

Answer **all** the questions

For
Examiner's
Use

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Use

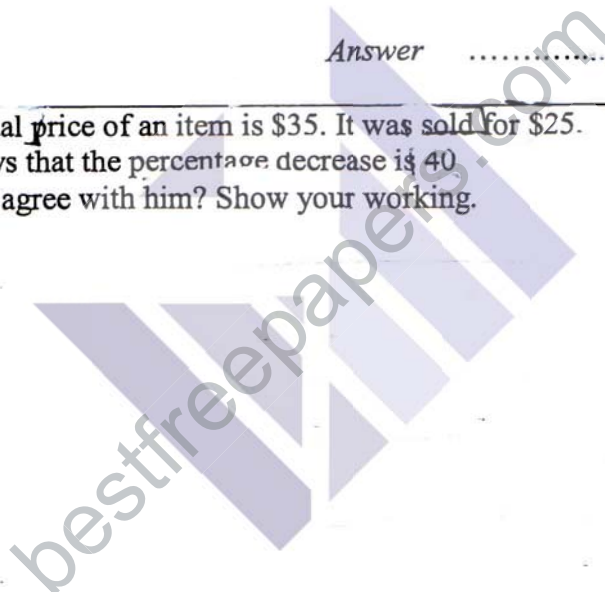
- 1 John takes 9 minutes to cycle through a tunnel that is 2700 metres long.
Find his speed in kilometres per hour.

Answerkm/h [2]

- 2 The usual price of an item is \$35. It was sold for \$25.
Jack says that the percentage decrease is 40.
Do you agree with him? Show your working.

Answer

I (agree/disagree) with Jack. [2]



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- 3 Alan, Ben and Charles ran for the post of President of Students' Council. Alan won 44% of the votes. Ben won 38% of the votes. Charles won 36 votes.

Find the total number of votes cast.

Answer [2]

- 4 By writing each value correct to 1 significant figure, estimate the value of

$$\left(\frac{49.3}{2.39 \times 95.3} \right)^{\frac{1}{2}}.$$

Show your working.

Answer [2]

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5 The probability that Jolene arrives at school before and after the reporting time of 0730 is $\frac{4}{5}$ and $\frac{1}{20}$ respectively.

- (a) Find the probability that Jolene will arrive at school at exactly 0730.

Answer [1]

- (b) Over a period of 100 days, estimate the number of days that Jolene will be late for school.

Answer [1]

6 (a) Solve $\frac{7}{x+2} = 3$

Answer $x =$ [1]

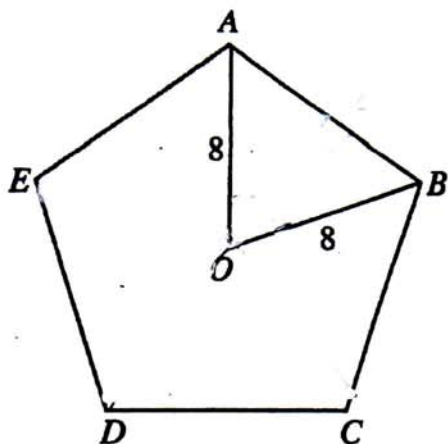
- (b) Solve the inequality $-2x \leq 15 + 3x$.

Answer [2]

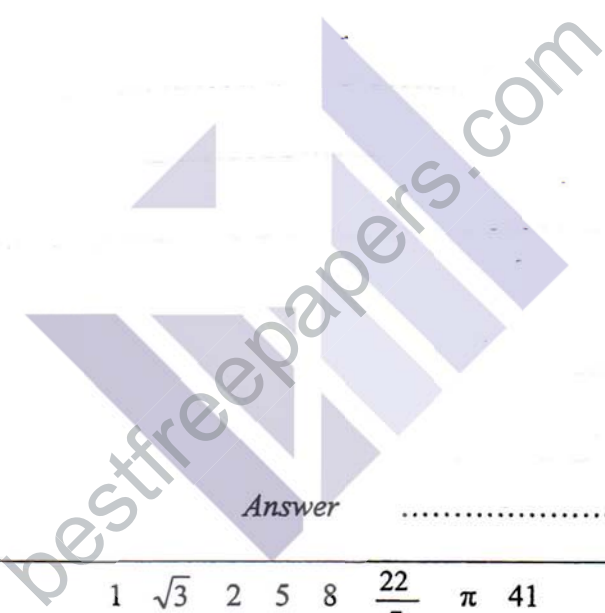
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7



$ABCDE$ is a regular pentagon with centre O . $OA = OB = 8$ cm.
Calculate the area of the pentagon.



Answercm² [3]

8

1 $\sqrt{3}$ 2 5 8 $\frac{22}{7}$ π 41

List down all

(a) irrational numbers,

Answer [1]

(b) prime numbers,

Answer [1]

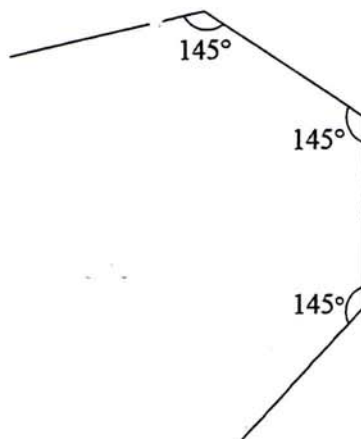
(c) perfect cubes.

Answer [1]

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9



James says that the figure is part of a regular polygon. Is he correct? Show your working.

Answer: James is

[3]

10 James received \$55 766 at the end of 6 years of investing in a financial instrument that earns 1.5% per year compound interest.

Calculate the interest James earned at the end of the 6 years. Give your answer to the nearest dollar.

Answer \$

[3]

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- 11 Two LED lights flash at different intervals.
The lights first flash together at 09 00.
They next flash together at 09 14.

- (a) The first LED light flashes once every 60 seconds.
Express 60 as a product of its prime factors. Give your answer
in index notation.

Answer $60 = \dots\dots\dots$ [1]

- (b) Find, in seconds, the smallest possible interval that the second light
flashes at.

Answer $\dots\dots\dots$ s [2]

- 12 Solve these simultaneous equations.

$$5x - 2y = 21$$

$$y + 8 = 2x$$

Answer $x = \dots\dots\dots$

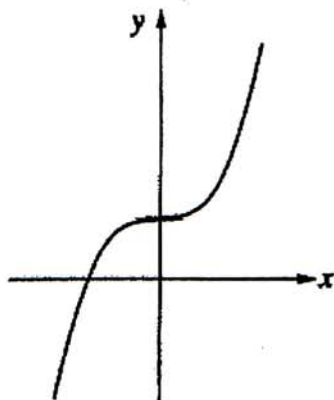
$y = \dots\dots\dots$ [3]

13

$y = x^3 + 5$	$y = 5 - x^3$	$y = 5 + x$	$y = 5 - x$
$y = x - 5$	$y = x^2 + 5$	$y = 5 - x^2$	$y = -5 - x^2$

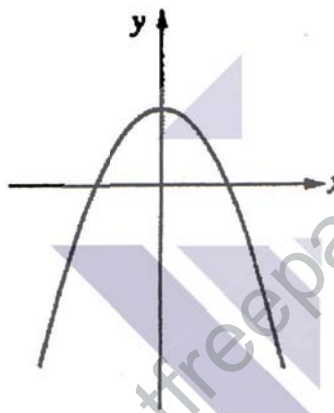
Write down a possible equation for each of the sketch graphs below.

(a)



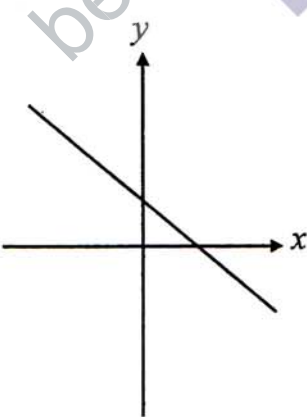
Answer [1]

(b)



Answer [1]

(c)



Answer [1]

- 14 (a) A class of 20 students were asked how many minutes they had taken to complete an assignment.
The results are shown in the stem-and-leaf diagram.

2	4 5 5 7 7 7 8 8 9 3
3	1 2 2 2 3 7
4	4 6 7 8
5	
6	9

Key: 3 | 2 means 32 minutes

- (i) Write down the modal time taken.
Answerminutes [1]
- (ii) Find the median time taken.

Answerminutes [1]

- (iii) Explain why the mean may not be an appropriate average to use to summarize the time taken by these students.

Answer

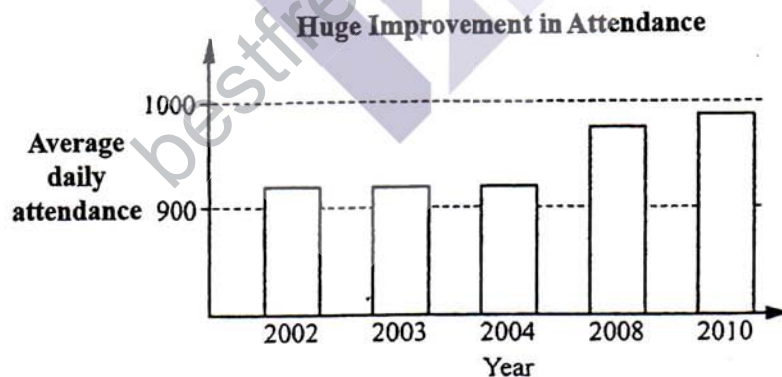
.....

.....

.....

[1]

(b)



The chart claims that there is a huge improvement in attendance over the years. Do you agree? Give your reason.

Answer

.....

.....

.....

[1]

- 15** The point A has coordinates $(a, 8)$.
The point B has a y -coordinate 4 more than that of A and a x -coordinate 3 less than that of A .

- (a) Write down the gradient of the line AB .

Answer [1]

- (b) Calculate the length of AB .

Answerunits [1]

- (c) Point C lies on the line AB and has coordinate $(-3, 6)$.
Find the equation of the line AB .

Answer [2]

- 16** In a sequence, the same number is subtracted each time to obtain the next term. The first four terms of the sequence are

26 a b 5

- (a) Find the values of a and b .

Answer $a = \dots\dots\dots$, $b = \dots\dots\dots$ [1]

- (b) Find an expression for the n^{th} term of this sequence.

Answer [1]

- (c) Explain why -237 is not a term of this sequence.

Answer

.....

..... [2]

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- 17 (a) Tap A takes 3 minutes to fill a tank with water.
Tap B takes 4 minutes to fill the same tank with water.
If both taps are turned on at the same time, how long will it take for the tank to be filled?

Answerminutes [2]

- (b) w is inversely proportional to x^2 .
When x has a certain value, $w = 5$.
Find the value of w when x is doubled.

Answer $w =$ [2]

- 18 (a) Given that $9^5 \div 3^x = 27^{\frac{2}{3}}$, find x .

Answer $x =$ [3]

- (b) Simplify $(2ab)^2 \div 3a^{-2}b^3 \times (8ac)^0$. Express your answer in positive index.

Answer [2]

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19 A rhombus $ABCD$ has sides 6 cm. Angle ABC is 50° .

- (a) Construct the rhombus and label its vertices $ABCD$. [2]
(b) Construct the perpendicular bisector of BC . [1]
(c) Construct the bisector of angle BAD . [1]
(d) Label the point P such that BP is equal to PD and is equidistant from B and C . [1]

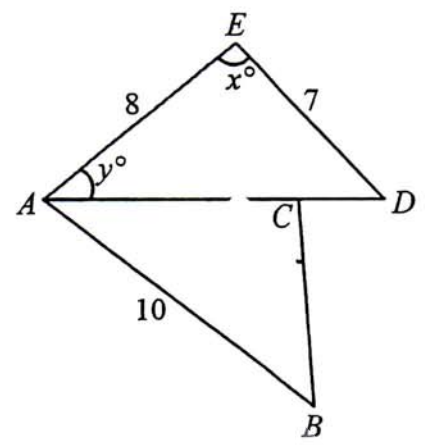
Answer (a), (b), (c) and (d)

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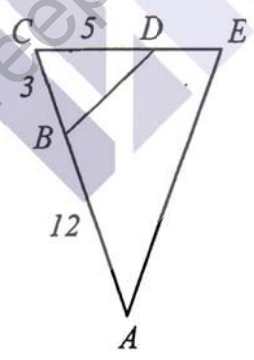
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- 20 (a) Triangles ABC and DAE are congruent.
 $AE = 8$ cm, $ED = 7$ cm and $AB = 10$ cm.
 Angle $AED = x^\circ$ and angle $DAE = y^\circ$.



- (i) Express in terms of x° and/or y° , the angle ACB .
 Answer $^\circ$ [1]
- (ii) Find the length CD .
 Answercm [1]

- (b) The two triangles in the diagram are similar.



- (i) Write down the pair of similar triangles.
 Answer
 Triangle is similar to triangle [1]
- (ii) Calculate the length DE .
 Answercm [2]

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21 (a) Factorise completely $3ap - 4bp + 12bq - 9aq$.

Answer [2]

(b) Given that $4x^2 - 9y^2 = 1$ and $4x - 6y = 5$, find the value of $2x + 3y$.

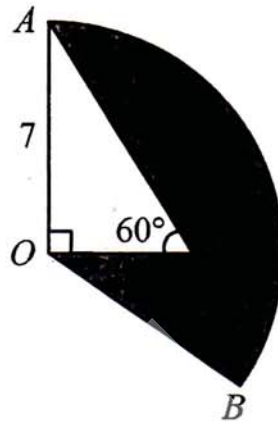
Answer [3]

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- 22 AOB is a sector of a circle, centre O , of radius 7 cm.
 AOC is a right-angled triangle. Angle $ACO = 60^\circ$ and angle $COB = 30^\circ$.

Find the area of the shaded region.



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Answercm² [5]

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- 23 Mr Tan is married with 2 children. He earned a gross annual income of \$76 200. Of this, the amount that will **not** be subjected to income tax is:

Personal relief	\$3000
Wife relief	\$2000
Child relief	\$4000 per child
CPF contribution	\$19 200

- (a) Calculate Mr Tan's chargeable income.

Answer \$..... [2]

The income tax rates are shown below:

Chargeable Income	Income Tax Rate (%)	Gross Tax Payable (\$)
First \$20,000	0	0
Next \$10,000	2	200
First \$30,000	-	200
Next \$10,000	3.50	350
First \$40,000	-	550
Next \$40,000	7	2,800

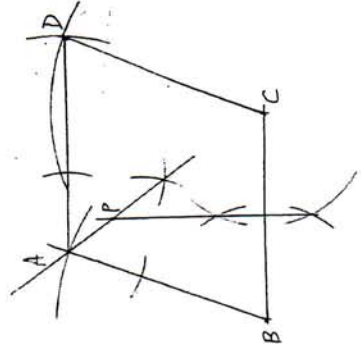
- (b) Calculate his income tax payable.

