Figure number	1	2	3	4	5
Number of diamonds	5	7	9	11	

[1]

(b) Write down an expression, in terms of n, for the number of diamonds in Figure n.

Answer (b) .... [1]

(c) Is it possible for a figure to have 120 diamonds? Explain clearly.

Answer (c)

....

....

....[2]

14 The graph cuts the x-axis at A and B and the y-axis at C.

$y = (x + 1)(x - 2)$
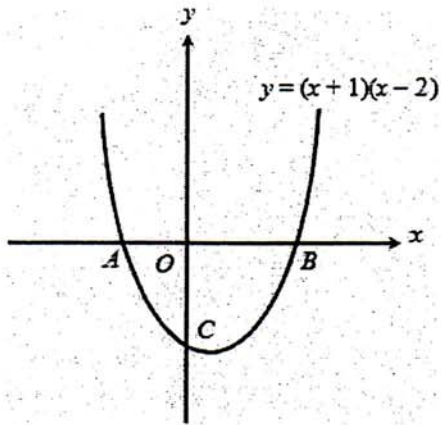
(a) Find the coordinates of A, B and C

Answer (a)   A (............, ...) [1]

B (............, ...) [1]

C (............, ...) [1]

(b) State the equation of the line of symmetry.

Answer (b) .... [1]

15 A bag contains of 4 red discs, 5 black discs and 2 yellow discs. A disc is drawn at random from the bag.

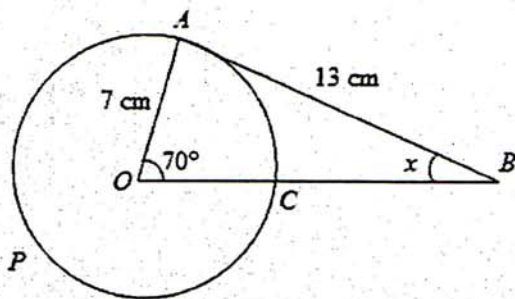**(a)** Write down the probability that a yellow disc is drawn.

Answer (a) .... [1]

(b) How many red discs must be added so that the probability of getting a red disc is 0.75.

Answer (b) .... [2]

16 In the figure below, *O* is the centre of the circle, *AB* is tangent to the circle at *A*, and *P* is a point on the circle.

(a) Explain why **triangle ABO** is a right angled triangle.

Answer (a)

....

....[1]

(b) Find ∠*x*.

Answer (b) ∠*x* = ...° [2]

(c) Find the length of *OB*.

Answer (c) ....cm. [1]

(d) Find the area of the major sector *APCO*.

Answer (d) ....cm² [2]

17 In the diagram, $AB = 80$ m, $BK = 50$ m, $\angle ABC = 50°$ and $\angle ACB = 80°$
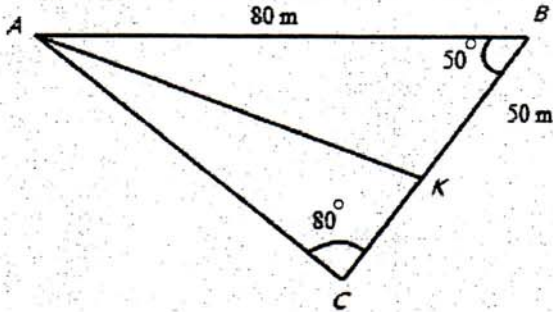
Calculate

(a) AC,

Answer (a) ....m [2]
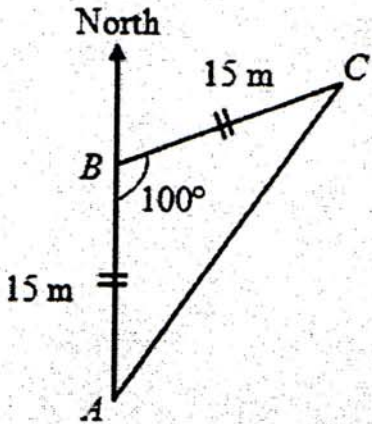
(b) AK.

Answer (b) ....m [2]

(c) A tower of 40 m height stands at point A. What is the angle of elevation to the top of the tower from point K.

Answer (c) ....° [2]

18 A, B and C are three cars in the corners of a car park. A is due south of B. Given that AB = BC = 15 m, calculate

(a) the bearing of C from A.

Answer (a) ....° [2]

(b) the bearing of A from C,

Answer (b) ....° [2]

(c) the area covered by the cars A, B and C.

Answer (c) ....m² [2]

19 In the diagram (not drawn to scale) below, *O* is the centre of the circle. *QS* is the diameter of the circle, ∠*OQP* = 15° and ∠*SOR* = 150°.
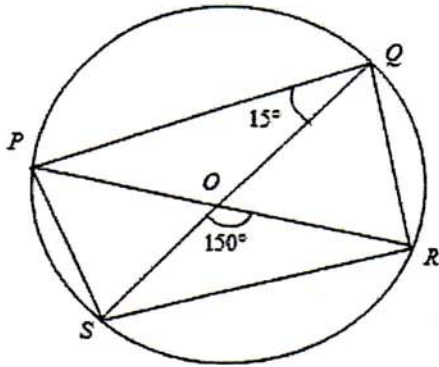
(a) ∠*QRS* is 90°. Identify another angle that is 90°

Answer (a) ....° [1]

(b) Find

(i) ∠*ORS*,

Answer (b) ....° [1]

(ii) ∠*SPO*.

Answer (b) ....° [1]

(c) Is *PQ* parallel to *SR*? Explain your answer.

Answer (c) .... [1]

20 In the diagram below, *BE* is parallel to *CD*.
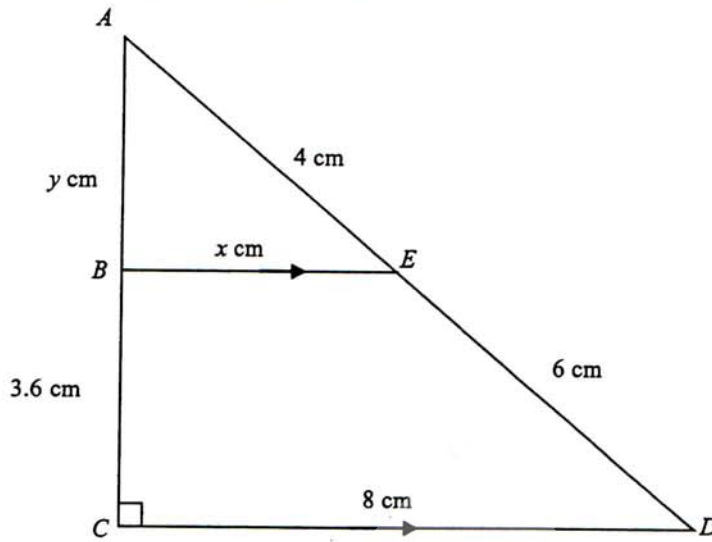
(a) State the pair of similar triangles.

Answer (a) △.................and △............. [1]

(b) Find the value of

(i) *x*,

Answer (b)(i) .... cm [2]

(ii) *y*.

Answer (b)(ii) .... cm [2]

21 The diagram below shows three sides of a regular polygon.
Each interior angle of the polygon is 162˚.
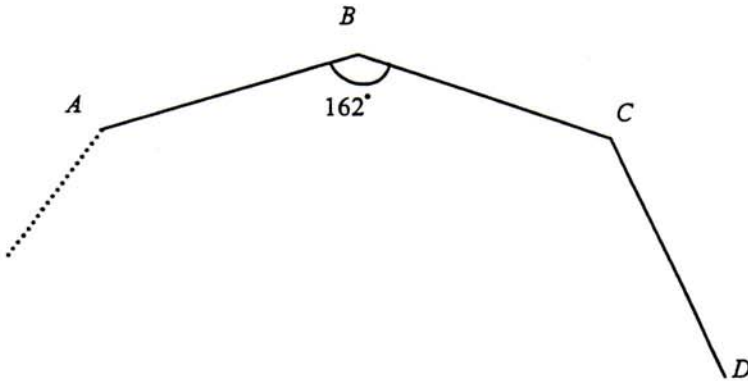
(a) Calculate ∠BAC.

Answer (a) ....˚ [2]

(b) How many sides does the polygon have?

Answer (b) .... [2]

22 **(a)** Solve the inequality $6(3x+4) > 10(2x-1)$.

Answer (a) .... [2]

(b) Hence, write down the largest prime number, which satisfy $6(3x+4) > 10(2x-1)$

Answer (b) .... [1]

-End of Paper-

CANBERRA SECONDARY SCHOOL

2016 Preliminary Examination 2

Secondary Four Normal Academic

MATHEMATICS
Paper 2 (4045/02)

5 August 2016
2 hours
0800 – 1000h

Name: _____ ( ) Class: _____

READ THESE INSTRUCTIONS FIRST

Write your full name, class and index number on all work you hand in.

Write in dark blue or black pen on both sides of the paper.

You may use a HB pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer all the questions.

Section B
Answer **one** question.

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 60.

The use of an approved scientific calculator is expected, where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For π, use either your calculator value or 3.142.

At the end of the examination, fasten all your work securely together.

FOR MARKER'S USE		
	Marks Awarded	Max Marks
Total		60

Mathematical Formulae

Compound interest

Total amount $= P\left(1+\dfrac{r}{100}\right)^n$

Mensuration

Curved surface area of a cone $= \pi r l$

Surface area of a sphere $= 4\pi r^2$

Volume of a cone $= \dfrac{1}{3}\pi r^2 h$

Volume of a sphere $= \dfrac{4}{3}\pi r^3$

Area of triangle $ABC = \dfrac{1}{2}ab\sin C$

Arc length $= r\theta$, where θ is in radians

Sector area $= \dfrac{1}{2}r^2\theta$, where θ is in radians

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

This question paper consists of **8** printed pages including the cover page.

Answer all the questions.
(52 marks)

1   A lorry travels for $1\frac{3}{4}$ hours at 55 km/h. It then travels another 196 km in
    2 hours 15 minutes. Find the average speed for the whole journey.   [2]

2   On the number line, the values are equal distance apart. Find the fractions a,
    b and c.

$$1\frac{1}{2} \qquad a \qquad b \qquad c \qquad 2\frac{1}{4}$$

[2]
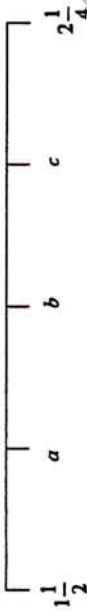
3   Alex had $50 000. He went on a trip to Japan which cost him 200 000 Yen.
    The exchange rate was $1 = 74.83 Yen.

    Calculate the amount Alex had left after paying for the holiday. Give your
    answer in dollars to the nearest dollar.   [2]

4   (a)   Simplify $\dfrac{5c^3}{4d^2} + \dfrac{20c^2}{d}$.   [2]

    (b)   Express the following as a single fraction in the simplest form
          $\dfrac{3}{5} - \dfrac{p-2}{3p}$.   [2]

    (c)   Given that $n = \sqrt{\dfrac{3gh}{7}}$, make g the subject of the formula.   [2]

5   (a)   Solve $2x^2 - 3x - 5 = 0$.   [2]

    (b)   Hence or otherwise, solve $2(3y-2)^2 - 3(3y-2) = 5$.   [3]

6   (a)   Simplify $m^{-\frac{1}{3}} \times m^{\frac{4}{5}} + m^{\frac{1}{15}}$.   [1]

    (b)   Given that $2^f = 4^5 \times 16^3$, find f.   [2]

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7   The bar chart below shows the number of visitors to Science center.
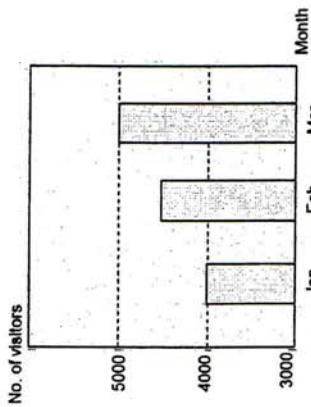
    (a)   Melissa says, "The number of visitors in March is twice the number of
          visitors in January".

          Do you agree with Melissa? Explain your answer.   [1]

    (b)   The pie chart shows the visitors to Science center in April.

          (i)   Calculate x.   [2]

          (ii) State the modal visitor.   [1]

8 A park P, an MRT Station T and a school S are located at the vertices of triangle PTS where PT = 1000 m, PS = 1200 m and $\angle$PTS = 70°.

(a) Using a scale of 1 cm to represent 100 m, construct an accurate scale drawing of the triangle PTS. Measure and write down the actual length of TS. [3]

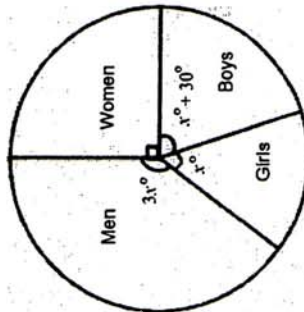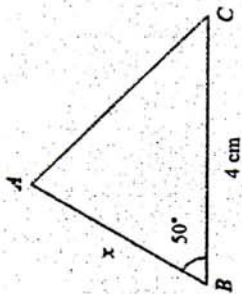(b) Draw the angle bisector of $\angle$PTS. [1]

(c) A bus stop is located inside the triangle PTS. It is 600 m from T and equidistant from PT and TS. Mark and label clearly with the letter B, the position of the bus stop. [2]

9 The diagram shows a triangle ABC. BC is 4 cm and $\angle$ABC = 50°.

(a) Given that AB = x cm, write down an expression, in terms of x, for the area of $\triangle ABC$. [1]

(b) Given that the area of $\triangle ABC$ is 9.2 cm². Find x. [2]

(c) Find the perimeter of $\triangle ABC$. [3]

10 The quadrilateral PQRS is a parallelogram. P is (–2, 2), Q is (–2, –2) and S is (3, –1).
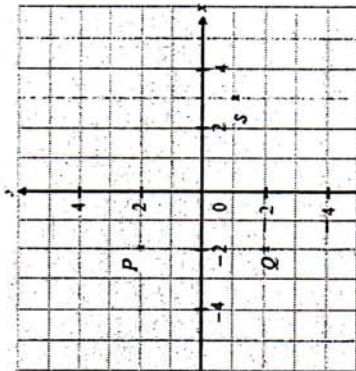
(a) State the coordinate of R. [1]

(b) Find the equation of line PS. [3]

(c) Find the length of line QS. [2]

(d) Find the area of parallelogram PQRS. [2]

11 **Answer the whole of this question on a sheet of graph paper.**

The variables x and y are connected by the equation $y = 3 - \dfrac{6}{x}$. Some of the corresponding values are shown in the table below.

x	1	2	3	4	5	6	7	8
y	–3	0	1	p	1.8	2	2.14	q

(a) Find the value of p and q. [2]

(b) Using a scale of 2 cm to represent 0.5 unit on the y-axis and 2 cm to represent 1 unit on the x-axis, draw the graph of $y = 3 - \dfrac{6}{x}$ for $1 \le x \le 8$. [3]

(c) Use the graph to find the value of x when y = 2. [1]

(d) By drawing a tangent, calculate the gradient of the graph at the point x = 2.5, giving your answer to two decimal places. [2]

Section B (8 marks)
Answer one question from this section. Each question carries 8 marks.

12 A cylindrical container is used to contain scented oil. The radius of the cylinder is 12 cm and $720\,\pi\ \text{cm}^3$ of scented oil is needed to fill up the container entirely.

(a) Find the height of the cylindrical container. [2]

(b) A conical cover is placed on top of the container as shown in the figure below and made into an oil diffuser. The ratio of the height of the cone to the height of the cylinder is 5 : 2.
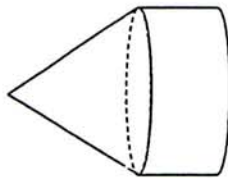
(i) Find the surface area of the oil diffuser. [4]

(ii) Jack had purchased the oil diffuser. During Christmas, he wanted to paint the diffuser into gold colour. Two brands of paint are available as shown in the table below.

Given that 1 ml of paint can cover 10 cm² area.

Brand	CoolPaint	ShiokPaint
Volume of paint per container	50 ml	100 ml
Price per container	$1.40	$2.00

Which brand of paint will be more value for money? Show your working. [2]

13 The cumulative frequency curve below illustrates the marks scored, out of 100, by 200 students in the end-of-year examinations.
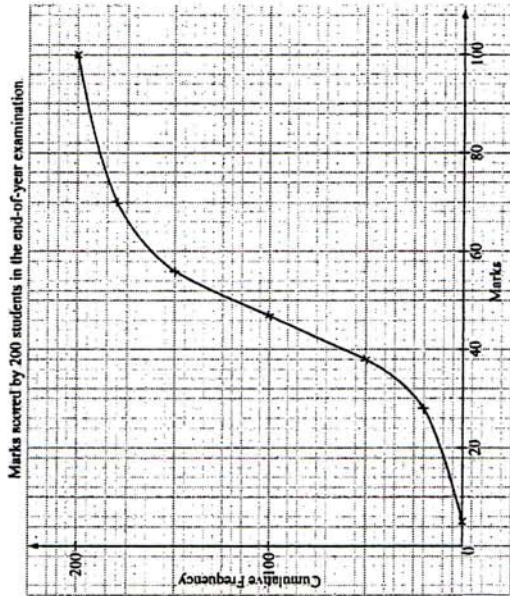
(a) Use the graph to find

(i) the median mark, [1]

(ii) the 60th percentile, [1]

(iii) the interquartile range [2]

(b) Given that 20% of the students score grade A in the examination, use the graph to find the minimum mark for grade A. [2]

(c) The probability that a student pass one subject is p. The probability that a student fail 2 subjects is 0.36.

Calculate the value of p. [2]

— End of Paper —

No.	Working	Marks
1	Total distance = $1\frac{3}{4} \times 55 + 196 = 292.25$ km	M1
	Avg speed = $292.25/4$ = 73.1 km/h	A1
2	$a = 1\frac{11}{16}$ $b = 1\frac{7}{8}$ $c = 2\frac{1}{16}$	B1 for any 2 Must be fraction
3	200 000 yen = \$2672.72	M1
	Amount left = 50 000 − 2672.72 = \$47327.28 ≈ \$47327	A1
4a	$\dfrac{5c^3}{4d^2} \div \dfrac{20c^2}{d}$	M1
	$= \dfrac{5c^3}{4d^2} \times \dfrac{d}{20c^2}$	
	$= \dfrac{c}{16d}$	A1
b	$\dfrac{3}{5} - \dfrac{p-2}{3p}$	M1
	$= \dfrac{9p - 5(p-2)}{15p}$	
	$= \dfrac{4p+10}{15p}$	A1
c	$n = \sqrt{\dfrac{3gh}{7}}$	M1
	$n^2 = \dfrac{3gh}{7}$	
	$g = \dfrac{7n^2}{3h}$	A1
5a	$\begin{array}{c|cc} & 2x & -5 \\ \hline x & & 1 \\ & 2x^2 & -5 \\ & -5x & 2x \\ & 2x^2 & -3x \end{array}$	M1
	$2x^2 - 3x - 5 = 0$	
	$(2x-5)(x+1) = 0$	
	$x = \dfrac{5}{2}$ or $x = -1$	A1

No.	Working	Marks
b	$x = \dfrac{5}{2}$ or $x = -1$	M1
	Let $x = 3y - 2$	
	$3y - 2 = \dfrac{5}{2}$ $3y - 2 = -1$	
	$y = \dfrac{3}{2}$ or $y = \dfrac{1}{3}$	A1, A1
6a	$m^{-\frac{1}{3}} \times m^{\frac{4}{5}} + m^{15} = m^{\frac{2}{5}}$	B1
b	$2^f = 4^5 \times 16^3$	M1
	$2^f = 2^{10} \times 2^{4\times3}$	
	$f = 10 + 12 = 22$	A1
7a	No. The y-axis did not start from zero. Or March = 5000, Jan = 4000	B1
bi	$3x + x + x + 30 + 90 = 360$	M1
	$5x = 240$	
	$x = 46$	A1
ii	Men	B1
9a	$\dfrac{1}{2}(x)(4)\sin 50° = 2x\sin 50°$	B1
b	$2x\sin 50° = 9.2$	M1
	$x = 6.00$	A1
c	$AC^2 = 6^2 + 4^2 - 2(6)(4)\cos 50°$	M1
	$AC^2 = 21.146$	
	$AC = 4.60$	M1
	Perimeter = 4.6 + 4 + 6 = 14.6 cm	A1
10a	(3, −5)	B1
b	Grad PS = $\dfrac{2-(-1)}{-2-3}$	M1
	$= -\dfrac{3}{5}$	

	$y = -\dfrac{3}{5}x + c$	
	Sub $x = 3, y = -1$	
	$-1 = -\dfrac{3}{5}(3) + c$	M1
	$c = \dfrac{4}{5}$	
	$y = -\dfrac{3}{5}x + \dfrac{4}{5}$	A1
c	Length QS = $\sqrt{5^2 + 1^2}$	M1
	$= \sqrt{26}$	
	$= 5.10$ (to 3 sf)	A1
d	Area = 5×4	M1
	$= 20\,unit^2$	A1
12a	$\pi(12)^2 h = 720\pi$	M1
	$h = 5cm$	A1
bi	Height of cone = $\dfrac{5}{2} \times 5 = 12.5cm$	M1
	Slant height of cone = $\sqrt{12.5^2 + 12^2}$	
	$= 17.3277$	M1
	Surface area =	
	$\pi(12)(17.3277) + 2\pi(12)(5) + \pi(12^2)$	M1
	$= 1482.62 cm^2$	
	$\approx 1480 cm^2$	A1
bii	Amount of paint needed = 148.3 ml	M1 – show all calculations
	3 coolpaint = \$1.40 x 3 = \$4.20	
	2 shiokpaint = \$2.00 x 2 = \$4.00	
	Jack should buy shiokpaint as it's cheaper.	A1
13ai	47 marks	B1
ii	50 marks	B1
iii	56 – 38	M1
	= 18 marks	A1
b	20% = 40 students	M1
	From graph, minimum mark = 59	A1
c	$\sqrt{0.36} = 0.6$	M1
	$p = 1 - 0.6 = 0.4$	A1

Solutions (Qn 6–11)

Qn.	Solutions/Answers	Marks Allocation
6	$(3x-1)(4x-7)=10$ $12x^2-21x-4x+7=10$ $12x^2-25x+7=10$ $12x^2-25x-3=0$ $x = \dfrac{-(-25)\pm\sqrt{(-25)^2-4(12)(-3)}}{2(12)}$ $x = 2.20$ or -0.114	M1 B1 for each value of B1
7(a)	$I = \dfrac{PRT}{100} = \dfrac{15000\times6.5\times3}{100} = \$2925$	M1 A1
7(b)	$A = P(1+\dfrac{r}{100})^3 = 15000(1+\dfrac{8}{100})^3$ $= \$18895.68$ Interest $= \$18895.68 - \$15000 = 3895.68$	M1 B1
8	% discount $= \dfrac{500-360}{500}\times100$ $= 28\%$	M1 A1
9	LCM of 6, 8 and 9 $= 2\times3\times1\times4\times3$ $= 72$ min $= 1$hr 12 min $0530 + 1$hr 12min $= 0642$	M1 A1 B1
10(a)	OPS $= 90-32 = 58$ OPR $= 90-58 = 32$ PRS $= 32°$ (Iso Triangle)	M1 A1
10(b)	PQR $= 180 - 32 - (90+32)$ $=26°$	M1 A1
11	$5x + 8y = 1110$ $2x + 10y = 750$	M1 B1 for each x

Solutions to 4NA Prelim 2 Paper 1

Qn.	Solutions/Answers	Marks Allocation
1(a)	2.702	B1
1(b)	2600	B1
2(a)	$198 = 2\times3^2\times11$	B1
2(b)	$198\,n = 2\times3^2\times11\times n$ $660 = 2^2\times3\times5\times11$ $132 = 2^2\times3\times11$ $n = 2$	M1 A1 B1
3 (a)	82 billion $= 83\times10^9$ $= 8.3\times10^{10}$	M1
3 (b)	$\dfrac{54.13\times8.06}{2.95+7.09} = \dfrac{50\times8}{3+7}$ $= \dfrac{400}{10} = 4$	A1
4	$10m = 1s$ $\dfrac{10}{1000}\ km = \dfrac{1}{3600}\ hr$ $\dfrac{10}{1000}\times3600km = 1hr$ $36km = 1hr$	M1 A1
5(a)	1 : 400 000 1cm : 4km ¼ x 28 : 28 km 7cm : 28 km	B1
(b)	1cm² : 4 x 4 km² 1cm² : 16 km² 3.5 cm² : 16 x 3.5 = 56 km²	M1 A1

Qn	Working	Marks
	and y answer.	M1 / B1 / M1
	$10x + 16y = 2220$	
	$10x + 50y = 3750$	
	$50y - 16y = 3750 - 2220$	
	$34y = 1530$	
	$y = 45$	
	$2x + 10(45) = 750$	
	$2x = 750 - 450$	
	$x = 150$	
12 (a)	Tree B.	B1
	The mean weight of pears from Tree B is lighter/lesser than from Tree A. Or any similar explanation.	B1
12(b)	Tree A.	B1
	The SD of the pear from tree A is smaller/less spread than tree B.	
	Or any similar explanation	B1
13(a)	13	B1
13(b)	$2n + 3$	B1
13(c)	No	B1
	120 is even number while total number of diamonds would be odd number.	
14(a)	A(-1, 0)	B1 each
	B(2, 0)	
	C(0, -2)	
14(b)	$x = 1/2$	B1
15(a)	2/11	B1
15(b)	$\frac{x+4}{11+x} = \frac{75}{100}$	M1
	$100x + 400 = 825 + 75x$	
	$25x = 425$	A1
	$x = 17$	
16(a)	Tangent to a circle form right angle	B1
16(b)	$x = 180 - 90 - 70 = 20°$	B1

Qn	Working	Marks
16(c)	$OB^2 = OA^2 + AB^2 = 13^2 + 7^2$	M1
	$OB^2 = 218$	
	$OB = 14.8cm$	B1
16(d)	$Area = \frac{290}{360} \times \pi r^2$	M1
	$Area = \frac{290}{360} \times \pi (7)^2$	
	$= 124cm^2$	A1
17(a)	$\frac{AC}{\sin 50} = \frac{80}{\sin 80}$	M1
	$AC = 62.2\ m$	A1
17(b)	$AK^2 = 80^2 + 50^2 - 2(80)(50)\cos 50$	M1
	$AK = 61.3\ m$	A1
17(c)	$\tan x = \frac{40}{61.3}$	M1
	$x = 33.1°$	A1
18(a)	$Angle = \frac{180 - 100}{2} = 40°$	M1
	$Bearing = 40°$	A1
18(b)	$Angle = 40 + 180$	M1
	$= 220°$	
	$Bearing = 220°$	A1
18(c)	$Area = \frac{1}{2} ab \sin c$	M1
	$= \frac{1}{2} \times 15 \times 15 \times \sin 100$	
	$= 111 m^2$	A1

19(a)	SPQ /QPS	B1
19(b)(i)	15° (isos. Δ)	B1
19(b)(ii)	$\angle SPO = 75°$ (angle in same segment)	B1
19(c)	Yes, they are parallel. $\angle PQO = \angle OSR = 15°$ (alt. angle)	No mark given if no workings/explaination on given B1
20(a)	ΔABE is similar to ΔACD	B1
20(b)(i)	$\frac{x}{8} = \frac{4}{10}$ $x = 3.2$ cm	M1 A1
20(b)(ii)	$\frac{y}{y+3.6} = \frac{4}{10}$ $y = 2.4$	M1 A1
21(a)	$\angle BAC = (180° - 162°) \div 2$ $= 9°$	M1 A1
21(b)	Exterior angle $= 180° - 162° = 18°$ Number of Sides $= 360° \div 18° = 20$	M1 A1
22(a)	$6(3x+4) > 10(2x-1)$ $18x+24 > 20x-10$ $34 > 2x$ $17 > x$	M1 A1
22(b)	$x = 13$	B1

85

DEYI SECONDARY SCHOOL

Preliminary Examination 2016
Secondary Four Normal Academic

MATHEMATICS

4045/01

Paper 1

12 August 2016
1040 – 1240h
2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.

If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
The total number of marks for this paper is **80**.

The use of an approved scientific calculator is expected, where appropriate.
If the degree of accuracy is not specified in the question and if the answer is not exact, give the answer correct to **3 significant figures**. Give answers in degrees to **1 decimal place**.
For π, use either your calculator value or 3.142.

For Examiner's Use
80

This document consists of **18** printed pages including the cover page. **[Turn over**

Mathematical Formulae

Compound Interest

$$\text{Total amount} = P\left(1 + \frac{r}{100}\right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2}ab\sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

Answer **all** the questions.

1   (a)   Find $\dfrac{320.5 \times 0.98}{0.321}$.

Write down all the figures on your calculator display.

Answer ...…..……….....…….......... [1]

(b)   Write your answer to **(a)** correct to 6 significant figures.

Answer .....…...….....……......... [1]

2   Draw on the grid, an enlargement, scale factor $1\frac{1}{2}$, of the figure below.
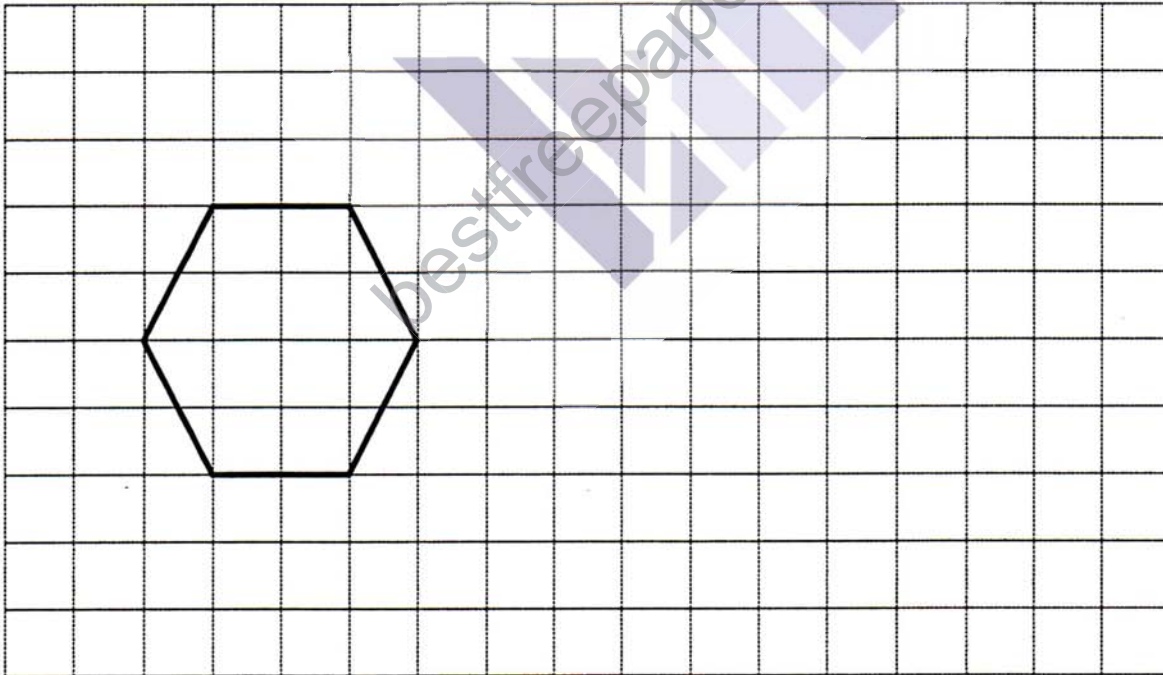
[2]

[Turn over

3   (a)   Calculate $\dfrac{1.5+\pi}{\sqrt{6}\times 9.82}$, giving your answer to 4 decimal places.

Answer .... [1]

(b)   The ethnic composition of resident population in Singapore is shown in the table below.

Ethnic Composition of resident population

Ethnic Group	Percentage %
Chinese	74.4
Malays	13.3
Indians	9.1
Others	3.2

Express the ratio of Chinese to the resident population in its lowest terms.

Answer .... : .... [1]

4   Solve

(a) $-\dfrac{p}{5}\leq 2$,

Answer .... [1]

(b) $-5(3-7x)=0$.

Answer $x=$............................... [1]

5

> **Pancake Recipe**
>
> 130 g all-purpose flour, (spooned and levelled)
> 30 g sugar
> 10 g baking powder
> 2.5 g teaspoon salt
> 130 ml milk
> 30 g unsalted butter, melted
> 1 large egg
> 14 ml vegetable oil
>
> Makes 15 pancakes

Given that 1 block of butter = 150 g, calculate how many blocks of butter does Martha need to buy to make 85 pancakes?

Answer … … … … … … … … blocks [2]

6   Max rides to school on his bicycle at an average speed of 45 km/h.

Express his speed in metres per second.

Answer …..………………..…………….m/s [2]

[Turn over

7
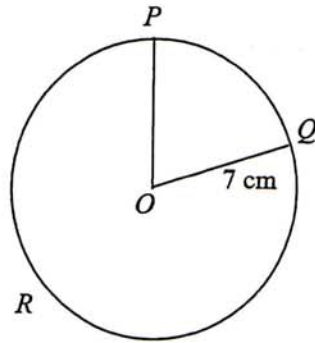
A circle, centre O, has radius 7 cm. P, R and Q are points on the circumference such that reflex angle $POQ = 295°$.

Taking $\pi = \dfrac{22}{7}$, find the area of the minor sector POQ.

Answer .... cm^2 [2]

8   **(a)**   Factorise completely $9pq - 27pr$.

Answer .... [1]

   (b)   Simplify $\dfrac{k^3 h^2 - k^3}{k^2 - k^2 h^2}$.

Answer .... [2]

91

9   There are 3 blue blouses, 4 red blouses, 5 green blouses, 3 pairs of black pants and 2 pairs of grey pants in a wardrobe. Winnie randomly picks a blouse first followed by a pair of pants. Find the probability that she picks

(a)   a red blouse,

Answer .... [1]

(b)   a green blouse and a pair of grey pants.