Answer \$..... [3]

End of Paper

Qn	Steps/Answer	Remarks	Total
1	Speed = $2700 \div 9 = 300$ m/min = 18 km/h	O.E.	[2]
2	Percentage decrease = $\frac{35 - 25}{35} \times 100\% = 28.6\%$ Disagree		[2]
3	$(100 - 44 - 38)\% = 36$ Total votes cast = $(100 + 18) \times 36 = 200$		[2]
4	$\frac{50}{(2 \times 100)^{\frac{1}{2}}}$ $\frac{1}{2}$		[2]
5	(a) $\frac{3}{20}$ (b) 5		[2]
6	(a) $x = \frac{1}{3}$ (b) $-5x \leq 15$ $x \geq -3$		[3]
7	(a) Angle $AOB = 360 \div 5 = 72^\circ$ Area of $AOB = \frac{1}{2}(8)(8)\sin 72^\circ$ Area of pentagon = $\frac{1}{2}(8)(8)\sin 72^\circ \times 5 = 152$ cm ²		[3]
8	(a) $\sqrt{3}, \pi$ (b) 2, 5, 41 (c) 1, 8		[3]
9	exterior angle = $180 - 145 = 35$ Number of sides = $360 \div 35 = 10.3$ James is wrong.		[3]
10	$55766 = P(1 + \frac{1.5}{100})^6$ $P = 51000$ Interest earned = \$4766		[3]
11	(a) $60 = 2 \times 2 \times 3 \times 5$ (b) $840 = 2 \times 2 \times 2 \times 3 \times 5 \times 7$ 2 nd light flashes once every $2 \times 2 \times 2 \times 7 = 56$ sec	14 min = 840 seconds	[3]
12	Either substitution or elimination method $x = 5$ $y = 2$		[3]
13	(a) $y = x^3 + 5$ (b) $y = 5 - x^2$ (c) $y = 5 - x$		[3]

14	(a)(i) 27 and 32 min (a)(ii) 31.5 min (a)(iii) There is an outlier of 69 minutes which will cause the mean to be skewed or inaccurate. Disagree. The years 2005 to 2007 are not displayed and there might have been a drop in attendance during that period. (b)		[4]
15	(a) $\frac{4}{-3}$ (b) 5 (c) $6 = -\frac{4}{3}(-3) + c$ $y = -\frac{4}{3}x + 2$	Rise/run	[4]
16	(a) $a = 19, b = 12$ (b) $26 - 7(n - 1)$ (c) $26 - 7(n - 1) = -237$ $n = 38.6$ As n is not an integer or whole number, -237 is not a term of this sequence.		[4]
17	(a) In 1 minute, they fill $\frac{1}{3} + \frac{1}{4} = \frac{7}{12}$ of the tank together They will take $\frac{12}{7} = 1.71$ minutes to fill the tank together. (b) $5 = \frac{k}{x^2} \Rightarrow k = 5x^2$ When x is doubled, $w = \frac{k}{(2x)^2} = \frac{k}{4x^2} = \frac{5x^2}{4x^2} = \frac{5}{4}$	Tap A fills $\frac{1}{3}$ of the tank in 1 minute while Tap B fills $\frac{1}{4}$ of the tank in 1 minute.	[4]
18	(a) $3^{10} + 3^* = 3^2$ $10 - x = 2$ $x = 8$ $4a^2b^2 + 3a^{-2}b^3 \times 1$ $= \frac{4a^4}{3b}$ (b)		[5]

19	<p>BI for correct length of sides 6 cm. BI for construction lines and arcs. BI for perpendicular bisector BI for angle bisector BI for point P.</p> 	[5]
20	<p>(a) x° (b) 3 cm (c) BCD, ECA (d) $\frac{15}{5} = \frac{CE}{3}$ $CE = 9$ $DE = 9 - 5 = 4\text{cm}$ $p(3a - 4b) - 3q(3a - 4b)$ $= (p - 3q)(3a - 4b)$</p>	<p>(a) $\frac{AC}{DC} = \frac{CE}{3}$ as $\frac{AC}{DC} = \frac{CE}{3}$</p> <p>(b) $(2x + 3y)(2x - 3y) = 5$ $4x - 6y = 5$ $2x - 3y = \frac{5}{2}$ Hence $2x + 3y = 5 + \frac{5}{2}$ $2x + 3y = 2$</p>

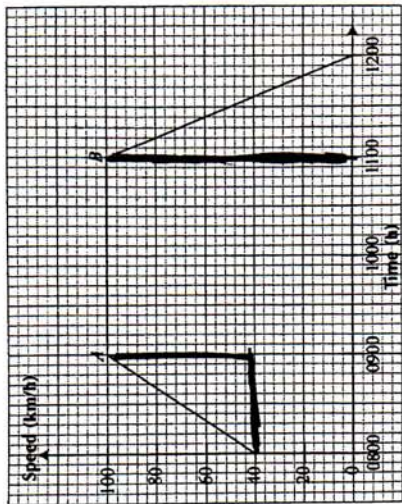
22	<p>$OC = \frac{7}{\tan 60^\circ}$ Area of AOC = $\frac{1}{2}(7)(\frac{7}{\tan 60^\circ})$ Area of sector AOB = $\frac{120^\circ}{360^\circ}(\pi)(7^2)$ Area of shaded region = $\frac{120^\circ}{360^\circ}(\pi)(7^2) - \frac{1}{2}(7)(\frac{7}{\tan 60^\circ})$ = 37.2 cm^2</p>	[5]
23	<p>(a) Total reliefs = \$32 200 Chargeable income = 76 200 - 32 200 = \$44 000 Tax on first \$40 000 = \$550 Tax on rest of income = $\frac{7}{100} \times 4000 = \\280 Total tax payable = 550 + 280 = \$830</p> <p>(b)</p>	[5]

Section A (52 marks)

Answer all the questions in this section.

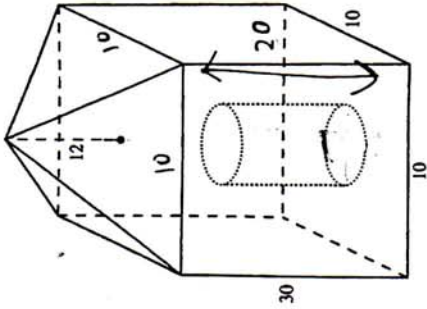
- 1 It is given that $v^2 = u^2 - 2gh$.
 (a) Evaluate v when $u = 30$, $g = 9.8$ and $h = 24.1$. [2]
 (b) Rearrange the formula to make u the subject. [2]
- 2 A plan of a flat is drawn on a scale 1 : 40.
 (a) The width of the flat on the plan is 20 cm. Find, in metres, the actual width of the flat. [1]
 (b) The floor area of the plan is 900 cm². Find, in square metres, the actual area of the flat. [2]
 (c) The flat is drawn on another plan of scale 1 : 50. What is the width of the flat on this plan? [1]

- 3 The population of Asia is approximately 4 543 000 000. Correct to the nearest 1 000 000.
 (a) Write down the least possible population of Asia. [1]
 (b) $4\,543\,000\,000 = k$ billion. Find k . [1]
 (c) The area of Asia is 4.34×10^7 square kilometres. Calculate the number of people per square kilometre in Asia. Give your answer in standard form. [2]



The diagram shows the speed-time graph of the journey of a motorcyclist.

- (a) How long did the motorcyclist travel at a constant speed? [1]
 (b) Find the acceleration of the motorcyclist in the first hour. [1]
 (c) Calculate the average speed of the motorcyclist for the entire journey. [3]
- 5 Given that p is an integer,
 (a) Write down an expression for the next odd number after $2p - 1$. [1]
 (b) Find, in its simplest form, the expression for the sum of these two odd numbers. [1]
 (c) Show that the sum of the squares of these two odd numbers is $8p^2 + 2$. [2]
 (d) Explain why the sum of the squares is an even number. [2]



A toy is made up of a right-pyramid and a cuboid. The sides of the base are 10 cm each. The height of the cuboid is 30 cm. The vertical height of the right-pyramid is 12 cm.

A cylindrical hole of diameter 5 cm and height 20 cm is removed from below the toy for the purpose of inserting a rod.

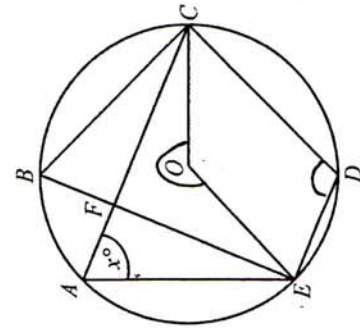
- (a) Calculate the volume of the toy. [3]
 - (b) The surface of the toy will be painted. 100 ml of paint can paint an area of 10 000 cm². Calculate, to the nearest ml, the volume of paint needed to paint 10 such toys. [4]
-
- 7 (a) Simplify $4x - 3(2y - x)$. [2]
 - (b) Factorise completely $-6x^2 + 27x - 27$. [2]
 - (c) Simplify $\frac{7x}{(x-6)^2} + \frac{2}{6-x}$. [3]

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

A stone is thrown from the top of a cliff. The height, h metres, of the stone above sea level t seconds after it is released can be modeled by the equation $h = 80 + 16t - 5t^2$. Some corresponding values of t and h are given in the table below.

t	0	1	2	3	4	5	6
h	80	91	92	83	64	35	p

- (a) Calculate the value of p . [1]
- (b) Using a scale of 2 cm to represent 1 second, draw a horizontal t -axis for $0 \leq t \leq 6$. Using a scale of 1 cm to represent 10 metres, draw a vertical h -axis for $-20 \leq h \leq 100$. On your graph, plot the points given in the table and join them with a smooth curve. [3]
 - (c) Use your graph to estimate
 - (i) the maximum height of the stone above sea level, [1]
 - (ii) the time taken for the stone to hit the water. [1]
 - (d) By drawing a tangent, find the gradient of the curve at (4, 64). [2]



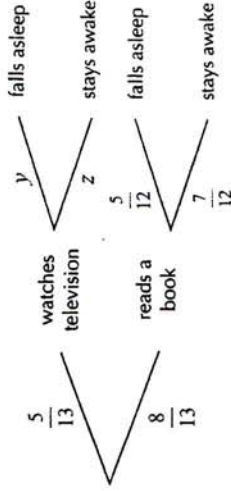
(c)

A circle has centre O . A , B , C , D and E lies on the circle. Angle $EAC = x^\circ$.

Find, in terms of x ,

- (i) angle EBC , [1]
- (ii) angle EDC , [1]
- (iii) reflex angle EOC . [1]

11 (a) Every night, Jamie either watches television or reads a book. She either falls asleep or stays awake while doing so. The probability tree diagram is shown below.



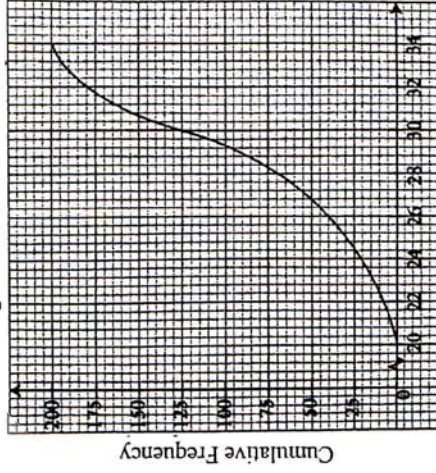
(i) Find y given that the probability of Jamie watching television and falling asleep is $\frac{5}{39}$. [1]

(ii) Find z . [1]

Find the probability that Jamie will

- (iii) stay awake on a particular night, [1]
- (iv) watch television and fall asleep on two consecutive nights. [1]

(b) The weights of 200 students were measured. The cumulative frequency curve shows the distribution of the weights.



Weight of Students (kg)

From the graph, estimate

- (i) the interquartile range, [2]
- (ii) the value of x , given that 37.5% of students weighed x kilograms or more. [2]

End of Paper

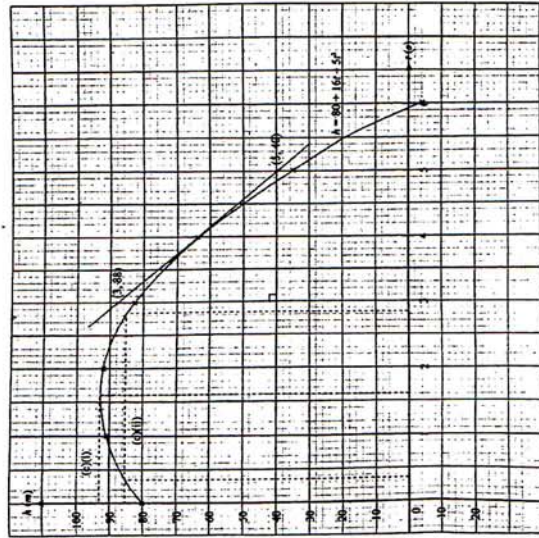


Qn	Steps/Answer	Remarks	Total
1	(a) $v^2 = 30^2 - 2(9.8)(24.1)$ $v = 20.7$ (b) $v^2 + 2gh = u^2$ $u = \pm\sqrt{v^2 + 2gh}$		[4]
2	(a) 8m (b) 1cm : 0.4m 1cm ² :0.16m ² 900 : 144 m ² (c) 16cm		[4]
3	(a) 4 542 500 000 (b) $k = 4.543$ (c) 105 $= 1.05 \times 10^2$	Accept 104.677..	[4]
4	(a) 2hr (b) 60 km/h ² (c) Total Distance = $\frac{1}{2}(40 + 100)(1) + (100 \times 2) + \frac{1}{2}(100)(1)$ $= 320$ km Average speed = $320 \div 4$ $= 80$ km/h		[5]
5	(a) $2p + 1$ (b) $2p - 1 + 2p + 1$ $= 4p$ (c) $(2p - 1)^2 + (2p + 1)^2$ $= 4p^2 - 4p + 1 + 4p^2 + 4p + 1$ $= 8p^2 + 2$ (d) $8p^2 + 2 = 2(4p^2 + 1)$ As $2(4p^2 + 1)$ is divisible by 2, the sum is an even number		[6]



6	(a) Volume of pyramid = $\frac{1}{3}(10 \times 10)(12)$ Volume of cuboid $= \frac{1}{3}(-10 \times 10)(12) + (10 \times 10 \times 30) - \pi(2.5)^2(20)$ $= 3010$ cm ³ (b) Height of triangular surface = $\sqrt{5^2 + 12^2} = 13$ cm Total surface area $= 4 \times (\frac{1}{2})(13)(10) + 4 \times (30)(10) + (10)(10) + 2\pi(2.5)(20)$ $= 1874$ cm ² Amount of paint needed for 1 toy = $\frac{1874}{10000} \times 100 = 18.74$ ml Amount of paint needed for 10 toys = 188 ml	Accept 3007 cm ³	[7]
7	(a) $4x - 3(2y - x)$ $= 4x - 6y + 3x$ $= 7x - 6y$ (b) $-6x^2 + 27x - 27$ $= -3(2x^2 - 9x + 9)$ $= -3(2x - 3)(x - 3)$ $= \frac{7x}{2} - \frac{(x-6)^2}{2(x-6)}$ $= \frac{7x - 2(x-6)}{(x-6)^2}$ $= \frac{5x + 12}{(x-6)^2}$	Should not round down to 187 ml	[7]

8 (a) $p = -4$



- (b)
- (ci) Maximum height above sea level = 93 m
(cii) Time taken to hit the water = 5.9 s
(d) Correct tangent drawn
Gradient at (4, 64) = -24 m/s

[8]

P1 – 5 points correctly plotted
P2 – all points correctly plotted
C1 – smooth curve
Minus 1 mark for incorrect scale

Accept 92-94
Accept 5.8-6.0 e.c.f from tangent drawn

[7]

9 (a) Deposit = $\frac{20}{100} \times 780 = \156

(b) Total amount paid if he chooses Package A =
 $156 + 12 \times 55 = \$816$

Interest for Package B = $\frac{624 \times 3.8 \times 2}{100} = \47.427

Total amount paid under Package B =
 $156 + 624 + 47.427 = \$827.424$

Cost of shipping by air = $(1250 + 100) \times 0.91 + 13.40 = \24.775

Cost of shipping by sea = $(1250 + 100) \times 0.39 + 39.90 = \44.775

Cheapest combination for Jimmy would be Package A and shipping by air.

Section B (Choose one question)

10 (a) (i)	$\angle CAB = 180 - 110 - 26 = 44^\circ$ $\frac{AC}{78} = \frac{\sin 26^\circ}{\sin 44^\circ}$ $AC = 49.2 \text{ m}$ bearing of A from B = $180 + 44 = 224^\circ$	Using alternate angles	[8]
(b)	$28 - 7 - 7 = 14 = \angle AOB$ angle $AOB = 2$ radians angle $EBC = x^\circ$ angle $EDC = (180 - x)^\circ$ reflex angle $EOC = (360 - 2x)^\circ$	Angles in same segment Angles in opp segment Angle at centre = twice angle at circumference	[8]
11 (a) (i)	$y = \frac{1}{3}$	$\frac{5}{39} + \frac{5}{13}$	[8]
(ii)	$z = \frac{2}{3}$		
(iii)	$\frac{8}{13}$		
(iv)	$\frac{25}{1521}$		
(b) (i)	Interquartile Range = $30.4 - 26.4 = 4 \text{ kg}$ 37.5% students = 75 students $x = 30$	$(\frac{5}{39})^2$ M1 if at least one of the quartiles are correct	[8]

Answer **all** questions.

1 (a) Calculate the exact value of $(-2 + 0.25)^2$.

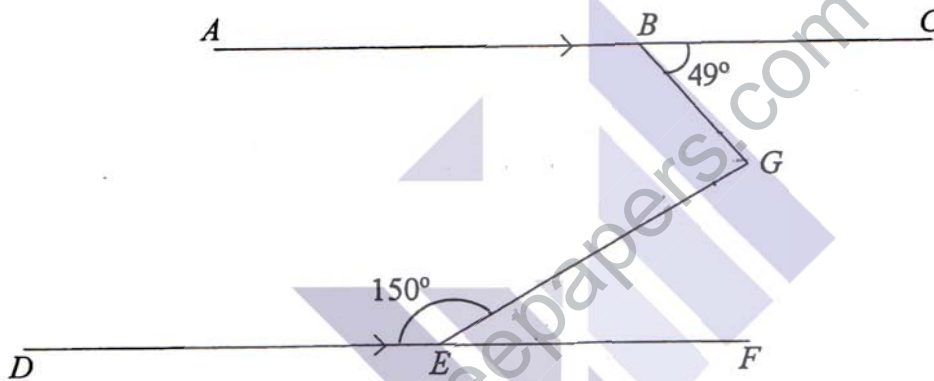
Answer (a) _____ [1]

(b) Calculate $\frac{\sqrt{241.97}}{3.88} + 5$:

Give your answer correct to 2 decimal places.

Answer (b) _____ [1]

2



In the diagram, line AC is parallel to line DF , angle $GBC = 49^\circ$ and angle $DEG = 150^\circ$.

Show, giving reasons, that angle EGB is 79° .

Answer _____

_____ [2]

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- 3 (a) Solve the inequality $1 - 2x > 5$.

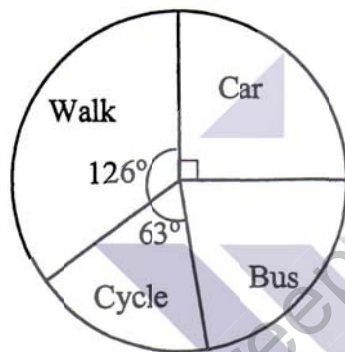
Answer (a) _____ [1]

- (b) Represent the solution of $1 - 2x > 5$ on the number line below.

Answer



- 4 A survey was done with a class of students to find out the mode of transport they take to school.
The results are represented in the pie chart below.



A student was selected at random.
Find the probability that the student selected

- (a) comes to school by car,

Answer (a) _____ [1]

- (b) takes the bus to school.

Answer (b) _____ [1]

5 Make n the subject of the formula $m = t(2n + 1)$.

Answer $n =$ _____ [2]

6 The first six terms of a number sequence are 7, 3, a , b , -9 and c .

(a) Find the values of a , b and c .

Answer (a) $a =$ _____
 $b =$ _____
 $c =$ _____ [1]

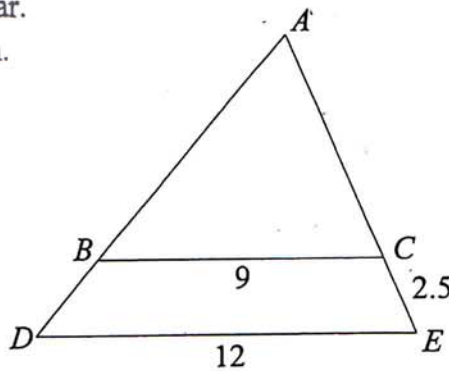
(b) Ali observes that all the terms in the sequence are odd.
He says that -67 is also a term of this sequence.
Do you agree with him? Explain your answer.

Answer

[1]

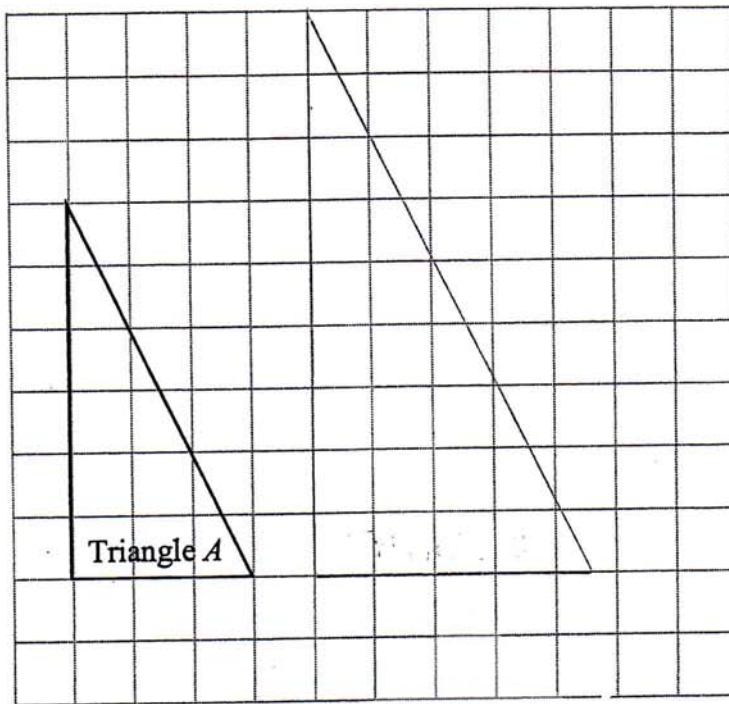
7 Triangle ABC and triangle ADE are similar.
 $BC = 9$ cm, $DE = 12$ cm and $CE = 2.5$ cm.

Find the length of AC .



Answer _____ cm [2]

Answer



[2]

9 In an octagon, three of the interior angles are $(x + 50)^\circ$, $(2x - 15)^\circ$ and $3x^\circ$.
The rest of the interior angles are x° .

(a) Find the value of x .

[2]

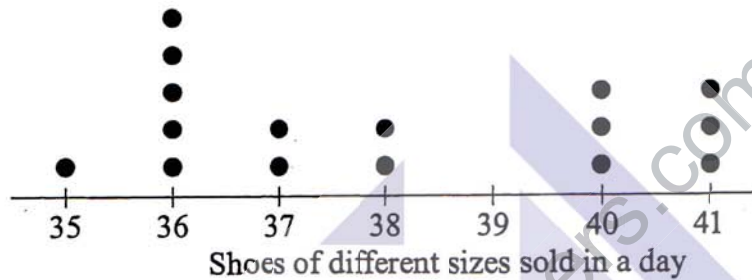
(b) Hence, write the down the largest exterior angle.

Answer (b) _____ $^\circ$ [1]

- 10 A cylindrical cup has a radius of 5 cm and height 13 cm.
The external surface of the cup is to be painted with gold paint.
Find the total surface area to be painted. Leave your answer in terms of π .

Answer _____ π cm² [3]

11



The dot diagram above shows the shoes of different sizes sold in a shop on a particular day.

- (a) Find the modal shoe size.

Answer (a) _____ [1]

- (b) Find the median shoe size.

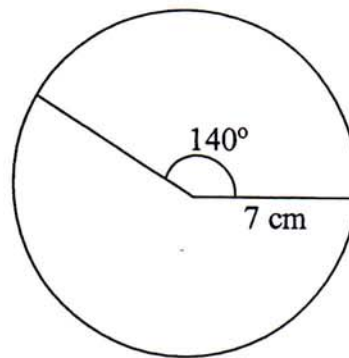
Answer (b) _____ [1]

- (c) The mean shoe size of the shoes sold is 38.
Is it advisable for the shop owner to stock up on size 38 shoes?
Explain your answer.

Answer _____

_____ [1]

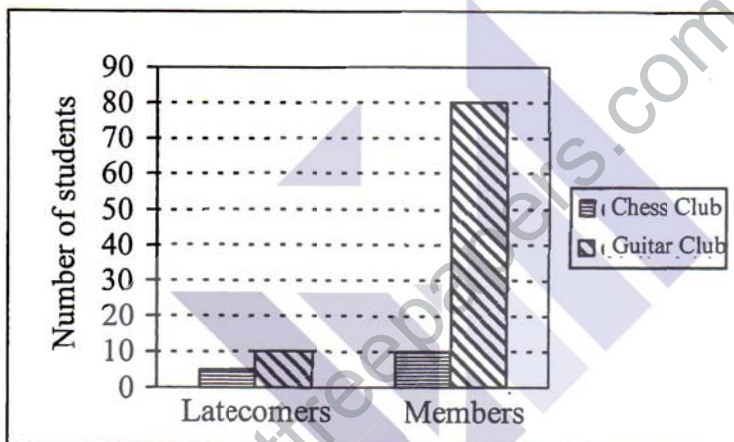
- 12 The diagram shows a circle with radius 7 cm.
Find the perimeter of the major sector.



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Answer _____ cm [3]

13



The bar chart above shows the number of latecomers and the total number of members from the Chess Club and Guitar Club respectively.

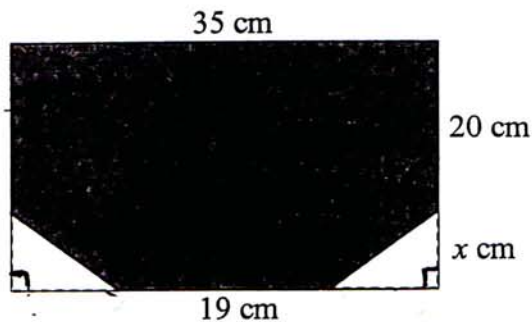
Raymond claims that students in the Chess Club are more punctual as there are less latecomers from the Chess Club.

With the use of appropriate calculations, explain why Raymond is wrong.

Answer _____

[3]

14



In the figure above, two congruent triangles are cut off from a rectangle.
Given that the **shaded** area is 862 cm^2 , find the value of x .

Answer $x =$ _____ [3]

15 Solve the simultaneous equations.

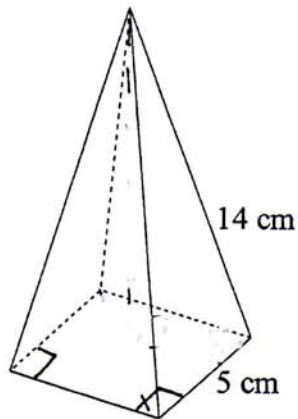
$$4x - 3y = 2$$
$$y = 2x + 1$$

Answer $x =$ _____
 $y =$ _____ [3]

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The diagram shows a pyramid with a square base of sides 5 cm and slant height 14 cm.

Find the volume of the pyramid.

Answer _____ cm³ [3]

17 (a) Write as a single fraction in its simplest form $\frac{1}{2a} + \frac{1}{3a}$.

Answer (a) _____ [1]

(b) Simplify $\frac{4x+10}{4x^2-25}$.

Answer (b) _____ [2]

18) The frequency table below shows the speed of 80 cars travelling along Punggol Road.

$30 \leq x < 40$	12
$40 \leq x < 50$	37
$50 \leq x < 60$	24
$60 \leq x < 70$	6
$70 \leq x < 80$	1

(a) Calculate an **estimate** of the mean speed of the cars travelling along Punggol Road.

Answer (a) _____ km/h [3]

(b) The estimated mean of 60 cars travelling along Sengkang Road is 52.4 km/h.

On which road are the cars travelling at a higher speed?
 Give a reason for your answer.

Answer _____ [1]

19 (a) The population of Singapore is 5.7 million in 2017.
 This population figure is a 46% increase from 2010.
 Find the population of Singapore in 2010.
 Give your answer in million.

Answer (a) _____ million [2]

(b) The cost of a smartphone is \$ p .
 During the Great Singapore Sale, there is a storewide discount of 20% and members are given an additional 5% off.
 Express the total discount in terms of p .

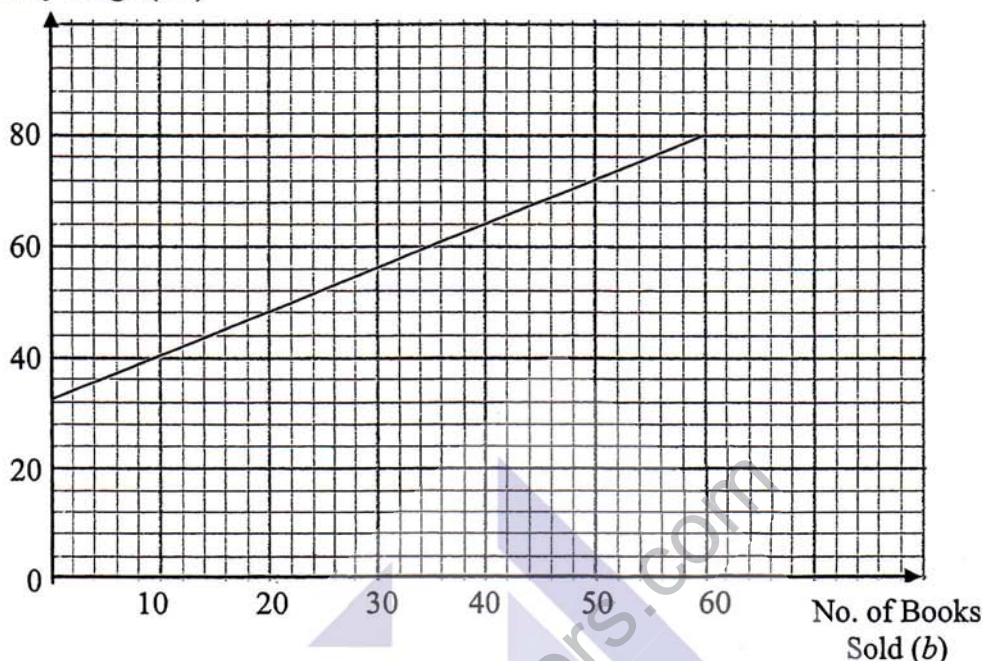
Answer (b) _____ [2]

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- 20 Sally is a sales assistant at a book shop.
Her daily wage consists of a basic wage \$ p , and commission of \$ q for every book she sells.
The graph below shows her daily wage.

Daily Wage (\$ w)



- (a) Find Sally's wage if she sells 20 books.