Answer .... [2]

10   The diagram shows part of a floor plan of a 5-room house.

(a)   Given that the figures on the map show the actual dimensions in millimetres, find the length of the balcony on the plan in centimetre.
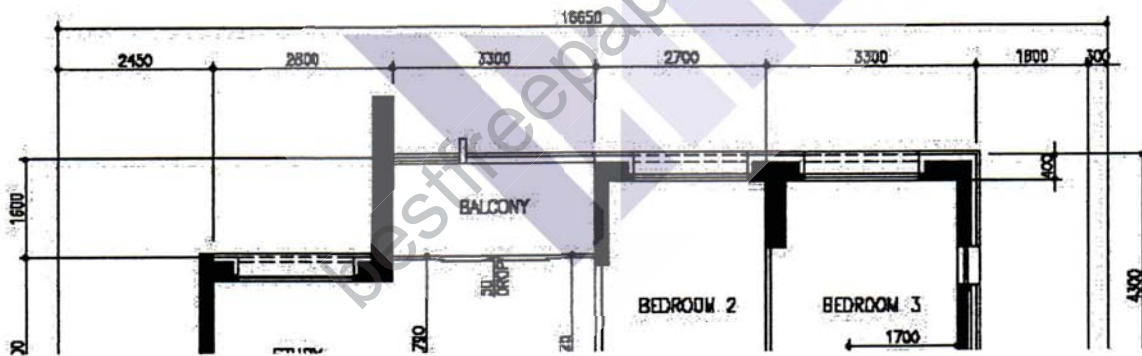
5-ROOM IMPROVED (CORRIDOR)
SCALE 1:100

Answer .... cm [1]

(b)   If the pot of a plant measures 20.2 cm in diameter, how many pots of plants can be planted along the length of the balcony?

Answer .... [2]

[Turn over

11   **(a)**   Given that $2^m = 16^8$, find m.

Answer $m =$ ....… [1]

      (b)   Given that $3^{4n} \times 9^{-n} = \dfrac{1}{729}$, find n.

Answer $n =$ ....… [2]

12   **(a)**   Find the lowest common multiple of 14 and 35.

Answer ....… [1]

      (b)   The square root of p is $2^2 \times 5^3$.

Find p as the product of its prime factors.

Answer $p =$ ....… [2]

93

13   Simplify

(a) $4x - (2x + 7)$,

Answer .... [1]

(b) $\dfrac{2}{x+3} - \dfrac{1}{x^2 - 9}$.

Answer .... [2]

---

14   Given that the exterior angle of a polygon is $x°$ and the interior angle is $3x° + 64.8°$,

(a)   find the value of x.

Answer $x =$ .... [2]

(b)   Marie stated that the polygon is indeed a regular polygon.
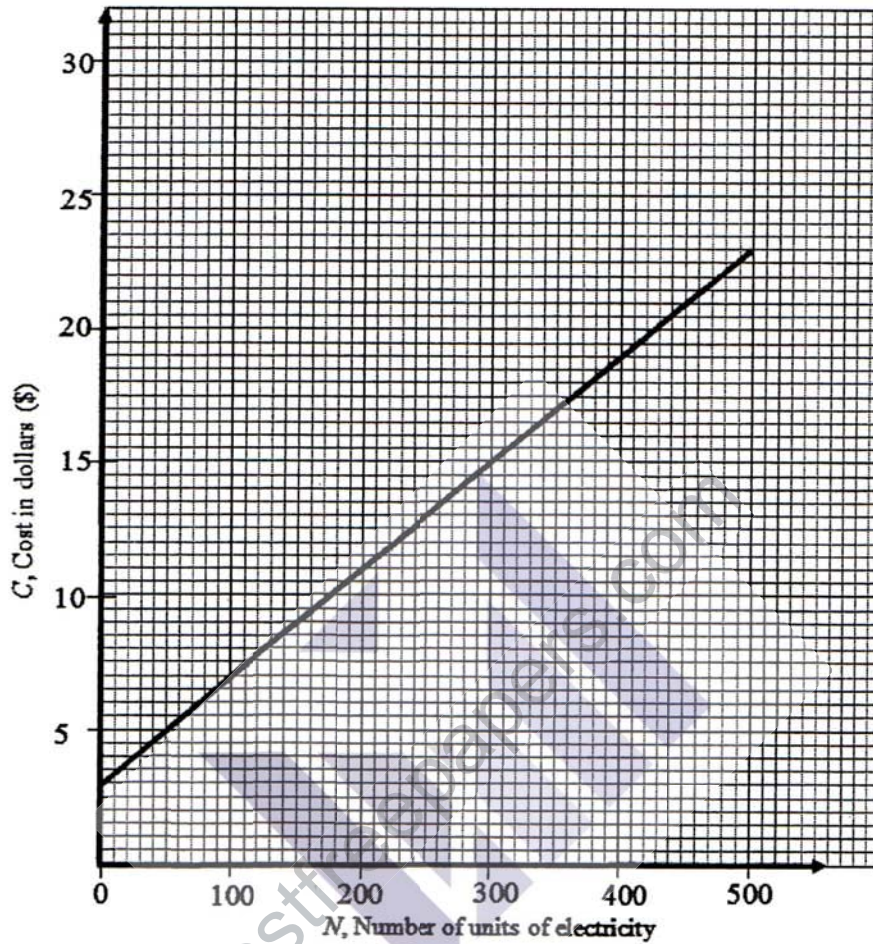
Is she correct?

Show your working.

Answer

[2]

---

15   The graph below shows the electricity charges in a city under Scheme *A*.

Answer (c)

(a)   Find the cost when 300 units of electricity were used.

                                        Answer $.……………...………………. [1]

(b)   Mr Tan's family paid $16.50 for their electricity bill in a particular month. How many
       units of electricity did his family use?

                                        Answer …..……………...…………units [1]

(c)   Under Scheme *B*, a flat rate of 6 cents was charged per unit.
       Draw a line on the grid to show this information.   [1]

(d)   From the graphs, how many units of electricity must be used for the charges to be the
       same under both schemes?

                                        Answer …..……………...…………units [1]

16 **(a)** By completing the square, express $x^2 - 12x - 5$ in the form $(x-t)^2 - r$.

Answer .... [2]

(b) Hence solve $x^2 - 12x - 5 = 0$.

Answer $x = $ .... [2]

---

17 **(a)**

<div style="border:1px solid">

SALE

20% discount off
cost price

</div>

A bicycle was sold at $240 in the sale.

How much must it be sold in order to make a profit of 15% on the cost price?
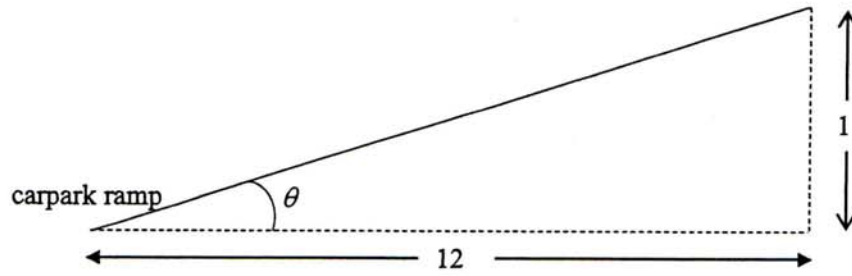
Answer $ .... [2]

(b) After two weeks, the percentage discount offered was changed.

Gabriel paid $285 for the same model of bicycle with a cost price of $380.

What was the new percentage discount?

Answer ....% [2]

[Turn over

18

In a multi - storey carpark, the steepness of the ramp is determined by the ratio 1:12 as shown.

(a) Show that θ is 4.76°.

Answer ....

....

....

.... [1]

(b) Explain how the gradient of the carpark ramp changes as the angle θ increases.

Answer ....

....

....

.... [1]

(c) Given that the vertical height of the carpark ramp is 3.5m and the length of a saloon car is 4.8 m, find the maximum number of cars allowed on the carpark ramp.

Answer ....[2]

19   Using only ruler, compass and protractor, construct

   (a)   a parallelogram *PQRS* such that *PQ* = 10 cm, *QR* = 7.5 cm, ∠*PQR* = 70°,   [1]

   (b)   the perpendicular bisector of *QR*,   [1]

   (c)   the bisector of angle *QPS*.   [1]

These two lines intersect at the point *X*.

   (d)   Mark clearly the point *X*.   [1]

   (e)   Measure the length of *QX*.

Answer (a), (b), (c) and (d)

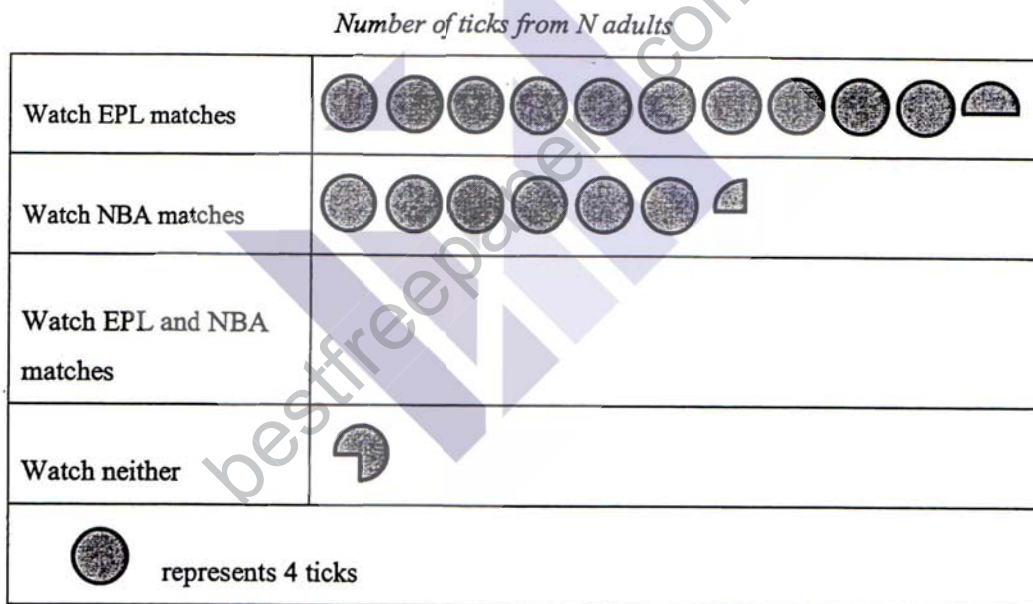*Answer* (e) *QX* = ...… cm [1]

[Turn over

20   The following survey was conducted for *N* adults to find out if they watch the English Premier
      League (EPL) soccer matches or the National Basketball Association (NBA) matches.

Do you watch the matches? You can tick more than 1 box.	
☐	I watch EPL match.
☐	I watch NBA match.
☐	I watch both.
☐	I watch neither.

A total of *M* ticks were recorded.

The incomplete pictogram shows the results.

Number of ticks from N adults

Watch EPL matches	
Watch NBA matches	
Watch EPL and NBA matches	
Watch neither	

⬤ represents 4 ticks

5% of the *N* adults watch neither the English Premier League (EPL) soccer matches nor the
National Basketball Association (NBA) matches.

The number of ticks for 'neither' is 3.75% of the *M* ticks.

(a) Find the value of M and N.

Answer $M = $....................................... [1]

$N = $ .... [1]

(b) Complete the pictogram on **page 14**. [1]

(c) Hence, deduce the number of adults who watch
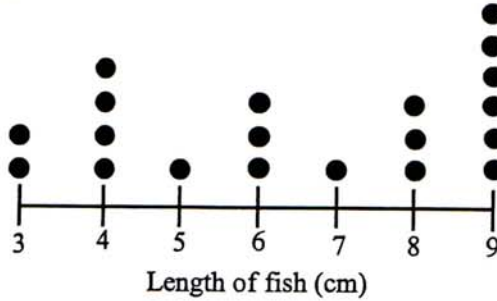
   (i) EPL matches only,

Answer .... [1]

   (ii) NBA matches only.

Answer .... [1]

[Turn over

21   The dot diagram represents the length, measured to the nearest cm, of 20 fish in an aquarium in a pet shop.

Find

(a)   the modal length of the fish,

Answer ....cm [1]

(b)   the median length of the fish,

Answer ....cm [1]

(c)   the mean length of the fish.

Answer ....cm [2]

(d)   Explain why the mode is not a good measure of the average in this case.

Answer ....

....

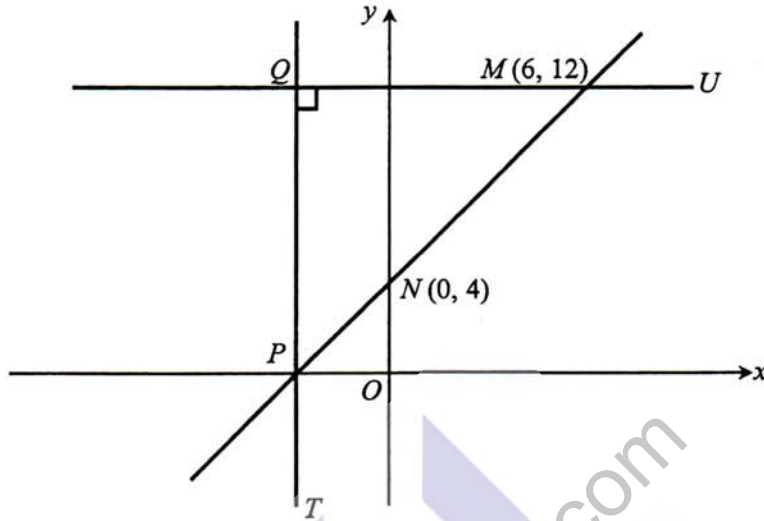...[1]

22 The diagram below shows a sketch of a straight line passing through the points M (6, 12), N (0, 4) and P, which lies on the x-axis. The lines QU and QT intersect at Q and $\angle MQP = 90°$.

(a) Calculate the length MN.

Answer ....units [2]

(b) Find the equation of the line MN.

Answer .... [2]

(c) Find the coordinates of the point P.

Answer P (.............. , ...) [1]

(d) State the equation of QP.

Answer .... [1]

[Turn over

23   (a)   Solve the equation $4x - \dfrac{3x+7}{6} = 7$.

Answer $x =$ ....……........... [2]

(b)   A painter can finish painting a house in 20 hours. If he works for 14 hours at the normal rate of pay and 6 hours at the overtime rate, he will be paid $115. However, if he works for 18 hours at the normal rate and 2 hours at the overtime rate, his earnings will be $105.

(i)   Write down two equations to represent the above information.

Answer .... [1]

.... [1]

(ii)   By solving these two simultaneous equations, find his normal and overtime rates of pay.

Answer $x =$ $..................................

$y =$ $.............................. [3]

END OF PAPER

Answer **all** the questions.

1 (a) Find $\dfrac{320.5 \times 0.98}{0.321}$.

Write down all the figures on your calculator display.

Answer .... 978.4735202 .... [1] (B1)

(b) Write your answer to (a) correct to 6 significant figures.

Answer .... 978.474 .... [1] (B1)

2 Draw on the grid, an enlargement, scale factor $1\tfrac{1}{2}$, of the figure below. [2]
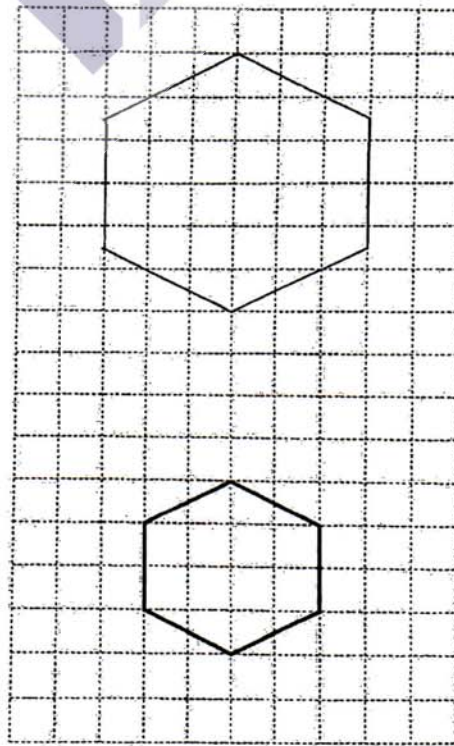
(B1) horizontal length of hexagon
(B1) slant length of hexagon

[Turn over]

3 (a) Calculate $\dfrac{1.5 + \pi}{\sqrt{6} \times 9.82}$, giving your answer to 4 decimal places. [1]

$= 0.19246560\!\ldots$

Answer .... 0.1930 .... [1] (B1)

(b) The ethnic composition of resident population in Singapore is shown in the table below.

Ethnic Composition of resident population

Ethnic Group	Percentage %
Chinese	74.4
Malays	13.3
Indians	9.1
Others	3.2

Express the ratio of Chinese to the resident population in its lowest terms.

$\dfrac{74.4}{100} = \dfrac{744}{100}$

$= \dfrac{93}{125}$

Answer .... 93 : 125 .... [1] (B1)

4 Solve

(a) $-\dfrac{p}{5} \le 2$,

$-p \le 10$

$p \ge -10$

Answer .... $p \ge -10$ .... [1] (B1)

(b) $-5(3 - 7x) = 0$.

method 1: $-15 + 35x = 0$

$35x = 15$

$x = \dfrac{3}{7}$

method 2: $3 - 7x = 0$

$7x = 3$

$x = \dfrac{3}{7}$

Answer $x =$ .... $\dfrac{3}{7}$ .... [1] (B1) each

5

Pancake Recipe

130 g all-purpose flour, (spooned and levelled)
30 g sugar
10 g baking powder
2.5 g teaspoon salt
130 ml milk
30 g unsalted butter, melted
1 large egg
14 ml vegetable oil

Makes 15 pancakes

Given that 1 block of butter = 150 g, calculate how many blocks of butter does Martha need to buy to make 85 pancakes?

15 pancakes → 30g

85 pancakes → $\frac{30 \times 85}{15}$ = 170g   (M1)

= 170g

Needs 2 blocks of butter for 170g.

$\frac{85}{15} \times 30g = 170g$ (M1)

$\frac{170}{150} = 1.133....$

≈ 2 blocks.   (A1)

Answer .... 2 .... blocks [2]

6

Max rides to school on his bicycle at an average speed of 45 km/h. Express his speed in metres per second.

1 km = 1000 m   1 h = 3600 s

45 km = 45000 m

∴ 45 km/h = $\frac{45000}{3600}$ (M1)

= 12.5 m/s   (A1)

Answer .... 12.5 .... m/s [2]
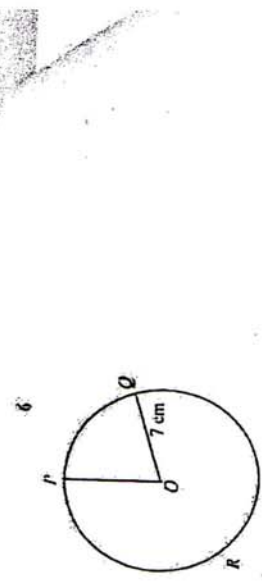
7

A circle, centre O, has radius 7 cm. P, R and Q are points on the circumference such that reflex angle POQ = 295°.

Taking $\pi = \frac{22}{7}$, find the area of the minor sector POQ.

Acute ∠POQ = 360° − 295° (∠s at a pt)

= 65°

∴ Area of minor sector POQ = $\frac{65}{360} \times \pi \times (7)^2$ (M1)

= $\frac{15}{72} \times \frac{22}{7} \times 49$

= $27\frac{29}{36}$ = 27.805....

≈ 27.8 cm²

Answer .... $27\frac{29}{36}$ or 27.8 .... cm² [2]   (A1)

8

(a) Factorise completely $9pq - 27pr$.

= $9p(q - 3r)$ (M1) factorise

Answer .... $9p(q - 3r)$ .... [1]   (B1)

(b) Simplify $\frac{k^3h^2 - k^3}{k^2 - k^2h^2}$.

= $\frac{k^3(h^2 - 1)}{k^2(1 - h^2)}$ (M1) factorise

= $\frac{k(h^2 - 1)}{-(h^2 - 1)}$

= $-k$ (A1)

Answer .... $-k$ .... [2]

9. There are 3 blue blouses, 4 red blouses, 5 green blouses, 3 pairs of black pants and 2 pairs of grey pants in a wardrobe. Winnie randomly picks a blouse first followed by a pair of pants.

Find the probability that she picks

(a) a red blouse,

$$\frac{4}{12} = \frac{1}{3}$$

Answer .... $\frac{1}{3}$ .... [1] **(B1)**

(b) a green blouse and a pair of grey pants.
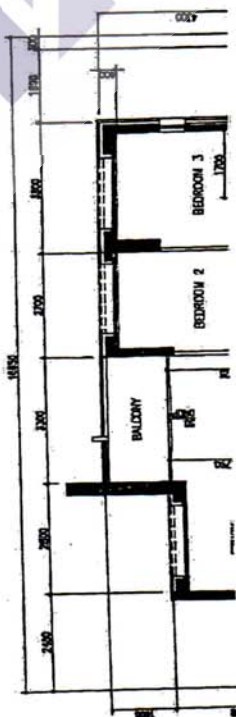
$$P(\text{a green blouse and a pair of grey pants})$$
$$= \frac{5}{12} \times \frac{2}{5}$$
$$= \frac{2}{12} = \frac{1}{6}$$ **(A1)**

Answer .... $\frac{1}{6}$ .... [2]

10. The diagram shows part of a floor plan of a 5-room house.

(a) Given that the figures on the map show the actual dimensions in millimetres, find the length of the balcony on the plan in centimetre.

5-ROOM IMPROVED (CORRIDOR)
SCALE 1:100

$$\frac{3300}{100} = 33 \text{ mm}$$
$$= 3.3 \text{ cm}$$

Answer .... 3.3 .... cm [1] **(B1)**

(b) If the pot of a plant measures 20.2 cm in diameter, how many pots of plants can be planted along the length of the balcony?

$$\frac{3300}{20.2} = 16.3366\ldots$$ **(M1)**
$$\approx 16$$ **(M1)**

Answer .... 16 .... [2]

Turn over

---

11. (a) Given that $2^m = 16^8$, find m.

$$2^m = (2^4)^8$$
$$2^m = 2^{32}$$
$$m = 32$$

Answer $m =$ .... 32 .... [1] **(B1)**

(b) Given that $3^{4n} \times 9^{-n} = \dfrac{1}{729}$, find n.

$$3^{4n} \times 3^{-2n} = \frac{1}{3^6}$$ **(M1)**
$$3^{4n-2n} = 3^{-6}$$
$$2n = -6$$
$$n = -3$$ **(A1)**

Answer $n =$ .... −3 .... [2]

12. (a) Find the lowest common multiple of 14 and 35.

Method 1: $14 = 2 \times 7$
$$35 = 5 \times 7$$
$$\text{LCM} = 2 \times 5 \times 7$$
$$= 70$$

Method 2:

	14,	35
7	2,	5
2	1,	5
5	1,	1

$$\text{LCM} = 7 \times 2 \times 5$$
$$= 70$$

Answer .... 70 .... [1] **(B1)**

(b) The square root of p is $2^2 \times 5^3$. Find p as the product of its prime factors.

$$\sqrt{p} = 2^2 \times 5^3$$
$$p = 2^4 \times 5^6$$

Answer $p =$ .... $2^4 \times 5^6$ .... [2] **(B2)**

13

Simplify

(a) $4x - (2x + 7)$.

$= 4x - 2x - 7$

$= 2x - 7$

Answer .... $2x - 7$ .... (B1) [1]
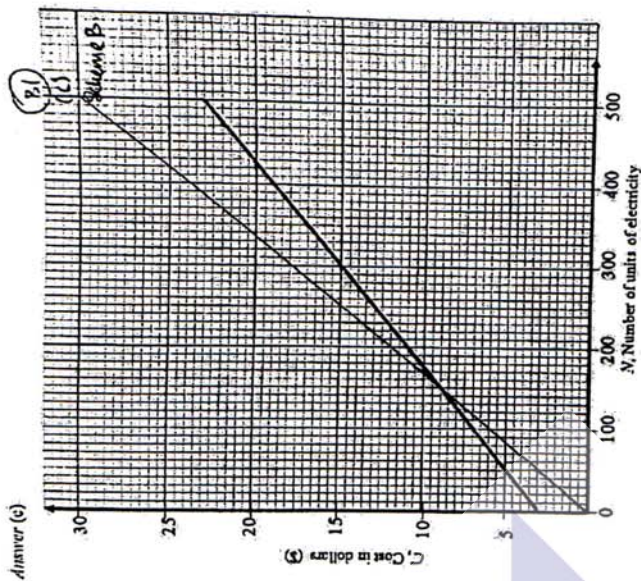
(b) $\dfrac{2}{x+3} - \dfrac{1}{x^2 - 9}$

$= \dfrac{2}{x+3} - \dfrac{1}{(x+3)(x-3)}$ ← (M1) factorise

$= \dfrac{2(x-3)-1}{(x+3)(x-3)}$

$= \dfrac{2x-6-1}{(x+3)(x-3)}$

$= \dfrac{2x-7}{(x+3)(x-3)}$ (M1)

Answer .... $\dfrac{2x-7}{(x+3)(x-3)}$ .... [2]

14

(a) Given that the exterior angle of a polygon is $x°$ and the interior angle is $3x° + 64.8°$, find the value of x.

Answer

$x° + 3x° + 64.8° = 180°$ (adj. ∠s on a str. line) (M1)

$4x° = 115.2°$

$x° = 28.8°$

$x = 28.8$ (M1)

Answer $x =$ .... 28.8 .... [2]

(b) Marie stated that the polygon is indeed a regular polygon.
Is she correct?
Show your working.

Answer

method 1: Each ext ∠ = 28.8°

No. of sides $= \dfrac{360°}{28.8°}$

$= 12.5$

Since 12.5 is not an integer,
Marie is incorrect. (M1)

method 2: Sum of int ∠s = $n(3x° + 64.8°)$

$(n-2) \times 180° = 151.2° n$

$28.8° n = 360°$

$n = 12.5$,
which is not an integer.

∴ Marie is incorrect. (M1)

[Turn over]

10

15 The graph below shows the electricity charges in a city under Scheme A.

Answer (c)

(a) Find the cost when 300 units of electricity were used.

Answer $ .... 15 .... (B1) [1]

(b) Mr Tan's family paid $16.50 for their electricity bill in a particular month. How many units of electricity did his family use?

(B1) (Accept 335 - 340)

Answer .... 340 .... units (B1) [1]

(c) Under Scheme B, a flat rate of 6 cents was charged per unit.
Draw a line on the grid to show this information.

$0.06 \times 500 = 30 [B1] [1]

(d) From the graphs, how many units of electricity must be used for the charges to be the same under both schemes?

(B1) (Accept 145 to 155)

Answer .... 150 .... units [1]

16 (a) By completing the square, express $x^2 - 12x - 5$ in the form $(x-r)^2 - r$.

$x^2 - 12x - 5$

$= x^2 - (2x + (-\frac{12}{2})^2 - (-\frac{12}{2})^2 - 5$ (M1) ensure $(-\frac{x}{2})^2$ seen.

$= (x-6)^2 - (-6)^2 - 5$

$= (x-6)^2 - 41$ (A1)

Answer $(x-6)^2 - 41$ [2]

(b) Hence solve $x^2 - 12x - 5 = 0$.

$(x-6)^2 - 41 = 0$

$(x-6)^2 = 41$

$x - 6 = \pm\sqrt{41}$

$\therefore x = 6 \pm \sqrt{41}$ (M1)
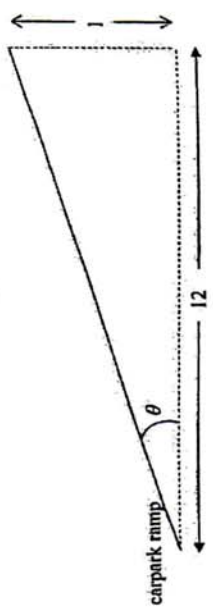
12.4 or -0.403 (A1)

Answer $x = $ .... [2]

SALE
20% discount off cost price

(a) A bicycle was sold at $240 in the sale. How much must it be sold in order to make a profit of 15% on the cost price?

$80\% \to \$240$

$100\% \to \frac{240 \times 100}{80}$ (M1)

$= \$300$ (cost price)

$\therefore 115\% \to \frac{300 \times 115}{100}$

$= \$345$ (A1)

Answer $ \$ $ 345 [2]

(b) After two weeks, the percentage discount offered was changed. Gabriel paid $285 for the same model of bicycle with a cost price of $380. What was the new percentage discount?

$\$380 - \$285$ (M1)

$\frac{\$380 - \$285}{\$380} \times 100\% = 25\%$ (A1)

Answer .... % [2]

[Turn over]

In a multi - storey carpark, the steepness of the ramp is determined by the ratio 1:12 as shown.

(a) Show that θ is 4.76°.

Answer $\tan\theta = \frac{1}{12}$

$\theta = \tan^{-1}(\frac{1}{12})$

$= 4.7636...°$

$= 4.76°$ (B1) [1]

(b) Explain how the gradient of the carpark ramp changes as the angle θ increases.

Answer As θ increases, the gradient of the ramp will also increase.   (B1) [1]

(c) Given that the vertical height of the carpark ramp is 3.5m and the length of a saloon car is 4.8 m, find the maximum number of cars allowed on the carpark ramp.

Horizontal distance of ramp $= 12 \times 3.5$

$= 42 m$

Length of ramp $= \sqrt{(3.5)^2 + (42)^2}$

$= 42.14558... m$ (M1) find length of ramp

$\therefore$ No of cars $= \frac{42.14558...}{4.8}$

$= 8.780...$ (M1)

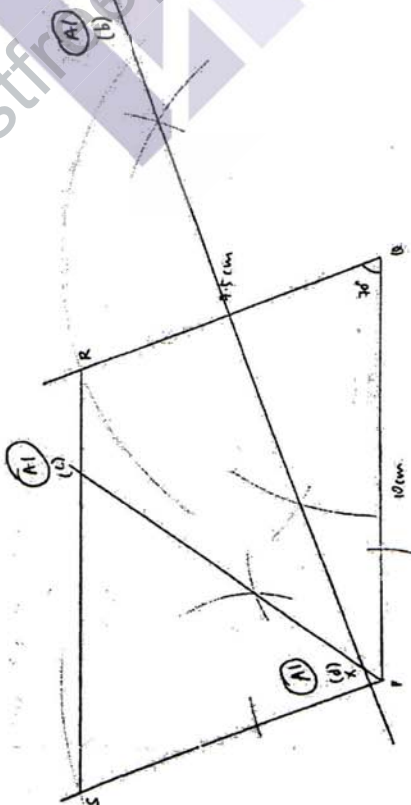$\therefore$ max number of cars = 8   (A1)

13

19. Using only ruler, compass and protractor, construct.

(a) a parallelogram $PQRS$ such that $PQ = 10.0$ cm, $QR = 7.5$ cm, $\angle PQR = 70°$, [1]

(b) the perpendicular bisector of QR, [1]

(c) the bisector of angle QPS. [1]

These two lines intersect at the point X.

(d) Mark clearly the point X.

(e) Measure the length of QX. [1]

Answer (a), (b), (c) and (d)

Answer (e) $QX =$ ....9.8........... cm [1]

[Turn over]

14

20. The following survey was conducted for N adults to find out if they watch the English Premier League (EPL) soccer matches or the National Basketball Association (NBA) matches.

Do you watch the matches? You can tick more than 1 box.
☐ I watch EPL match.
☐ I watch NBA match.
☐ I watch both.
☐ I watch neither.

A total of M ticks were recorded.

The incomplete pictogram shows the results.

Number of ticks from N adults

represents 4 ticks

5% of the N adults watch neither the English Premier League (EPL) soccer matches nor the National Basketball Association (NBA) matches.

The number of ticks for 'neither' is 3.75% of the M ticks.

21   The dot diagram represents the length, measured to the nearest cm, of 20 fish in an aquarium in a pet shop.

Length of fish (cm)

Find

(a)   the modal length of the fish,

Answer .... 9 .... cm [1]   (B1)

(b)   the median length of the fish,

$$\text{median} = \frac{6+7}{2}$$

$$= 6.5 \text{ cm}$$

Answer .... 6.5 .... cm [1]   (B1)

(c)   the mean length of the fish.

$$\text{mean} = \frac{2(3) + 4(4) + 1(5) + 3(6) + 1(7) + 3(8) + 6(9)}{20}$$ (M1)

$$= \frac{130}{20}$$

$$= 6.5 \text{ cm}$$ (A1)

Answer .... 6.5 .... cm [2]

(d)   Explain why the mode is not a good measure of the average in this case.

Answer ① The value of mode is far from the value where most of the data is.   (B1)
② The mode (9cm) is an extreme value that does not represent the average well.

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15

(a)   Find the value of M and N.

3.75% of M ticks → 3 ticks

$$100\% \longrightarrow \frac{100 \times 3}{3.75}$$

$$= 80 \text{ ticks}$$

5% of N adults → 3 adults

$$100\% \longrightarrow \frac{3 \times 100}{5}$$

$$= 60$$

Answer M = ... 80 .... [1]   (B1)
         N = ... 60 .... [1]   (B1)

(b)   Complete the pictogram on page 14.

(c)   Hence, deduce the number of adults who watch

(i)   EPL matches only.

method 1:   42 − 10 = 32 ✓

method 2: $(10\frac{1}{2} - 2\frac{1}{2}) \times 4 = 32$ ✓

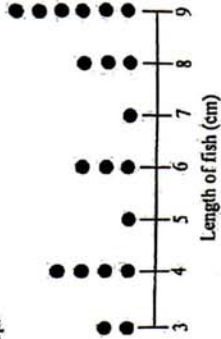Answer .... 32 .... [1]   (B1)

(ii)   NBA matches only.

method 1:   25 − 10 = 15 ✓

method 2: $(6\frac{1}{4} - 2\frac{1}{2}) \times 4 = 15$ ✓

Answer .... 15 .... [1]   (B1)

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18

23 (a) Solve the equation $4x - \dfrac{3x+7}{6} = 7$. [2]

common denominator and
cross-multiply (M1)

$24x - 3x - 7 = 42$
$21x = 49$
$x = 2\frac{1}{3}$ (A1)

Answer $x = $ ..... $2\frac{1}{3}$ .....