Answer (a) \$ _____ [1]

- (b) Find the value of p and of q .

Answer (b) $p =$ _____
 $q =$ _____ [2]

- (c) Lisa is a sales executive who works at the same shop.
She has no basic wage and receives \$1.60 for every book she sells.
By drawing a line to represent Lisa's daily wage against the number of books sold, find the number of books she must sell in order to earn the same amount as Sally.

Answer (c) _____ [1]

21 The line l has equation $2y = x - 12$.

- (a) Line l cuts the x -axis at A and cuts the y -axis at B .
Find the coordinates of points A and B .

Answer (a) A (,)
 B (,) [2]

- (b) Point $C(4, k)$ lies on line l . Find the value of k .

Answer (b) $k =$ _____ [1]

- (c) Line m is parallel to line l and passes through the point $(0, -1)$.
Write down the equation of line m .

Answer (c) _____ [1]

22 The floor plan of a school is drawn to the scale of $1 : 200$.

- (a) The actual dimension of a classroom is 10 m by 12.5 m.
Find the dimension, in cm, of the same classroom on the plan.

Answer (a) _____ cm by _____ cm [2]

- (b) The school hall is represented by 28 cm².
Work out the area, in m², of the hall on the plan.

Answer (b) _____ m² [2]

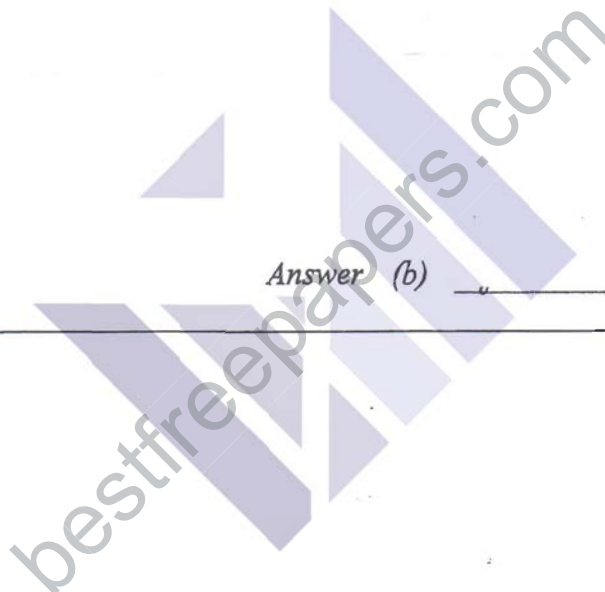
23 R is the point $(3, -2)$ and S is the point $(-1, 4)$.

(a) Calculate the length of RS .

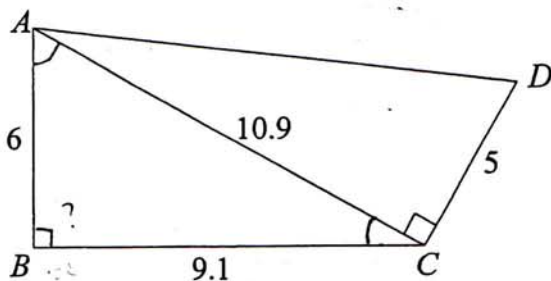
Answer (a) _____ units [2]

(b) Find the equation of the line RS .

Answer (b) _____ [3]



- 24 The diagram shows a piece of land $ABCD$.
Triangle ACD is a right-angled triangle.
 $AB = 6$ m, $BC = 9.1$ m, $AC = 10.9$ m and $CD = 5$ m.



- (a) Show that angle $ABC = 90^\circ$.

Answer

[2]

- (b) Calculate angle BCD .

Answer (b) _____

[2]

- (c) Find the perimeter of the land.

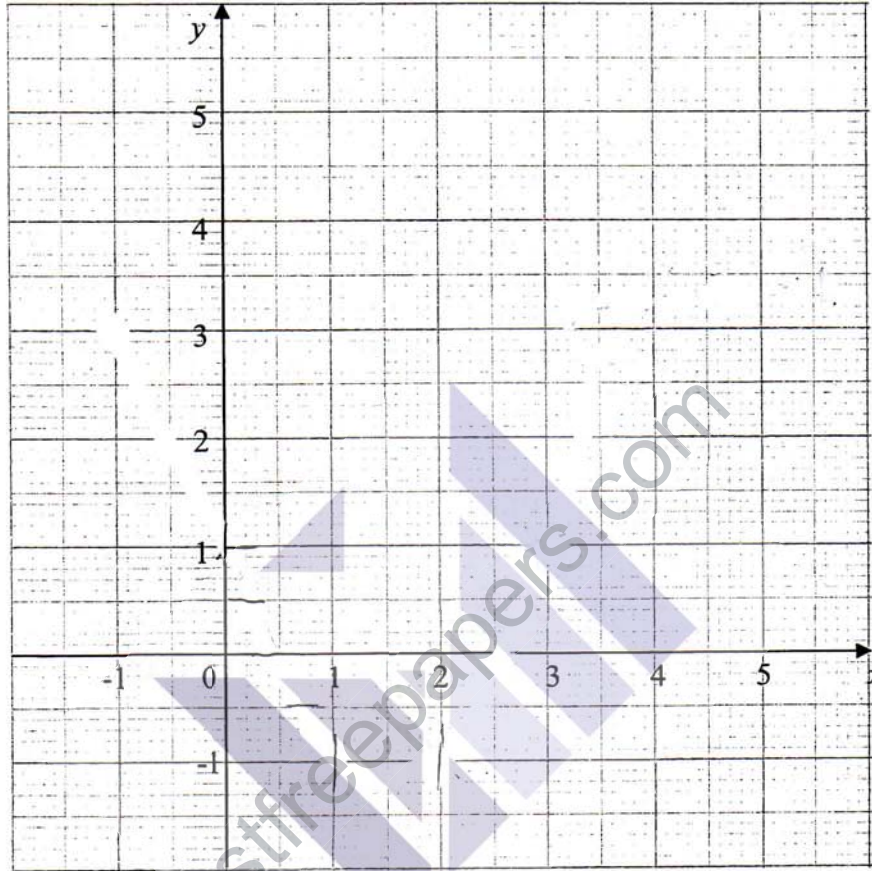
Answer (c) _____ m [2]

25 (a) Complete the table for $y = x^2 - 3x + 1$.

	-1	0	1	2	3	3.5
		1	-1	-1	1	

[1]

(b) Draw the graph of $y = x^2 - 3x + 1$.



[3]

(c) (i) On the same axes, draw the graph of $y = -x + 2$.

[1]

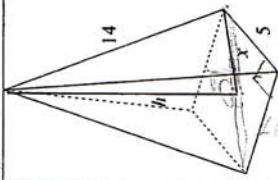
(ii) Hence, write down the solution(s) of $x^2 - 2x - 1 = 0$.

Answer (cii) $x =$ _____ [1]

-End of Paper-

Question	Answer	Mark Scheme
1 a	$3.0625, 3\frac{1}{16}, \frac{49}{16}$	BI Do not accept 3.06
b	9.01	BI
2 a	<p> $\angle x = 49^\circ$ (alt \angles) $\angle y = 180^\circ - 150^\circ$ (int \angles) $= 30^\circ$ $\angle EGB = 49^\circ + 30^\circ$ $= 79^\circ$ (shown) </p>	BI – correct working with angles labelled (or indicated in diagram) BI – correct reasons
3 a	$1 - 2x > 5$ $-2x > 4$ $x < -2$	BI
b	$x < -2$ 	BI
4 a	$\frac{1}{4}$ or 0.25	BI Accept $\frac{90}{360}$
b	$\angle(\text{Bus}) = 360 - 90 - 126 - 63$ $= 81^\circ$ $P(\text{Bus}) = \frac{81}{360}$ $= \frac{9}{40}$ or 0.225	BI Accept 81 Accept $\frac{360}{360}$
5	$m = (2n + 1)$ $m = 2nt + t$ $m - t = 2nt$ $n = \frac{m-t}{2t}$	BI M1 A1 Accept explanation by listing: ... -65, -69, -73, ... -67 is not a term of the sequence.
6 a	$a = -1, b = -5, c = -13$	BI
b	General Term: $4n - 11$ $4n - 11 = -67$ $4n = 78$ $n = 19.5$ Since n is not a positive integer, -67 is not a term of the sequence.	BI

Question	Answer	Mark Scheme
7	$\frac{AC}{AC + 2.5} = \frac{9}{12}$ $12AC = 9AC + 22.5$ $3AC = 22.5$ $AC = 7.5$	M1 A1 Accept working by ratio method BC:DE = 9:12 → AC:AE = 3:4 AC:CE = 3:1 AC = 2.5cm x 3 = 7.5cm
8	Right-angled triangle with base 4.5 units & height 9 units.	B2 BI – Scale factor of 1.5 (working) seen Or BI – Triangle B drawn correctly
9 a	Sum of int. angles = $(8 - 2) \times 180^\circ$ $= 1080^\circ$ $x + 50 + 2x - 15 + 3x + 5x = 1080$ $11x + 35 = 1080$ $11x = 1045$ $x = 95$	M1 A1 BI – only one of the sides correct
b	Largest Ext Angle = $180 - 95$ $= 85^\circ$ Curved Surface Area = $2\pi(5)(13)$ $= 130\pi$ Base Area = $\pi(5)^2$ $= 25\pi$ Total Area = $130\pi + 25\pi$ $= 155\pi$	BI M1 M1 A1 Allow logical ECF No A1 for 486.95...
11 a	Mode = 36	BI
b	Median = 37.5	BI
c	No. He should stock up on the modal size 36 instead. (or size 38 is not the size that is mostly sold, etc)	BI Accept any other logical answers
12	Major arc length = $\frac{360 - 140}{360} \times \pi(7)^2$ $= 26.8780$ Perimeter = $26.8780 + 7 + 7$ $= 40.8780$ $= 40.9$	M1 M1(eef) A1

Question	Answer	Mark Scheme
13	<p>%age of latecomers (chess) = $\frac{5}{10} \times 100\% = 50\%$</p> <p>%age of latecomers (guitar) = $\frac{10}{80} \times 100\% = 12.5\%$</p> <p>The students in the Chess Club are less punctual as the percentage of latecomers is higher.</p>	<p>BI ——— Accept 40% or 60% (for chess club)</p> <p>BI ———</p> <p>BI ——— Award BI as long as they mention % or proportion</p>
14	<p>$35(20+x) = 862 + 2 \times \frac{1}{2} \times 8 \times x$</p> <p>$700 + 35x = 862 + 8x$</p> <p>$27x = 162$</p> <p>$x = 6$</p>	<p>M2 Award M1 if $35(20+x)$ or $2 \times \frac{1}{2} \times 8 \times x$ seen</p>
15	<p>$4x - 3y = 2$ —(1)</p> <p>$y = 2x + 1$ —(2)</p> <p>Sub (2) into (1),</p> <p>$4x - 3(2x + 1) = 2$</p> <p>$4x - 6x - 3 = 2$</p> <p>$-2x = 5$</p> <p>$x = -2.5$</p> <p>Sub $x = -2.5$ into (2),</p> <p>$y = 2(-2.5) + 1$</p> <p>$y = -4$</p>	<p>M1 (or elimination method)</p> <p>A1</p>
16	<p>$x^2 = 2.5^2 + 2.5^2$</p> <p>$x = \sqrt{12.5} = 3.5355$</p> <p>$h^2 + (\sqrt{12.5})^2 = 14^2$</p> <p>$h = \sqrt{183.5} = 13.546$</p> <p>$vol = \frac{1}{3} \times (5 \times 5) \times \sqrt{183.5}$</p> <p>$= 112.885$</p> <p>$= 113$ (3sf)</p> 	<p>M1 ——— Award if they use their own/wrong height</p> <p>A1</p>
17 a	<p>$\frac{1}{2a} + \frac{1}{3a} = \frac{2}{6a} + \frac{2}{6a}$</p> <p>$= \frac{5}{6a}$</p>	<p>BI</p>

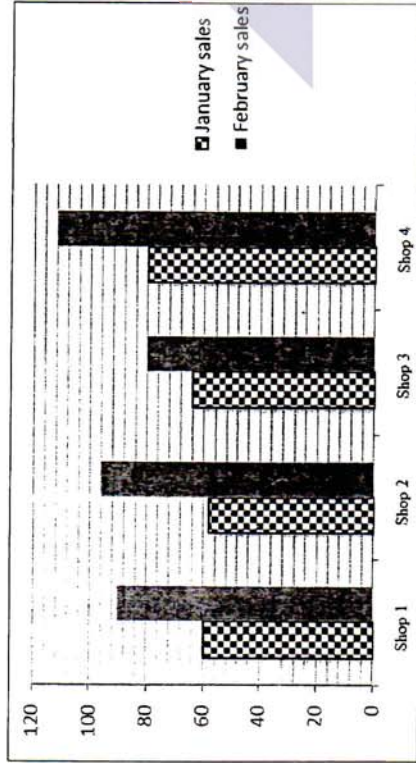
Question	Answer	Mark Scheme
b	<p>$\frac{4x+10}{4x^2-25}$</p> <p>$= \frac{2(2x+5)}{(2x+5)(2x-5)}$</p> <p>$= \frac{2}{2x-5}$</p>	<p>M1 ——— For factorising the denominator</p> <p>A1</p>
18 a	<p>Estimated Mean = $\frac{3870}{80}$</p> <p>$= 48.375$</p>	<p>M2 M1 for $\sum fx$</p> <p>A1</p>
b	<p>Sengkang Road as the mean speed is higher.</p>	<p>BI Award ECF from (a)</p>
19 a	<p>$\frac{100}{146} \times 5.7$ mil</p> <p>$= 3.9041$ mil</p> <p>$= 3.90$ mil (3sf)</p>	<p>M1</p> <p>A1</p>
b	<p>Price after 20% discount = $\frac{80}{100} \times p$</p> <p>$= 0.8p$</p> <p>Additional 5% discount = $\frac{5}{100} \times 0.8p$</p> <p>$= 0.04p$</p> <p>Total discount = $0.04p + 0.2p$</p> <p>$= 0.24p$</p>	<p>M1 Award M1 for 0.8p or 0.2p seen.</p> <p>Award 1 mark if 24% / 0.24 seen or if they sub in values for p.</p> <p>M1</p>
20 a	<p>\$48</p>	<p>A1</p> <p>BI</p>
b	<p>$p = 32$</p> <p>$q = 0.8$</p>	<p>BI ——— Allow ECF from (a)</p> <p>BI</p>
c	<p>40 books</p>	<p>BI</p>
21 a	<p>When $y=0$,</p> <p>$0 = x - 12$</p> <p>$x = 12$</p> <p>When $x=0$,</p> <p>$2y = -12$</p> <p>$y = -6$</p> <p>When $x=4, y=k$,</p> <p>$2k = 4 - 12$</p> <p>$k = -4$</p> <p>$2y = x - 12$</p> <p>$y = \frac{1}{2}x - 6 \Rightarrow m = \frac{1}{2}$</p> <p>Ans: $y = \frac{1}{2}x - 1$</p>	<p>BI</p> <p>BI</p>
b	<p>When $x=4, y=k$,</p> <p>$2k = 4 - 12$</p> <p>$k = -4$</p> <p>$2y = x - 12$</p> <p>$y = \frac{1}{2}x - 6 \Rightarrow m = \frac{1}{2}$</p> <p>Ans: $y = \frac{1}{2}x - 1$</p>	<p>BI</p>
c	<p>$y = \frac{1}{2}x - 6 \Rightarrow m = \frac{1}{2}$</p> <p>Ans: $y = \frac{1}{2}x - 1$</p>	<p>BI</p>

Question	Answer	Mark Scheme
22 a	1 cm : 200 cm 1 cm : 2 m Ans: 5 cm by 6.25 cm	M1 A1 Accept 6.25 cm by 5 cm
b	1 cm : 2 m 1 cm ² : 4 m ² 28 cm ² : 4 × 28 m ² = 112 m ²	M1 A1
23 a	$RS = \sqrt{(3 - (-1))^2 + (-2 - 4)^2}$ = 7.21	M1 A1
b	$m = \frac{4 - (-2)}{-1 - 3}$ $m = -1.5$ $y = -1.5x + c$, sub in (3, -2) $-2 = -1.5(3) + c$ $-2 = -4.5 + c$ $c = 2.5$ Ans: $y = -1.5x + 2.5$	M1 M1 — Award even if their gradient is wrong A1
24 a	$AB^2 + BC^2 = 6^2 + 9^2 = 118.81$ $AC^2 = 10.9^2 = 118.81$ Since $AB^2 + BC^2 = AC^2$, by converse of Pythagoras Theorem, $\angle ABC = 90^\circ$	B1 B1
b	$\sin \angle BCA = \frac{6}{10.9}$ $\angle BCA = 33.398$ $\angle BCD = 33.398 + 90 = 123.4^\circ$	M1 A1
c	$AD^2 = 10.9^2 + 5^2$ $AD = 11.992$ Perimeter = 11.992 + 6 + 9.1 + 5 = 32.092 = 32.1 m	M1 A1
25	Refer to attached graph	

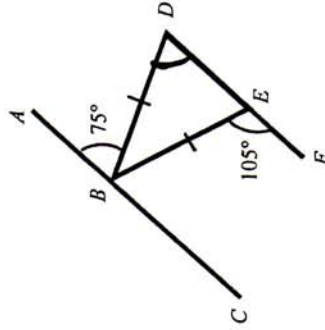
Section A (52 marks)

Answer all the questions in this section.