(b) A painter can finish painting a house in 20 hours. If he works for 14 hours at the normal rate of pay and 6 hours at the overtime rate, he will be paid $115. However, if he works for 18 hours at the normal rate and 2 hours at the overtime rate, his earnings will be $105.

(i) Write down two equations to represent the above information.

Answer ..... $14x + 6y = 115$ ..... [1]
..... $18x + 2y = 105$ ..... [1] (B2)

(ii) By solving these two simultaneous equations, find his normal and overtime rates of pay.

$14x + 6y = 115$ —①
$18x + 2y = 105$ —②

② × 3 : $54x + 6y = 315$ —③

③ − ① : $40x = 200$
            $x = 5$

from ② : $18(5) + 2y = 105$
          $2y = 15$
          $y = 7.50$

simultaneously (M1)

Answer $x = $ \$ ..... 5 ..... (A1)
       $y = $ \$ ..... 7.50 ..... [3] (A1)

17

22 The diagram below shows a sketch of a straight line passing through the points $M(6,12)$, $N(0,4)$ and P, which lies on the x-axis. The lines QU and QP intersect at Q and $\angle MQP = 90°$.

(a) Calculate the length MN.

length $= \sqrt{(6-0)^2 + (12-4)^2}$ (M1)
$= \sqrt{36+64}$
$= 10$ units   (A1)

(b) Find the equation of the line MN.

grad $= \dfrac{12-4}{6-0}$ (M1)
$= \dfrac{4}{3}$
$c = 4$

$\therefore y = \frac{4}{3}x + 4$ or $3y = 4x + 12$ (A1)

Answer ..... $y = \frac{4}{3}x + 4$ ..... [2]

(c) Find the coordinates of the point P.

At P, $y = 0$
$4x + 12 = 0$
$x = -3$

Answer $P($ ..... -3 ..... , ... 0 ..... $)$ [1] (B1)

(d) State the equation of QP.

Answer ..... $x = -3$ ..... [1] (B1)

Name :		Index no:	Class:	Calculator Model:

DEYI SECONDARY SCHOOL

Preliminary Examination 2016
Secondary Four Normal Academic

4045/02

16 August 2016
0800 – 1000h
2 hours

MATHEMATICS
Paper 2

Additional Materials: 5 sheets of writing paper
1 graph paper

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer all questions.

Section B
Answer one question.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 60.

If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.

The use of an approved scientific calculator is expected, where appropriate.
If the degree of accuracy is not specified in the question and if the answer is not exact, give the answer correct to 3 significant figures. Give answers in degrees to 1 decimal place.
For π, use either your calculator value or 3.142.

At the end of the examination, arrange all your answer scripts in order of the questions answered and fasten them securely together.

This document consists of 9 printed pages including the cover page.　　　**[Turn over**

2

Mathematical Formulae

Compound Interest

Total amount $= P\left(1 + \dfrac{r}{100}\right)^n$

Mensuration

Curved surface area of a cone $= \pi r l$

Surface area of a sphere $= 4\pi r^2$

Volume of a cone $= \dfrac{1}{3}\pi r^2 h$

Volume of a sphere $= \dfrac{4}{3}\pi r^3$

Area of triangle $ABC = \dfrac{1}{2}ab\sin C$

Arc length $= r\theta$, where θ is in radians

Sector area $= \dfrac{1}{2}r^2\theta$, where θ is in radians

Trigonometry

$\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

$a^2 = b^2 + c^2 - 2bc\cos A$

Statistics

Mean $= \dfrac{\sum fx}{\sum f}$

Standard deviation $= \sqrt{\dfrac{\sum fx^2}{\sum f} - \left(\dfrac{\sum fx}{\sum f}\right)^2}$

Section A (52 marks)

Answer all the questions in this section.

1. Without the use of calculator, evaluate $4.37\times10^4 - 0.125\times10^5$, giving your answer in standard form. [2]

2. On the number line below, the fractions are equal distance apart.

$$\frac{1}{6} \qquad k \qquad h \qquad m \qquad \frac{1}{3}$$

Find the fractions k, h and m. [2]

3. Simplify and express the following in positive index form.

(a) $\dfrac{36a^{-3}}{9a^4}$, [2]

(b) $b^3c^{-5}\times(b^{-2}c^4)^3$. [2]

4. p is directly proportional to the square of q.

It is given that $p = 16$ when $q = \dfrac{1}{4}$.

(a) Find the formula connecting p and q. [2]

(b) Calculate the value of p when $q = 3$. [1]

(c) Calculate the values of q when $p = 25$. [2]

5. The exchange rate between Singapore dollars ($) and Euros (€) is S$1 = €0.65.

Leslie won a lucky draw prize of S$25 000.

He used some of the money to pay for a trip to France that cost €2800.

(a) Calculate how many dollars Leslie had left after paying for the trip.

Give your answers to the nearest cents. [2]

(b) If Leslie invested the lucky draw prize of S$25 000 at 2.25% compounded half yearly for 3 years, calculate the interest earned after 3 years.

Give your answers to the nearest cents. [3]

6. It was announced on the 6th of June 2016 that Underwater World Singapore will be closing after 25 years and that the ticket prices had been lowered to its 1991 opening price from June 7 till June 26.

The chart below shows the admission fees:

Adult	Child (3 – 12 years old)	Child (below 3 years old)
S$9.00	S$5.00	Free

Mrs Aniston set a budget of S$150. She planned to invite some of her adult friends and 8 primary school children on a day trip, together with her twin boys of 4 years old and one 8-month-old baby girl to the Underwater World Singapore.

(a) If x and y represent the number of adults and children going to the Underwater World Singapore, write down an expression for the total cost of the admission fees. [1]

(b) What is the maximum number of adults that Mrs Aniston can invite to come along? [3]

(c) If Mrs Aniston increased her budget by S$80 to invite some senior citizens, how many senior citizens can she invite? [2]

[Turn over

**7.** In the triangle below, $AB = 5$ cm, $AC = 12$ cm and $BC = 13$ cm.
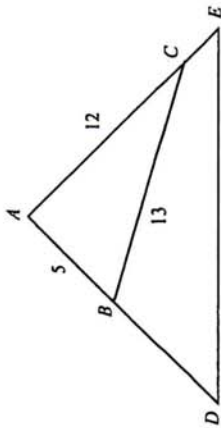
(a) Explain why angle BAC is a right-angle. [2]

(b) AC is produced to E such that $CE = 4$ cm and triangle ABC is similar to triangle AED.

   (I) Calculate BD. [2]

   (II) Find the exact value of $\cos \angle ADE$. [2]

8. Given the following sequence

$$\frac{3}{5}, \frac{5}{10}, \frac{7}{15}, \frac{9}{20}, \ldots\ldots\ldots$$

(a) Write down the next two terms. [2]

(b) Find the nth term of the sequence. [2]

(c) Is it possible to have $\frac{185}{455}$ in the sequence? [2]

Show how you decide.

6

9. **(a)** The bar chart below shows the revenue of a company in its first four years of operation.
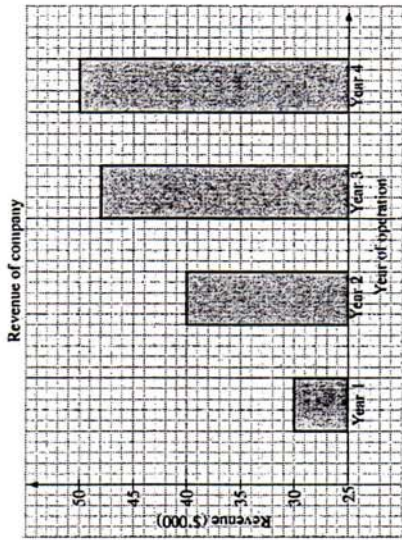
The sales manager says that the revenue for Year 2 is 3 times that of Year 1.

Is the sales manager correct? Explain your answer. [1]

(b) The pie chart shows the composition of the four different races in a constituency of 36 000 residents.
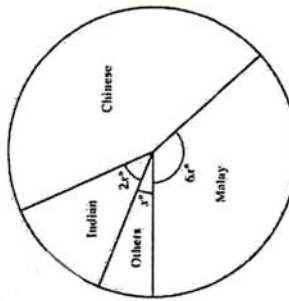
   (I) Find the value of x if 45% of the residents are Chinese. [2]

   (II) Find the number of Malay residents in the constituency. [2]

   (III) Express the number of Indian residents as a percentage of all residents in the constituency. [2]

[Turn over]

10 **Answer the whole of this question on a sheet of graph paper.**

The table below is for $y = 5 - 2x - 2x^2$.

x	-3	-2	-1	0	1	2	3
y	-7	1	p	5	1	-7	-19

(a) Find the value of p. [1]

(b) Using a scale of 2 cm to 1 unit, draw a horizontal x-axis for $-3 \leq x \leq 3$.

Using a scale of 2 cm to 5 units, draw a vertical y-axis for $-20 \leq y \leq 10$.

On your axes, plot the points given in the table and join them with a smooth curve. [3]

(c) Find the coordinates of the maximum point of the curve. [1]

(d) Use your graph to solve the equation $5 - 2x - 2x^2 = 0$. [2]

(e) By drawing a tangent, find the gradient of the curve at the point where $x = 1.5$. [2]

Section B (8 marks)

Answer only one question from this section. Each question carries 8 marks.

11 A farmer owns a small circular plot of land as shown in the diagram. Q is due east of P and POR is a straight path that cuts through the plot of land with O as the centre of the plot of land.

The length of path OR is given as 200 metres.
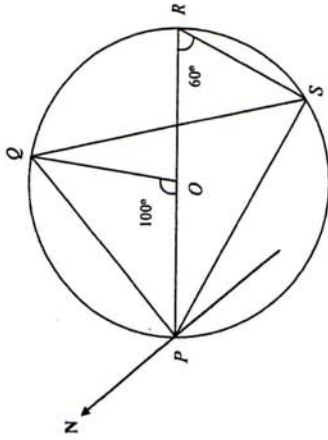
Calculate

(a) the length of PQ, [2]

(b) the bearing of S from P, [2]

(c) the area of triangle PQR. [2]

A boy stands at the top of a vertical tower of height 45 m at R and looks at the shed at P.

(d) Calculate the angle of depression from the boy to the shed. [2]

[Turn over

9

12 The cumulative frequency graph shows the wages per week of 80 workers in Warehouse *A*.
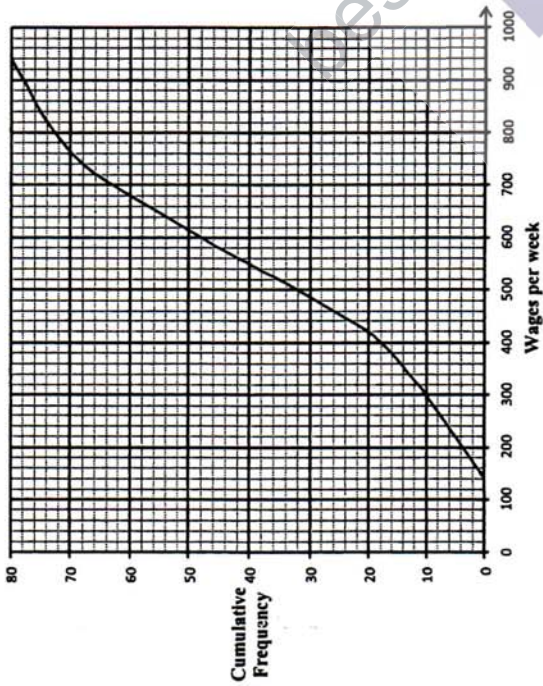
(a) Use the graph to find
   (i)   the number of workers who earn more than $380 a week,   [1]
   (ii) the median wage,   [1]
   (iii) the interquartile range.   [2]

(b) Two workers are selected at random. Find the probability that one earns less than $380 and the other earns at least $460.   [2]

(c) The box-and-whisker plot shows the distribution of wages per week of the workers in Warehouse *B*.
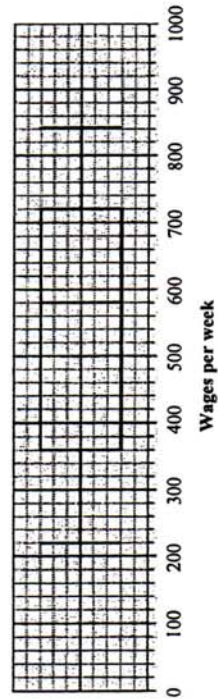
Compare the weekly wages of the workers in the two factories in two different ways. [2]

~End of Paper~

2016 4N/A Prelim Exam Paper 2. (4045) — Marking Scheme

Q1. $4.37 \times 10^4 - 0.125 \times 10^5$ (M1)
$= 4.37 \times 10^4 - 1.25 \times 10^4$
$= 3.12 \times 10^4$ (A1) [2]

$0.437 \times 10^5 - 0.125 \times 10^5$ (M1)
$= 0.312 \times 10^5$
$= 3.12 \times 10^4$ (A1)

Q2. $\dfrac{36a^{-3}}{9a^4} = 4a^{-7}$ (M1) $\dfrac{a^m}{a^n} = a^{m-n}$ rule

$= \dfrac{4}{a^7}$ (A1) [2]

$\dfrac{4}{k} = \dfrac{4}{7}$

$\therefore k = 7$

$\dfrac{4}{7} + \dfrac{4}{k} = \dfrac{4}{7}$

$m = \dfrac{4}{7} + \dfrac{4}{7}$ (A2) −1 mark for every one wrong answer

$m = \dfrac{4}{7}$ [2]

Q3. (a) $b^3c \times (b^{-2}c^4)^2$ (M1) $(a^b)^m = a^{bm}$ rule
$= b^3c \times b^{-4}c^8$
$= b^{-1}c^9$
$= \dfrac{c^9}{b}$ (A1) [2]

Q4. (a) $p = kq^2$
$p=16, q=2$ (M1) find k
$16 = k(2)^2$
$k = 4$ (B1)
$\therefore p = 4q^2$ (A1)

(b) $q=3, p = 4(3)^2$
$\therefore p = 36$ (B1) [4]

Q5. (a)(i) $S\$1 = €0.65$
$€0.65 = S\$1$
$€2800 = \dfrac{2800}{0.65}$
$= S\$4307.69230...$ (M1)

Amount left $= S\$25000 - S\$4307.69230$
$= S\$20692.30769$
$= S\$20692.31$ (nearest cents) (A1) [2]

(b) Amt $= S\$25000\left(1 + \dfrac{3.5}{2}/100\right)^6$ (M1) Rate ÷ 2
$= \$...$

Interest earned $= S\$2069.53792 - 638+9.53792$
$= S\$1935.77885$
$= S\$1935.68$ (nearest cents) (A1) (M1) Accuracy must be here [3]

Q6 (a) Total amount $= \$(9x + 5(y-1))$ (B1) [5]

(i) $9x + 5(11-1) = \$140$ (M1)
$9x = 100$
$x = 11\tfrac{1}{9}$
No. of adults $= 11$
$\therefore$ Max no. of adults to invite $= 11-1 = 10$ (A1) [1]

(b) $9x = \$100 + \$80$ increased $\$80$ (M1)
$9x = \$180$
$x = 20$
Total number of adults $= 20$
$\therefore$ Mrs Anyan can invite another $20-11 = 9$ senior citizens (A1) [2]

Q8. (a) $\frac{13}{25}$, $\frac{13}{30}$

(b) $T_n = \frac{2n+1}{5n}$ — numerator (N), denominator (D)

(c) $\frac{185}{455} = \frac{2n+1}{5n}$

$925n = 910n + 455$

$15n = 455$

$n = 30\frac{1}{3}$

Since it is not an integer, thus $\frac{185}{455}$ is not in the sequence.

OR

For denominator $= 455$, $n = 455 \div 5 = 91$

Numerator $= 2(91)+1 = 163$

$\therefore \frac{163}{455}$ is in the sequence, $\frac{162}{455}$ is not in the sequence.

Q9. (a) No, the sales manager is incorrect as the bar chart is misleading because the vertical axis did not start from 0.

OR

Year 2 → $40000, Year 1 → $30000

$40000 is not 3 times of $30000. Thus the manager is incorrect.

(b)(ii) Representing Chinese: $\frac{45}{100} \times 360° = 162°$

$162° + 24° + x° + 6x° = 360°$ (angles at a point) with 162° found

$8x° + 186 = 360$

$8x° = 174$

$x° = 22°$

$\therefore x = 22$

OR

$55\% \times 360° = 198°$

$198° = 2x° + x° + 6x°$

$9x° = 198°$

$x° = 22°$

$x = 22$

(b)(iii) No. of weekly residents $= \frac{6(22)}{360} \times 36000 = 13200$

No. of Indian Residents $= \frac{2(22)}{360} \times 36000 = 4400$

$\therefore$ Percentage $= \frac{4400}{36000} \times 100\% = 12\frac{2}{9}\%$ or 12.2%

OR

$\frac{2(22)}{360} \times 100\% = 12\frac{2}{9}\%$ or 12.2%

Q8. (a)(i) $AB^2 = 5^2 = 25$

$AC^2 = 12^2 = 144$

$BC^2 = 13^2 = 169$

Since $AB^2 + AC^2 = 25 + 144 = 169 = 13^2 = BC^2$

$AB^2 + AC^2 = BC^2$

By converse of Pythagoras' Theorem, $\triangle ABC$ is a right-angled triangle and $\angle BAC = 90°$

(b)(i) $\frac{AD}{AC} = \frac{AE}{AB}$

$\frac{5+BD}{12} = \frac{12+4}{5}$

$25 + 5BD = 192$

$5BD = 167$

$\therefore BD = 33.4\text{ cm}$ or $33\frac{1}{3}\text{ cm}$

(ii) $DE = \sqrt{(33.4+1.5)^2 + (12+4)^2}$

$= 41.6\text{ cm}$

$\therefore \cos \angle ADE = \frac{33.4+1.5}{41.6}$

$\therefore \cos \angle ADE = \frac{12}{13}$

OR

$\cos \angle ADE = \cos \angle ACB = \frac{12}{13}$

Graph table:

x	-3	-2	-1	0	1	2	3
y	-7	5	5	5	1	-7	-19

$y = 5 - 2x - 2x^2$

$y = 5 - 2x - x$

(e) tangent
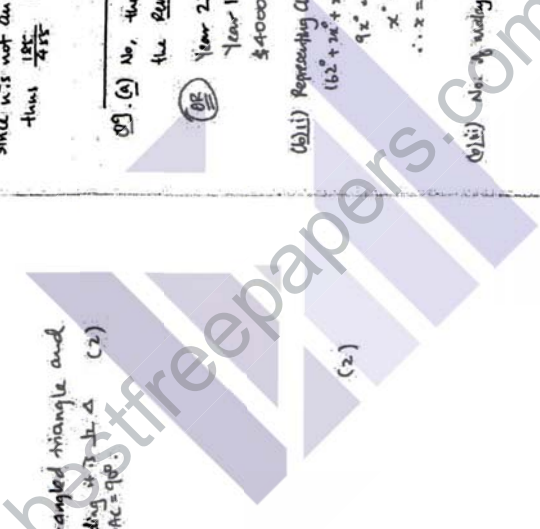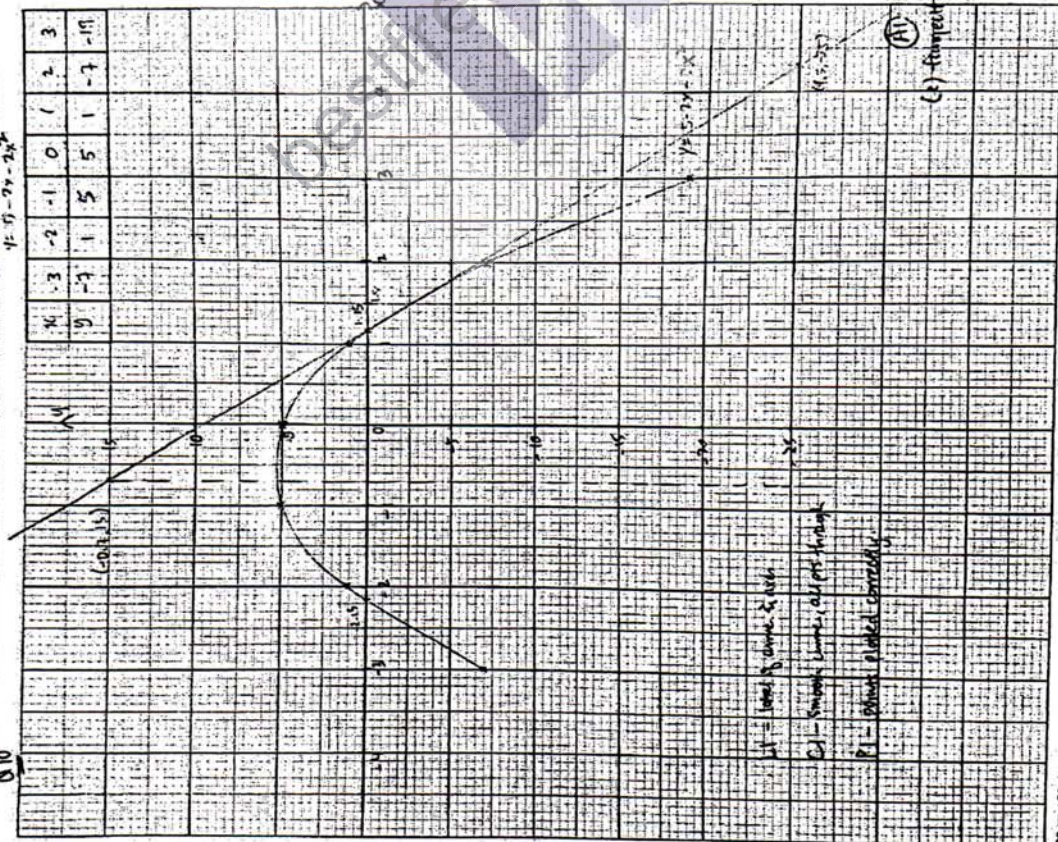
(b) $x = -1$, $y = 5 - (2)(-1) - 2(-1)^2$ **B1**
∴ $p = 5$

(c) max pt is $(-\tfrac{1}{2}, 5.25)$ **A1**
Acceptable if max pt ≡ (   ) seen.
(but must emphasise the error)
y coordinate accepts from 5.25 to 5.5

(d) $5 - 2x - 2x^2 = 0$
∴ $x = -2.15$ or 1.15 **A2** (± 0.05 for each)

(e) Gradient $= \dfrac{-25 - 15}{4.5 - (-0.5)}$
$= -8$ **A1**

Section B (4045/02)

Q11.

(a) $PQ^2 = 200^2 + 200^2 - 2(200)(200)\cos 100°$ (M1) cosine rule

$PQ^2 = 93891.85...$

$PQ = 306.4177...$

$\therefore PQ = 306\ m$ (3sf) (A1)

(b) $\angle OPQ = \dfrac{180° - 100°}{2}$ (base angles isos $\triangle$)

$= 40°$

$\angle PSR = 90°$ (rt $\angle$ in semicircle)

$\angle SPR = 180° - 90° - 60°$ ($\angle$ sum of $\triangle$)

$= 30°$

$\therefore$ bearing of S from P $= 90° + 40° + 30°$ (M1) marking out the relevant angles

$= 160°$ (A1)

(c) Area of $\triangle PQR = \dfrac{1}{2}(400)(306.4177...)\sin 40°$ (M1) *accuracy must be here*

$= 39392.31...$ Award (M1) if used 306 in calculation to

$= 39400\ m^2$ (3sf) (A1) do (A1) mark.

(d)

Let θ be the angle of elevation from P to boy.

$\tan\theta = \dfrac{45}{400}$ (M1)

$\theta = 6.41978...°$

$\therefore \angle$ of depression $= 6.4°$ (A1)

* No (A1) none if students just state

θ is the $\angle$ of depression w/o showing that it is due to // lines, by alt. $\angle$s and concluding that $\angle$ of depression $= \theta$

[8]

Q2. (a) (i) Earned at least $380 a week $= 16$ workers

$\therefore$ No. of workers earning more than $380 a week $= 80 - 16$

$= 64$ workers (B1)

(ii) median wage $= \$550$ (B1)

(iii) $Q_1 = \$420$

$Q_3 = \$680$

$\therefore IQR = \$680 - \$420 = \$260$ (A1)

(iv) having 26 workers who... the other earns at least $460 who replacement cost.
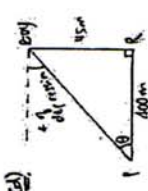
$P(\text{one earns less than } \$380 \text{ and the other earns at least } \$460)$

$= \left(\dfrac{16}{80}\right)\left(\dfrac{26}{79}\right) + \left(\dfrac{26}{80}\right)\left(\dfrac{16}{79}\right)$ (M1)

$= \dfrac{108}{395}$ (A1)

(b) (i) median wage for Warehouse B $= \$580$

The workers in Warehouse B earns more per week as compared to the workers in Warehouse A as the average weekly wages for workers in Warehouse B is at $580, which is higher than the average weekly wages for workers in Warehouse A at $550. (A1)

• context must be clear in comparison

• comparing weekly wages of workers for Warehouse B!

(ii) $Q_1 = \$360$, $Q_3 = \$720$

IQR for weekly wages of workers in Warehouse B $= \$720 - \$360$

$= \$360$.

The spread of the wages per week for the workers in Warehouse B is wider than the spread of the wages per week for the workers in Warehouse A. Thus, the wages per week for workers in Warehouse A is more consistent than the wages per week for the workers in Warehouse B. (A1)

(A1) context must be clear (or above)

[8]

![East Spring Secondary School logo]

East Spring Secondary School
Towards Excellence and Success

Name : _____ (   )

Class : _____

Preliminary Examination 2016
Secondary 4 Normal Academic

Mathematics   4045/01
Paper 1

18 August 2016   **2 hours**
Thursday   **0745 – 0945**

<u>Additional materials:</u>
nil

READ THESE INSTRUCTIONS FIRST

Write your Name and Index Number on all the work you hand in.

Write in dark blue or black pen. You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions in this booklet.

If working is needed for any question, it must be shown with the answer.

Omission of essential working will result in loss of marks.

You are expected to use an electronic calculator to evaluate explicit numerical expressions. If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to **three significant figures**.

For π, use either your calculator value or 3·142, unless the question requires the answer in term of π.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is **80**.

```
 _____
|         / |
|       /   |
|     /     |
|   /       | 80
| /         |
|_____|
```

This question paper consists of **16** printed pages including the cover page.

Mathematical Formulae

Compound Interest

$$\text{Total amount} = P\left(1+\frac{r}{100}\right)^{n}$$

Mensuration

$$\text{Curve surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^{2}$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^{2} h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^{3}$$

$$\text{Area of triangle ABC} = \frac{1}{2}ab\sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Area of sector} = \frac{1}{2}r^{2}\theta \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^{2} = b^{2} + c^{2} - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^{2}}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^{2}}$$

Answer **ALL** questions.

1. Arrange the following numbers in ascending order.

$$\pi, \quad -\frac{1}{4}, \quad \sqrt{3}, \quad 0.2^2, \quad 5$$

Ans: _____ [1]

2. Evaluate

   a) $\dfrac{7.5 - (3.2 + 4)}{3 \times 10^{-3}}$

   Ans: _____ [1]

   b) $\dfrac{64 \div \sqrt[3]{0.125}}{4}$

   Ans: _____ [1]

3. By writing each number correct to 1 significant figure, **estimate** the value of

$$\frac{16.25 \times 0.48}{2.054}$$

You must show your working.

Ans: _____ [2]

4. Express

   a) 12.5% as a fraction in its lowest terms.

   Ans: _____ [1]

   b) $\frac{1}{4}$ as a decimal.

   Ans: _____ [1]

5. Filbert folded some paper cranes and placed them into 3 bags. The ratio of the number of paper cranes in Bag A, B and C is 8 : 3 : 2 respectively.
   The number of paper cranes in Bag C is 20.

   a) What fraction of the paper cranes are in Bag B?

   Ans: _____ [1]

   b) Calculate the total number paper cranes folded.

   Ans: _____ [2]

6. a) Express 168 as a product of its prime factors.

Ans: _____ [1]

b) Given that $72 = 2^3 \times 3^2$, find the lowest common multiple of 72 and 168.

Ans: _____ [1]

c) Write down the smallest positive integer, n, such that $72n$, is a perfect cube.

Ans: _____ [1]

7. Solve these simultaneous equations

$$7x - 2y = 2$$
$$3x + 4y = 30$$

Ans: $x =$ _____

$y =$ _____ [3]

8.
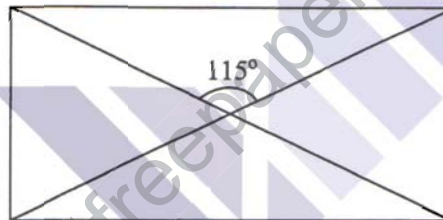
a) In the rectangle, the obtuse angle formed when the diagonals meet is 115°.
    Calculate the value of the acute angle formed.

Ans: _____° [1]

b) List two quadrilaterals with two equal acute angles and two equal obtuse angles.

Ans: _____ [1]

c) Some properties of a square are different from those of a rhombus.
    Write down one such property.

Ans: _____ [1]

9. Factorise each of the following completely.

a) $5a(2b - c) - (2b - c)$

Ans: _____ [1]

b) $8a^2 - 2b^2$

Ans: _____ [2]

10. In the diagram below, triangle PQX is similar to triangle RSX.
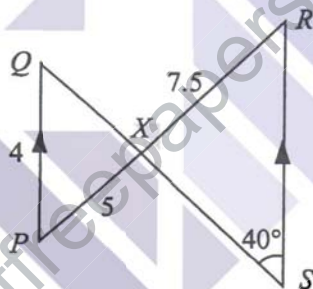
Given that $PQ = 4$ cm, $PX = 5$ cm, $RX = 7.5$ cm and $\angle RSX = 40°$, find

a) the length of RS,

Ans: _____ cm [2]

b) $\angle PQX$

Ans: _____ ° [1]

11. The first four terms of a sequence are 2, 8, 14 and 20.

   a) Write down in terms of *n*, the *n*th term of this sequence.

   Ans: _____ [1]

   b) Write down the 78th term.

   Ans: _____ [1]

   c) Which term is 164 in the sequence?

   Ans: _____ [1]

12. Each of the letters of the word 'POSSIBLE' is written on a card. The cards are then shuffled and placed into a box. A card is then drawn at random from the box. Find the probability that the letter on the card drawn is

   a) a 'S'

   Ans: _____ [1]

   b) a consonant

   Ans: _____ [1]

   c) a 'T'

   Ans: _____ [1]

13. a) Given that $5^x = 25^{x-3}$, find the value of x.

Ans: _____ [2]

b) Simplify $\sqrt{121y^4} \times y$.

Ans: _____ [2]

14. a) By completing the square, $x^2 + 7x - 2$ can be expressed in the form $(x+p)^2 + q$.
Find p and q.

Ans: $p =$ _____ , $q =$ _____ [2]

b) Hence, solve $x^2 + 7x - 2 = 0$.
Give your answers correct to two decimal places.

Ans: _____ [2]

15. a) Expand and simplify $(x-3)(2x^2-5x+1)$.

Ans: _____ [2]

b) Simplify $\dfrac{3d^3}{4e} \div \dfrac{18d^2e^2}{5}$

Ans: _____ [2]

16. It is given that $\dfrac{pr}{p+r} = 1$

a) Express p in terms of r.

Ans: _____ [2]

b) Find the value of p when $r = 5$.

Ans: _____ [2]

17. A map is drawn using a scale of 2 cm to represent 1 km.
Calculate

a) the scale of the map in the form of 1 : n.

Ans: _____ [1]

b) the actual distance, in kilometres, represented by a line, 15 cm long on the map.

Ans: _____ km [1]

c) the area on the map, in square centimetres, which represents an actual area of 6 km².

Ans: _____ cm² [2]

18. In the diagram, AB and PQ are straight lines. PQ is parallel to AB and AP is parallel to XY. Given that $XY = BY$ and $\angle APQ = 119°$, calculate
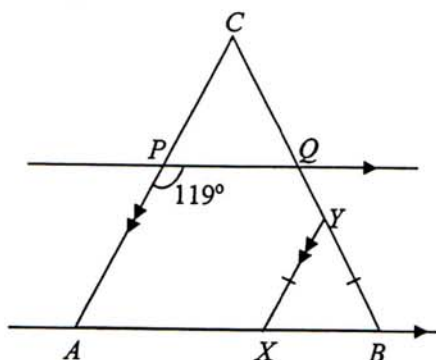
a) $\angle PAX$

Ans: _____ ° [1]

b) $\angle QYX$

Ans: _____ ° [2]

c) $\angle ACB$

Ans: _____ ° [1]

19. a) The exterior angle of a regular polygon is 24°. How many sides does it have?

Ans: _____ [1]

b) In a pentagon, two of the interior angles are 100° and 104° while the three other interior angles are equal. Find one of these equal angles.

Ans: _____° [3]

20. Joseph wants to save $50 000 in a bank for 5 years. The bank offers him two investment plans.

> Plan A pays 4.5% simple interest per year.
> Plan B pays 4.2% compound interest per year.

a) Calculate how much money Joseph will have at the end of 5 years if he selects Plan A.

Ans: $ _____ [2]

b) Show with working, which plan should he choose such that he will benefit more?

Ans: _____ [3]

21. The diagram shows the straight lines AB and AC. The line AB has a gradient of $-\dfrac{2}{3}$ and crosses the x-axis at point B.
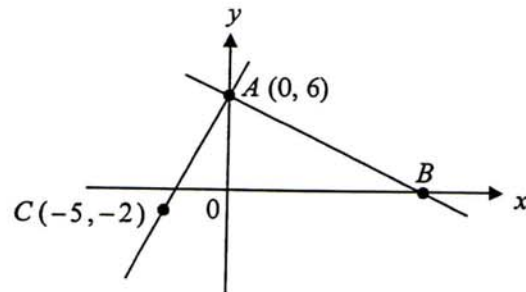
a) Write down the equation of the straight line AB.

Ans: _____ [1]

b) Find the coordinates of B.

Ans: _____ [2]

c) Calculate the length of AC.
Give your answer correct to 2 decimal places.

Ans: _____ [2]

22. The stem and leaf diagram below shows the marks obtained by students in a class.

Girls		Boys
8 0	6	1 6
7 5 3 2	7	0 0 0 3
8 6 1 1	8	1 1 2 4 5
4 1 0	9	2

Key
Girls: 0|6 represent 60
Boys: 6|1 represents 61

a) Find the total number of students in the class.

Ans: _____ [1]

b) Find the median marks of the girls.

Ans: _____ marks [1]

c) Find the modal marks of the boys.

Ans: _____ marks [1]

d) What is the percentage of students who scored more than 85 marks?

Ans: _____ % [2]

23. In the right-angled triangle ABC, D is a point on the side AB.
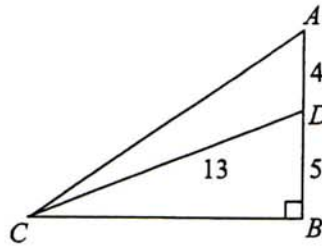
Given that $AD = 4$ cm, $BD = 5$ cm and $CD = 13$ cm.

a) Show that $BC = 12$ cm. [1]

b) Write $\cos \angle BCD$ as a fraction.

Ans: _____ [1]

c) Find $\angle ACB$.

Ans: _____° [2]

d) Calculate the area of triangle ACD.

Ans: _____ [2]

~ End of Paper ~

2016 Prelim 4NA Paper 1 Marking Scheme

No.	Working	Marks
1	$-\dfrac{1}{4}$, 0.2^2, $\sqrt{3}$, π, 5	B1
2a	100	B1
2b	32	B1
3	$16.25 \times 0.48 = \dfrac{20 \times 0.5}{2}$ 2.054 $= 5$	M1 A1
4a	$\dfrac{1}{8}$	B1
4b	0.25	B1
5a	$\dfrac{3}{8+3+2} = \dfrac{3}{13}$	B1
5b	2units → 20 cranes 13units → $\dfrac{20}{2} \times 13$ $= 130$ cranes	M1 A1
6a	2 | 168 2 | 84 2 | 42 3 | 21 7 | 7 1 $168 = 2^3 \times 3 \times 7$	B1
6b	LCM $= 2^3 \times 3^1 \times 7 = 504$	B1
6c	$n = 3$	B1
7	$7x - 2y = 2$ -----(1) $3x + 4y = 30$ -----(2) (1)×2 $14x - 4y = 4$ -----(3) (2)+(3) $17x = 34$ $x = 2$ Sub $x = 2$ in (1) $7(2) - 2y = 2$ $y = 6$	M1 (either elimination or substitution) A1 A1
8a	Acute angle $= 180° - 115° = 65°$	B1
8b	Rhombus, Parallelogram	B1
8c	Square has 4 right angles and rhombus does not. Or the sides of a square are perpendicular to one another, unlike the sides of a rhombus.	A1
9a	$(2b - c)(5a - 1)$	B1
9b	$8a^2 - 2b^2 = 2(4a^2 - b^2)$ $= 2(2a - b)(2a + b)$	M1 A1
10a	$\dfrac{RS}{PQ} = \dfrac{RX}{PX}$ $\dfrac{RS}{4} = \dfrac{7.5}{5}$ $RS = \dfrac{7.5}{5} \times 4$ $= 6$ cm	M1 A1
10b	$\angle PQX = 40°$ (alt angle)	B1
11a	$2 + 6(n - 1) = 6n - 4$	B1
11b	78th term $= 6(78) - 4 = 464$	B1
11c	$6n - 4 = 164$ $n = \dfrac{164 + 4}{6} = 28$	A1
12a	$\dfrac{2}{8} = \dfrac{1}{4}$	B1
12b	$\dfrac{5}{8}$	B1
12c	0	B1
13a	$5^x = 25^{x-3}$ $5^x = 5^{2(x-3)}$ $x = 2x - 6$ $x = 6$	M1 A1
13b	$\sqrt{121y^4} \times y = 11y^2 \times y$ $= 11y^3$	M1 A1

Q	Working	Marks
14a	x^2+7x-2 $= x^2+7x+\left(\frac{7}{2}\right)^2-\left(\frac{7}{2}\right)^2-2$ $= \left(x+\frac{7}{2}\right)^2 - \frac{49}{4}-2$ $= \left(x+\frac{7}{2}\right)^2 - \frac{57}{4}$ $p=\frac{7}{2},\ q=-\frac{57}{4}$	A2
14b	$x^2+7x-2=0$ $\left(x+\frac{7}{2}\right)^2-\frac{57}{4}=0$ $x=\pm\sqrt{\frac{57}{4}}-\frac{7}{2}$ $x=0.275$ or $x\approx-7.27$ (3sf)	A2
15a	$(x-3)(2x^2-5x+1)$ $=2x^3-5x^2+x-6x^2+15x-3$ $=2x^3-11x^2+16x-3$	M1 A1
15b	$\frac{3d^3}{4e}\div\frac{18d^2e^2}{5}=\frac{3d^3}{4e}\times\frac{5}{18d^2e^2}$ $=\frac{5d}{24e^3}$	M1 A1
16a	$\frac{pr}{p+r}=1$ $pr=p+r$ $pr-p=r$ $p(r-1)=r$ $p=\frac{r}{r-1}$	M1 A1
16b	$p=\frac{r}{r-1}$ $p=\frac{5}{5-1}$ $=\frac{5}{4}$	M1 A1

Q	Working	Marks
17a	2 cm : 1 km 1 cm : 0.5 km 1 cm : $0.5\times100\times1000=50\,000$ cm 1 : 50 000	A1
17b	1 cm : 0.5 km 15 cm : $15\times0.5=7.5\,km$	A1
17c	1 cm : 0.5 km 1 cm² : 0.25 km² 6 km² $=\dfrac{6}{0.25}=24\,cm^2$	M1 A1
18a	$\angle PAX=180-119=61°$ (int angle)	A1
18b	$\angle PAX=\angle BXY=61°$ (corr angle) $\angle QYX=61°+61°=122°$ (ext angle)	M1 A1
18c	$\angle ACB=180-61-61=58°$ (angle sum of tri)	A1
19a	$\dfrac{360}{n}=24$ $n=\dfrac{360}{24}=15$	M1
19b	Sum of int angle $=(5-2)180=540°$ One of the equal angle $=\dfrac{540-100-104}{3}$ $=112°$	M1 M1 A1
20a	Interest $=\dfrac{50000\times4.5\times5}{100}=\$11250$ Total $=\$50\,000+\$11\,250=\$61\,250$	M1 A1
20b	$A=50000\left(1+\dfrac{4.2}{100}\right)^5$ $=\$61419.83$ He should choose Plan B.	M1 A1 A1
21a	Equation : $y=-\dfrac{2}{3}x+6$	B1

21b	When $y = 0$, $0 = -\dfrac{2}{3}x + 6$ $\dfrac{2}{3}x = 6$ $x = 6 + \dfrac{2}{3}$ $x = 9$	M1 A1 (ecf 2 if (a) is wrong)
21c	Length $= \sqrt{(-5-0)^2 + (-2-6)^2}$ $= 9.43$ (2dp)	M1 A1
22a	Total $= 13 + 12 = 25$ students	B1
22b	Median $= 81$	B1
22c	Modal $= 70$	B1
22d	Girls : 5 students Boys : 1 student No. of students who scored more than 85 = 6 $\% = \dfrac{6}{25} \times 100\%$ $= 24\%$	M1 A1
23a	$BC = \sqrt{13^2 - 5^2} = 12$ cm [shown]	A1
23b	$\cos \angle BCD = \dfrac{12}{13}$	B1
23c	$\tan \angle ACB = \dfrac{9}{12}$ $\angle ACB = \tan^{-1}\dfrac{9}{12} = 36.9°$	M1 A1
23d	Area $= \dfrac{1}{2} \times 4 \times 12$ $= 24$ cm²	M1 A1

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East Spring Secondary School
Towards Excellence and Success

Name: _____ (   )

Class: _____

Preliminary Examination 2016
Secondary 4 Normal Academic

Mathematics
Paper 2

4045/02

15 August 2016
Monday

2 hours
0745 – 0945

Additional materials:
4 Writing papers
1 Graph paper

INSTRUCTIONS TO CANDIDATES

Write your Name and Index Number on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Section A
Answer all questions.

Section B
Answer 1 out of 2 questions

The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 60.

If working is needed for any question, it must be shown with the answer.
Omission of essential working will result in loss of marks.

You are expected to use an electronic calculator to evaluate explicit numerical expressions. If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place. For π, use either your calculator value or 3·142.

At the end of the examination, fasten all your work securely together.

60

Mathematical Formulae

Compound Interest

Total amount $= P\left(1 + \dfrac{r}{100}\right)^n$

Mensuration

Curve surface area of a cone $= \pi r l$

Surface area of a sphere $= 4\pi r^2$

Volume of a cone $= \dfrac{1}{3}\pi r^2 h$

Volume of a sphere $= \dfrac{4}{3}\pi r^3$

Area of triangle $ABC = \dfrac{1}{2}ab\sin C$

Arc length $= r\theta$, where θ is in radians

Area of sector $= \dfrac{1}{2}r^2\theta$ where θ is in radians

Trigonometry

$\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

$a^2 = b^2 + c^2 - 2bc\cos A$

Statistics

Mean $= \dfrac{\sum fx}{\sum f}$

Standard deviation $= \sqrt{\dfrac{\sum fx^2}{\sum f} - \left(\dfrac{\sum fx}{\sum f}\right)^2}$

2016 Prelim 4NA Paper 2   *Towards Excellence and Success*   page 2/7

This question paper consists of 7 printed pages including the cover page.

Section A (52 marks)

Answer all the questions in this section.

1. 12 workers can paint a block of building in 21 days.

   a) How many days would it take 9 workers to paint the same building? [1]

   b) If the building is to be painted in 14 days, how many workers are needed? [1]

2. The diameter of a micro-organism is 0.000 001 754 cm.

   a) Express the diameter, in centimetres, of the micro-organism, giving your answer in standard form. [1]

   b) Find the radius, in millimetres, of the micro-organism, giving your answer in standard form. [2]

3. a) Solve the inequality $3 + 5x < 18$. [1]

   b) Draw the solution on a number line. [1]

   c) Write down the largest possible prime number of x. [1]

4. Mr Lim is 5 times as old as his son, Jason.

   a) If Jason's age is y years, write down in terms of y, Mr Lim's age. [1]

   b) In 9 years' time, Mr Lim will be three times as old as Jason. Write down an equation in y and hence find Jason's age now. [3]

5. a) Factorise $2x^2 - 13x + 15$. [2]

   b) Solve $5x^2 - 7x + 2 = 4x - 1$
   Give your answers correct to 2 decimal places. [3]

6. a) The speed of a car is 45 km/h.
   Express the speed in metres per second. [2]

   b) A train travels with a speed 65 km/h for 1.5 hours. It then travels for another 2.5 hours at x km/h. Given that the average speed of the train is 70 km/h, find the value of x. [3]

---

7. Spherical solid iron balls of radius 0.8 cm are melted down to make a solid iron pyramid with a rectangular base as shown in the diagram below. $PQ = 8$ cm, $QR = 6$ cm and $VP = 13$ cm.
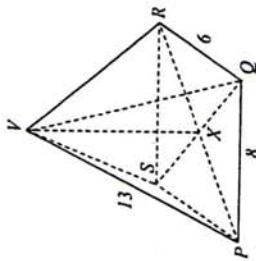
   a) Show that the length of $VX = 12$ cm. [2]

   b) Calculate the mass, in grams, of the pyramid given that the density of iron is 8 g/cm³. [2]

   c) Find the minimum number of iron balls required to make the pyramid. [2]

8. A toy manufacturer sets the selling price of their new toy at $15 each. The toy distributor is paid a commission by the manufacturer to sell the toys as follows:

   | 4% of the selling price for the first 1000 toys sold. |
   | 7% of the selling price for the next 1000 toys sold. |
   | 10% of the selling price for the remaining toys sold. |

   If 2850 toys were sold,

   a) Show that the commission earned by the distributor is $2925. [3]

   b) Calculate the total profit made by the manufacturer if the production cost per toy was $5. [3]

   c) The manufacturer decides to give a 5% discount for each toy. Calculate the total selling price of the toys after the discount. [2]

9. Answer the whole of this question on a single sheet of graph paper.

The table below is for $y = x^3 - 4x^2 + 14$.

x	-2	-1	0	1	2	3	4	5
y	-10	p	14	11	6	5	14	q

a) Calculate the values of p and q. [2]

b) Using a scale of 2 cm to 1 unit on the horizontal x-axis for $-2 \leq x \leq 5$.
Using a scale of 2 cm to 5 units on the vertical y-axis for $-10 \leq x \leq 40$.
Plot the graph of $y = x^3 - 4x^2 + 14$ for $-2 \leq x \leq 5$. [3]

c) Find the value of x when $y = 25$. [1]

d) By drawing a tangent, find the gradient of the graph $y = x^3 - 4x^2 + 14$ when $x = -1$. [2]

10. The table below shows part of the PUB bill incurred for electricity, gas and water for the household use by Chia's family.

CURRENT MONTH CHARGES	Usage	Rate ($)
Electricity Services		
Opening Reading on 19-07-2016 : 57984		
Reading taken on 04-08-2016 : 58218		
Electricity	234 kWh	0.2728
Gas Services by City Gas Pte Ltd		
Opening Reading on 19-07-2016 : 8850		
Reading taken on 04-08-2016 : 8862		
Gas	12 kWh	0.1799
Water Services by Public Utilities Board		
Opening Reading on 19-07-2016 : 1580.8		
Reading taken on 04-08-2016 : 1593.8		
Water	13.0 Cu M	1.1700

a) Find the amount payable for water usage. [1]

b) Given that the rate of GST on the utilities bill is 7%, find the GST that the Chia's family has to pay. [2]

In the following month, the consumption of gas decreased to 10kWh, electricity increased by 20% and consumption of water remained unchanged.

c) Find the percentage decrease in the consumption of gas. [2]

d) Find the total utilities bill inclusive of GST to 2 decimal places. [3]

Section B (8 marks)

Answer one question from this section. Each question carries 8 marks.

11. In the diagram, O is the centre of the circle $ABCD$. $\angle OAC = 31°$ and $\angle BDC = 54°$.
Line BOD is a diameter of the circle.

Calculate

a) $\angle CBD$ [2]

b) $\angle CAD$ [1]

c) $\angle AOD$ [2]

d) $\angle AOB$ [1]
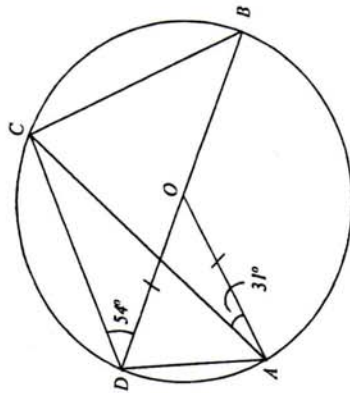
e) Area of sector AOB, given that $OB = 4$ cm. [2]
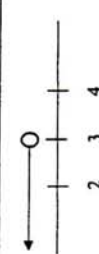
12. A bag contains 5 red balls and 7 blue balls. Two balls are taken at random from the bag, one after the other and are not replaced.

First ball   Second ball
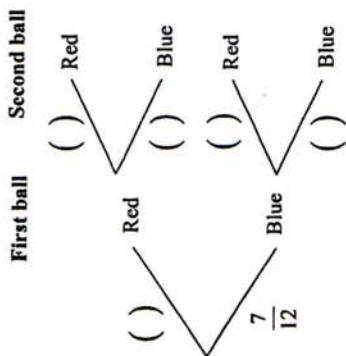
a) Copy and complete the probability tree shown. [2]

b) Calculate the probability that

    i)   the first ball is red, [1]

    ii)   both balls are red, [1]

    iii)   one ball is red while the other ball is blue, [2]

    iv)   at least one ball is blue [2]

~ End of paper ~

6b	$\dfrac{(65\times1.5)+2.5x}{1.5+2.5}=70$	M1
	$\dfrac{97.5+2.5x}{4}=70$	
	$2.5x=280-97.5$	
	$x=\dfrac{182.5}{2.5}$	M1
	$x=73$ km/h	A1
7a	$PX=\sqrt{4^2+3^2}=5$ cm	M1
	$VX=\sqrt{13^2-5^2}$	A1
7b	Volume $=\dfrac{1}{3}\times(8\times6)\times12=192\,\text{cm}^3$	M1
	Mass $=192\times8=1535$g	A1
7c	Vol of a ball $=\dfrac{4}{3}\times\pi\times0.8^3=2.14466\ \text{cm}^3$	M1
	No. of iron balls $=\dfrac{192}{2.14466}=89.5$	
	Min number = 89 balls	A1
8a	Commission earned	M2
	$=(\frac{4}{100}\times15\times1000)+(\frac{7}{100}\times15\times1000)+(\frac{10}{100}\times15\times850)$	
	$=600+1050+1275$	
	$=\$2925$ [shown]	A1
8b	Profit per toy $=15-5=\$10$	M1
	profit $=10\times2850=\$28500$	M1
	Final profit $=28500-2925=\$25\,575$	A1
8c	Total selling price $=\dfrac{95}{100}\times15\times2850$	M1
	$=\$40612.50$	A1
9a	$p=9,\quad q=39$	A2
9b	See attached	Scale → B1 Plot → B1 Curve → B1
9c	$x=4.55\ \pm0.1$	A1
9d	Drawing of gradient line	M1
	From graph, gradient $=\dfrac{19.5-5}{0.1-(-1.2)}=11.2\pm1.2$	A1

1a	12 workers → 21 days	
	9 workers → $\dfrac{12}{9}\times21=28$ days	A1
1b	21 days → 12 workers	
	14 days → $\dfrac{21}{14}\times12=18$ workers	A1
2a	1.754×10^{-6} cm	B1
2b	Radius $=\dfrac{0.000001754}{2}\times10$	M1
	$=8.77\times10^{-6}$ mm	A1
3a	$3+5x<18$	
	$5x<15$	
	$x<3$	A1
3b	(number line: open circle at 3, arrow to left; marks 2, 3, 4)	B1
3c	2	B1
4a	5y	B1
4b	$5y+9=3(y+9)$	M1
	$5y+9=3y+27$	M1
	$2y=18$	
	$y=9$ years old	A1
5a	$\begin{array}{c|cc} & 2x & -3 \\ \hline x & 2x^2 & -3x \\ -5 & -10x & 15 \end{array}$	M1
	$2x^2-13x+15=(2x-3)(x-5)$	A1
5b	$5x^2-7x+2=4x-1$	M1
	$5x^2-7x+2-4x+1=0$	
	$5x^2-11x+3=0$	M1 A2
	$x=1.88$ or $x=0.32$ (2dp)	
6a	45 km/h $=\dfrac{45\times1000}{1\times60\times60}$	M1
	$=12.5$ m/s	A1

12bii	P(both balls are red) = $\dfrac{5}{12} \times \dfrac{4}{11} = \dfrac{5}{33}$	A1
12biii	P (one ball is red, the other is blue) = $\left(\dfrac{5}{12} \times \dfrac{7}{11}\right) + \left(\dfrac{7}{12} \times \dfrac{5}{11}\right)$ $= \dfrac{35}{66}$	M1 A1
12biv	P(at least one ball is blue) = 1 − P(both balls are red) $= 1 - \dfrac{5}{33}$ $= \dfrac{28}{33}$	M1 A1

10a	Amount = 13 × 1.17 = $15 .21	A1
10b	Total = (234×0.2728)+(12×0.1799)+15.21 = 81.204	M1
	GST = $\dfrac{7}{100}$ ×81.204 = $5.68 (2dp)	A1
10c	Decrease = 12−10 = 2 kWh	M1
	Percentage = $\dfrac{2}{12}$ ×100% = 16.7%	A1
10d	Electricity = 1.2×234×0.2728 = $76.602	M1
	Total bill = 76.602 + (10×0.1799) + 15.21 = 93.611	M1
	With GST = 93.611×1.07 = $100.16 (2dp)	A1
11a	∠BCD = 90° (angle in semicircle)	M1
	∠CBD = 180−90−54 = 36° (angle sum of triangle)	A1
11b	∠CAD = ∠CBD = 36° (angles in same segment)	B1
11c	∠AOD = 180−2(36+31)	M1
	= 46° (angles in isosceles triangle)	A1
11d	∠AOB = 180−46 = 134° (angles on a straight line)	A1
11e	Area of sector = $\dfrac{134}{360}$ × π × 4²	M1
	= 18.7 cm² (3sf)	A1
12a	First ball Second ball — $\left(\dfrac{5}{12}\right)$ Red, $\dfrac{7}{12}$ Blue; Red → $\left(\dfrac{4}{11}\right)$ Red, $\left(\dfrac{7}{11}\right)$ Blue; Blue → $\left(\dfrac{5}{11}\right)$ Red, $\left(\dfrac{6}{11}\right)$ Blue	A2 (Minus one mark for 1 error)
12bi	P(first ball is red) = $\dfrac{5}{12}$	B1

FAIRFIELD METHODIST SCHOOL (SECONDARY)

PRELIMINARY EXAMINATION 2016
SECONDARY 4 NORMAL (ACADEMIC)

MATHEMATICS SYLLABUS A   4045/01

Paper 1

Date: 27 July 2016   Duration: 2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.

If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is 80.

You are expected to use a scientific calculator to evaluate explicit numerical expressions.
If the degree of accuracy is not specified in the question and if the answer is not exact, give
the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

For Examiner's Use	
Paper 1	/ 80

Setter: Mrs Jessica Chak

This question paper consists of 18 printed pages including the cover page.

Name: _____ (   )   Class: _____

Mathematical Formulae

Compound interest

$$\text{Total amount} = P\left(1+\frac{r}{100}\right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Area of a triangle } ABC = \frac{1}{2}ab\sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

Answer **all** the questions.

1   The temperature in a freezer is –23 °C. The temperature outside the freezer is 31 °C.
    (a)   Find the difference between these two temperatures.

Answer (a) ....°C [1]

    (b)   Find the mean of the two temperatures.

Answer (b) ....°C [1]

2   The distance from a ship to a lighthouse is 267 400 000 cm.

    (a)   Write 267 400 000 in standard form.

Answer (a) .... [1]

    (b)   The speed of sound is 340.29 m/s.
        Calculate the time taken, in seconds, for the ship's horn to be heard at the lighthouse, after it's sounded.

Answer (b) .... s [2]

3   At a game's booth, you are asked to guess a mystery number based on the following three clues.

Clue One: This number is between the 201 and 250.

Clue Two: When you divide this number by 7, you will get a remainder of 4.

Clue Three: When you divide this number by 12, you will have no remainder.

What is the number?

Answer .... [2]

4   A farmer has 0.7 hectares of land to grow tomatoes, potatoes and cabbages. He allocated half of his land to grow potatoes, one-third of the other half to grow cabbages and the remainder land to grow tomatoes.

(a)   Express the land for growing tomatoes as a fraction of the total land of the farmer.

Answer (a)... [1]

(b)   Given that 1 hectare = 10 000m^2, how much land was allocated to grow tomatoes. Express your answer in m^2.

Answer (b)... m^2 [2]

5   **(a)**   Represent the positions of the following values on the number line provided.

$\sqrt{7.7}$ 0.97^3 π
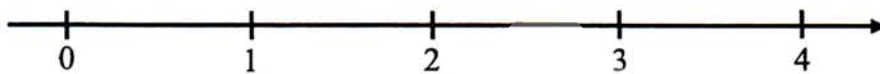
Answer (a)   [2]

(b)   Write down the inequality sign to complete the following linear inequality.

$\sqrt{7.7}$ ☐ π

Answer (b) .... [1]

---

6   Given that $\dfrac{2}{x+p} = \dfrac{3}{q}$, express x in terms of p and q.

Answer .... [3]

7   A map is drawn to a scale of 1 : 20 000.

(a)   On the map, the perimeter of a soccer field is represented by a length of   185 cm.

Calculate the actual perimeter of the soccer field, giving your answer in kilometres.

Answer (a) .... km [1]

(b)   The actual area of a lake is 6.4 km^2.

Calculate the area on the map which represents the lake, giving your answer in square centimetres.

Answer (b) .... cm^2 [2]

8   Write $\dfrac{4}{x-3} - \dfrac{1}{x^2-6x+9}$ as a fraction in its simplest form.

Answer .... [2]

9   Given that $x=3$, $y=-2$ and $z=5$, find the value of

   (a) $2x+y$,

Answer (a).. [1]

   (b) x^3z,

Answer (b).. [1]

   (c) $\dfrac{5x+3z}{y}$.

Answer (c).. [1]

10   Adrian is n years old now and Beth is 37 years younger than Adrian.

Find an expression, in its simplest form, for the sum of their ages in five years' time.

Answer .... years old [2]

11   A photograph is 10 cm wide and 14 cm high. An enlargement of the photograph has a
      height of 35 cm.
      Calculate the width of the enlarged photograph.

      Answer .... cm [1]

12   Factorise
      (a) $x^2 - 9$,

             Answer (a) .... [1]

      (b) $6x^2 + x - 2$.

             Answer (b) .... [2]

13   List the two pairs of coordinates, (x, y), for which x and y are positive integers, such
      that $4x + 3y = 29$.

      Answer (.........., ...) and (.........., ...) [2]

14   **(a)**   Given that $7^h = 7^{-3} \times 7^{11}$, find h.

Answer (a) $h =$ ………………..………………………… [1]

(b)   Given that $7^p = \dfrac{7^{\frac{2}{3}}}{7^{-4}}$, find p.

Answer (b) $p =$ ………………..…………………….. [1]

(c)   Given that $4^t = 64^3$, find t.

Answer (c) $t =$ ………………..……………….……. [1]

15   Simplify

(a) $\dfrac{ab}{c^2} \times \dfrac{4c}{6a^2b}$,

Answer (a) .... [2]

(b) $(x-3y)^2 - 2y$,

Answer (b) .... [1]

(c) $a^2 - (a-b)(a+b)$.

Answer (c) .... [2]

16   The diagram is made up of rectangles and squares. The sides of each rectangle are of length x metres and y metres. The sides of each square are of length $\frac{1}{2}x$ metres.
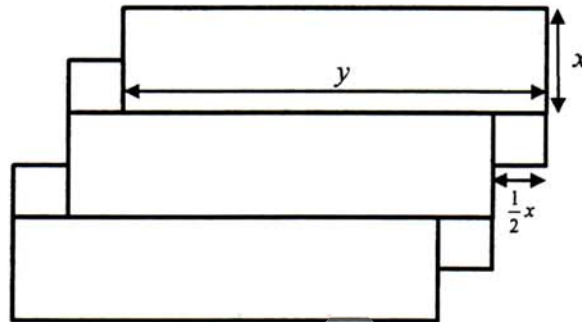
Simplifying each answer as far as possible, find an expression, in terms of x and y, for

(a)   the perimeter of the diagram,

Answer (a) .... m [1]

(b)   the area of the diagram.

Answer (b) .... m² [2]

17 **(a)** Written as a product of its prime factors, $198 = 2 \times 3^2 \times 11$.
Write 660 as a product of its prime factors.

Answer (a) .... [1]

(b) **(i)** Find the highest common factor for 198 and 660.

Answer (b)(i)... [1]

(ii) Find the smallest positive integer, *n*, such that $198n$ is a perfect cube.

Answer (b)(ii) n =.. [1]

18 On any given day, the probability that I will miss the train is $\dfrac{1}{3}$.

Find the probability that
(a) I will miss the train on two particular consecutive days,

Answer (a) .... [2]

(b) I will miss the train on just one of the two particular consecutive days.

Answer (b) .... [2]

19   The diagram shows a card made up of a sector *ABCD* and a semicircle *ADE*.
      The circular arc *BCD* has centre *A* and radius 21 cm. Angle *BAD* = 65°.
      The semicircle *DEA* has centre *O*.
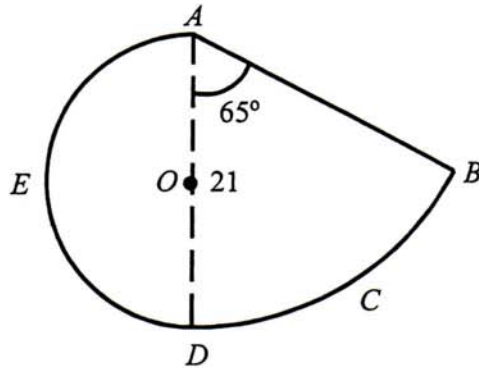
Calculate

(a)   the length of the arc *BCD*,

Answer (a) ……………………………………..…….... cm [2]

(b)   the total surface area of the card *ABCDE*.

Answer (b) …………………………………………..…... cm² [2]

20   Solve

(a) $\dfrac{3}{a}=\dfrac{5}{a-2}$,

Answer (a) a = ... [2]

(b) $\dfrac{b-1}{3}+\dfrac{b+5}{2}=8.$

Answer (b) b = ... [3]

21

Figure 1

Figure 2

Figure 3

Figure 4
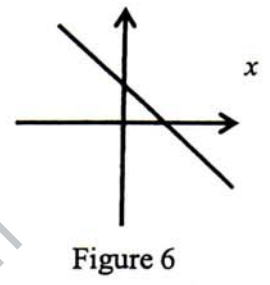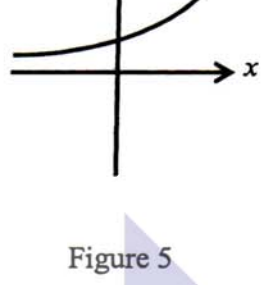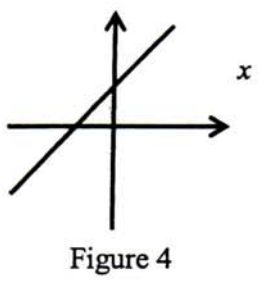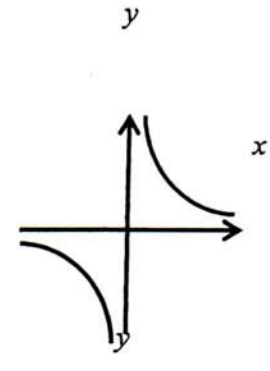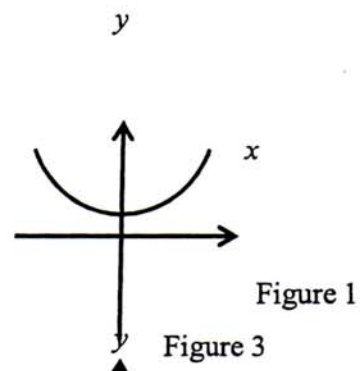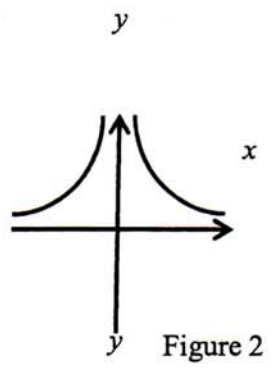
Figure 5

Figure 6

Which of the above could be the graph of

(a) $y = \dfrac{1}{x}$,

Answer (a) Figure …………………………..…… [1]

(b) $y = 1 - x$,

Answer (b) Figure …………………………..…… [1]

(c) $y = x^2 + 1$.

Answer (c) Figure …………………………..…… [1]

22 List the integer values of x for which $7x > 65$ and $25 - 2x \geq 1$.

Answer ……………………………………………..………... [2]

23   The graph shows the rate of exchange between Pounds Sterling (£) and Singapore Dollars ($).

Pounds Sterling (£) — vertical axis
Singapore Dollar ($) — horizontal axis
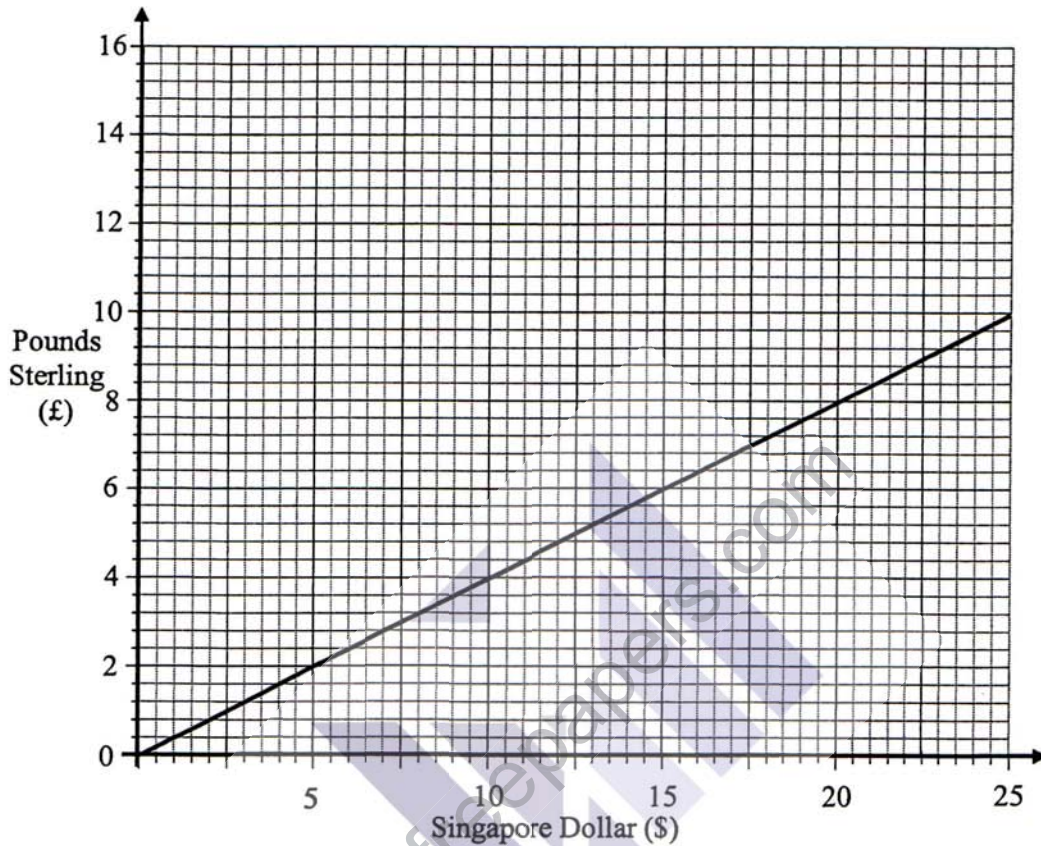
(a)   Use the graph to estimate

(i)   the value of $20 in pounds,

Answer (ai) £……………………………………..…... [1]

(ii)   the value of £6 in dollars,

Answer (aii) $……………………………...……………... [1]

(b)   Hence, find the value, in dollars, of a car which costs £15 000.