- 1 A company owns 4 shops selling a food product. The bar chart shows the sales in the month of January and February.



- (a) Find the difference in sales between January and February for Shop 1. [1]
- (b) The owner decided to close down one of the shops due to insufficient cash flow. His son told him to close down Shop 3. Do you agree? Explain your answer. [1]
- 2 A car travelled at a uniform speed of 80 km/h for 45 min. It then travelled for 120 km at a uniform speed of 90 km/h. Calculate
- (a) the total distance, in kilometres, for the whole journey. [1]
- (b) the total time, in hours, for the whole journey. [1]
- (c) the average speed for the whole journey. [2]



In the diagram above, ABC and DEF are straight lines and $BD = BE$. Angle ABD and angle BEF are 75° and 105° respectively.

(a) Find

- (i) angle BDE ,
- (ii) angle DBE .

(b) Using your answers to part (a), explain why $AC \parallel DF$. Show all your working.

4 Calculate

(a) (i) $\sqrt{(-6)^2 - 2(2)(-3)}$,

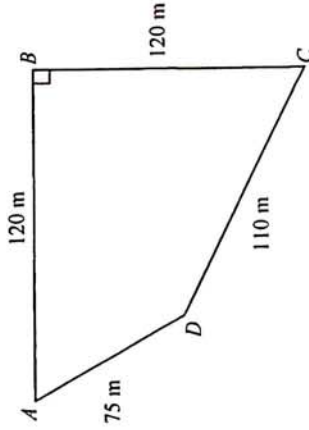
(ii) $\frac{3.76 + 12.88}{42.44 - 8.99}$.

(b) 7.6 billion people consume 100 million cans of carbonated drinks.

(i) Express 7.6 billion in standard form.

(ii) Calculate the average number of cans consumed per person, giving your answer in standard form.

5 The diagram shows a sketch of a plot of land $ABCD$.



(a) Make an accurate scale drawing of the plot of land.
Use a scale of 1 cm to represent 10 m. [3]

(b) A statue, S , is built inside the plot of land.
It is on the perpendicular bisector of CD and also on the bisector of angle BAD . [2]

Construct and label the position of the statue on your scale drawing. [2]

6 (a) Express 156 and 360 as the product of their prime factors. [2]
 (b) Find the lowest common multiple of 156 and 360. [2]
 (c) Is 147 a prime number? Explain your answer. [1]

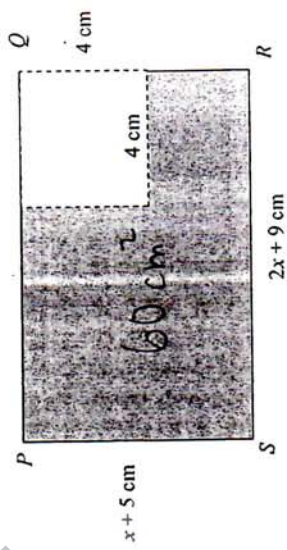
7 (a) Which of these ratios are equivalent to the ratio $2a : 3$? [2]
 $2a + 2 : 3 + 2$ $2ab : 3b$ $4a : 9$ $\frac{a}{3} : \frac{1}{2}$

(b) The ratio of boys to girls in a group of children was 3 : 4.
 The total number of children in the group was 49.
 (i) How many girls were there? [1]
 (ii) When more girls joined the group, the ratio of boys to girls became 7 : 10.
 How many girls joined the group? [2]

8 (a) Simplify, leaving your answers in positive index form, $\left(\frac{27}{8x}\right)^{\frac{1}{3}}$. [2]

(b) Factorise completely
 (i) $10rs - 15s + 8ru - 12ru$, [2]
 (ii) $4x^2 - 10x - 14$. [2]

9 The diagram shows a rectangle $PQRS$ of length $2x + 9$ cm and breadth $x + 5$ cm.



A square of side 4 cm is cut out from the rectangle at corner Q , as shown in the diagram.
 (a) Given that the area of the shaded region is 60 cm^2 , form an equation in x and show that it reduces to $2x^2 + 19x - 31 = 0$. [3]
 (b) Solve the equation $2x^2 + 19x - 31 = 0$, giving your answers correct to 2 decimal places. [3]
 (c) Calculate the length of rectangle $PQRS$. [2]

Section B (8 marks)

- 10 The annual waste and recycling statistics from the National Environment Agency shows the amount of food waste generated in Singapore from 2014 to 2016. The total population of Singapore was 5.61 million in 2016.

Year	Non-recyclable Food Waste (tonnes)	Recyclable Food Waste (tonnes)	Total Food Waste Generated (tonnes)
2014	687 200	101 400	788 600
2015	681 400	104 100	785 500
2016	679 900	111 100	791 000

1 Tonne = 1000 kg

The table below shows the estimated average mass of food servings (in kg) for the 3 meals of an individual per day in 2016.

Breakfast	Lunch	Dinner
0.6	0.8	1.1

- (a) What was the average mass, in kg, of total food waste generated per individual (i) in 2016, [2]
(ii) per day in 2016? [1]
- (b) Find the estimated total mass of daily food servings by an individual in 2016. [1]
- (c) Hence, estimate the percentage mass of food that is wasted per day by an individual in 2016. [2]

- (d)

<ul style="list-style-type: none"> The non-recyclable food waste generated in 2016 can fill up 500 Olympic-sized swimming pools. The volume of an Olympic-sized swimming pool is 2500 m³.
--

Based on the information given above, estimate the density of non-recyclable food waste in kg/m³. [2]

11. (a) Five cards are numbered 2 to 6. Two cards are drawn at random without replacement.

Find the probability that

- (i) both cards are even numbered.
(ii) no even cards are drawn.

The masses of 6 grapes are measured and recorded.

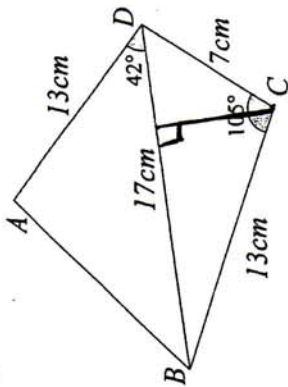
The following information is available:

- Three of the grapes weigh 6.2 g, 6.4 g and 7 g respectively.
- The median mass is 6.55 g.
- The mode is 7 g.
- The mean is 6.6 g.

Find the mass of each of the remaining 3 grapes.

Greendale Secondary School Preliminary Examination 2018 7 Secondary 4 Normal Academic Mathematics Paper 2

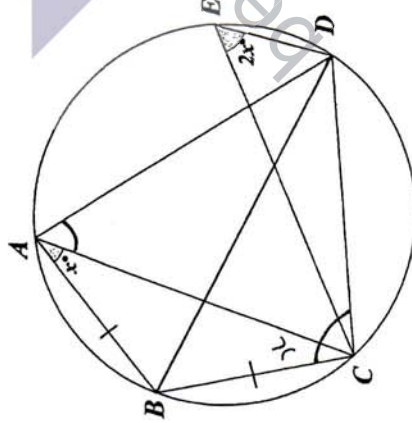
12. (a) In the diagram, $AD = 13$ cm, $DC = 7$ cm, $BD = 17$ cm and $BC = 13$ cm. Angle $ADB = 42^\circ$ and angle $BCD = 105^\circ$.



Calculate

- (i) the length AB , [3]
 (ii) the area of the triangle BCD . [2]

- (b) In the figure, $AB = BC$, angle $BAC = x^\circ$ and angle $CED = 2x^\circ$.



- (a) Find, in terms of x ,
 (i) angle CAD , [1]
 (ii) angle BCD . [1]
 (b) Given that BD is the diameter of the circle, find x . [1]

End of paper

2018 Prelim Sec 4NA Math P2
 Mark Scheme

1(a)	30	BI
1(bi)	Yes I agree. Shop 3 has the least combined January and February sales.	BI
		Total: 2marks
2(a)	Total distance = $80 \times \frac{45}{60} + 120 = 60 + 120 = 180 \text{ km}$	BI
2(b)	Total time = $\frac{45}{60} + \frac{120}{90} = 2 \frac{1}{12} \text{ h}$	BI
2(c)	Average speed = $\frac{180}{2 \frac{1}{12}} = 86.4 \text{ km/h}$	M1(ecf) A1
		Total: 4marks
3(ai)	$75^\circ \times 2x^\circ \times 2x^\circ$	BI
3(aii)	30°	BI
3(b)	$\angle BDE = \angle ABD = 75^\circ$ or $\angle ABE = \angle FEB = 105^\circ$ They are alternate angles, $AC \parallel DF$.	BI BI
		Total: 4marks
4(ai)	$\sqrt{48} = 6.93$	BI
4(aii)	$16.64 \approx 0.497$ (3sf) 33.45	BI
4(bi)	7.6×10^9	A1
4(bii)	$\frac{100 \times 10^6}{7.6 \times 10^9}$ $\approx 0.0132 = 1.32 \times 10^{-2}$ cans	M1(ecf) A1
		Total: 5marks

5(a)/ (b)		(a) Intersecting arcs to find D Accuracy Correct Scale (b) Perpendicular bisector of DC and Bisector of angle BAD Label intersection point S	BI BI BI M1 A1(ecf)
6(a)	$156 = 2^2 \times 3 \times 13$ $360 = 2^3 \times 3^2 \times 5$	Total: 5marks BI BI	
6(b)	$LCM = 2^3 \times 3^2 \times 5 \times 13$ $= 4680$	M1 A1	
6(c)	No. It has more than 2 factors No. It is divisible by 3 / 7 No. It is a multiple of 3 / 7 No. 3 / 7 is a factor of 147.	BI (Any of the explanation)	

2018 Prelim Sec 4NA Math P2
Mark Scheme

	No. Since 147 can be expressed as the product of its prime factors. No. Since $147 = 3 \times 7^2$	Total: 5 marks
7(a)	$2ab : 3b$ $\frac{a}{3} : \frac{1}{2}$	B1 B1 (Minus 1 mark for each additional wrong answer) B1
7(bi)	Number of girls = $\frac{4}{7} \times 49 = 28$	
7(bii)	Number of boys = $49 - 28 = 21$ Number of girls now = $\frac{10}{7} \times 21 = 30$ Number of girls that joined the group = $30 - 28 = 2$	M1 A1
8(a)	$\left(\frac{8x}{27}\right)^{\frac{1}{3}}$ $= \frac{2x^{\frac{1}{3}}}{3}$	Total: 8 marks M1 A1
8(bi)	$= 5s(2r - 3t) + 4u(2r - 3t)$ $= (5s + 4u)(2r - 3t)$	M1 A1
8(b)	$2(2x^2 - 5x - 7)$ $= 2(2x - 7)(x + 1)$	M1 A1
9(a)	$(x + 5)(2x + 9) - 4^2 = 60$ $2x^2 + 9x + 10x + 45 - 16 = 60$ $2x^2 + 19x - 31 = 0$	Total: 6 marks M1 M1 A1
9(b)	$2x^2 + 19x - 31 = 0$ $x = \frac{-19 \pm \sqrt{(19)^2 - 4(2)(-31)}}{2(2)}$ $x = 1.42$ or $x = -10.92$	M1 A1, A1
9(c)	Length of PQRS $= (2x + 9) = 2(1.419) + 9$ $= 11.8cm$	M1 A1 Total: 8 marks

10(ai)	Average mass of food wasted per individual in 2016 $= 791\,000 \times 1000 + (5.61 \times 10^6)$ $= 140,998$ $= 141$ kg	M1 A1
10(aii)	Average mass of food wasted per individual per day in 2016 $= 140,998 + 365$ $= 0.3863$ (accept 366 days) $= 0.386$ kg	B1(ecf)
10(b)	Average mass of food intake by an individual $= 0.6 + 0.8 + 1.1$ $= 2.5$ kg	B1
10(c)	Percentage of mass of food wasted by an individual in 2016 $= \frac{0.3863}{2.5} \times 100\%$ $= 15.452\%$ $= 15.5\%$	M1(ecf) A1(ecf)
10(d)	Food waste produced $= 679\,900$ tonnes $= 679900000$ kg Volume of 500 Olympic pools $= 500 \times 2500$ $= 1250000$ m ³ Density of food waste $= \frac{\text{mass}}{\text{volume}}$ $= \frac{679900000}{1250000}$ $= 534.92$ kg/m ³	M1 A1
Section A		Total: 8 marks Total: 52 marks
11(ai)	Even no. = 2, 4, 6 Odd no = 3, 5 Probability that both cards are even numbered = $\frac{3}{5} \times \frac{2}{4}$ $= \frac{3}{10}$	M1

2018 Prelim Sec 4NA Math P2
Mark Scheme

11(a)(i)	Probability that no even cards are drawn = $\frac{2}{5} \times \frac{1}{4}$ $= \frac{1}{10}$	M1 A1
11(b)	Showing $= 6.6 \times 6 = 39.6$ or $6.55 \times 2 = 13.1$ 7 g 6.7 g 6.3 g	B1 B1 B1 B1
		Total: 8 marks
12(a)(i)	$AB^2 = 13^2 + 17^2 - 2(13)(17) \cos 42$ $AB^2 = 129.5299871$ $AB = 11.4$	M1 M1 A1
(a)(ii)	Area = $\frac{1}{2} \times 7 \times 13 \times \sin 105$ $= 43.9 \text{ cm}^2$	M1 A1
(b)(ai)	$2x^\circ$	B1
(b)(a)(i)	$180^\circ - 3x^\circ$	B1
(b)(b)	$x + 2x = 90^\circ$ $3x = 90^\circ$ $x = 30^\circ$	B1
		Total: 8 marks
		Total: 8 marks
		Section B
		Total: 8 marks
		Overall: 60 marks

Name and Register Number:

()

Class:



**SENG KANG SECONDARY SCHOOL
'N' PRELIMINARY EXAMINATION 2018**

MATHEMATICS

4045/01

4 NORMAL ACADEMIC

14 August 2018

Paper 1

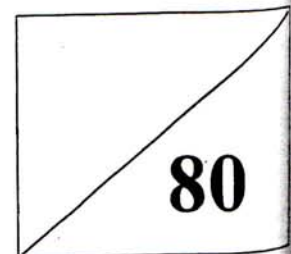
2 hours

READ THESE INSTRUCTIONS FIRST

Candidates answer on the Question Paper.
Write your class, index number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, 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.
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, 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 80.