Answer (b) $……………………………...…………...…... [1]

(c)   During the 2016 economic downturn, it was given that £1 = $1.80.
      Use the same gird above, draw the conversion graph between Singapore
      Dollars and the new Pounds Sterling.   [2]

24   In the diagram, the lines *BC* and *QR* are parallel. The lines *QB* and *RC*, when produced, meet at *X*. The triangle *BQR* is isosceles with *QB* = *QR*.
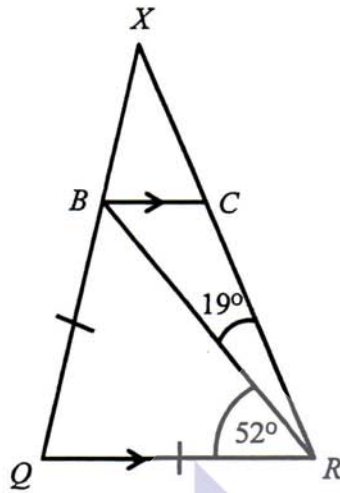
Given that angle *BRC* = 19° and angle *BRQ* = 52°, calculate

(a)   angle *CBR*,

Answer (a) ....° [1]

(b)   angle *BCX*,

Answer (b) ....° [1]

(c)   angle *BXC*.

Answer (c) ....° [2]

25 In the diagram, B is the point $(0, 16)$ and C is the point $(0, 6)$.

The sloping line through B and the horizontal line through C meet at the point A.
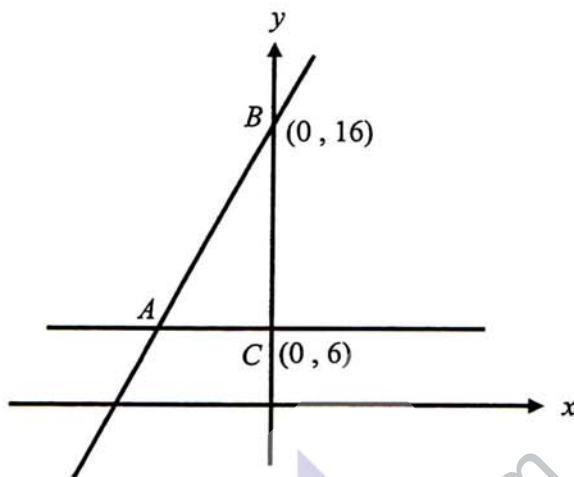
(a) Write down the equation of the line AC.

Answer (a) .... [1]

(b) Given that the gradient of the line AB is 2, find the equation of the line AB.

Answer (b) ....° [2]

(c) Calculate the coordinates of the point A.
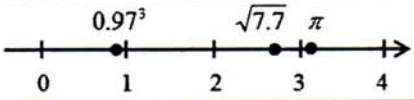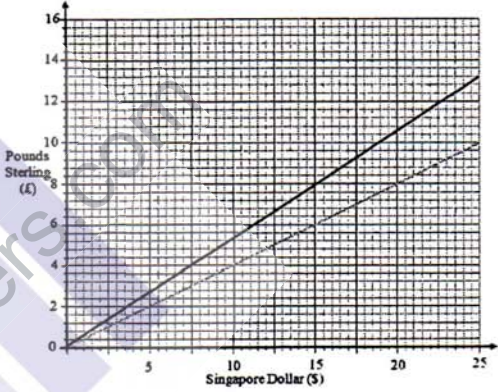
Answer (c) (...................... , ...) [2]

(d) Calculate the area of the triangle ABC.

Answer (d) .... units² [2]

~ End of Paper ~

1a	54	**19a**	23.8 (3sf)
1b	4	**19b**	423 (3sf)
2a	2.674×10^8 cm	**20a**	$a = -3$
2b	Time Taken $= 7.86 \times 10^3$ (3sf)	**20b**	$b = 7$
3	228	**21a**	Figure 3
4a	$\dfrac{1}{3}$	**21b**	Figure 6
		21c	Figure 2
4b	$2333\dfrac{1}{3}$ or 2330 (3sf)	**22**	$\therefore x = 10, 11, 12$
5a	(number line: 0.97^3 between 0 and 1; $\sqrt{7.7}$ and π between 3 and 4)	**23ai**	£8
		23aii	$15
		23b	$37500
5b	$\sqrt{7.7} < \pi$	**23c**	(graph)
6	$x = \dfrac{2q-3p}{3}$ or $\dfrac{2q}{3} - p$		
7a	37 km		
7b	160 cm^2		
8	$\dfrac{4x-13}{(x-3)^2}$		
9a	4		
9b	135		
9c	-15		
10	$2n - 27$		
11	25	**24a**	52°
12a	$(x-3)(x+3)$	**24b**	71°
12b	$(3x+2)(2x-1)$	**24c**	33°
13	$(2, 7)$ and $(5, 3)$	**25a**	$y = 6$
14a	8	**25b**	$y = 2x + 16$
14b	$p = 4\dfrac{2}{3}$ or $\dfrac{14}{3}$	**25c**	$(-5, 6)$
14c	$t = 9$	**25d**	25
15a	$\dfrac{2}{3ac}$		
15b	$x^2 - 6xy + 9y^2 - 2y$		
15c	b^2		
16a	$8x + 2y$		
16b	$3xy + x^2$		
17a	$660 = 2^2 \times 3 \times 5 \times 11$		
17bi	HCF = 66		
17bii	1452		
18a	$\dfrac{1}{9}$		
18b	$\dfrac{4}{9}$		

For 23c:

NAME: _____ ( ) CLASS: _____

FAIRFIELD METHODIST SCHOOL (SECONDARY)

PRELIMINARY EXAMINATION 2016
SECONDARY 4 NORMAL (ACADEMIC)

MATHEMATICS SYLLABUS A   4045/02

Paper 2

Date: 28 July 2016   Duration: 2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer all questions.
The number of marks is given in brackets [ ] at the end of each question or part question.

If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is 60.

You are expected to use a scientific calculator to evaluate explicit numerical expressions.
If the degree of accuracy is not specified in the question and if the answer is not exact, give
the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

For Examiner's Use	
Paper 2	/ 60

Setter: Mrs Jessica Chak

This question paper consists of <u>10</u> printed pages including the cover page.

Name: _____ ( ) Class: _____

Mathematical Formulae

Compound interest

$$Total\ amount = P\left(1 + \frac{r}{100}\right)^n$$

Mensuration

Curved surface area of a cone $= \pi r l$

Surface area of a sphere $= 4\pi r^2$

Volume of a cone $= \frac{1}{3}\pi r^2 h$

Volume of a sphere $= \frac{4}{3}\pi r^3$

Area of a triangle $ABC = \frac{1}{2}ab\sin C$

Arc length $= r\theta$, where θ is in radians

Sector area $= \frac{1}{2}r^2\theta$, where θ is in radians

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$Mean = \frac{\sum fx}{\sum f}$$

$$Standard\ deviation = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

Section A (52 marks)
Answer all the questions.

1   In the diagram, $AB = 6$ cm, $BC = 4$ cm, $AE = 8$ cm and BE is parallel to CD.
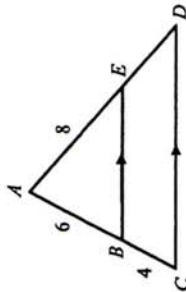
Find the value of ED. [2]

2   A new credit card offered 2 types of discount for customers to choose from.

Discount Type A: 12% off the total expenditure

Discount Type B: $200 off followed by 8% off the remaining expenditure.

Which discount plan should David choose if his total expenditure was $6595? Explain with clear workings. [3]

3   Charmaine took 3 tests, an English test, a Mathematics test and a Science test. Her marks in the three tests were in the ratio 6 : 3 : 5 respectively. Her total mark for all the three tests are 210.

(a) Calculate her mark in the Science test. [2]

(b) Charmaine was disappointed with her Mathematics test mark and retook the test. She made an improvement of 80% in her test mark. Calculate her new Mathematics test mark. [2]

4   A tour bus left Singapore for Malacca at 09 45. The tour bus travelled at an average speed of 90 km/h to Yong Peng, a town 145 km away where it made a rest stop. After resting for 15 minutes, the tour bus continued on the remaining journey of 155 km, which took 1 hour 30 minutes. Calculate

(a) the time taken for the tour bus to reach Yong Peng, in hours and minutes, correct to the nearest minute. [2]

(b) the average speed taken by the tour bus for the whole journey. [2]

5   (a) During a period of 60 days, a weather station recorded the number of millimetres of rain collected each day. The results are given in the table below.

Rain (mm height)	$0 \le x < 2$	$2 \le x < 4$	$4 \le x < 6$	$6 \le x < 8$	$8 \le x < 10$	$10 \le x < 12$
Days	10	15	12	10	8	5

Calculate an estimate for the mean number of millimetres of rain collected each day. [3]

(b) A number of 40 children were asked what was their favourite TV channel and their responses were recorded in a table below.

Favourite Channel	301	302	303	304
Number of Children	6	13	9	12

To analyse the results, which central tendency measure would be the most suitable? Explain your answer. [2]

8 The cost, C dollars, of a mobile data plan is given by the formula

$$C = a + bn$$

where n is the number of units of data used, and a and b are constants.

(a) When 200 units of data are used, the cost is $49 and when 500 units of data are used, the cost is $85.

Write down two equations to represent the above information, in a and b. [2]

(b) Solve these equations to find the values of a and b. [3]

9 In the diagram, ABC is a straight line, $BD = 17$ cm, $\angle BCD = 90°$ and $\angle BDC = 28.1°$.
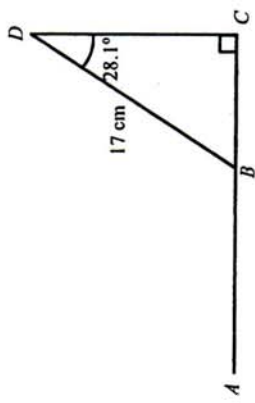
Calculate

(a) the length of BC, [2]

(b) $\cos \angle ABD$, [2]

(c) the area of triangle BCD. [2]

6
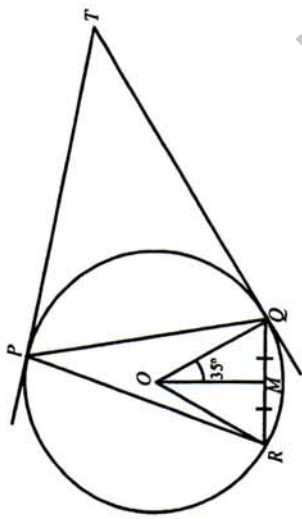
A circle with a centre O passes through P, Q and R. The tangents to the circle at P and Q meet at T. The midpoint of RQ is M. $\angle QOM = 35°$.

(a) Calculate

(i) $\angle ORM$, [1]

(ii) $\angle RPQ$. [1]

(b) Given that $\angle PQO = 15°$, calculate $\angle PTQ$, giving a reason for each step of this calculation. [3]

7
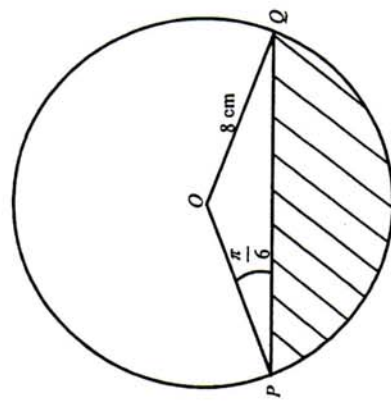
In the diagram, O is the centre of a circle of radius 8 cm. PQ is a chord and $\angle OPQ = \dfrac{\pi}{6}$. The minor segment of the circle formed by the chord PQ is shaded.

(a) Show that $\angle POQ = \dfrac{2\pi}{3}$. [2]

(b) Calculate the area of the shaded region. [3]

11 Answer the whole of this question on a sheet of graph paper.

This table of values is for $y = 3x^2 - x^3$.

x	-2	-1	0	1	2	3	4
y	20	4	0	0	a	0	-16

(a) Calculate the value of a. [1]

(b) Draw the graph of $y = 3x^2 - x^3$ for $-2 \leq x \leq 4$. [3]

Use a scale of 2 cm to represent 1 unit on the x-axis and 2 cm to represent 5 units on y-axis.

(c) Use your graph to find the values of x when $y = 3$. [1]

(d) By drawing a tangent, find the gradient of the curve at the point where $x = 0.5$. [2]

---

10 Here is some information about a fire extinguisher.

Fire Extinguisher Tank

Mass: 1.2 kg

Extinguishing Medium:
Tank can be filled with XYZ Powder to a maximum of 40% of its total volume.

In this question, the fire extinguisher tank can be modelled as a cylinder with a cone on top.
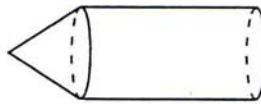
(a) Given that the volume of the empty fire extinguisher is 2312.466 cm³, express the volume in cubic metres. [1]

(b)

Useful Information
- Density of XYZ Powder: 1250 kg/m³

The fire extinguisher tank is filled with the maximum amount of XYZ powder and the rest with pressurized gas.

Find the mass, in kilograms, of a filled fire extinguisher. [4]

(c) State one assumption made in part (b). [1]

Section B (8 marks)

Answer one question from this section.

12 In the diagram, ABC represents a horizontal triangular field and AD represents a vertical tree of height 19 m in the corner of the field. The bearing of A from B is $078°$. $AB = 108$ m, $AC = 81$ m and $BC = 135$ m.
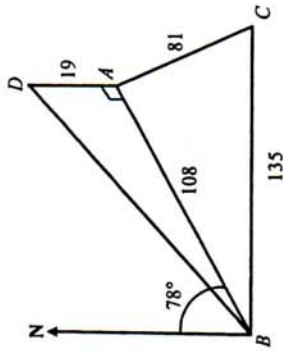
(a) Find the bearing of B from A. [1]

(b) Calculate angle BCA. [3]

(c) Show that triangle ABC is a right-angled triangle. [2]

(d) Calculate the angle of elevation of the top of the tree from B. [2]

---

13 The cumulative frequency graph represents the Mathematics test mark obtained by a group of 50 students.
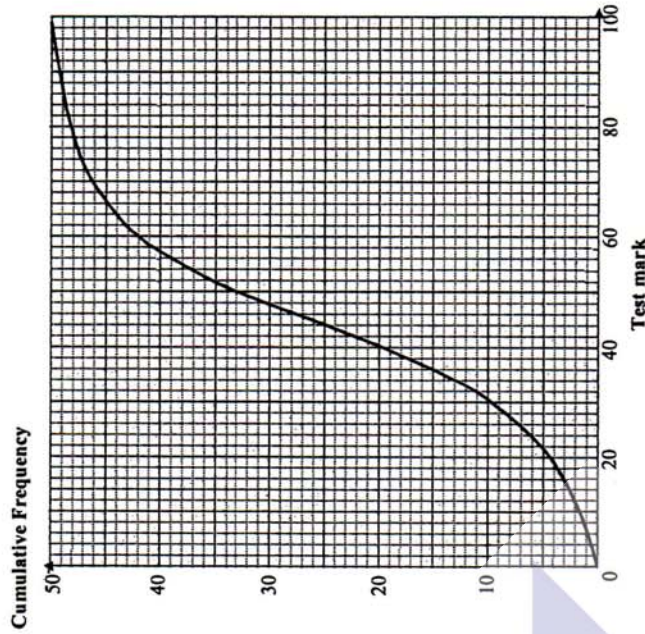
(a) Use the graph to find

(i) the median mark, [1]

(ii) the interquartile range. [2]

(iii) the number of students who scored 78 marks or more, [1]

(iv) the pass mark which would allow 80% of pupils to pass the test. [2]

(b) Two of the students were chosen at random.

Find the probability that both student score at least 60 marks. [2]

~ End of Paper ~

1	$ED = 5\frac{1}{3}$ or 5.33
2	Expenditure after Type A Discount = $5803.60 Expenditure after Type B Discount = $5883.40 David should choose Type A discount.
3a	75 marks
3b	81 marks
4a	1 hour 37 minutes
4b	$89\frac{31}{121}$ km/h or 89.3 km/h
5a	Mean = 5.2
5b	Mode because this average is based on the children's preferences / opinion
6ai	55°
6aii	35°
6b	$\angle PTQ = 30°$
7	$\angle POQ = \frac{2\pi}{3}$
8a	$49 = a + 200b$ $85 = a + 500b$
8b	$a = 25$, $b = 0.12$
9a	$BC = 8.01$
9b	$-\frac{8}{17}$
9c	60 cm²
10a	0.002312466 m³
10b	2.36 kg (3sf)
10c	Mass of the pressurized gas is negligible, or The fire extinguisher tank has negligible thickness
11a	$a = 4$
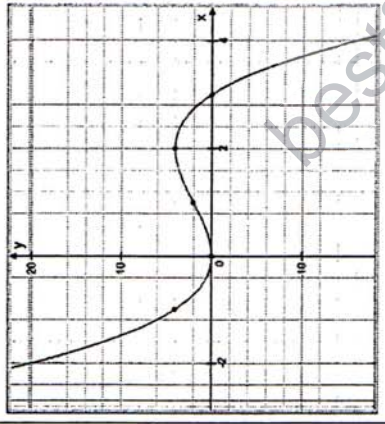
11b		
11c	$x = -0.8 \pm 0.1$ or $x = 1.4 \pm 0.1$ or $x = 2.5 \pm 0.1$	
11d	Gradient of tangent = 2.25 ± 0.4	
12a	Bearing of B from A = 258°	
12b	$\angle BCA = 53.1°(1d.p.)$	
12c	$BA^2 + AC^2 = 108^2 + 81^2 = 18225$ $BC^2 = 135^2 = 18225$ By converse of Pythagoras Theorem, $BA^2 + AC^2 = BC^2$, Therefore, triangle ABC is right-angled triangle.	
12d	Angle of Elevation = $\angle DBA = 10.0°$ (1dp)	
13ai	Median mark = 44 marks	
13aii	Interquartile range = 20 marks	
13aiii	2 students	
13aiv	80% of 50 students = 40 students Pass mark = 30 marks	
13b	P(both student score at least 60 marks) = $\frac{4}{175}$	

Geylang Methodist School (Secondary)
Preliminary Examination 2016

Candidate Name

Class

Index Number

MATHEMATICS

4045/01

Paper 1

Sec 4 Normal (Academic)

Candidates answer on the Question Paper.

2 hours

Setter : Mr Wong Han Ming

2 August 2016

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use a pencil for any diagram or graph.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
If working is needed for any question, it must be shown with the answer.
Omission of essential working will result in the loss of marks.
Calculators should be used where appropriate.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to 3 significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

For Examiner's Use
80

This document consists of **17** printed pages including the cover page and 1 blank page.

[Turn over

Mathematical Formulae

Compound interest

$$\text{Total amount} = P\left(1+\frac{r}{100}\right)^n$$

Mensuration

Curved Surface Area of a cone $= \pi r l$

Surface Area of a sphere $= 4\pi r^2$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2}ab\sin C$$

Arc length $= r\theta$, where θ is in radians

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

[Turn over 2

Answer **all** the questions.

1   Arrange the following numbers in descending order.

$$0.3, \quad -0.3, \quad , 0.3^0, \quad 0.\dot{3}$$

Answer _____ [1]

_____

2   **(a)**   In a class, 64% of the students are boys. Write the ratio of the number of girls to the total number of students in the class in its simplest form.

Answer   *(a)* _____ [1]

(b) $25\dfrac{5}{7}\%$ of the cars produced in a factory are white. Given that the number of white cars the factory produces is 36, find the total number of cars that the factory produces.

Answer   *(b)* _____ [1]

_____

3   By writing each number correct to 1 significant figure, estimate the value of
$$\frac{331.27 + 48.216}{9.03 - 1.73}.$$
You **must** show your working.

Answer _____ [2]

_____

[Turn over 3

4   Simplify $\dfrac{5^3 \times 5^7}{5^{15}}$, expressing your answer as a single power of 5.

Answer _____ [2]

---

5   Given that triangle *ABC* is similar to triangle *XYZ* in the diagram below, find
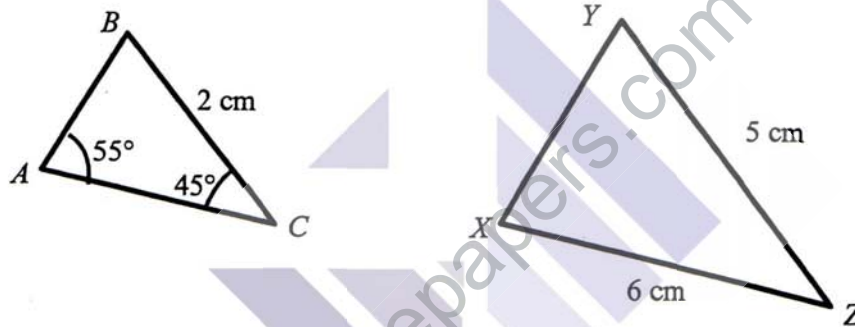
(a)   the value of the angle *XYZ*.

Answer   *(a)* _____ ° [1]

(b)   the length of *AC*.

Answer   *(b)* _____ cm [1]

[Turn over 4

6   **(a)**   Express 5292 as the product of its prime factors.

Answer   (a) _____ [1]

(b)   Find the lowest common multiple of 5292 and $2 \times 3^4 \times 5 \times 7^2$, giving your answer as the product of its prime factors.

Answer   (b) _____ [1]

7   A bag contains red, blue and yellow marbles.

(a)   If a marble is drawn at random, the probability of drawing a red marble is r and the probability of drawing a blue marble is b. Write an expression in terms of r and/or b, for the probability of drawing a yellow marble.

Answer   (a)   P(yellow) = _____ [1]

(b)   Justin claims that the value of r is 0.35 and the value of b is 0.74. Explain why Justin cannot be correct.

Answer (b) _____

_____

_____ [1]

[Turn over 5

8
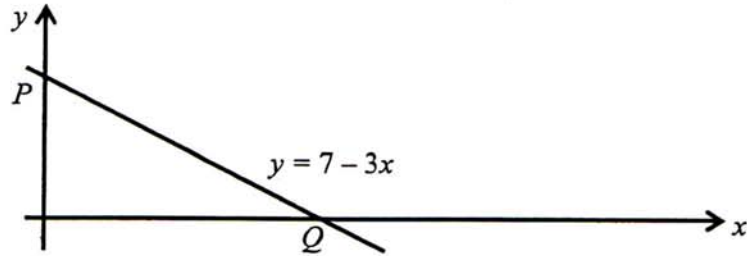
The line $y = 7 - 3x$ is shown in the diagram and intersects the y and x axes at P and Q respectively. Find the coordinates of P and Q.

Answer $P =$ _____ [1]

$Q =$ _____ [1]

9   The population of Singapore in 2015 is 5.5 million.

(a)   Express the population of Singapore in 2015 in standard form.

Answer   (a) _____ [1]

(b)   If the population of Singapore in 2014 is 5.47 million, by how many people did the population increase from 2014 to 2015?

Answer   (b) _____ people [1]

[Turn over 6

10   Given the diagram, express c in terms of a and b.
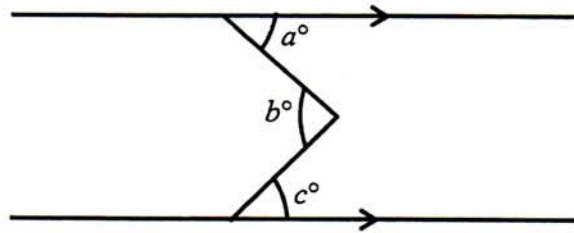
                                    Answer _____ [2]

11   Solve the simultaneous equations.

$$3x - 2y = -9$$
$$x = 4 - 4y$$

                    Answer $x =$ _____

                              $y =$ _____ [3]

[Turn over 7

12   (a)   A class has 40 students and 1 teacher. By letting *S* represent the number of students and letting *T* represent the number of teachers, form an equation in *S* and *T*.

Answer   (a) _____ [1]

(b)   Make *k* the subject of the formula.

$$2x + 3k = 3x - y$$

Answer   (b) _____ [2]

13   Four angles in an octagon are in the ratio 1 : 2 : 3 : 4. The remaining angles are 65° each. Find the value of the largest angle of the octagon.

Answer _____ ° [3]

[Turn over 8

14 **(a)** A symmetrical dot diagram is used to represent a set of 6 data values as shown.
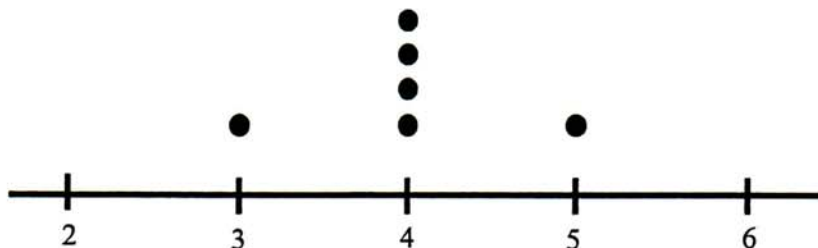
This set of data has mean = median = mode = 4.

Draw an asymmetrical (non-symmetrical) dot diagram below with 6 data values using the number line below, such that the mean, median and mode are the same as the previous diagram.

Answer (a)

[2]

(b) State the appropriate sign (<, =, >) in the statement below.

Answer (b)

The standard deviation of the symmetrical diagram is _____ the standard deviation of the asymmetrical diagram. [1]

15 Find the equation of the straight line passing through the points (1 , −13) and (−1 , −5).

Answer _____ [3]

16 (a) Solve $4^{x+1} = 2^{6x} \div 2^{3x-3}$.

Answer   *(a)* $x=$ _____ [2]

(b) Simplify $\left(5^{5x+7}\right)^0 \times 3^{2x+1} \div 3^{2x-2}$.

Answer   *(b)* _____ [2]

17 A map is drawn to a scale of 1 : *n*. A straight road of 4 km is represented by 5 cm on the map.

(a) Find the value of *n*.

Answer   *(a)* $n=$ _____ [2]

(b) A pond is represented by 3 cm² on the map. Find the actual area of the pond in square kilometers.

Answer   *(b)* _____ km² [2]

[Turn over 10

18 Expand and simplify,

(a) $5(x-3)-2x(5-3x)$,

Answer (a) _____ [2]

(b) $2(2x-3)(4-x)$.

Answer (b) _____ [2]

19 **(a)** Jenny bought a dress for \$92. She then sold it to Mary for \$115. Express the profit Jenny made as a percentage of what she paid for it.

Answer (a) _____ % [2]

(b) Mary then sells it to Nellie at a loss of 10% of what she herself paid for it. How much did Nellie pay for the dress?

Answer (b) \$ _____ [2]

[Turn over 11

20 Factorise completely,
   (a) $27x - 9y$,
   (b) $x^2 - 4y^2$,
   (c) $2x^2 - 5x - 3$.

Answer (a) _____ [1]

(b) _____ [1]

(c) _____ [2]

183

21   Given that $x = -1$, $y = 2$ and $z = 3$, find the value of
    (a) $3x^2 + y - z$,

    (b) $\dfrac{4x}{y+z}$,

    (c) $\dfrac{x - y^2}{z}$.

Answer   *(a)* _____ [1]

            (b) _____ [2]

            (c) _____ [2]

22   Solve the following equations.
   (a) $(2x+1)(x-5)=0$,
   (b) $2x-(x+3)=4x$,
   (c) $\dfrac{3}{3x+1}=2$.

Answer   *(a)* x = _____ [1]

          (b) x = _____ [2]

          (c) x = _____ [2]

[Turn over 14

185

23   The first four terms of a number sequence is

$$2, -1, -4, -7.$$

(a)   Write the next two terms of the sequence.
(b)   Find an expression in terms of n for the nth term of the sequence.
(c)   Find the 250th term.
(d)   Showing your reasoning clearly, deduce if -229 can be a term in the sequence.

Answer   *(a)* _____ [1]

(b) _____ [2]

(c) _____ [2]

(d) _____

_____

_____ [2]

[Turn over 15

24   **(a)** m varies inversely as $\sqrt{n}$. Given that $m = 9$ when $n = 16$, find the value of m when $n = 25$.

Answer   *(a)* _____ [2]

(b) p is directly proportional to q^3. If q is increased by 50%, find the percentage increase of p.

Answer   *(b)* _____ [3]

187

25   For this question, all construction lines must be shown. Zero marks will be awarded if construction lines are not shown.

(a)   In the space below, where *PQ* has been drawn, construct a triangle *PQR* where *QR* = 6.5 cm and *PR* = 8.5 cm.

[2]

Using a pair of compasses only,

(b)   construct the perpendicular bisector of *PQ*.   [1]

(c)   construct the angle bisector of angle *PQR*.   [1]

P ——————————————————————————— *Q*

END OF PAPER

188

[Turn over 17

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189
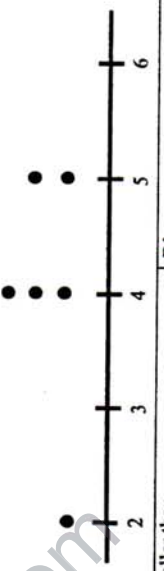
Answers

No.	Working / Answer	Marks
1	$0.3^0,\ 0.\dot{3},\ 0.3,\ -0.3$	B1
2a	$9:25$	B1
2b	140	B1
3	$\dfrac{331.27+48.216}{9.03-1.73}$	M1
	$=\dfrac{300+50}{9-2}$	
	$=\dfrac{350}{7}$	
	$=50$	A1 (Zero marks awarded for not showing working)
4	$\dfrac{5^3\times 5^7}{5^{15}}$	M1
	$=5^{3+7-15}=5^{-5}$	A1 (Do not award this mark for $\frac{1}{5^5}$ or 3125)
5i	80	B1
5ii	2.4	B1
6i	$2^2\times 3^3\times 7^2$	B1
6ii	$2^2\times 3^4\times 5\times 7^2$	B1
7i	$1-b-r$ (or equivalent)	B1
7ii	Any statement that indicates the student knows that the sum of probabilities cannot exceed 1 and the sum of the probabilities for Justin's claim is already 1.09 for 2 colours.	A1
	OR	OR
	Since P(yellow) $= 1-b-r$, subbing in the values of b and r will give P(yellow) a negative value which is impossible.	A1
8	$P=(0,7)$; $Q=\left(2\frac{1}{3},0\right)$	B1 for P, B1 for Q
9i	5.5×10^6	B1
9ii	30000	B1
10	$c=b-a$	M1 for indicating correct knowledge of alternate/corresponding/interior angles on the diagram
		A1 for correct answer

No.	Working / Answer	Marks
11	$3x-2y=-9$ eqn 1	
	$4y=4-x$ eqn 2	
	From eqn 2	M1 for either correct substitution or elimination method
	$x=4-4y$	
	Sub into eqn 1	
	$3(4-4y)-2y=-9$	
	$12-12y-2y=-9$	
	$-14y=-21$	
	$y=1.5$	A1 for correct x
	$x=-2$	A1 for correct y
12a	$S=40T$	B1 (Accept any equivalent equation)
12b	$2x+3k=3x-y$	M1 for knowing to move $3k$ to the RHS
	$3k=3x-y-2x$	
	$k=\dfrac{x-y}{3}$	A1
13	Sum of angles in an octagon $=1080^\circ$	M1
	Sum of the 4 angles in the ratio	
	$=1080-4(65)$	
	$=820^\circ$	
	10 units $=820^\circ$	M1
	1 unit $=82^\circ$	
	Largest angle	
	$=4$ units	A1
	$=328^\circ$	
14i		B1 for ensuring that the mode is 4
		B1 for ensuring that the mean and median is 4
14ii	(Accept mirror image of the answer below)	A1
15	smaller than	B1
	Grad of line	M1 for finding correct gradient
	$=\dfrac{-13-(-5)}{1-(-1)}$	
	$=-4$	
	Sub $(1,-13)$ into $y=-4x+c$	M1 for finding correct y intercept
	$c=-9$	
	Eqn is $y=-4x-9$	A1

21b	$\dfrac{4x}{y+z}$ $=\dfrac{4(-1)}{2+3}$ $=-\dfrac{4}{5}$	M1 A1
21c	$\dfrac{x-y^2}{z}$ $=\dfrac{-1-2^2}{3}$ $=-\dfrac{5}{3}$	M1 A1
22a	$(2x+1)(x-5)=0$ $x=-\dfrac{1}{2}$ or $x=5$	B1 for both correct answers
22b	$2x-(x+3)=4x$ $2x-x-3=4x$ $x-3=4x$ $x=-1$	M1 for opening brackets correctly A1
22c	$\dfrac{3}{3x+1}=2$ $3=6x+2$ $6x=1$ $x=\dfrac{1}{6}$	M1 for multiplying the denominator correctly A1
23a	$-10,\ -13$	B1 for both correct answers
23b	$-3n+5$	B1
23c	-745	B1
23d	$-3p+5=-229$ $p=78$ Therefore, -229 is a number of the sequence.	M1 A1

16i	$4^{x+1}=2^{6x}+2^{3x-3}$ $2^{2(x+1)}=2^{6x}+2^{3x-3}$ $2x+2=6x-(3x-3)$ $2x+2=3x+3$ $x=-1$	M1 for changing to base 2 correctly A1
16ii	$\left(5^{3x+2}\right)^0\times3^{2x+1}\div9^{x-1}$ $=1\times3^{2x+1}\div3^{2(x-1)}$ $=3^{2x+1-(2x-2)}$ $=3^3$ $=27$	M1 for changing to base 3 OR knowing that an exponent of 0 will always equal to 1. A1
17i	5 cm : 400 000 000 cm 1 cm : 80 000 000 cm $n=80\,000$	M1 A1
17ii	1 cm : 0.8 km 1 cm² : 0.64 km² 3 cm² : 1.92 km²	M1 A1
18a	$5(x-3)-2x(5-3x)$ $=5x-15-10x+6x^2$ $=-5x-15+6x^2$	M1 A1
18b	$2(2x-3)(4-x)$ $=2(11x-2x^2-12)$ $=22x-4x^2-24$	M1 for expanding 1 time correctly A1
19i	Profit = $23 Percentage profit $=\dfrac{23}{92}\times100\%$ $=25\%$	M1 A1
19ii	Amount Nellie paid $=\$115\times90\%$ $=\$103.50$	M1 A1
20a	$27x-9y$ $=9(3x-y)$	B1
20b	x^2-4y^2 $=(x+2y)(x-2y)$	B1
20c	$2x^2-5x-3$ $=(2x+1)(x-3)$	A1, A1 for each correct bracket
21a	$3x^2+y-z$ $=3(-1)^2+2-3$ $=2$	B1

24a	$m = \dfrac{k}{\sqrt{n}}$	
	$9 = \dfrac{k}{\sqrt{16}}$	
	$k = 36$	M1 for finding k
	$m = \dfrac{36}{5}$	
	$m = 7.2$	A1
24b	$p = kq^3$	
	$k = \dfrac{p}{q^3}$	M1 for making k the subject
	When q becomes 1.5q.	
	p_{new}	
	$= k(1.5q)^3$	
	$= \left(\dfrac{p}{q^3}\right)\left(\dfrac{27}{8}q^3\right)$	M1 for correct equation after q is increased by 50%
	$= \dfrac{27}{8}p$	
	Percentage change	
	$\dfrac{\frac{27}{8}p - p}{p} \times 100\%$	
	$= 237.5\%$	A1
25	Construction	

Mathematical Formulae

Compound interest

$$\text{Total amount} = P\left(1 + \frac{r}{100}\right)^n$$

Mensuration

Curved Surface Area of a cone = $\pi r l$

Surface Area of a sphere = $4\pi r^2$

Volume of a cone = $\frac{1}{3}\pi r^2 h$

Volume of a sphere = $\frac{4}{3}\pi r^3$

Area of triangle $ABC = \frac{1}{2}ab\sin C$

Arc length = $r\theta$, where θ is in radians

Sector area = $\frac{1}{2}r^2\theta$, where θ is in radians

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$
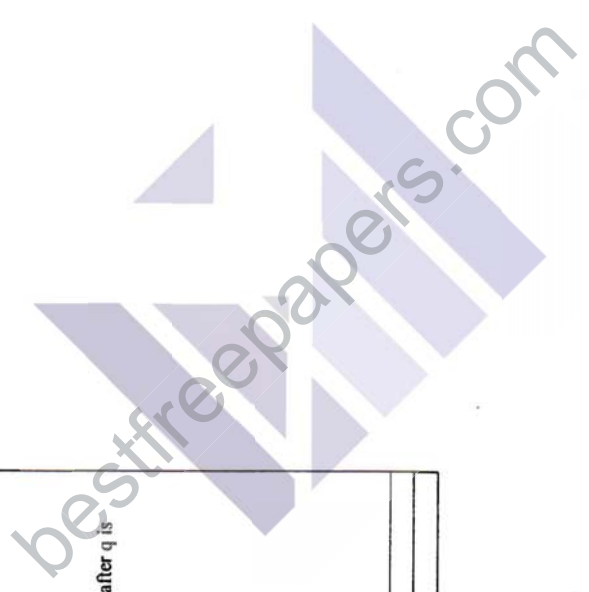
Geylang Methodist School (Secondary)
Preliminary Examination 2016

MATHEMATICS   **4045 / 02**

PAPER 2   **4 Normal (Academic)**

Additional Materials provided: Writing Papers
                                  Graph Paper

Duration: 2 hours

Setter: Mr Wong Han Ming   3 August 2016

READ THESE INSTRUCTIONS FIRST

Write ALL your answers and working on the writing papers provided.
Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
If working is needed for any question, it must be shown below that question.
Omission of essential working will result in loss of marks.

SECTION A
Answer ALL questions (52 marks)

SECTION B
Answer ONE question (8 marks)

INFORMATION FOR CANDIDATES

The number of marks is given in [ ] at the end of each question or part question.
The total number of marks for this paper is **60 marks.**

You are advised not to spend too much time on any one question.
You are expected to use a scientific electronic calculator to evaluate explicit numerical expressions.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer correct to three significant figures. Give answers in degrees to one decimal place.
For π, use either the calculator value or 3.142.
At the end of the examination, fasten all your work securely together.

For Examiner's Use
60

This document consists of **7** printed pages including the cover page and 1 blank page.

[Turn over 2

Section A (52 marks)
Answer all the questions in this section.

1

  (a) Factorise $x^2 + 6x + 9$ completely.   [1]

  (b) Hence, simplify $\dfrac{5}{x+3} + \dfrac{x-2}{x^2+6x+9}$, expressing your answer as a single fraction.   [3]

2 Bank A and Bank B offers interest rates on their deposits as follows.

  Bank A: 1% simple interest per annum
  Bank B: 0.5% compound interest per annum compounded annually

  Jake intends to deposit $100 000 into a bank for 2 years. Which bank should he choose if he wishes to get the most returns for his deposit? Justify your answer.   [5]

3 Sally buys a computer priced at $4200. She pays a downpayment of 30% of the price and pays the remainder in monthly instalments over a period of 3 years at an interest rate of 1.5% per annum. Find the amount of each monthly instalment she has to pay. Give your answer correct to 2 decimal places.   [4]

4 Charles is x years old.
  Barry is 20 years older than Charles.
  5 years later, Charles will be half as old as Barry.

  (a) Write down an expression in x for Charles' age 5 years later.   [1]

  (b) Write down an expression in x for Barry's age 5 years later.   [1]

  (c) Form an equation in x, and solve it to find Charles' age.   [3]

5 Answer the whole of this question on a single sheet of graph paper.

  The table of values below is for the curve $y = 2x - \dfrac{4}{x}$.

x	1	2	3	4	5	6	7	8
y	−2	2	4.7	p	9.2	q	13.4	15.5

  (a) Find the values of p and of q.   [2]

  (b) Using a scale of 2 cm to 1 unit on the x-axis and 1 cm to 1 unit on the y-axis, draw the graph of $y = 2x - \dfrac{4}{x}$ for $1 \le x \le 8$.   [3]

  (c) Use your graph to find the value of y when $x = 3.5$.   [1]

  (d) By drawing a tangent at $x = 1.5$, find the gradient of the tangent on the graph at the point where $x = 1.5$.   [3]

[Turn over 3

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6 A pole is made using a cylinder with a hemispherical top as shown. The height of the cylinder is 1.5 m and the radius of the hemisphere is 0.3 m.
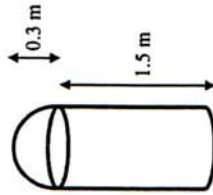
  (a) Find the volume of the pole, giving your answer in terms of π.   [3]

  (b) The pole is planted 0.3 m into the ground and the exposed area of the pole is painted in stripes of red and white as shown. The hemisphere is painted totally in white.
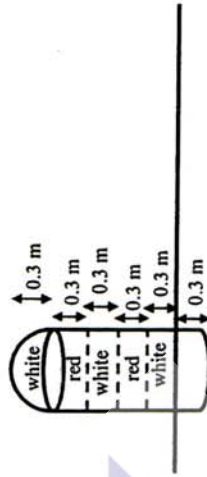
    (i) In terms of π, calculate the surface area that is to be painted red.   [2]

    (ii) In terms of π, calculate the surface area that is to be painted white.   [2]

7

  ABC and ADE are right angle triangles and ACD is a straight line. The ratio of AC to CD is 3 : 2. $AB = 4$ cm, $BC = 7.5$ cm and $DE = 10$ cm. Calculate

  (a) angle BAC in degrees,   [2]

  (b) the length of AE.   [5]

[Turn over 4

8

Speed (m/s)

Time (s)

A car accelerates consistently from rest for 10 seconds and continues at a constant speed, v m/s. The speed – time graph of the car is shown.

(a) Given that the distance travelled in the first 10 seconds is 225 m, show that $v = 45$. [1]

(b) Find the acceleration of the car for the first 10 seconds of the journey. [1]

(c) At time t seconds, the car would have travelled a total distance of 1800 m. Find the value of t. [2]

9 In Singapore, in order to own a car, a Certificate of Entitlement (COE) must first be purchased before buying the car. In short,

Cost of owning a car = Cost of car + Cost of COE.

(a) In 2015,
Jimmy bought a car which costs $60 000 and a COE which costs $45 000.
Dennis bought a car which costs $60 000 and a COE which costs $ 47 020.

Calculate the percentage increase in the total price Dennis paid as compared to the total price Jimmy paid. [3]

(b) In 2016, Dennis decides to scrap his car.
By scrapping his car, Dennis is able to get back 90% of the price he paid for his COE and 75% of the price he paid for the car. Show that he received $87 318 in total when he scrapped his car. [3]

(c) After scrapping his car in 2016, Dennis decides to buy a new car which costs $65 000. He kept the amount he received from scrapping his car. He also has additional savings of $20 000 to purchase the new car. What is the maximum price the COE can be in 2016, for him to be able to afford to buy the car? [1]

Section B (8 marks)

Answer any **one** question from this section. Each question carries 8 marks.

10
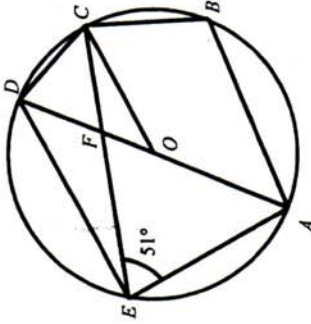
In the diagram, O is the centre of the circle and AD is a straight line. $\angle AEC = 51°$. Stating your reasons clearly, calculate

(i) $\angle AOC$, [2]

(ii) $\angle ABC$, [2]

(iii) $\angle ADC$, [2]

(iv) $\angle CED$. [2]

11

(a) In a class of 22 boys and 18 girls, 2 students are chosen at random to be the chairperson and vice-chairperson of the class. The first student chosen would be the chairperson and the second student chosen would be the vice-chairperson.

   (i) Find the probability the chairperson and vice-chairperson are both girls. [1]

   (ii) Find the probability that out of the two selected students, one would be a boy and one would be a girl. [2]
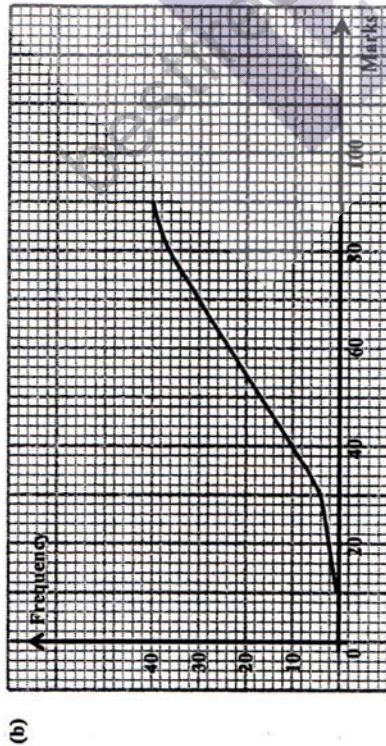
(b) In a Mathematics test, the scores of 40 students are represented using the cumulative frequency graph as shown.

   (i) Find the interquartile range of the graph. [2]
   (ii) Find the median mark. [1]
   (iii) Find the range of the graph. [2]

[Turn over 7

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. 8

Answers

1a	$x^2 + 6x + 9 = (x+3)^2$	B1
1b	$\dfrac{5}{x+3} + \dfrac{x-2}{x^2+6x+9}$ $= \dfrac{5(x+3)}{(x+3)^2} + \dfrac{x-2}{(x+3)^2}$ $= \dfrac{5x+15+x-2}{(x+3)^2}$ $= \dfrac{6x+13}{(x+3)^2}$	M1 for changing the denominator of the first fraction M1 for expressing as a single fraction correctly A1
2	Bank A Interest $= \dfrac{PRT}{100}$ $= \dfrac{100000(1)(2)}{100}$ $= \$2000$ Bank B Total amount $= P\left(1+\dfrac{r}{100}\right)^n$ $= 100000\left(1+\dfrac{0.5}{100}\right)^2$ $= \$101002.50$ Interest $= \$1002.50$ Therefore, Bank A would be chosen.	M1 A1 M1 A1 A1

3	Remainder amount $= \$4200 \times 70\%$ $= \$2940$ Interest $= \dfrac{PRT}{100}$ $= \dfrac{2940(1.5)(3)}{100}$ $= \$132.30$ Remaining amount to pay $= 2940 + 132.30$ $= \$3072.30$ Monthly installment $= \dfrac{3072.30}{3\times12}$ $= \$85.34$	M1 M1 M1 A1
4i	$x+5$	B1
4ii	$x+25$ or $2(x+5)$	B1
4iii	$\dfrac{1}{2}(x+25) = x+5$ $x+25 = 2x+10$ $x = 15$	M1 for forming the equation correctly M1 for correct algebraic manipulation A1 for answer
5a	$p = 7$; $q = 11.3$	B1 ; B1
5b	See graph	M1 for correct scale B1 for correct line M1 for writing eqn of line
5c	5.9 (error of ±0.2)	A1 (Do not give this mark if dotted lines on the graph is not shown)
5d	Gradient $= 3.78$	M1 for tangent M1 for correct calculation of gradient A1

8a	$\frac{1}{2}(10)(v) = 225$ $5v = 225$ $v = 45$	A1 for showing the equation of triangle = 225
8b	Acceleration = 45 / 10 = 4.5 m/s²	B1
8c	Area of rectangle = 1800 − 225 = 1575 $t - 10 = 1575 / 45$ $t - 10 = 35$ $t = 45$	M1 A1
9a	Amount Jimmy paid = 45 000 + 60 000 = \$105 000 Amount Dennis paid = 47 020 + 60 000 = \$107 020 Percentage increase $= \dfrac{107020 - 105000}{105000} \times 100\%$ = 1.92%	M1 for finding the amounts that Jimmy and Dennis paid M1 for finding (107020 − 105000) correctly A1
9b	90% of Dennis' COE price = 47 020 × 90% = \$42 318 75% of car price = 60 000 × 75% = \$45 000 Total amount Dennis received = 42 318 + 45 000 = \$87 318	M1 M1 A1
9c	Max price of COE = 87 318 + 20000 − 65 000 = \$42 318	A1

6a	Volume of cylinder $= \pi r^2 h$ $= \pi(0.3)^2(1.5)$ $= 0.135\pi$ Volume of hemisphere $= \dfrac{2}{3}\pi r^3$ $= \dfrac{2}{3}\pi(0.3)^3$ $= 0.018\pi$ Total volume of material $= 0.135\pi + 0.018\pi$ $= 0.153\pi$ m³	M1 for volume of cylinder M1 for volume of hemisphere A1
6bi	Surface area (red) $= 2\pi rh$ $= 2\pi(0.3)(0.6)$ $= 0.36\pi$ m²	M1 for correct subbing of values into the correct formula for surface area of hemisphere A1
6bii	Surface area (white) $= 0.36\pi + 2\pi r^2$ $= 0.36\pi + 2\pi(0.3)^2$ $= 0.54\pi$ m²	M1 for correct subbing of values into the correct formula for surface area of hemisphere A1
7a	$\tan \angle BAC = \dfrac{7.5}{4}$ $\angle BAC = 61.9°$	M1 A1
7b	$AC^2 = 4^2 + 7.5^2$ $AC = 8.5$ cm Length of AD $= 8.5 \times \dfrac{5}{3}$ $= 14\dfrac{1}{6}$ cm Length of AE $= \sqrt{\left(14\dfrac{1}{6}\right)^2 - 10^2}$ $= 10.0$ cm	M1 for finding AC M1 M1 M1 A1

Q5

x	-2	2	3	4	5	6	7	8
y			4.7	7	9.2	11.3	13.4	15.5

i) 0.67, 1.13
c) y = 5.8
d) grad = $\frac{6-04}{3-13}$
= 3.73

$y = 2x - \frac{14}{x}$

10i	Angle AOC = 51 × 2 (angle at center = 2×angle at circumference) =102°	A1 for reason A1 for answer
10ii	Angle ABC = 180 – 51 (angles in opp seg) =129°	A1 for reason A1 for answer
10iii	Angle ADC = 51° (angles in the same seg)	A1 for reason A1 for answer
10iv	Angle CED = 90 – 51 (angle in a semicircle) = 39°	A1 for reason A1 for answer
11ai	P (G,G) $\frac{18}{40} \times \frac{17}{39}$ $= \frac{51}{260}$	B1
11aii	P(B, G) + P(G, B) $= \left(\frac{22}{40} \times \frac{18}{39}\right) \times 2$ $= \frac{33}{65}$	M1 A1
11bi	Q1 = 40 Q3 = 70 IQR = 30	M1 for correct Q1 OR Q3 A1
11bii	Median = 55 marks	B1
11biii	Min = 10 Max = 90 Range = 80	M1 for correct Min OR Max value A1
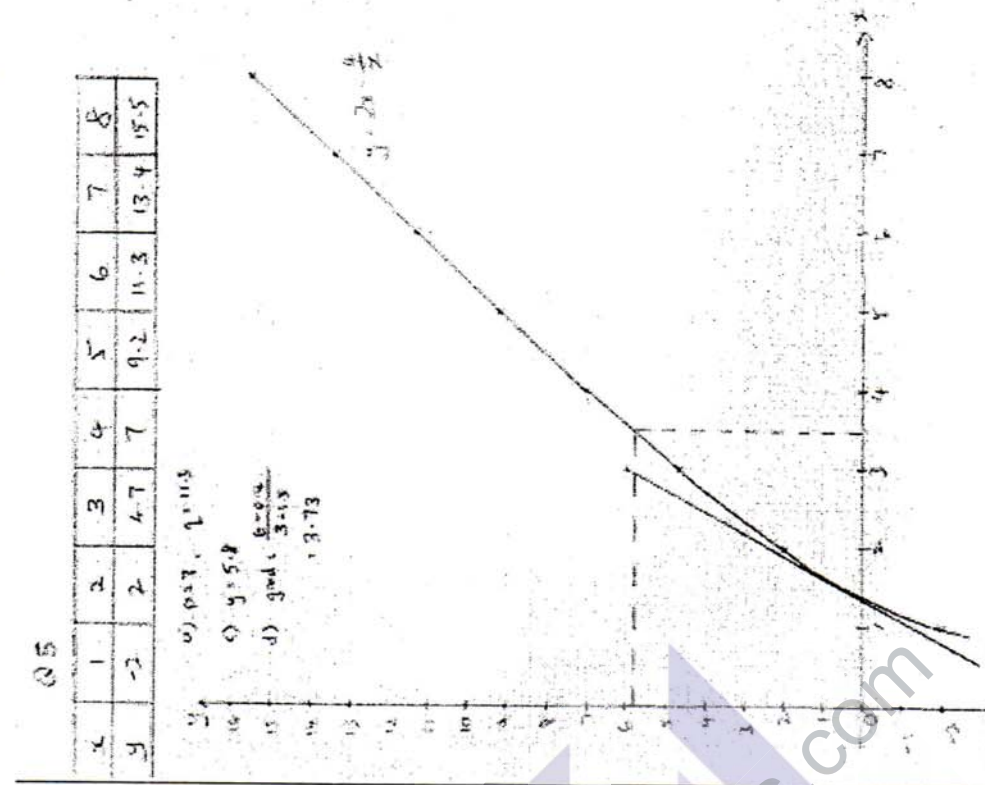
GUANGYANG SECONDARY SCHOOL, SINGAPORE
2016 PRELIMINARY EXAMINATION TWO
Secondary Four Normal (Academic)

CANDIDATE
NAME

CENTRE
NUMBER

INDEX
NUMBER

CLASS/
REG No.   /

MATHEMATICS SYLLABUS A   **4045/01**
Paper 1   **18 August 2016**
                                                             2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
You are required to use a scientific calculator to evaluate explicit numerical expressions.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

Marks:

/80

For Examiner's Use

CALCULATOR MODEL:
                    *

*State 'no calculator' if you do not have a
calculator. Failure to fill in the calculator
model will result in loss of marks.*

This question paper consists of 18 printed pages, inclusive of this cover page

200

Mathematical Formulae

Compound interest

$$\text{Total amount} = P\left(1 + \frac{r}{100}\right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2}ab\sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}.$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

For
Examiners'
Use

3

For
Examiners'
Use

Answer **all** the questions.

1 **(a)** Calculate $\dfrac{0.48 \times \sqrt[3]{951}}{24.71}$

Write down the first five digits on your calculator display.

Answer.................................…..…… [1]

(b) Write your answer to part **(a)** correct to 3 significant figures.

Answer ...…........................……… [1]

2
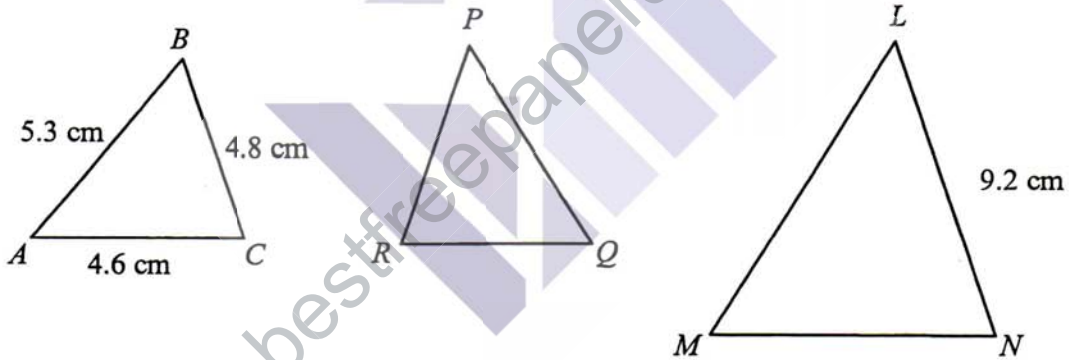
(a) Triangle *ABC* and triangle *PQR* are congruent triangles.
State the length of *RQ*.

Answer ……….....................…..… cm [1]

(b) Triangle *LMN* is an enlargement of triangle *ABC*.
Find the scale factor of the enlargement.

Answer .………...........................…… [1]

[Turn over

3   Ten people move house.
    The distance, in kilometres, of their new house from their old house are listed below.

    6   12   7   11   10   9   128   8   2   9

    Which of the following, mean, mode or median, would not be appropriate to describe the distribution?
    Give a reason for your answer.

    Answer .... because..

    .... [2]

4   **(a)**   The diagram shows the sketch of graph $y = \dfrac{4}{x}$ for $x > 0$.

    Complete the sketch for **x < 0** in the same axes.   [1]
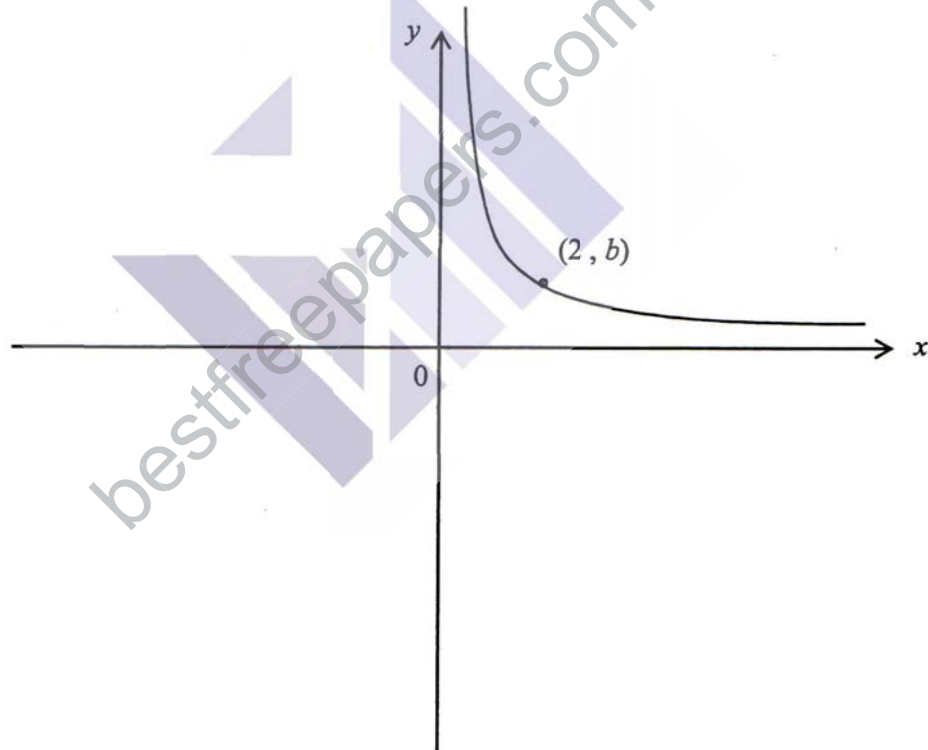
    (b)   Given that $(2, b)$ lies on the graph $y = \dfrac{4}{x}$, find the value of b.

    Answer b = ... [1]

[Turn over

For
Examiners'
Use

5

For
Examiners'
Use

5
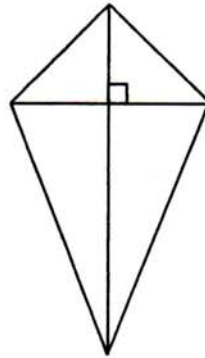
In the kite, the diagonals bisect each other at right angle.

(a) List **two** quadrilaterals with the diagonals bisect each other at right angle.

Answer .... [1]

(b) Some properties of a kite are different from those of a rhombus.
Write down **one** such property.

Answer ....

.... [1]

6 Mrs Raja buys some boxes of pencils and some packets of pens for people to use at a workshop.

There are 40 pencils in a box. There are 15 pens in a packet.

She gives one pencil and one pen to each person at the workshop.

She has no pencil and also no pen left.

Find the least number of boxes of pencils and packets of pens Mrs Raja bought.

Answer................. boxes of pencils

.... packets of pens [3]

[Turn over

7   The force of attraction, F newtons, between two magnets is inversely proportional to the square of the distance, x centimetres, between them.
   (a) Write down an expression for F in terms of x and a constant k.

Answer $F = $ .... [1]

   (b) When the magnets are 4 cm apart, the force is 3 newtons.
        Find the value of constant k.

Answer $k = $ .... [1]

   (c) Hence find the force when the magnets are 2 cm apart.

Answer $F = $ .... newtons [1]

8   The mass of a certain atom is approximately 12 nanograms.
   (a) Write 12 nanograms in grams using standard form.

Answer .... g [1]

   (b) A container contains 2 billion such atoms.
        Find the total mass, in grams, of the atoms in the container.

Answer .... g [2]

[Turn over

9 These are the first 5 terms in a sequence.

$$3 \quad 9 \quad 15 \quad 21 \quad 27$$

(a) Write down the next two terms in the sequence.

Answer .... , ... [1]

(b) Write down an expression, in terms of n, for the nth term of this sequence.

Answer .... [1]

(c) Ben says that 150 is in the sequence.
Is Ben correct?
Show your working.

Answer ....

....

.... [1]

10 (a) Simplify $2^a \div 2^{-3a}$.

Answer .... [1]

(b) Given that $3^{24} \times 27 = 3^b$, find b.

Answer $b =$ .... [2]

[Turn over

Solve

11 **(a)** $3x - 4 > 11$,

Answer .... [1]

(b) $\frac{4-y}{3} = 2$.

Answer $y =$................................. [2]

12 **(a)** Factorise completely $12a - 40ab + 10b - 3$.

Answer .... [2]

(b) Simplify $\frac{2}{x+3} - \frac{1}{x}$.

Answer .... [2]

[Turn over

13 $x^2 - 10x - 3$ can be expressed in the form $(x-p)^2 + q$.

    (a) Find p and q.

Answer p = ...

q = ... [2]

    (b) Hence solve $x^2 - 10x - 3 = 0$.

Answer x = ... [2]

14   Ray has $620.
     He divided the money among his 3 children — Alice, Benny and Cindy.

     The amount of money Alice and Benny received is in the ratio of 3 : 2.
     The amount of money Benny and Cindy received is in the ratio 5 : 3.

   (a) Express the amount of money received by Alice, Benny and Cindy in the ratio
        $A : B : C$.

        Answer .... : .... : .... [2]

   (b) Express the ratio of money received by Benny to the total amount of money Ray
        has.

        Answer .... : .... [1]

   (c) What is the difference in the amount of money Alice and Benny received?

        Answer $............................ [1]

                                                                    [Turn over

For
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Use

11

For
Examiners'
Use

15
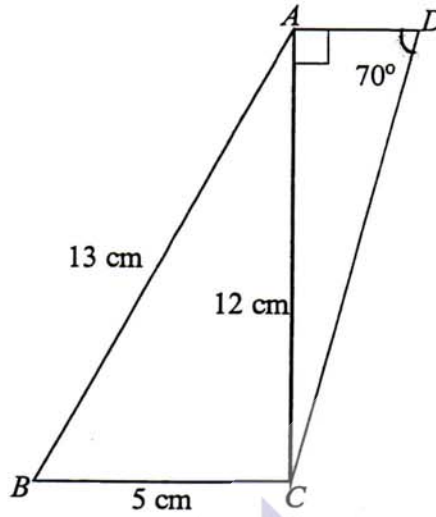
In the diagram, AB = 13 cm, BC = 5 cm, AC = 12 cm, angle ADC = 70° and angle CAD = 90°.

(a) Nadiah says that triangle ABC is a right-angled triangle.
Is she correct?
Show your working.

Answer

[2]

(b) Calculate the length of AD.

Answer AD =.................... cm [2]

16
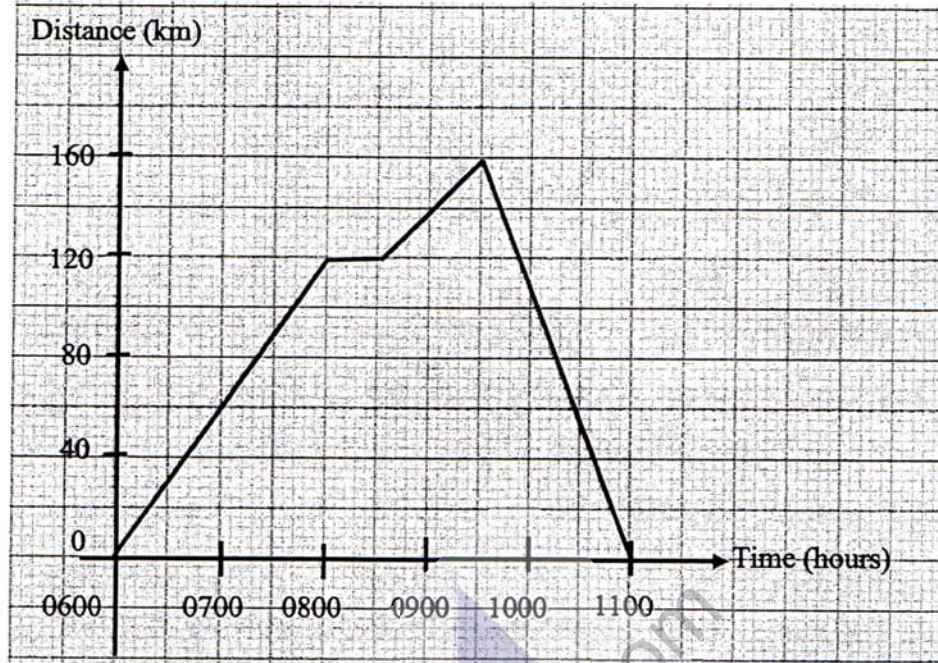
The travel graph shows a taxi's journey to and fro from point A to point B.
On the way to point B the taxi stops to do car washing.

(a) Calculate the speed of the taxi, in kilometres per hour, in the first two hours.

Answer ....km/h [1]

(b) Find, in kilometres per hour, the average speed of the taxi.

Answer ....km/h [1]

A lorry travels from Point B to Point A an hour after the taxi started its journey.

The lorry takes 3 hours to reach Point A.

(c) On the same axes, draw the distance-time graph of the lorry. [1]

(d) At which time will both the lorry and taxi meet?

Answer .... [1]

[Turn over

17
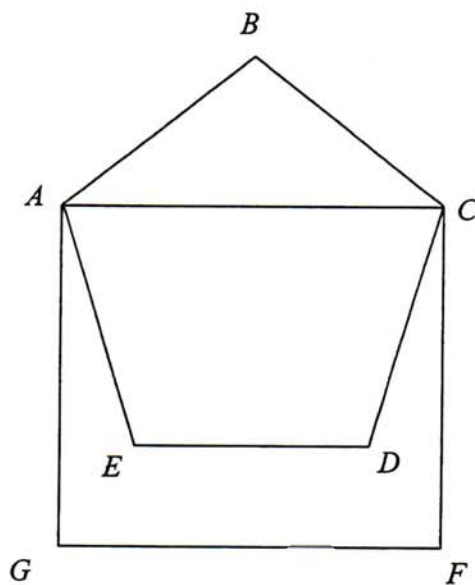
ABCDE is a regular pentagon.

ACFG is a square.