Parent's / Guardian's Signature:

This document consists of 17 printed pages and 1 blank page.

[Turn Over

*Mathematical Formulae**Compound interest*

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

Geometry and Measurement

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

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

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

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

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

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

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

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.

For
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Use

For
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Use

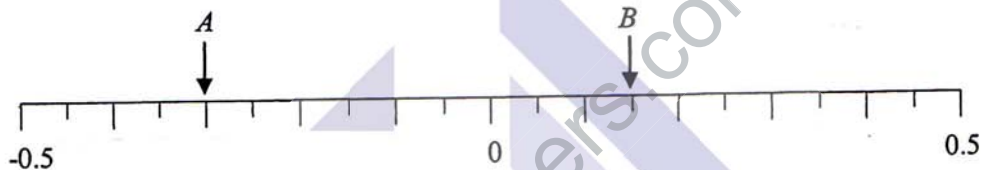
- 1 (a) Evaluate $\frac{8.194^2 - \sqrt[3]{31.5}}{9.0168 \times 0.42}$, giving your answer correct to 4 significant figures.

Answer (a) [1]

- (b) Write 0.000 004 923 in standard form.

Answer (b) [1]

2



- (a) Write down the numbers indicated by the arrows *A* and *B*.

Answer *A* =

B = [2]

- (b) Draw an arrow on the number line above to represent $\frac{2}{5}$ and label it *C*. [1]

- 3 A car is travelling at a speed of 65.2 km/h. Find this speed in metres per seconds.

Answerm/s [2]

[Turn Over

4 (a) Solve $5 + 2x < -9$.

Answer (a) [1]

(b) Hence, state the largest whole number that satisfies the inequality.

Answer (b) [1]

5 (a) Giving your answers in the simplest form, calculate

(i) $(5a^3b)^2$

Answer (a)(i) [1]

(ii) $x^3 \div \sqrt{x}$

Answer (a)(ii) [2]

(b) Find the value of n if

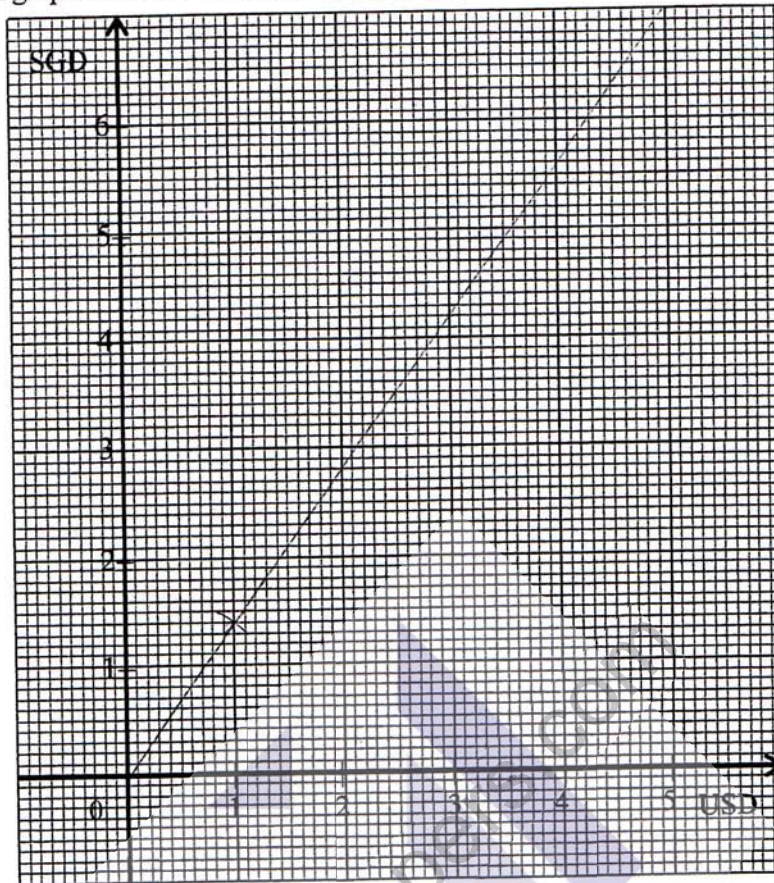
(i) $5^n = 1$

Answer (b)(i) $n = \dots$ [1]

(ii) $7^n = \frac{7^{-3}}{7^2}$

Answer (b)(ii) $n = \dots$ [1]

- 6 (a) Given that 1 US dollar (USD) is equal to 1.4 Singapore dollars (SGD), draw a currency conversion graph for USD to SGD in the grid provided.



[1]

- (b) Use your graph to convert

(i) 3.5 USD to SGD

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

(ii) 3 SGD to USD

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

- 7 The line $2y + 4x - 5 = 0$.

(a) Make y the subject of the formula.

Answer (a) [1]

(b) State the gradient and the coordinates of the y -intercept.

Answer (b) gradient = [1]

coordinates of y -intercept = [1]

Turn Over

- 8 A local fast food restaurant offers the following promotion.

Mega Feast Set Meal (\$59.90)

15 pieces of Chicken
12 pieces of Nuggets
2 Popcorn Chicken
4 medium Whipped Potato
(Recommended for 6 people)

Mr Tan has \$280.

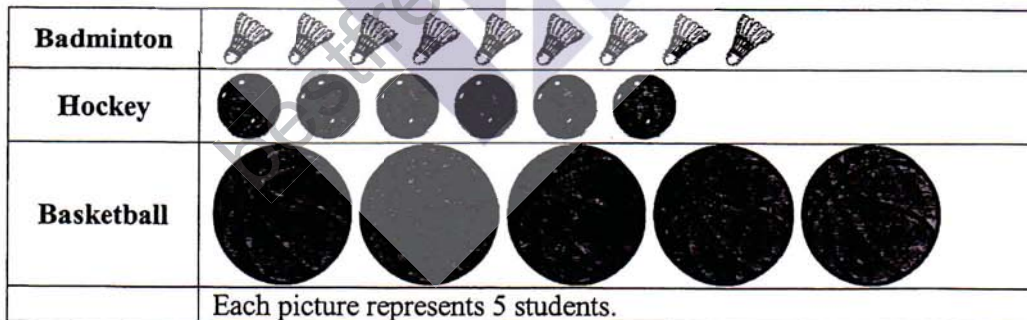
- (a) Find the maximum number of people that he will be able to buy the meal for.

Answer (a) [1]

- (b) What is the average number of nuggets a person can consume?

Answer (b) [1]

- 9 The pictogram shows the number of students in Badminton, Hockey and Basketball CCAs respectively.



- (a) State one feature of the pictogram that may be misleading and explain why.

Answer (a).....

..... [2]

- (b) Which CCA has the most students?

Answer (b) [1]

10 (a) -2, 7, 16, 25, ...

(i) Write down the next two terms in the sequence.

Answer (a)(i) [1]

(ii) Find an expression for the n^{th} term in this sequence.

Answer (a)(ii) [1]

(b) The n^{th} term of a different sequence is given by $n^2 - 1$.

(i) Find the 10th term.

Answer (b)(i) [1]

(ii) Is 324 a term in this sequence?
Given a reason for your answer.

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

11 Solve the simultaneous equations.

$$5x - 2y = 21$$

$$y = 2x - 8$$

Answer $x = \dots\dots\dots, y = \dots\dots\dots$ [3]

[Turn Over

- 12 Mr Tan bought a camera for \$195.50 during the Great Singapore sale after a discount of 15%.

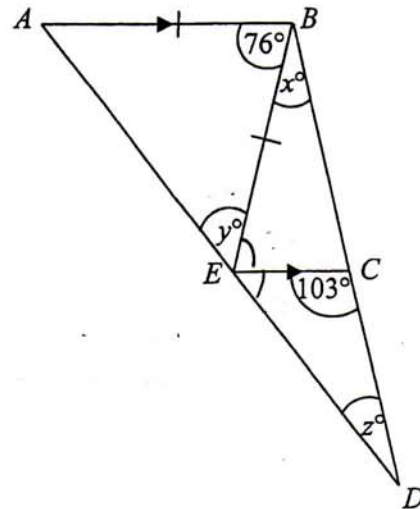
(a) Calculate the original price of the camera.

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

(b) He later sold the camera off at a profit of 15%. Calculate the amount Mr Tan receive from selling his camera.

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

- 13 AED and BCD are straight lines. AB is parallel to EC and $AB = BE$. Angle $ECD = 103^\circ$ and angle $ABE = 76^\circ$. Calculate the angles x , y and z .



Answer $x =$ $^\circ$ [1]

$y =$ $^\circ$ [1]

$z =$ $^\circ$ [1]

- 14 A particular brown paint is achieved by mixing red, blue and yellow paint in the ratio of 3 : 7 : 4.

An artist requires 189 ml of the brown paint.

- (a) How much red paint does he have to use?

Answer (a)ml [1]

- (b) If he has 30 ml of red paint only, how much brown paint is he short of?

Answer (b)ml [2]

- 15 Michelle travels to school either by car, bus or the MRT. The probability that she goes to school by car is 0.25 and by bus is 0.48.

Find the probability that

- (a) she cycles to school,

Answer (a) [1]

- (b) she takes the MRT to school.

Answer (b) [1]

[Turn Over

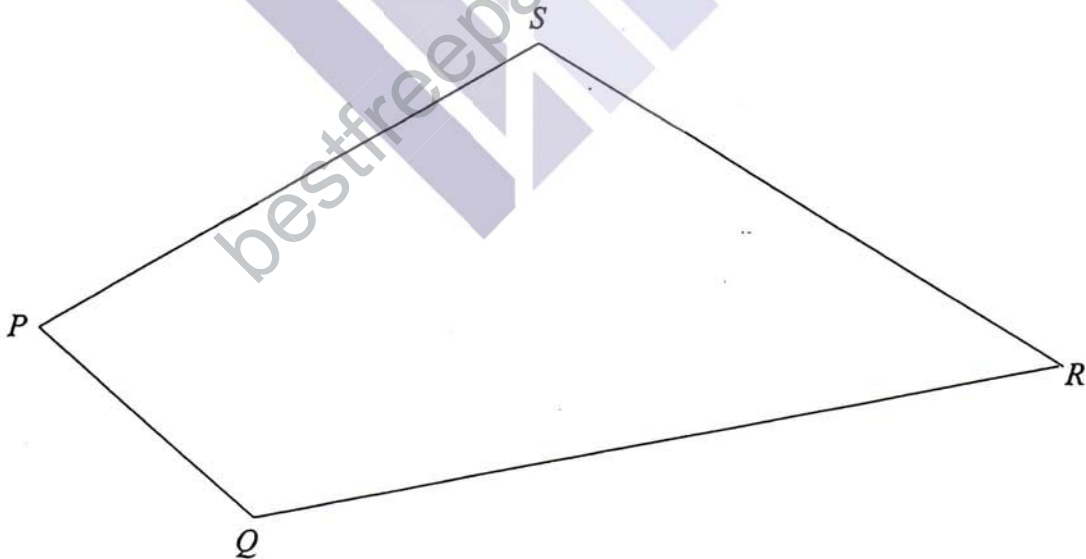
16 (a) Simplify $-3 + 4(a - 2)$.

Answer (a) [1]

(b) Write as a simple fraction $\frac{3}{x-2} + \frac{x}{2x+1}$.

Answer (b) [2]

17 $PQRS$ is a quadrilateral.



(a) Name one obtuse angle in $PQRS$ and measure the angle.

Answer angle =° [2]

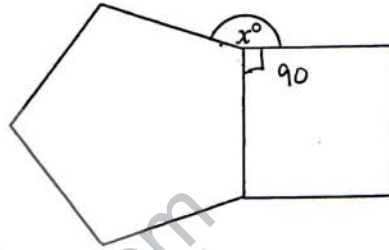
(b) Construct the perpendicular bisector of PS on the diagram above. [1]

(c) Construct the angle bisector of $\angle SRQ$ on the diagram above. [1]

- 18 (a) (i) Find the size of an interior angle of a regular pentagon.

Answer (a)(i)° [1]

- (ii) The diagram shows a figure made up of a regular pentagon and a square whose sides are of equal length. Calculate the angle, x° , between the two shapes.



Answer (a)(ii)° [1]

- (b) Name the special quadrilateral that has only one pair of parallel lines.

Answer (b) [1]

- 19 (a) Express $x^2 - 6x + 1$ in the form $(x - h)^2 + k$.

Answer (a) [2]

- (b) Hence solve $x^2 - 6x + 1 = 0$.

Answer (b) $x = \dots\dots\dots$ or $\dots\dots\dots$ [2]

[Turn Over

20

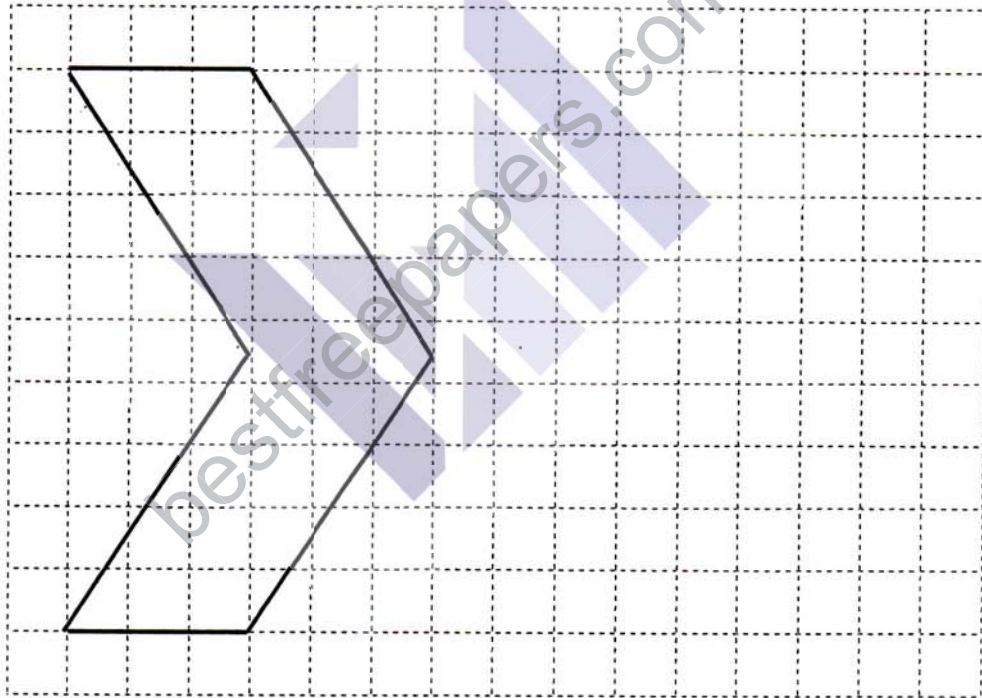
Scale 1 : 4



- (a) Determine the actual length, in cm, of the spoon from the scale diagram above.

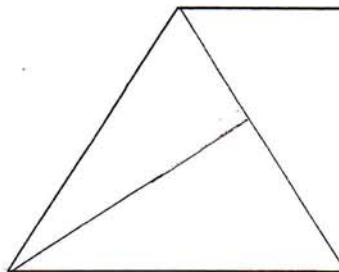
Answer (a)cm [1]

- (b) Draw a reduction of this figure using a scale factor $\frac{1}{3}$.



[2]

- (c) Draw two lines to divide the given shape into three congruent shapes.



[1]

- 21 The marks for 21 students in their Mathematics test are shown in the stem-and-leaf diagram.

0	8	9							
1	0	2	3	4	5	7	8	8	9
2	0	1	3	4	7				
3	5	6	8	9					
4	2								

Key

1	0	means 10 marks
---	---	----------------

- (a) Find
- (i) the range of the marks,

Answer (a)(i)marks [1]

- (ii) the median mark.

Answer (a)(ii)mark [1]

- (b) A student missed the test. He sat for the test later.
His teacher told him that his score increased the range by 2 but decreased the median.
Write down the student's possible mark for the test.

Answer (b)mark [1]

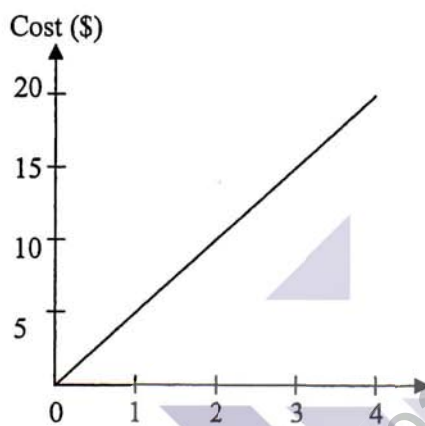
22 Class 4N went for an outing at Pasir Ris Park after their GCE N-Levels. They saw the following advertisements.

Bicycles for Rent
\$5 per hour or part thereof

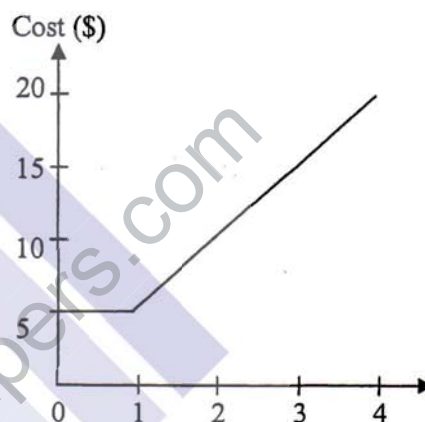
Burger Queen Student Meal
\$5 per set

Chicken Wings
\$5 per kg

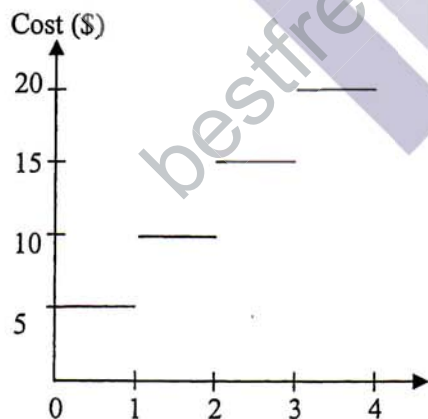
Match the graphs below with the advertisements above.



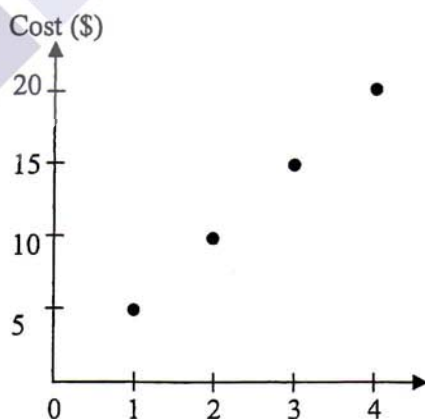
Graph A



Graph B



Graph C



Graph D

- Answer*
- Bicycles for Rent: Graph [1]
 - Burger Queen Student Meal: Graph [1]
 - Chicken Wings: Graph [1]

For
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UseFor
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Use

- 23 (a) Given that p is directly proportional to the cube of $(q + 1)$ and that $p = 64$ when $q = 1$,
- (i) express p in terms of q ,

Answer (a)(i) [2]

- (ii) find the value of q when $p = 125$

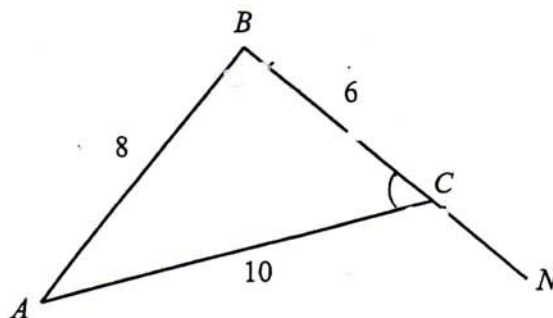
Answer (a)(ii) [1]

- (b) 5 painters take 8 hours to paint a block of flats. On a certain day, 2 painters were absent. Find the time taken, in hours and minutes, for the remaining men to paint a block of flats.

Answer (b)hours.....mins [2]

[Turn Over

- 24 ABC is a triangle in which $AC = 10$ cm, $BC = 6$ cm and $AB = 8$ cm. N is a point on BC produced.



- (a) Explain why $\angle ABC$ is a right angle.

Answer

[2]

- (b) Write down, as a fraction in the simplest form,

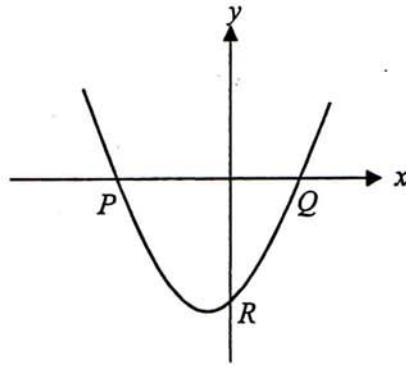
(i) $\tan \angle ACB$,

Answer (b)(i) [1]

(ii) $\cos \angle ACN$

Answer (b)(ii) [1]

- 25 The graph of $y = (x - 3)(x + 5)$ cuts the x -axis at P and Q . It cuts the y -axis at R .



Write

- (a) the coordinates of the point R ,

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

- (b) the coordinates of the points P and Q ,

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

Q (.....,) [1]

- (c) the equation of the line of symmetry,

Answer (c) [1]

- (d) the minimum value of y .

Answer (d) [1]

END OF PAPER

Mathematical Formulae

Name and Register Number:	Class:
()	()



SENG KANG SECONDARY SCHOOL
'N' PRELIMINARY EXAMINATION 2018

MATHEMATICS **4045/02**
4 NORMAL ACADEMIC **15 August 2018**
 Paper 2 **2 hours**

READ THESE INSTRUCTIONS FIRST

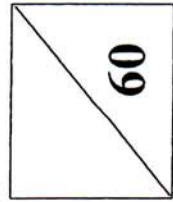
Candidates answer on the Question Paper.
 Write your class, index number and name on all the work you hand in.
 Write in dark blue or black pen.
 You may use an HB pencil for any diagrams or graphs.
 Do not use staples, paper clips, glue or correction fluid.

Section A
 Answer all questions.

Section B
 Answer one question.

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 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.



Parent's / Guardian's Signature:

This document consists of 8 printed pages and 0 blank pages.

Compound interest

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

Geometry and Measurement

Curved surface area of a cone = πrl

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

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

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

Section A (52 marks)

Answer all the questions in this section.

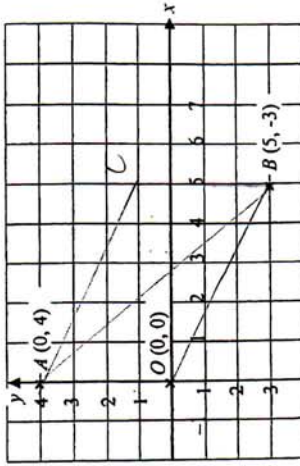
- 1 (a) Expand and simplify $4(3y - 2) - 5(y - 2)$. [2]
 - (b) Factorize $p^2 - 8p + 12$ completely. [1]
 - (c) Solve $\frac{x+1}{2} = \frac{x-3}{4}$. [2]
- 2 (a) Express 84 as the product of its prime factors. [1]
 - (b) Find the smallest positive integer value m such that $84m$ is a perfect square. [1]
 - (c) Given that $45 = 3^2 \times 5$ find the smallest positive integer value of n for which $84n$ is a multiple of 45. [1]
- 3 (a) Lin invests \$22000. He receives compound interest at 2.6% per year. How much interest does he receive at the end of the five years? [3]
 - (b) Ning bought a second-hand car for \$44 000. She paid \$5000 as down-payment and paid the remaining amount by hire-purchase scheme at a simple interest of 5% per annum for 4 years. Calculate her monthly installments. [3]

- 4 The heights of 20 students in a class are given below in cm.

Height	Frequency
$140 \leq x < 150$	3
$150 \leq x < 160$	6
$160 \leq x < 170$	8
$170 \leq x < 180$	3

- (a) If these results were represented by a pie chart, calculate the angle for the sector representing heights such that $160 \leq x < 170$. [2]
- (b) Calculate an estimate of the mean height of the students. [2]
- (c) Calculate the least possible mean height of the 20 students. [1]

5



The points $A(0, 4)$, $B(5, -3)$ and $O(0, 0)$ are shown on the grid.

Find

- (a) the length of the line segment AB , [2]
- (b) the area of triangle AOB , [2]
- (c) the coordinates of the point C such that $AOCB$ is a parallelogram. [1]

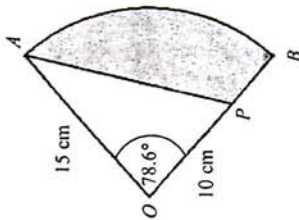
Answer the whole of this question on the graph paper.

- 6 (a) Copy and complete this table for values for $y = -2x + 10 - \frac{6}{x}$. [3]

x	0.5	1	2	3	4	5	6	7
y	-3	2	a	2	0.5	-1.2	-3	-4.9

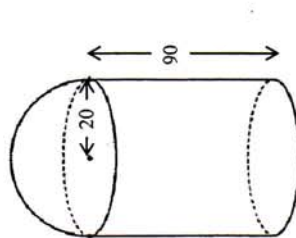
- (b) Draw the graph of $y = -2x + 10 - \frac{6}{x}$. [1]
Use a scale of 2 cm to 1 unit on the horizontal x -axis and a scale of 2 cm to 1 unit on the vertical y -axis [2]
- (c) Use your graph to find the values of x when $y = 1$. [2]
- (d) By drawing a tangent, find the gradient of the curve $y = -2x + 10 - \frac{6}{x}$ when $x = 3$. [2]

- 7 The point P lies on the radius OB such that $OP = 10$ cm. Angle $AOB = 78.6^\circ$.



- (a) Find the area of the sector AOB .
 (b) Calculate the area of triangle AOP and hence, find the shaded area.
 (c) Convert 78.6° to radians.

[2]
 [2]
 [1]



The diagram shows a rubbish bin.
 It is made from a cylinder and a hemisphere, both of radius 20 cm.
 The height of the cylinder is 90 cm.

- (a) Find the total volume of the bin.
 The external surface area of the bin is to be painted.
 (b) (i) Calculate the total surface area of the bin.
 (ii) Given that 0.0116 ml of paint is needed for every 1 cm^2 of surface area, calculate how much paint is needed to paint the bin.

[3]
 [3]
 [2]

- 9 Mrs Ong earns a salary of \$6400 a month in 2017.
 In the same year, she received a bonus of 1.5 months of salary.

- (a) Calculate Mrs Ong's total annual income.

Mrs Ong lives with her husband, 2 children and her mother

The table below shows the various income tax reliefs that a person can be entitled to.

Type of Tax Relief	Amount
Personal	\$5000
Child	1 st child – 15% of mother's income 2 nd child – 20% of mother's income 3 rd and each subsequent child – 25% of mother's income
Parent Relief	Staying together – \$9000 Not staying together – \$5500 each
CPF Contributions	20% of salary

- (b) Find the income tax relief Mrs Ong is entitled to in 2017.

The table below shows the income tax rates for the Year 2017.

Chargeable Income	Rate (%)	Gross Tax Payable (\$)
First \$20000	0	0
Next \$10000	2	200
First \$30000	-	200
Next \$10000	3.5	350
First \$40000	-	550
Next 40000	7	2800
First \$80000	-	3350
Next \$40000	11.5	4600
First \$120000	-	7950
Next \$40000	15	6000

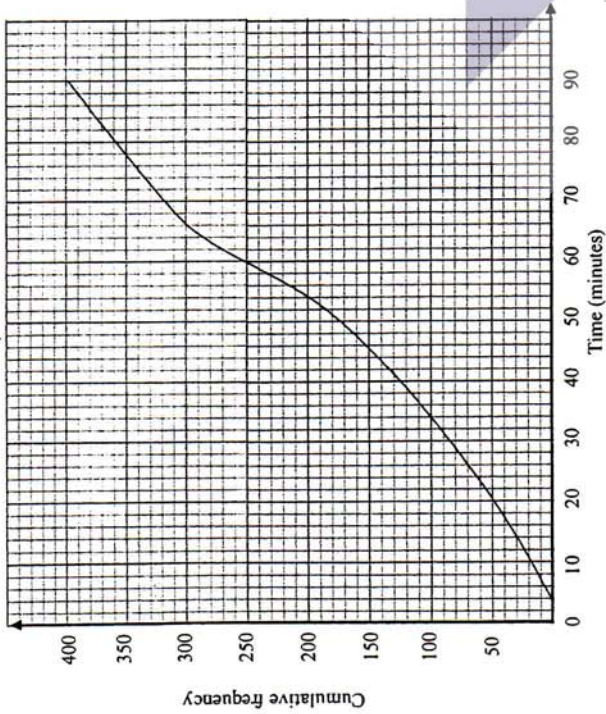
- (c) Given that chargeable income = total annual income – reliefs, calculate the total amount of income tax that Mrs Ong has to pay for the whole of 2017.

[3]

Section B (8 marks)

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

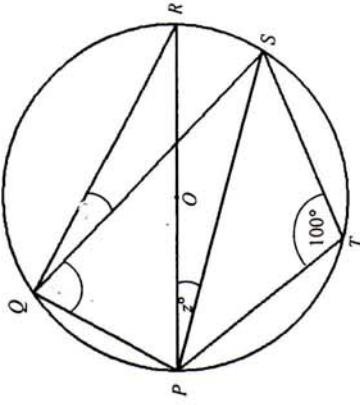
- 10 (a) The waiting times spent by 400 patients at a polyclinic are recorded. The cumulative frequency curve below shows the distribution of their waiting times.