Find angle *DCF*.

You must show all your working.

Answer ∠*DCF* = ...° [4]

For
Examiners'
Use

14

For
Examiners'
Use

18
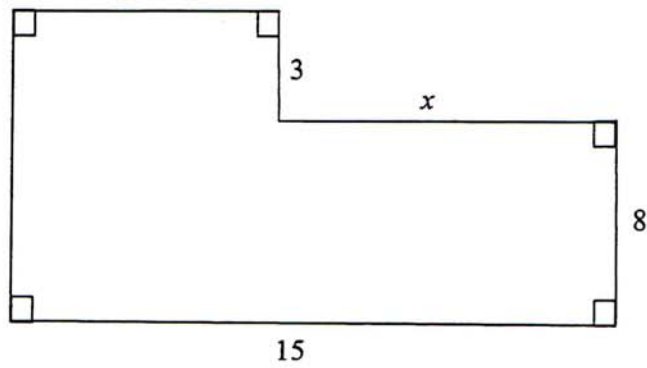
The diagram shows the floor of a house.
The area of the floor is 138 m².

(a) Find x.

Answer $x =$ ………….........…………… [3]

(b) The owner of the house needs to polish the floor.
One tin of polish normally costs $19.
One tin of polish covers 12 m² of floor.
There is a discount of 30% off the cost of the polish.
The owner has $150. Does he have enough money to polish the floor?
Justify your answer.
Answer

[3]

[Turn over

For
Examiners'
Use

15

For
Examiners'
Use

19 The table shows information on the cost of sending a standard regular letter and a standard large letter by post.

Local Postage Rate		
All rates refer to Singapore Currency (inclusive of 7% GST)		
Weight Set Up to	Standard Regular (C5,C6 & DL size envelope)	Standard large (Up to C4 size envelope)
20 g	$0.30	$0.60
40 g	$0.37	
100 g		$0.90
250 g		$1.15
500 g		$1.70
1 kg		$2.55

A company wants to post 400 letters.

One twentieth of the letters are standard regular and the rest are standard large.

All the standard regular letters weigh 30 g.

(a) Find the cost of posting all the standard regular letters.

Answer $................................. [2]

70% of the standard large letters weigh 90 g and the rest of the standard large letters weigh 200 g.

(b) Find the total cost of posting all the standard large letters.

Answer $................................. [3]

For
Examiners'
Use

16

For
Examiners'
Use

20
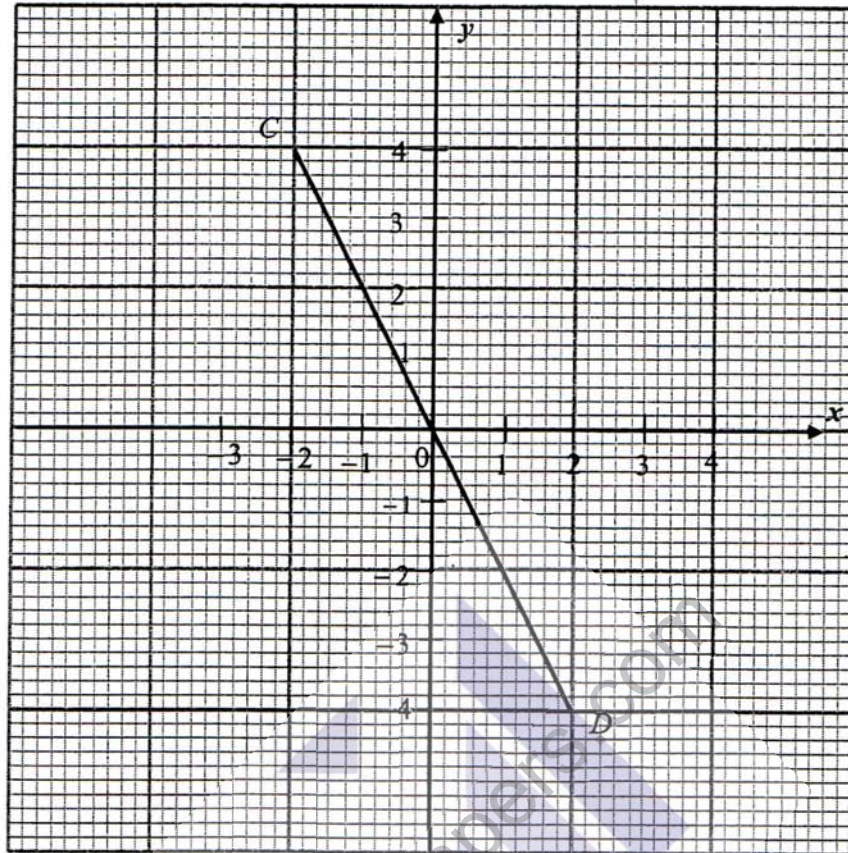
(a) Calculate the length *CD*.

Answer .... units [2]

(b) Draw the line $y = 2x - 4$.
Hence find the coordinates of the point where $y = 2x - 3$ crosses *CD*.

Answer (............... , ...) [2]

(c) Find the equation of *CD*.

Answer .... [1]

[Turn over

21
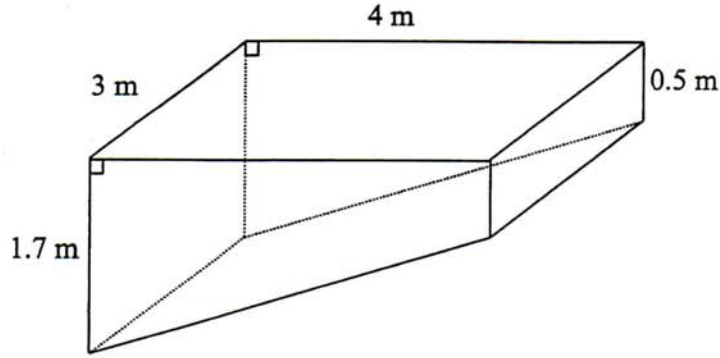
A pool, 3 m wide by 4 m long, is 0.5 m deep at the shallow end and 1.7 m deep at the other end.
The pool is completely full of water.

(a) Find the volume of the water in the pool.

Answer ……………..…………cm^3 [2]

Brandon wants to empty the pool so he can clean it.
Brandon uses a pump to empty the pool.
The volume of water in the pool decreases at a constant rate.
The water level of the pool drops by 10 cm in the first 20 minutes.

(b) How much more time Brandon has to wait for the pump to empty the pool completely? Give you answer in hours and minutes.

Answer ……….…..…. hours………… mins [4]

[Turn over

For
Examiners'
Use

18

For
Examiners'
Use

22 $ABCD$ is a quadrilateral. $AB = 9$ cm, $BC = 4.5$ cm, $AD = 7$ cm, $BD = 8.5$ cm and angle $ABC = 70°$. AB is drawn below.

(a) Complete the quadrilateral.   [2]

A _____ B

(b) Measure the obtuse angle in quadrilateral $ABCD$.

Answer ....° [1]

(c) Construct the perpendicular bisector of AD.   [1]

(d) Construct the bisector of angle BAD.   [1]

(e) Given that the perpendicular bisector in **(c)** and the angle bisector in **(d)** meet at the point T, measure TA.

Answer ....cm [1]

--- *End of Paper* ---

Right table

SN	Answer	Mark	Comments
7a	$F = \dfrac{k}{x^2}$	B1	
7b	$3 = \dfrac{k}{4^2}$, $\;3 \times 16 = k$, $\;k = 48$	B1	
7c	$F = \dfrac{48}{x^2}$, $\;= \dfrac{48}{2^2}$, $\;= 12$	B1	
8a	1.2×10^{-8}	B1	
8b	$1.2 \times 10^{-8} \times 2 \times 10^{9}$, $\;= 24$	M1, A1	
9a	33, 39	B1	B0 if only one answer is correct.
9b	$6n - 3$	B1	
9c	When $6n - 3 = 150$, $\;n = \dfrac{153}{6} = 25.5$, $\;\neq$ an integer, Ben is incorrect	B1	B0 if only there is no conclusion.
10a	$2^{a-(-3a)} = 2^{4a}$	B1	
10b	$3^{24} \times 27 = 3^b$, $\;3^{24} \times 3^3 = 3^b$, $\;3^{24+3} = 3^b$, $\;b = 24 + 3 = 27$	M1	
11a	$x > 5$	A1	
11b	$4 - y = 6$, $\;-y = 6 + 4$, $\;y = -2$	M1, A1	
12a	$4a(3 - 10b) + (10b - 3)$, $\;= 4a(3 - 10b) - (3 - 10b)$, $\;= (4a - 1)(3 - 10b)$	M1, A1	Alt: $=3(4a - 1) - 10b(4a - 1)$ $=(4a - 1)(3 - 10b)$ — M1
12b	$\dfrac{2x - (x + 3)}{x(x + 3)}$	M1	

Sec 4NA Prelim Exam Math Paper 1 2016 Marking Scheme

SN	Answer	Mark	Comments
1a	0.1910	B1	
1b	0.191	B1	
2a	$RQ = CB = 4.8$	B1	
2b	$\dfrac{LN}{AC} = \dfrac{9.2}{4.6} = 2$	B1	
3	Mean; The extreme value 128 will distort the result.	B1, B1	
4		B1	
4b	When $x = 2$, $\;b = 2$	B1	
5a	Rhombus and square	B1	
5b	A rhombus has 4 equal sides whereas a kite has 2 pairs of equal sides.	B1	
6	$40 = 2^2 \times 3 \times 5$; $\;15 = 3 \times 5$; LCM of 40 and 15 is $2^2 \times 3 \times 5 = 120$	M1	
	Least No. of boxes of pencil $= \dfrac{120}{40} = 3$	A1	
	Least No. of boxes of pens $= \dfrac{120}{15} = 8$	A1	

16a
$$\text{Speed} = \frac{120}{2}$$
$$= 60 \text{ km/h}$$
B1

16b
$$\text{Average Speed} = \frac{320}{5}$$
$$= 64 \text{ km/h}$$
B1

16c

B1

16d 0754 — B1

17
$$\text{angle } BCD = \frac{(5-2) \times 180^o}{5}$$
$$= 108^o$$
M1
$$\text{angle } ACD = 180^o - 108^o \text{ (int. angle)}$$
$$= 72^o$$
M1
$$\text{angle } DCF = 90^o - 72^o$$
$$= 18^o$$
M1
A1

18a
$$(8+3)(15-x) + 8x = 138$$
M1
$$11(15-x) + 8x = 138$$
M1
$$165 - 3x = 138$$
$$x = 9$$
A1

Alt:
$$11 \times 15 - 3x = 138 \text{ -- M1}$$
$$3x = 11 \times 15 - 138 \text{ -- M1}$$
$$x = \frac{27}{3} = 9 \text{ -- A1}$$

18b
$$\text{No. of tins required} = \frac{138}{12} = 11.5$$
$$\approx 12$$
M1
$$\text{Cost after 30\% discount} = (0.7 \times \$19) \times 12$$
$$= \$159.60 > \$150$$
M1

$$= \frac{2x - x - 3}{x(x+3)}$$
$$= \frac{x-3}{x(x+3)}$$
A1

13a
$$(x-5)^2 - 28$$
$$p = 5 \text{ and}$$
$$q = -28$$
B1
B1

13b
$$(x-5)^2 = 28$$
M1
$$x - 5 = \pm\sqrt{28}$$
$$x = 10.3 \text{ or } -0.292$$
A1

14a
$$A:B \quad B:C$$
$$3:2 \quad 5:3$$
$$15:10 \quad 10:6$$
$$A:B:C$$
$$15:10:6$$
M1

14b
$$10:(15+10+6)$$
$$10:31$$
A1

14c
$$\text{Unit difference} = 15 - 10$$
$$= 5$$
B1
$$1 \text{ unit} = \$620 \div 31$$
$$= \$20$$
$$5 \text{ units} = 5 \times \$20$$
$$= \$100$$

15a
Since $5^2 + 12^2 = 13^2$.
$$BC^2 + AC^2 = AB^2$$
M1

By converse of Pythagoras' Theorem, triangle ABC must be a right-angled triangle.
A1

Alt:
Cosine Rule.
B1

15b
$$\tan 70^o = \frac{12}{AD}$$
M1
$$AD = \frac{12}{\tan 70^o}$$
M1
$$= 4.37 \text{ cm}$$
A1

21a	$y = -2x$	B1
22a	Volume $= [\frac{1}{2} \times (1.7 + 0.5) \times 4] \times 3$ $= 13.2 \text{ m}^3$	M1 A1
22b	Volume of water emptied in 20 mins $= 3 \times 4 \times 0.1$ $= 1.2 \text{ m}^3$	M1
	1.2 m³ of water emptied in 20 mins Then rate of water emptied $= 1.2 \times 3$ $= 3.6 \text{ m}^3/\text{h}$	M1
	Total time taken to empty the pool $= \frac{13.2}{3.6}$ $= 3\frac{2}{3} \text{ hr}$ $= 3 \text{ hr } 40 \text{ min}$	M1
	Extra time required $= 3 \text{ hr } 40 \text{ min} - 20\text{min}$ $= 3 \text{ hr } 20 \text{ min}$	A1
23a, 23c,d		

(a) point C — B1
    point D — B1
Bo if no arcs shown
—1m if no joining of lines
(c) — B1
(d) — B1

23b	135 ± 1	B1
23e	4.1 ± 0.1	B1

19a	He does not have enough money	A1
	$\frac{1}{20} \times 400 = 20$ *standard regular letters*	
	Cost of 20 letters = 20 × $0.37 = $ 7.40	M1 A1
19b	No. of standard large letters = 400 – 20 = 380	M1
	Cost of letters weigh 100g = 0.7 × 380 × $0.90 = $239.40	
	Cost of letters weigh 200g = 0.3 × 380 × $1.15 = $131.10 Total cost = $239.40 + $131.10 = $370.50	M1 A1
20a	Length of CD $= \sqrt{(-4-4)^2 + (2-(-2))^2}$ = 8.94 units	M1 A1
20b		

Accept 1.375

(b)

—— B1

(1, −2) —— B1

GUANGYANG SECONDARY SCHOOL, SINGAPORE
2016 PRELIMINARY EXAMINATION TWO
Secondary Four Normal (Academic)

MATHEMATICS SYLLABUS A
Paper 2

4045/02
19 August 2016
2 hours

Additional Materials: Answer Paper
Graph paper (1 sheet)

READ THESE INSTRUCTIONS FIRST

Write your answers and working on the separate Answer Paper provided.
Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Section A
Answer all questions.

Section B
Answer one question.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 60.

The use of an approved scientific calculator is expected, where appropriate.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

At the end of the examination, fasten all your work securely together.

1

Mathematical Formulae

Compound interest

Total amount $= P\left(1 + \dfrac{r}{100}\right)^n$

Mensuration

Curved surface area of a cone $= \pi r l$

Surface area of a sphere $= 4\pi r^2$

Volume of a cone $= \dfrac{1}{3}\pi r^2 h$

Volume of a sphere $= \dfrac{4}{3}\pi r^3$

Area of triangle $ABC = \dfrac{1}{2}ab\sin C$

Arc length $= r\theta$, where θ is in radians

Sector area $= \dfrac{1}{2}r^2\theta$, where θ is in radians

Trigonometry

$\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

$a^2 = b^2 + c^2 - 2bc\cos A$

Statistics

Mean $= \dfrac{\sum fx}{\sum f}$

Standard deviation $= \sqrt{\dfrac{\sum fx^2}{\sum f} - \left(\dfrac{\sum fx}{\sum f}\right)^2}$

2

4 The stem-and-leaf diagram shows the Mathematics test scores of 10 boys.

```
4 | 5
5 | 2 3 4 4 5
6 | 2 5 8
7 | 2
```
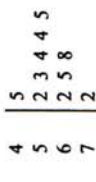
Key: 4|5 represents 45

(a) State the modal mark. [1]

(b) What fraction of the boys score at least 55 marks? [1]

(c) Find the mean mark. [2]

---

5 (a) Mr Lim invested $30 000 in a company which pays an interest at the rate of 2% per year compounded yearly.
Calculate the total interest he would have earned in 10 years. [2]

(b) He attended a concert at the Esplanade Concert Hall.
The cost of the ticket, inclusive of 7% Goods and Services Tax (GST), was S$201.16.
Calculate, correct to the nearest cent, the GST paid for the ticket. [2]

(c) He spent Japanese Yen ¥500 000 for a holiday trip to Japan.
The exchange rate was S$1 = ¥77.172.
Calculate the amount he spent for the holiday.
Give your answer correct to the nearest dollars. [2]

Section A (52 marks)

Answer all the questions in this section.

1

Lines *AB* and *CD* are parallel.

Find *y*. [2]

---

2 Bag *A* contains 4 red and 6 white buttons.
Bag *B* contains 7 red and 5 white buttons.
A button is drawn at random from Bag *A* followed by another button from Bag *B*.
Find the probability of drawing two buttons of different colours. [2]

---

3 A concert sells adult tickets and child tickets.

The total cost of 3 adult tickets and 1 child ticket is $30.

The total cost of 1 adult ticket and 3 child tickets is $22.

Find the cost of each adult ticket and each child ticket. [4]

6 The table below is for $y = \dfrac{15}{x} + 0.5x - 10$.

The values of y are corrected to one decimal place.

x	1	1.5	2	3	4	5	6	8
y	5.5	p	−1.5	−3.5	−4.3	−4.5	−4.5	−4.1

(a) Calculate the value of p. [1]

(b) On a sheet of graph paper draw an x-axis, for values of x from 1 to 8, using a scale of 2 cm to 1 unit, and a y-axis, for values of y from −5 to 6, using a scale of 2 cm to 1 unit.

Draw the graph of $y = \dfrac{15}{x} + 0.5x - 10$ for $1 \le x \le 8$. [3]

(c) By drawing a tangent, find the gradient of the curve $y = \dfrac{15}{x} + 0.5x - 10$ when $x = 2$. [2]

(d) Use your graph to find the x-coordinate of the minimum point of the curve $y = \dfrac{15}{x} + 0.5x - 10$. [1]
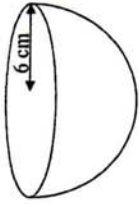
7 A hemispherical bowl of negligible thickness has a radius of 6 cm.

(a) Calculate

   (i) the volume, [2]

   (ii) the external surface area of the bowl. [2]
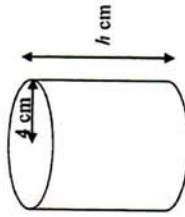
(b) A cylinder of radius 4 cm and height h cm has the same volume as the bowl.
Calculate the height of the cylinder. [2]

8 (a) Given that $s = \dfrac{u^2}{5t}$, express u in terms of s and t. [2]

(b) Simplify $\dfrac{2x^2 - 7x + 6}{x^2 - 4}$. [3]

(c) Solve the equation $x = \dfrac{1}{3x - 5}$.
Give your answers correct to 2 decimal places. [3]

5

6

9 In the diagram, $ABCD$ are four corners of a park.

It is given that C is due east of D, A is on a bearing of 210° from D, angle $BCD = 65°$, $AB = 50$ m, $BD = 30$ m and $AD = 45$ m.

There is a lamppost at C which has a height of 6 m.
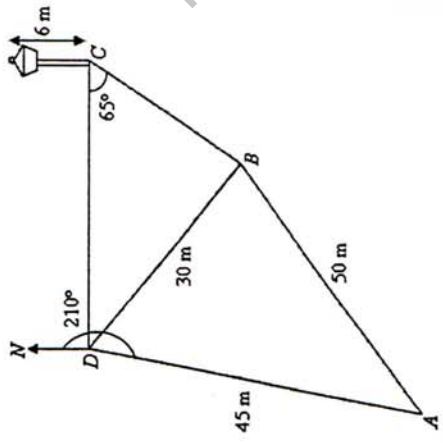
Find

(a) the angle ADB, [3]

(b) the bearing of B from D, [1]

(c) the length of BC, [2]

(d) the angle of elevation of the top of the lamppost from B. [2]

---

10 A lampshade is made in the shape of a cone, as shown in **Diagram I**.
When this cone is cut open, it forms a shape of a sector of a circle with centre O as shown in **Diagram II**.

The sector has radius 25 cm and the angle subtended is 280°.

Diagram I   **Diagram II**
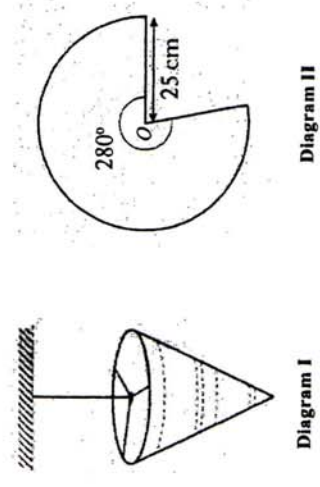
(a) Find the curved surface area of the lampshade. [2]

Each sector is cut from a rectangular piece of material.
The material has a dimension of 50 cm by l cm.
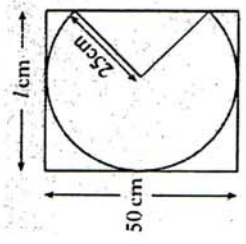
(b) Find the minimum length l, required for the piece of material. [3]

8

7

12 The cumulative frequency curve shows the distribution of time taken, in seconds, by a lorry to travel along a certain stretch of expressway for 120 trips.
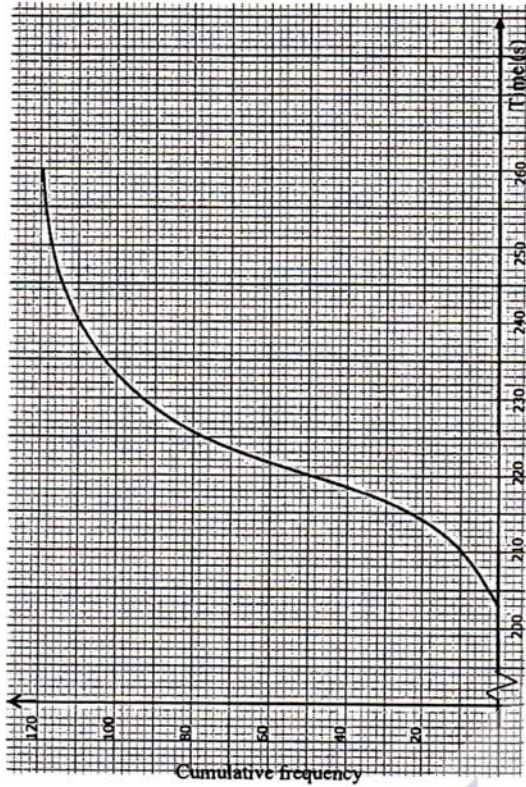
(a) Use the graph to find
  (i) the median time, [1]
  (ii) the interquartile range. [2]

(b) Given that 15% of the trips are liable to receive a speeding ticket, find the time taken that will exceed the speeding limit. [1]

(c) If two particular trips were selected at random, find the probability that at least one trip will exceed the speed limit. [2]

(d) The time taken by a tour bus to travel along the same stretch of expressway over 120 trips is given by the following box-and-whisker plot.
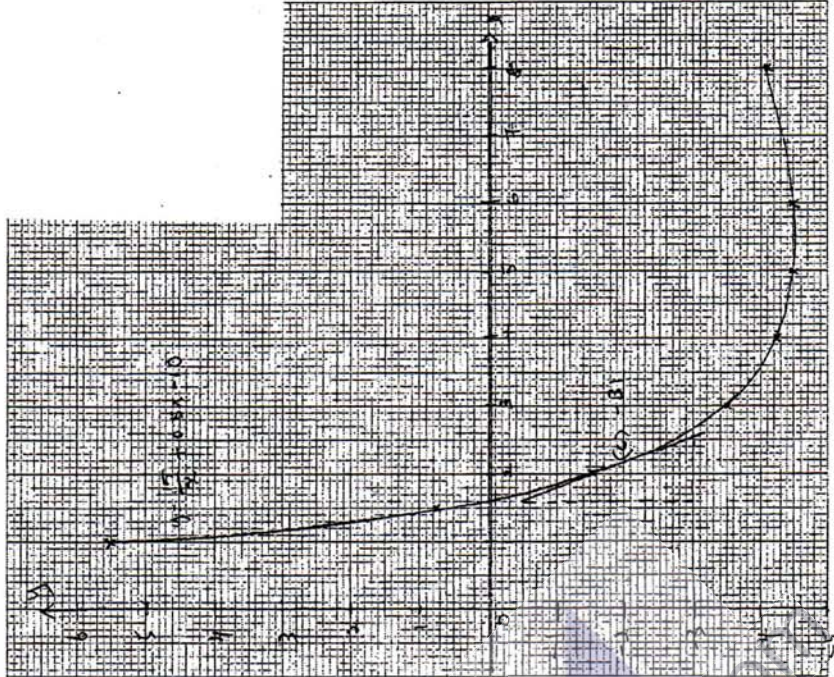
Compare the time taken by the bus and the lorry in two different ways. [2]

--- *End of paper* ---

10

Section B (8 marks)

Answer one question from this section. Each question carries 8 marks.

11 In the diagram, O is the centre of the circle passing through A, B and C. DE is the tangent of the circle at point C.

(a) Given that reflex angle $BOC = 246°$. Stating your reasons clearly, find
  (i) angle BAC, [2]
  (ii) angle OCB, [2]

(b) **(i)** Show that angle BOC is approximately 1.99 radians. [1]
  (ii) Hence, given that $OB = 5$ cm, find the area of the shaded segment. [3]

9

Sec 4NA Prelim Exam Math Paper 2 2016 Marking Scheme

SN	Answer	Mark	Comments
1	$2y + 6y = 180°$ (int angle)	M1	-1 mark for any missing degree.
	$8y = 180°$		
	$y = 22.5°$	A1	
2	$P(\text{different colors}) = \left(\dfrac{4}{10} \times \dfrac{5}{12}\right) + \left(\dfrac{6}{10} \times \dfrac{7}{12}\right)$	M1	
	$= \dfrac{31}{60}$	A1	
3	Let x be the cost of adult ticket and y be the cost of child ticket		
	$3x + y = 30$		Forming two algebraic
	$x + 3y = 22$	M1	equations
	$3x + y - 3x - 9y = 30 - 66$	M1	
	$-8y = -36$		
	$y = 4.5$		
	$x = 22 - 3(4.5)$		
	$x = 8.5$	A1	
	Cost of adult ticket = \$8.50		
	Cost of child ticket = \$4.50		
4a	Mode = 54 marks	B1	
4b	$\dfrac{1}{2}$	B1	
4c	Mean $= \dfrac{45 + \ldots + 72}{10}$	M1	
	$= 58$ marks	A1	
5a	$Amount = 30000\left(1 + \dfrac{2}{100}\right)^{10}$	M1	
	$= \$36\,569.83$		
	Interest $= \$36\,569.83 - \$30\,000$		
	$= \$6569.83$	A1	
5b	$GST = \dfrac{201.16}{107} \times 7$	M1	
	$= \$13.16$	A1	
5c	Amount spent $= \dfrac{500\,000}{77.172}$	M1	A0 if not 2dp or no/one conclusion only
		A1	

2

SN	Answer	Mark
6a	$= \$6\,479$ (nearest \$)	B1
6b	$p = 0.75$	B1

$y = \dfrac{5}{x} + 0.5x - 1.0$

All points plotted – P2
At least 6 points plotted – P1
Smooth curve – C1
-1 if wrong axes or wrong scale.

SN	Answer	Mark
6c	Gradient $= \dfrac{-2.5}{0.9}$	B1
	$= -2.77$	
	Accept answers between -3.75 to -2.15	
6d	Min point = 5.5	B1
	Accept 5.4 to 5.6	

3

	=20.9 m	A1
9d	Let θ be the angle of elevation $\tan\theta = \dfrac{6}{20.856680}$	M1
	$\theta = \tan^{-1}\left(\dfrac{6}{20.856680}\right)$ = 16.04934 = 16.0° (1dp)	A1
10a	Curved surface area of the shade $= \dfrac{280}{360} \times \pi \times 25 \times 25$	M1
	= 1527.163095 =1530 cm²	A1
10b	$\dfrac{x}{25} = \cos\left(\dfrac{360°-280}{2}\right)$	M1
	$x = 25 \times \cos\left(\dfrac{360-280}{2}\right)$ = 19.15111108	M1
	$l = 25 + 19.15111108$ = 44.15111108 = 44 cm (nearest cm)	A1
11ai	$\angle BAC = \dfrac{360°-246°}{2}$	M1
	= 57° ($\angle$ at centre = 2 $\angle$ at circumference)	A1
11aii	$\angle OCB = \dfrac{180°-114°}{2}$	M1
	= 33° (base $\angle$ of isos. Δ)	A1
11bi	$\angle BOC$	B1
	$= \dfrac{\pi}{180} \times (360 - 246)$ = 1.9896 rad =1.99 rad	M1
11b	Area of the segment $= \dfrac{1}{2} \times 5 \times 5 \times (1.98967534 - \sin 1.989675347)$ =13.451623	M1, M1
	=13.5 cm²	A1
12ai	Median = 221.5 - 222 s	B1
12aii	Interquartile range = 229 - 217 = 12	M1 A1

5

7ai	Volume of the bowl $= \dfrac{2}{3} \times \pi \times 6 \times 6 \times 6$	M1
	= 452.3893421169 = 452 cm³ (3sf)	A1
7aii	External surface area of the bowl $= 2 \times \pi \times 6 \times 6$	M1
	= 226.194671058 = 226 cm²(3sf)	A1
7b	Height of cylinder = $\dfrac{452.3893421169}{\pi \times 4 \times 4}$	M1
	= 9.00 cm (3sf)	A1
8a	$u^2 = 5st$ $u = \pm\sqrt{5st}$	M1 A1
8b	$\dfrac{(2x-3)(x-2)}{(x-2)(x+2)}$ $= \dfrac{(2x-3)}{(x+2)}$	M1 M1
8c	$x = \dfrac{1}{3x-5}$ $3x^2 - 5x = 1$ $3x^2 - 5x - 1 = 0$	A1
	$x = \dfrac{5 \pm \sqrt{(-5)^2 - 4(3)(-1)}}{2(3)}$	M1
	$x = \dfrac{5 \pm \sqrt{37}}{6}$ $x = 1.85$ or $x = -0.18$	A1
9a	$50^2 = 30^2 + 45^2 - 2(30)(45)\cos ADB$	M1
	$\cos ADB = \dfrac{50^2 - 30^2 - 45^2}{-2(30)(45)}$ $ADB = 80.9°$	M1
		A1
9b	Bearing of B from $D = 210 - 80.9$ = 129.1°	B1
9c	$\angle CDB = 129.0564478° - 90°$ $= 39.0564478°$ $\dfrac{BC}{\sin 39.0564478°} = \dfrac{30}{\sin 65°}$ $BC = \dfrac{30 \times \sin 39.0564478°}{\sin 65°}$ = 20.856680	M1

4

12b	$\dfrac{15}{100} \times 120 = 18$ $\therefore$ Time taken = 213 (213 to 213.5)	B1	
12c	P(at least 1 exceed the speed) $= \dfrac{18}{120} \times \dfrac{102}{119} + \dfrac{102}{120} \times \dfrac{18}{119} + \dfrac{18}{120} \times \dfrac{17}{119}$ $= \dfrac{39}{140}$	M1 A1	Alt: $= 1 - \dfrac{102}{120} \times \dfrac{101}{119}$ $= \dfrac{39}{140}$
12d	Median = 218 s Median of the tour bus are lower than the lorry which means tour bus travel faster in the expressway Interquartile range = 235 − 208 = 27 Interquartile range of the tour bus is higher than the lorry which means tour bus speed is less consistent than the lorry.	B1 B1	

KENT RIDGE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2016

MATHEMATICS
PAPER 1

4045/01

SECONDARY 4 NORMAL (ACADEMIC)

Monday 22 August 2016

2 hours

Name: _____ ( ) **Class: Sec** _____

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class in the spaces provided at the top of this page.

Do not open this question paper until you are told to do so.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

DO NOT USE staples, paper clips, highlighters, glue, correction fluid or correction tape.

Answer **all** questions.

Write your answers in the spaces provided on the question paper .

If working is needed for any question it must be shown in the space below that question.

Omission of essential working will result in loss of marks.

Calculators should be used where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

The number of marks available is given in the brackets [ ] at the end of each question or part question.

The total mark for this paper is **80**.

For Examiner's Use	
Total	**80**

The Question Paper consists of 18 printed pages, including this page.

Setter: Ms Genevieve Thong

[Turn over

Mathematical Formulae

Compound interest

$$\text{Total amount} = P\left(1 + \frac{r}{100}\right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2}a b \sin C$$

$$\text{Arc length} = r\theta \text{ , where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2}r^2\theta \text{ , where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\sum f x}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum f x^2}{\sum f} - \left(\frac{\sum f x}{\sum f}\right)^2}$$

Answer **all** the questions.

1 Evaluate $\dfrac{9.194^2 - \sqrt[3]{931.5}}{8.917 \times 0.12}$. Give your answer to 4 significant figures.

Answer .... [1]

2 Solve $(3x - 1)(-2x + 5) = 0$.

Answer .... [2]

3 (a) Express 1.5% as a fraction in its lowest terms.

Answer .... [1]

(b) Bill invested $300 for 5 years at 2% per year simple interest. Find the total interest.

Answer $ .... [2]

4 Find the distance between the points $(2,7)$ and $(-3,-5)$.

Answer .... units [2]

5 Simplify $\dfrac{4x^2}{5} \div \dfrac{8x}{15}$.

Answer .... [2]

6 The maximum speed of a cheetah is 120 km/h.

(a) Express the maximum speed in metres per second.

Answer (a) .... m/s [1]

(b) Find the minimum time, in seconds, the cheetah takes to travel 100 m.

Answer (b) .... s [1]

7   In the class Sec 1N2, there are 24 boys out of 40 students.

    (a)   Write down the ratio of number of boys to number of girls.

          Answer (a) .... [1]

    (b)   If 4 of the boys can paint the classroom in 8 hours, how many boys will be needed to paint the same classroom in 2 hours?

          Answer (b) .... [2]

8   Solve $11x^2 - 15x = 110$ using the quadratic formula, giving your answers correct to 2 decimal places.

          Answer .... [3]

9   Find the smallest integer value of x that satisfies the inequality $3x + 2 > 20$.

Answer   .... [2]

10   **(a)**   Solve $4^{2x} = 32$.

Answer (a)   .... [2]

(b)   Given that $3^{13} \div 27 \times 5^0 = 3^k$, find k.

Answer (b)   .... [2]

11 In the diagram, $VPQR$ is a pyramid. Given that $\angle PRQ = 90°, \angle PQR = 50°, QR = 8$ cm, $VR = 7$ cm and the edge VR is vertical,
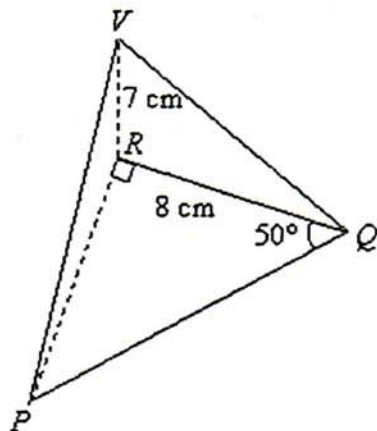
Calculate

(a) PQ,

Answer (a) ....cm [1]

(b) $\angle VQR$,

Answer (b) .... °[1]

(c) VQ.

Answer (c) ....cm [1]

12 (a) Express 112 as the product of its prime factors.

Answer (a) .... [1]

(b) Find the highest common factor of 108 and 112.

Answer (b) .... [2]

13 Given the formula $xw = y(w + x) - 5$,

(a) make x the subject of the formula,

Answer (a) .... [2]

(b) find x when $y = 3$, and $w = 2$.

Answer (b) .... [1]

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14 **(a)** In a rectangle, the obtuse angle formed when the diagonals meet is $(x+15)°$. Write an expression for the acute angle formed, leaving your answer in its simplest terms.

$(x+15)°$
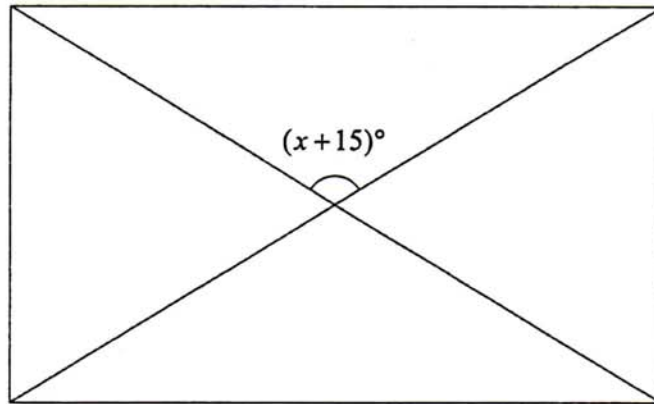
Answer (a) .... [1]

(b) List two quadrilaterals with two equal acute angles and two **equal obtuse angles**.

Answer (b) ....

.... [1]

(c) Some properties of a square are different from those of a rhombus. Write down one such property.

Answer (c) ....

.... [1]

15 The equation of each of the curves below is of the form $y = ax^n$, where n is an integer. State a possible value for n in each case.
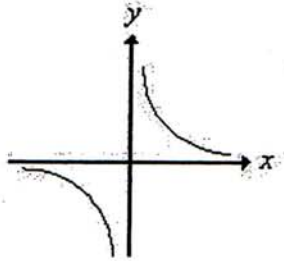
| Graph 1 | Graph 2 | Graph 3 |

...
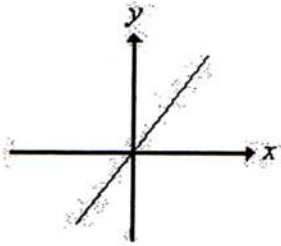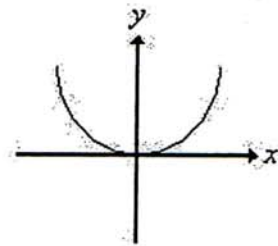
Answer Graph 1: $n =$ .... [1]

Graph 2: $n =$ .... [1]

Graph 3: $n =$ .... [1]

16 Julian buys 12 pears and 2 apples and the total cost is $10.20.
Adam buys 6 pears and 9 apples and the total cost is $9.90.
The cost of Julian's fruits can be shown by the equation $12p + 2a = 1020$.

(a) Write the cost of Adam's fruits in terms of p and a.

Answer (a) .... [1]

(b) Hence solve the simultaneous equations to find the cost of each pear and each apple.

Answer A pear costs .... cents

An apple costs .... cents [2]

17 A map is drawn to a scale of 1 : 20 000.

(a) A river is represented by 15 cm on the plan. Find the actual length of the river in meters.

Answer (a) .... m [2]

(b) Find the area, in square kilometres, of a forest represented by 36 cm² on the map.

Answer (b) .... km² [2]

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18 The diagram shows an equilateral triangle *ABC*, a pair of parallel lines *BCD* and *EF* and *ACF* is a straight line. Find, **stating your reasons clearly,**
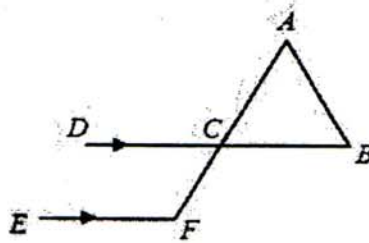
(a) ∠*DCF*.

Answer *(a)* .... ° [1]

(b) ∠*CFE*,

Answer *(b)* .... ° [1]

(c) the length of *AB* if the area of △*ABC* is 10 cm².

Answer *(c)* ....cm [2]

19 The graph shows the amount of money received by a magazine company from the sale of magazines and the expenses incurred in generating the sales.

Amount of money ($)

Number of Magazines sold
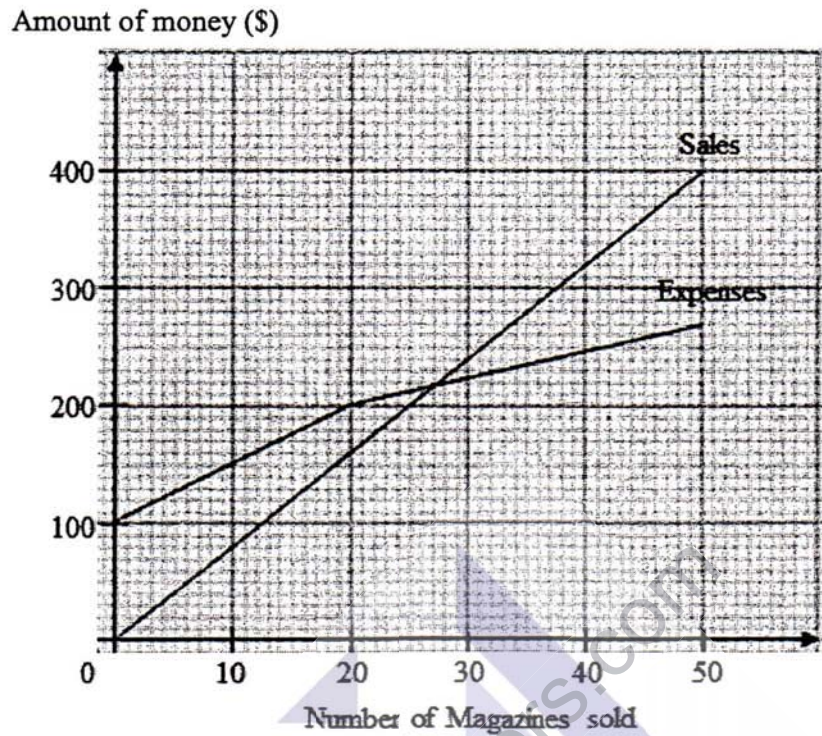
(a) Find the minimum number of magazines that must be sold to break even.

Answer (a) .... [1]

(b) Find the amount of profit made when 50 magazines were sold.

Answer (b) .... [1]

(c) Find the expenses per magazine when less than 20 magazines were sold.

Answer (c) .... [1]

20 (a) Expand and simplify $(2x+5)^2$.

Answer (a) .... [1]

(b) Factorise completely

(i) $81y^2 - x^2$,

Answer (b)(i) .... [1]

(ii) $2x^2 - 5x - 3$,

Answer (b)(ii) .... [1]

(iii) $3ab - 6ac + b - 2c$.

Answer (b)(ii) .... [2]

21 Mr. Smith's gross annual income was $74 000 for the year 2011. He has 2 children and his wife is not working. The tax reliefs are shown below:

Tax relief	Amount
Personal	$1500
Wife	$2000
Children	$1250 each
CPF contribution	$14800
Donations to charity	$12000

An extract of the tax rates from the Inland Revenue Department is shown below.

	Chargeable Income ($)	Rate (%)	Gross Tax Payable ($)
On the first	20 000		0
On the next	10 000	2.75	825
On the first	30 000		825
On the next	10 000	3.15	315
On the first	40 000		1 140
On the next	40 000	4.85	1 940
On the first	80 000		3080
On the next	80 000	15.5	12 400
On the first	160 000		15 480
Remaining amount above	160 000	25.45	

(a) Calculate the amount of income tax that Mr. Smith has to pay.

Answer (a) $ .... [2]

(b) Mr Faz paid $84 610 for his income tax in 2011. Calculate his chargeable income, for 2011.

Answer (b) $ .... [3]

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22 **(a)** $x^2 - 4x - 9$ can be written as $(x + p)^2 + q$.

Find p and q.

Answer *(a)* $p =$ ....

$q =$ .... [2]

(b) Hence, solve $x^2 - 4x - 9 = 11$.

Answer *(b)* .... [3]

23 The diagram shows an open cylindrical tank of radius 1 m and height 10 m. The tank contains water to a depth of 4 m.
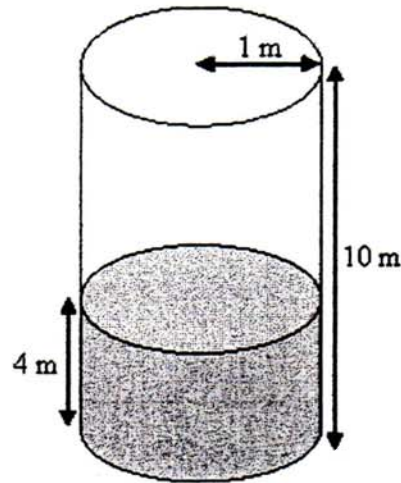
(a) Calculate the area of the tank which is in contact with the water.

Answer (a) .... [2]

(b) Calculate the volume of water in the tank.

Answer (b) .... [2]

(c) If a spherical metal ball of volume 15 m³ is dropped into the tank. Calculate the increase in the water level, rounding off your answer to 2 decimal places.

Answer (c) .... [2]

24 The table below shows you the values for the graph of $2y = 3x + 2$.

$$2y = 3x + 2$$

x	-2	0	2
y	a	1	4

(a) Find a.

Answer *(a)* $a =$ .... [1]
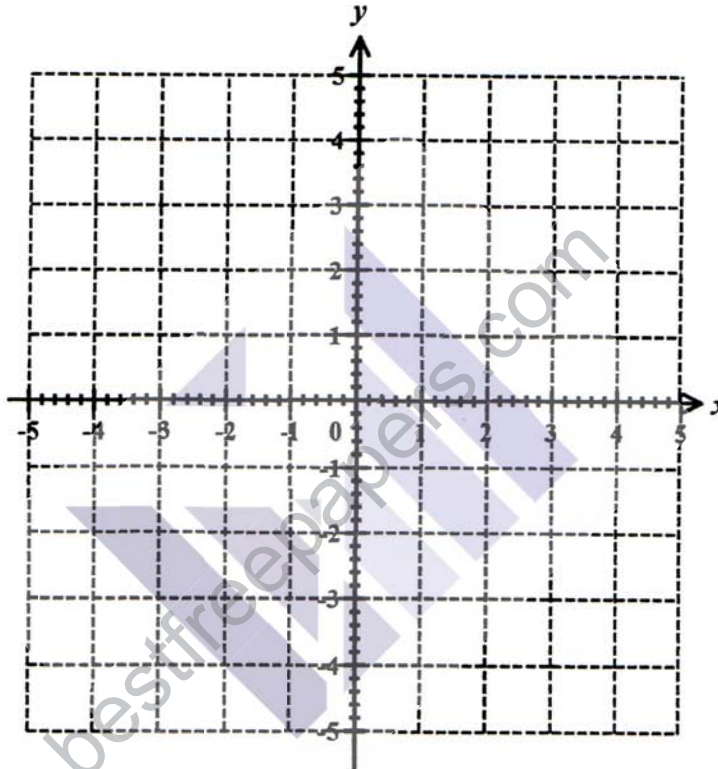
(b) In the grid given above, plot the line $2y = 3x + 2$.   [2]

(c) Write down the gradient of the line $2y = 3x + 2$.

Answer *(c)*   .... [1]

(d) (i) On the same grid above, draw the line $y = 2$.   [1]

(ii) Write down the coordinates of the intersection point of the two lines.

Answer *(d)(ii)*(............................. , ...) [1]

End of Paper

Preliminary Examinations
Mathematics (4NA)
Paper 1 Marking Scheme

Qn. No.		Solution	Marks Awarded	Remarks
1		69, 87	B1	
2		$x = \frac{1}{3}$ or $x = \frac{5}{2}$	B2	B1 for each correct answer
3	a	$\frac{1.5}{100} = \frac{3}{200}$	A1	
		$I = \frac{300(2)(5)}{100}$	M1	
		$= \$30$	A1	
4		$\sqrt{(7-(-5))^2 + (2-(-3))^2}$	M1	
		$= 13\,units$	A1	
5		$\frac{4x^2}{5} \times \frac{15}{8x}$	M1	M1 for changing to multiplication
		$= \frac{3x}{2}$	A1	
6	(a)	$\frac{120000}{60 \times 60}$	B1	
		$= 33.3\,m/s$		
	(b)	$\frac{100}{33.333}$	B1	
		$= 3s$		
7	(a)	$3:2$	B1	
	(b)	$B = \frac{k}{H}$		Or
		$4 = \frac{k}{8}$		Paint classroom –32 man hours
		$k = 32$		2 hours requires 16 boys
		$B = \frac{32}{2}$	M1	
		$= 16$	A1	

Qn. No.		Solution	Marks	Remarks
8		$\dfrac{-(-15) \pm \sqrt{(15)^2 - 4(11)(-110)}}{2(11)}$	M1	
		$= 3.92, -2.55$	A2	
9		$3x > 18$	M1	
		$x > 6$	A1	
		$\therefore$ smallest integer x is 7		
10	(a)	$2^{4x} = 2^5$	M1	
		$x = \frac{5}{4}$	A1	
	(b)	$3^{13-3} = 3^4$	M1	Recognise $5^0 = 1$ or $27 = 3^3$
		$k = 10$	A1	
11	(a)	$\cos 50° = \frac{8}{PQ}$		
		$PQ = 12.45$	A1	
		$= 12.4\,cm$		
	(b)	$\tan \angle VQR = \frac{7}{8}$	A1	
		$\angle VQR = 41.2°$		
	(c)	$VQ = \sqrt{7^2 + 8^2}$	A1	
		$= 10.63\,cm$		
12	(a)	$112 = 2^4 \times 7$	B1	
	(b)	$108 = 2^2 \times 3^3$	M1	
		$HCF = 2^2 = 4$	A1	
				$2\,|\,108 \quad 112$
				$2\,|\,54 \quad 56$
				$27 \quad 28$
				M1
13	(a)	$xw = xy + yw - 5$	M1 for bring all x terms	
		$xw - xy = yw - 5$	A1	
		$x = \frac{yw - 5}{w - y}$		
	(b)	$x = \frac{3(2) - 5}{2 - 3}$	A1	
		$= -1$		

Table (Questions 14–19)

Qn	Part	Working	Marks	Remarks
14	(a)	$(165-x)^\circ$	A1	
	(b)	parallelogram; rhombus	B1	
	(c)	All angles in a square are 90 degrees but that is not true for rhombus	B1	
		Diagonals are equal in length for square but not rhombus		
15	(a)	Negative odd number	B1	
	(b)	1	B1	
	(c)	2	B1	
16	a	$6p + 9a = 990.$	B1	
	b	(2)x2:		
		$12p + 18a = 1980 \; - - - (3)$		
		(3) – (1) :		
		$12p + 18a - (12p + 2a) = 960$	M1	Elimination or substitution
		$pear = 75cents$		
		$apple = 60cents$	A1	
17	(a)	1 : 20000		
		1cm rep 20000cm		
		1cm rep 200m		
		$\therefore 15\,cm\ rep\ 200 \times 15 = 3000m$	M1	Convert cm to m
			A1	
	(b)	1cm rep 200m		
		1cm rep 0.2km		
		1cm^2 rep 0.04km^2	M1	
		36cm^2 rep 1.44 km^2	A1	
18	(a)	60° (vertically opp angles)	B1	Must have reason
	(b)	120° (interior angles DC//EF)	B1	Must have reason
	(c)	$\frac{1}{2}(AB)^2 \sin 60° = 10$	M1	
		$AB = 4.81cm$	A1	
19	(a)	27 magazines	B1	

Table (Questions 20–22)

Qn	Part	Working	Marks	Remarks
	(b)	400-270=130	B1	
	(c)	200/20=$10	B1	
20	(a)	$4x^2 + 20x + 25$	A1	
	(bi)	$(9y+x)(9y-x)$	A2	
	(bii)	$(2x+1)(x-3)$	A2	
	(biii)	$3a(b-2c)+1(b-2c)$	A2	
		$=(b-2c)(3a+1)$	M1 / A1	
21	(a)	Chargeable income $= 74000-1500-2000-1250(2)$	M1	
		$\qquad\qquad -14800-12000$		
		$=41200$		
		$tax = 1140 + \frac{4.85}{100} \times 1200 = \$1198.20$	A1	84610-15480 M1
	(b)	Remaining amt		
		$84610 - 15480 = \$69130$	M1	
		Chargeable income		
		$160000 + \frac{100}{25.45} \times 69130$	M1	$\dfrac{100}{25.45} \times 69130$
		$160000 + 271630.65$		
		$= \$431630.65$	A1	
22	(a)	$x^2 - 4x - 9$	M1	
		$= (x-2)^2 - 4 - 9$		
		$p = -2$		
		$q = -13$	A1	A1 is awarded only if both p and q are given correctly with the correct signs.

(b)	$x^2 + 8x - 9$ $= (x-2)^2 - 13$ Solve $(x-2)^2 - 13 = 11$ $(x-2)^2 = 24$ $x = \pm\sqrt{24} + 2$ $x = 6.90, -2.90$	M1	Note : Hence… So any other technique will be given 0 marks. e.c.f
			For x-coordinate accept (0.6-0.8)

23 (a)	$\pi(1)^2 + \pi(2)(4)(1)$ $= 28.27m^2$	M1 A1	For curved Surface
(b)	$\pi(1)^2(4)$ $= 12.566m^3$	M1 A1	
(c)	$15 = \pi(1)^2(h)$ $h = 4.77m$	M1 A1	
24 (a)	$a = -2$	A1	
(b)	(b) C1 – all points plotted correctly C1 – line drawn joining the points with labelling (d)(i) C1 – line drawn correctly with labelling		

(c)	$\frac{3}{2}$	B1	
d(ii)	(0.67,2)	B1	Based on what is seen on QP

Calculator Model: ☐

KENT RIDGE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2016

MATHEMATICS SYLLABUS A   4045/02
PAPER 2
SECONDARY 4 NORMAL (ACADEMIC)

Wednesday 17 August 2016   **2 hours**

Name: _____ ( )   Class: Sec _____

Additional Materials:
Answer papers
Graph paper (1 sheet)
Plain paper (1 sheet)

READ THESE INSTRUCTIONS FIRST

Do not open this question paper until you are told to do so.

Write your answers and working on the separate pieces of paper provided.
Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer all questions.

Section B
Answer one question.

You are expected to use a scientific calculator to evaluate explicit numerical expressions.
If the degree of accuracy is not specified in the question and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.
You are reminded of the need for clear presentation in your answers.
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for the paper is 60.

For Examiner's Use
Total   60

[Turn over

This Question Paper consists of **10** printed pages, including this page.

Setter: Ms Genevieve Thong

Mathematical Formulae

Compound interest

$$\text{Total amount} = P\left(1+\frac{r}{100}\right)^n$$

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Surface area of a sphere $= 4\pi r^2$

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Area of triangle $ABC = \frac{1}{2}ab\sin C$

Arc length $= r\theta$, where θ is in radians

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$$\text{Mean} = \frac{\sum fx}{\sum f}$$

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2

## Section A (52 marks)
Answer **ALL** questions from this section.

1. The variable y is inversely proportional to the square of the variable x. It is also given that when $y = 4$, $x = 3$. Find

   (a) the equation relating y and x, [2]

   (b) the value of x when $y = 12$. [2]

2. A motorist rode 85 km from town P to Q at an average speed of x km/h.

   (a) Write down an expression, in terms of x, for the number of hours taken to travel from P to Q. [1]

   He returned from Q to P by the same route. His average speed for the return journey was 2 km/h less than on the outward journey.

   (b) Write down an expression, in terms of x, for the number of hours taken to travel from Q to P. [1]

   He took 2 hours more on the return journey than on the outward journey.

   (c) Write down an equation in x, and show that it reduces to $x^2 - 2x - 85 = 0$. [2]

   (d) Solve the equation $x^2 - 2x - 85 = 0$, correct your answers to 3 significant figures. [3]

   (e) Find the duration of the return journey. [2]

3. Based on the Singapore Tourism Board Annual Report 2008/2009, the income generated from tourists visiting Singapore in 2008 was estimated to be \$15.2 billion.

   (a) Express 15.2 billion in standard form. [1]

   (b) It is estimated that 10.1 million tourists visited Singapore in 2008. Calculate the average income generated from each tourist. [2]

4. The speed-time graph illustrates the motion of a body during a period of 5 minutes.
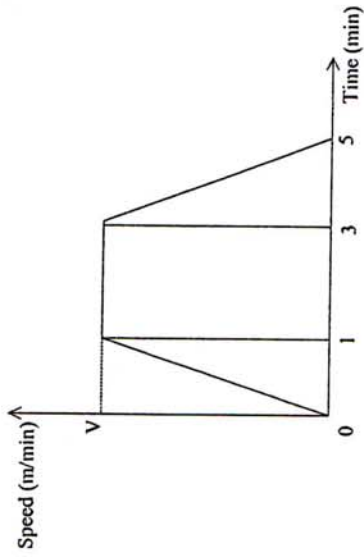
   If the maximum speed V is 0.5 m/min, calculate

   (a) the deceleration, in m/min² during the last 2 minutes, [2]

   (b) the total distance travelled by the body in the 5 minute period. [2]

5. The two vases shown below are geometrically similar.
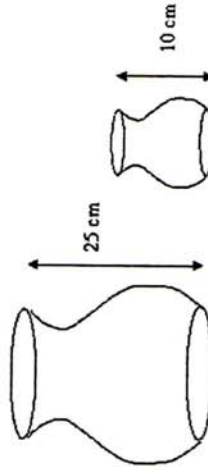
   Find

   (a) the diameter of the larger vase if the diameter of the smaller vase is 6 cm, [2]

   (b) the volume of the smaller vase if the volume of the bigger vase is 1125 cm³. [2]

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6. Consider the number pattern

1st term	$1^2 - 0^2 = 1$
2nd term	$2^2 - 1^2 = 3$
3rd term	$3^2 - 2^2 = 5$
4th term	$4^2 - 3^2 = 7$
	$p^2 - q^2 = 101$
nth term	?

(a) Write down the 7th line of the pattern. [1]

(b) Find the integer values of p and q which satisfy the equation $p^2 - q^2 = 101$. [1]

(c) Write down an expression in terms of n for the nth term of number pattern. [1]

(d) Without using the calculator and showing appropriate working, find the value of $143^2 - 142^2$. [1]

7. Wei Jie wants to buy a bicycle which costs $1250.

(a) The cost of the bicycle, $1250, is inclusive of 7% Goods and Services Tax (GST).

Calculate the price of the bicycle before GST. [1]

Wei Jie wants to take up a loan to buy the bicycle. He is given two options as shown below:

Option	A	B
Rate	2.2% simple interest per year	0.3% per annum compounded monthly
Time taken to repay	6 months	$\frac{1}{3}$ year

(b) Showing your working clearly, explain which option would be better for Wei Jie. [4]

8. The following dot diagram shows the number of credits cards that each of 21 regular customers of a restaurant has.

Number of Credit Cards Owned by Customers
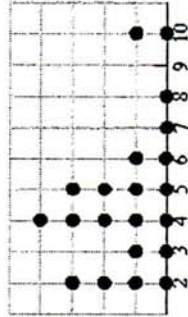
Find

(a) the percentage of patrons who have at least 5 credit cards, [1]

(b) the modal number of credit cards, [1]

(c) the mean number of credit cards, [2]

(d) the median number of credit cards. [1]

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9 Answer the whole of this question on a single sheet of plain paper.

The triangle PQR has $PQ = 5$ cm, $PR = 11$ cm and $\angle QPR = 30°$.

(a) Draw triangle PQR accurately. [2]

(b) The perpendicular bisector of QR meets PQ produced at S. Draw the line PS. [2]

(c) Measure $\angle PQR$. [1]

(d) Measure QS. [1]

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10 Answer the whole of this question on a single sheet of graph paper.

Two variables x and y are connected by the equation $y = x^2 + 2x - 4$.
Some corresponding values of x and y are given in the table below.
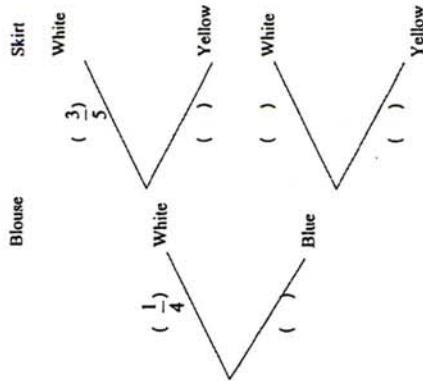
x	-4	-3	-2	-1	0	1	2
y	4	-1	p	-5	-4	-1	4

(a) Determine the value of p. [1]

(b) Using a scale of 2 cm to 1 unit for both axes, plot the graph of $y = x^2 + 2x - 4$. [3]

(c) State the coordinates of the minimum point. [2]

(d) Using your graph, solve the equation $x^2 + 2x - 4 = 0$. [2]

Section B (8 marks)

Answer one question from this section. Each question carries 8 marks.

11 (a) Susie has 2 white and 6 blue blouses. To match the blouses, she has 6 white and 4 yellow skirts. Every morning she selects a blouse and a skirt at random.

(i) Copy and complete the probability diagram. [2]

Blouse   Skirt

$(\frac{1}{4})$ White

White $(\frac{3}{5})$ White

        ( )   Yellow

        ( )   White

Blue   ( )   Yellow

(ii) Calculate the probability that Susie will select a blouse and a skirt of the same colour. [2]

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(b) DA is the tangent to the circle with centre O. A, B and C are points on the circumference of the circle and $\angle CAD = 78°$. Stating the reasons clearly, find

    (i) $\angle DAO$,   [1]

    (ii) $\angle COA$,   [2]

    (ii) $\angle ABC$.   [2]

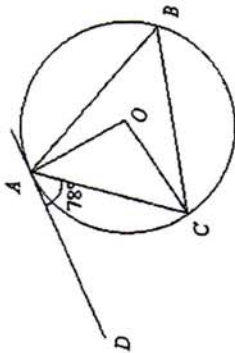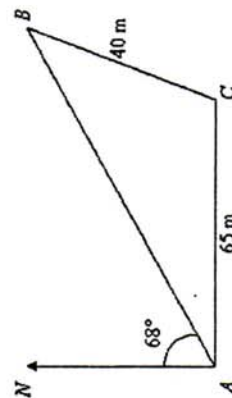<div style="text-align:center">End of Paper</div>

(b) The cumulative frequency curve shows the marks obtained by 80 students in a Science test. The maximum mark for the test is 80. Use the graph below to find

Marks
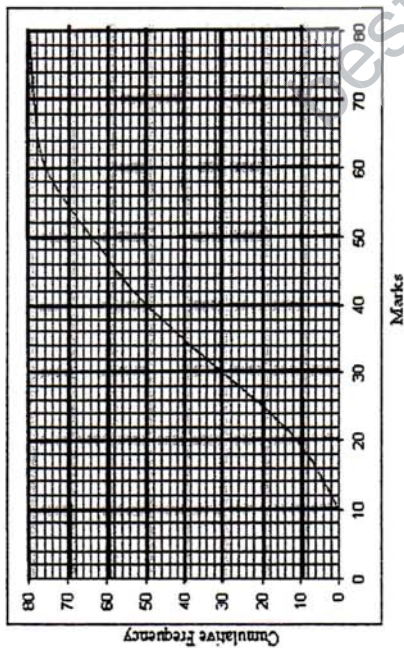
    (i) the median mark,   [1]

    (ii) the interquartile range,   [1]

    (iii) the 70th percentile.   [1]

    (iv) If the passing mark is 40, use the graph to find the number of students who passed. [1]

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(a) In the diagram below, A is due west of C, $BC = 40$ m, $AC = 65$ m and the bearing of B from A is $068°$.

Calculate

    (i) $\angle BAC$.   [1]

    (ii) bearing of C from B.   [2]

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Qn. No.		Solution	Marks Awarded	Remarks
1	a	$4 = \dfrac{k}{3^2}$		M1 awarded as long as correct k found
		$k = 36$	M1	
		$y = \dfrac{36}{x^2}$	A1	
	b	$12 = \dfrac{36}{x^2}$	M1	
		$x = \pm\sqrt{3}$	A1	No A1 for $\pm$ missing
		$x = 1.73\ or\ -1.73$		
2	a	$\dfrac{85}{x}$ hours	B1	B1 for each correct answer
	b	$\dfrac{85}{x-2}$ hours	B1	Must have units
	c	$\dfrac{85}{x-2} - \dfrac{85}{x} = 2$	B1	expression
		$85x - 85(x-2) = 2(x-2)(x)$	B1	Rid of denominator
		$0 = 2x^2 - 4x - 170$		
		$0 = x^2 - 2x - 85$		
	d	$x = \dfrac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-85)}}{2(1)}$	A2	M1 working
		$x = 10.27$		
		$= 10.3, -8.27$		
	e	$\dfrac{85}{10.27-2}$		
		$\dfrac{85}{10.27-2} + 2$	M1	
		$\dfrac{85}{10.27} + 2$	A1	
		$= 10.3h$		
3	a	1.52×10^{10}	B1	Recognise million 10^6
	b	$\dfrac{15.2 \times 10^9}{10.1 \times 10^6} = \$1504.95$	M1 ecf	
			A1	
4	a	$\dfrac{0-0.5}{2}$	M1	
		$= -0.25$	A1	
		Deceleration $= 0.25$ m/min²		

Qn. No.		Solution	Marks Awarded	Remarks
	b	$\dfrac{1}{2} \times 0.5 + 2 \times 0.5 + \dfrac{1}{2}(0.5 \times 2)$	M1	Or $\dfrac{1}{2}(5+2)(\tfrac{1}{2})$
		$= 1.75m$	A1	Area of trapezium
5	a	$\dfrac{10}{25} = \dfrac{6}{d}$	M1	Correct ratio compared
		$d = 15cm$	A1	
	b	$\left(\dfrac{10}{25}\right)^3 = \dfrac{v}{1125}$	M1	
		$v = 72cm^3$	A1	
6	(a)	$7^2 - 6^2 = 13$	A1	
	(b)	$p=51;\ q=50$	A1	
	(c)	$n^2 - (n-1)^2 = 2n - 1$	A1	
	(d)	$143^2 - 142^2 = (143 + 142)(143 - 142)$	A1	No mark if working not seen.
		$= 285$		
7	(a)	$\$1168.22$	A1	No mark for
	(b)	$I = \dfrac{(1250)(2.2)(0.5)}{100}$ $\qquad 1250\left(1 + \dfrac{0.3/12}{100}\right)^4$	M1 either or	$1250\left(1 + \dfrac{0.3\frac{1}{2}}{100}\right)^3$
		$= \$13.75$ $\qquad = 1251.25$		$= 1251.25$
		$\$1263.75$	A1 for total or interest for option B	
		Option B	A1 for total or interest op A	
			A1 final Ans	
8	a	$\dfrac{10}{21} \times 100\% = 47.6\%$	B1	
	b	4	B1	
	c	$\dfrac{2 \times 4 + 3 \times 2 + 4 \times 5 + 5 \times 4 + 6 \times 2 + 7 + 8 + 10 \times 2}{21}$	M1	
		$= 4.81$	A1	
	d	4	B1	

Q4.

a) labels and accurate drawing 1m construction arcs 1m
b) perpendicular bisector drawn B1 points drawn B1
c) 130° R1 129.5° to 130.5° B1
d) 5.6 cm B1

11	(ai)			
	(aii)	$\frac{1}{4} \times \frac{3}{5} = \frac{3}{20}$	multiplication	M1 A1
11	(bi)	35 marks		B1
	(bii)	47-25=22 marks or 46-25=21 marks		B1
	(biii)	44 marks		B1
	(biv)	30 students		B1
12	(ai)	$\angle BAC = 90° - 68° = 22°$		B1
	(aii)	$\dfrac{\sin ABC}{65} = \dfrac{\sin 22°}{40}$	$360° - (112 + 37.498°)$	M1
		$\angle ABC = 37.498°$		
		bearing $= 360° - (180° - 68°) - 37.498°$		
		$= 210.5°$		A1
12	(bi)	90° tangent perpendicular to rad		B1
	(bii)	$COA = 180° - 2(90° - 78°)$ (base angle isos.triangle)		M1
		$= 156°$		A1
	(biii)	$\angle ABC = 156/2 = 78°$ (angle at centre= 2 angle at circumference)		M1 A1