Use the graph to estimate

- (i) the minimum waiting time, [1]
 - (ii) the interquartile range, [2]
 - (iii) the percentage of patients who waited more than an hour, [2]
- (b) The probability that Seng Kang Secondary School's Volleyball team will win any match is 0.65. The probability that they will draw is 0.1. Calculate the probability that, in their next two matches, Seng Kang Secondary School will win one and lose the other. [3]

11 (a)

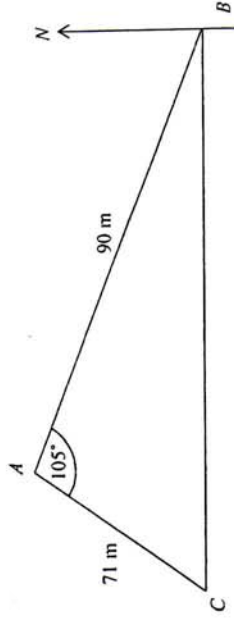


P, Q, R, S and T are points on a circle, centre O . PR is the diameter of the circle. Angle $PTS = 100^\circ$.

Find the value of

- (i) x ,
- (ii) y ,
- (iii) z .


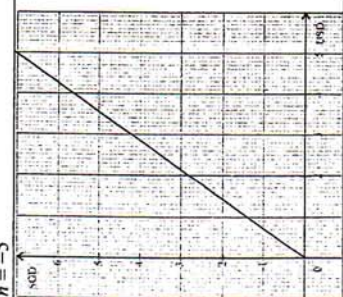
(b)



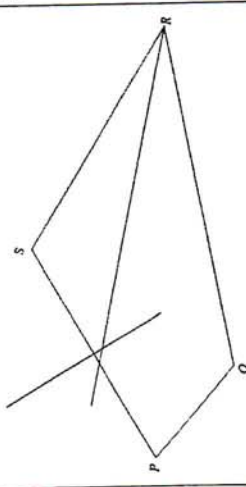
A, B and C are three points on a field where C is due west of B . $AB = 90$ m, $AC = 71$ m and $\angle CAB = 105^\circ$.

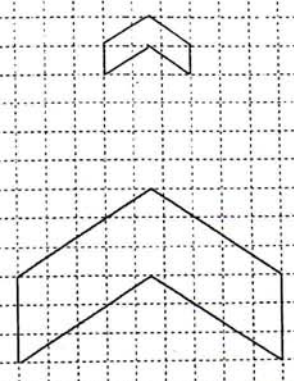
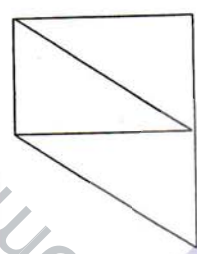
- (i) Show that the length of BC is 128 m. [2]
- (ii) Find angle ABC . [2]
- (iii) Calculate the bearing of A from B . [1]

END OF PAPER

1(a)	16.90	BI
1(b)	4.923×10^{-6}	BI
2(a)	$A = -0.3$ $B = 0.15$	BI
2(b)		BI with label
3	65.2 km/h = 65200 m/h = $\frac{65200}{3600}$ m/s = 18.1 m/s	M1 for conversion from km to m A1
4(a)	$5 + 2x < -9$ $2x < -14$ $x < -7$	BI
4(b)	$x < -7$	BI FT
5(a)(i)	$(5a^3b)^2 = 25a^6b^2$	BI
5(a)(ii)	$x^3 + \sqrt{x}$ $= x^3 + x^{\frac{1}{2}}$ $= x^{\frac{5}{2}}$	M1 A1
5(b)(i)	$5^n = 1$ $5^n = 5^0$ $n = 0$	BI
5(b)(ii)	$7^n = 7^{-3}$ $7^n = \frac{1}{7^3}$ $7^n = 7^{-5}$ $n = -5$	BI
6(a)		BI
6(b)(i)	SGD 4.90	BI
6(b)(ii)	USD 2.15	BI

7(a)	$2y + 4x - 5 = 0$ $2y = -4x + 5$ $y = -2x + 2.5$	BI
7(b)	Gradient = -2 y-intercept = (0, 2.5)	BI FT BI FT
8(a)	No. of sets = $280 + 59.90 = 4.6744 \approx 4$ Number of people = $4 \times 6 = 24$	BI
8(b)	Average = $(12 \times 4) / 24 = 2$	BI FT
9(a)	Size of the pictures are not the same / different sizes, giving the impression that basketball has more students because of the larger image even though it actually has the least.	Aspect + corresponding implication M1, A1
9(b)	Badminton	BI
10(a)(i)	34, 43	BI
10(a)(ii)	$-11 + 9n$	BI
10(b)(i)	$10^2 - 1 = 99$	BI
10(b)(ii)	$n^2 - 1 = 324$ $n^2 = 325$ $n = 18.027$ Since n is not a whole number, 324 is not a term in this sequence.	BI
11	$5x - 2y = 21$ ----- (1) $y = 2x - 8$ ----- (2) Subs (2) into (1) $5x - 2(2x - 8) = 21$ $5x - 4x + 16 = 21$ $x = 5$ $y = 2$	M1 A1 A1
12(a)	Original price = $\frac{100}{85} \times 195.50 = \230	BI
12(b)	Selling price = $\frac{115}{100} \times 195.50 = \$224.825 = \$224.83$	BI
13	$x = 103^\circ - 76^\circ = 27^\circ$ (// lines, corr. \angle) $y = \frac{180^\circ - 76^\circ}{2} = 52^\circ$ (isos. Δ) $z = 180^\circ - 76^\circ - 27^\circ - 52^\circ = 25^\circ$ (sum of \angle in a Δ)	BI BI BI
14(a)	$\frac{3}{14} \times 189 = 40.5$ ml	BI
14(b)	$\frac{14}{3} \times 30 = 140$ ml $189 - 140 = 49$ ml	M1 A1
15(a)	0	BI
15(b)	$1 - 0.25 - 0.48 = 0.27$	BI
16(a)	$-3 + 4(a - 2)$ $= -3 + 4a - 8$ $= 4a - 11$	BI

16(b)	$\frac{3}{x-2} + \frac{x}{2x+1}$ $= \frac{3(2x+1) + x(x-2)}{(x-2)(2x+1)}$ $= \frac{6x+3+x^2-2x}{(x-2)(2x+1)}$ $= \frac{x^2+4x+3}{(x-2)(2x+1)}$	M1 A1
17(a)	$\angle PQR = 129^\circ (+/- 1^\circ)$ $\angle PSR = 119^\circ (+/- 1^\circ)$	B2 (either answers) 1 mark for naming angle, 1 mark for value B1 angle bisector B1 perpendicular bisector
17(b)(c)		
18(a)(i)	$\frac{(5-2) \times 180^\circ}{5} = 108^\circ$	B1
18(a)(ii)	$360^\circ - 108^\circ - 90^\circ = 162^\circ$	B1
18(b)	Trapezium	B1
19(a)	$x^2 - 6x + 1$ $= x^2 - 6x + 3^2 - 3^2 + 1$ $= (x-3)^2 - 8$	B1 for -3 and B1 for -8 M1
19(b)	$(x-3)^2 - 8 = 0$ $(x-3)^2 = 8$ $x = \pm\sqrt{8} + 3$ $x = 5.83$ or $x = 0.172$	A1 B1
20(a)	$4 \times 5.4 = 21.6$ cm	

20(b)		B1 correct reduction of horizontal line B1 correct reduction of slant lines
20(c)		B1
21(a)(i)	42 - 8 = 34 marks	B1
21(a)(ii)	Median = 19 marks	B1
21(b)	6 marks	B1
22	Bicycle for Rent: Graph C Burger Queen Student Meal: Graph D Chicken Wings: Graph A	B1 B1 B1
23(a)(i)	$p = k(q+1)^3$ $64 = k(1+1)^3$ $k = 8$ $p = 8(q+1)^3$	M1 A1
23(a)(ii)	$125 = 8(q+1)^3$ $\frac{125}{8} = (q+1)^3$ $q = 1.5$	B1
23(b)	5 painters --- 8 hours 3 painters --- $8 + \frac{3}{5} = 13\frac{1}{3}$ h $= 13$ h 20 mins	M1 A1
24(a)	$AB^2 + BC^2 = 8^2 + 6^2 = 100$ $AC^2 = 10^2 = 100$ $\therefore AB^2 + BC^2 = AC^2$ By Pyth. Thm, $\angle ABC$ is a right angle	M1 A1
24(b)(i)	$\tan \angle ACB = \frac{4}{3}$	B1

24(b)(ii)	$\cos \angle ACN = -\frac{3}{5}$	BI
25(a)	When $x = 0$ $y = (0 - 3)(0 + 5) = -15$	BI
25(b)	$P(-5, 0)$	BI
	$Q(3, 0)$	BI
25(c)	$x = \frac{3 + (-5)}{2}$	BI
25(d)	$x = -1$	BI
	$y = (-1 - 3)(-1 + 5) = -16$	BI

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1	(a) $4(3y-2) - 5(y-2)$ $= 12y - 8 - 5y + 10$ $= 7y + 2$	M1 A1
	(b) $p^2 - 8p + 12$ $= (p-2)(p-6)$	BI
	(c) $\frac{x+1}{2} = \frac{x-3}{4}$ $4(x+1) = 2(x-3)$ $4x+4 = 2x-6$ $2x = -10$ $x = -5$	M1 A1
2	(a) $84 = 2^2 \times 3 \times 7$	BI
	(b) $84m = 2^2 \times 3 \times 7 \times m$ $m = 3 \times 7 = 21$	BI
	(c) $n = 3 \times 5 = 15$	BI
3	(a) Amount $= P \left(1 + \frac{R}{100} \right)^n$ $= 22000 \left(1 + \frac{2.6}{100} \right)^5$ $= 25012.63725$ Interest $= \$25012.63725 - \22000 $= \$3012.637$ $= \$3012.64$	M1 M1 A1
	(b) Remaining amount $= 44000 - 5000$ $= 39000$ Total installments $= \text{interest} + \text{remaining amount}$ $= \frac{PRT}{100} + 39000$ $= \frac{39000(5)(4)}{100} + 39000$ $= 46800$ Monthly installments $= 46800 / (4 \times 12)$ $= \$975$	M1 M1 A1

[Turn Over

4	(a) Angle $= \frac{8}{20} \times 360^\circ$ $= 144^\circ$	M1 A1
	(b) Mean $= \frac{3(145) + 6(155) + 8(165) + 3(175)}{20}$ $= 160.5 \text{ cm}$	M1 A1
	(c) Least possible mean height $= \frac{3(140) + 6(150) + 8(160) + 3(170)}{20}$ $= 155.5 \text{ cm}$	A1
5	(a) Length $= \sqrt{(0-5)^2 + (4-(-3))^2}$ $= 8.6023$ $= 8.60 \text{ units}$	M1 A1
	(b) Area $= \frac{1}{2} \times 4 \times 5$ $= 10 \text{ units}^2$	M1 A1
	(c) (5, 1)	BI
6	(a) $a = 3$	
	(b) On graph paper	A-axis and labels P - plots and smooth curve
	(c) $x = 3.68$ or 0.81	A1 for each value
	(d) Gradient $= -\frac{4}{3}$ or -1.33	M1 A1
7	(a) Area $= \frac{78.6}{360} \times \pi \times 15^2$ $= 154.38$ $= 154 \text{ cm}^2$	
	(b) Area of triangle $= \frac{1}{2} \times 10 \times 15 \times \sin 78.6^\circ$ $= 73.520 \text{ cm}^2$ Shaded area $= 154.38 - 73.520$ $= 80.859$ $= 80.9 \text{ cm}^2$	
	(c) 78.6° $= \frac{78.6 \times \pi}{180}$ $= 1.3718$ $= 1.37 \text{ rad}$	

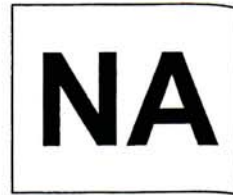
<p>8 (a)</p> <p>Volume of hemisphere + Volume of cylinder $= \frac{1}{2} \times \frac{4}{3} \pi (20)^3 + \pi (20)^2 (90)$ $= 16755.16 + 113097.335$ $= 129852.49$ $= 130000 \text{ cm}^3$</p>	<p>M1 for hemisphere M1 for cylinder A1</p>	
<p>(b) (i)</p> <p>Surface area = S.A. of hemisphere + S.A. of cylinder + circular base $= \frac{1}{2} \times 4\pi (20)^2 + 2\pi (20)(90) + \pi (20)^2$ $= 2513.274 + 11309.7335 + 1256.637$ $= 15079.644$ $= 15100 \text{ cm}^2$</p> <p>(ii)</p> <p>Amount of paint $= 15079.644 \times 0.0116$ $= 174.92$ $= 175 \text{ ml}$</p>	<p>M1 for hemisphere M1 for cylinder A1 M1 A1</p>	
<p>9 (a)</p> <p>Total income $= 6400 \times 12 + 6400 \times 1.5$ $= \\$86400$</p>	<p>M1 A1 Award 1 mark if students calculate salary without bonus.</p>	
<p>(b)</p> <p>Tax relief $= 5000 + \frac{15}{100} \times 86400 + \frac{20}{100} \times 86400 + 9000 + \frac{20}{100} \times 86400$ $= \\$61520$</p>	<p>M1 for calculating parent and personal relief M1 for calculating percentages for child and cpf A1</p>	
<p>(c)</p> <p>Chargeable income $= 86400 - 61520$ $= \\$24880$ Total income tax $= \frac{2}{100} \times 4880$ $= \\$97.60$</p>	<p>M1 M1 A1</p>	

[Turn Over

<p>10 (a)</p> <p>(i) 4 mins (ii) $66 - 34 = 32 \text{ mins}$ (iii) Percentage $= \frac{400 - 250}{400} \times 100$ $= 37.5\%$</p>	<p>BI M1, A1</p>	
<p>(b)</p> <p>Probability of losing $= 1 - 0.65 - 0.1$ $= 0.25$ P(win 1, lose 1) $= P(\text{win then lose}) + P(\text{lose then win})$ $= 0.65(0.25) + 0.25(0.65)$ $= 13/40 \text{ or } 0.325$</p>	<p>BI M1 A1 Award 1 mark if students only considered one event</p>	
<p>11 (a)</p> <p>(i) $x = 180^\circ - 100^\circ = 80^\circ$ (ii) $y = 90^\circ - 80^\circ = 10^\circ$ (iii) $z = 10^\circ$</p>	<p>BI BI FT BI FT</p>	
<p>(b)</p> <p>(i) BC $= \sqrt{90^2 + 71^2 - 2(90)(71)\cos 105^\circ}$ $= 128.2525$ $= 128 \text{ m}$</p> <p>(ii)</p> <p>$\frac{\sin ABC}{71} = \frac{\sin 105^\circ}{128.2525}$ $\sin ABC = 0.53473$ $ABC = 32.235 = 32.3^\circ$ (iii) bearing = $270^\circ + 32.235^\circ = 302.3^\circ$</p>	<p>M1 A1 M1 FT A1 FT BI FT</p>	



**SWISS COTTAGE SECONDARY SCHOOL
SECONDARY FOUR NORMAL ACADEMIC
PRELIMINARY EXAMINATION**



Name: _____ ()

Class: _____

MATHEMATICS SYLLABUS A

4045/01

Paper 1

Wednesday 15 August 2018

2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB 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 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 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

This document consists of **20** printed pages.

Setter: Ms Tan Hui Lan
Vetter: Ms Yeo Koon Koon

[Turn over

*We Nurture Students to **Think, Care and Lead** with P.R.I.D.E.*

Mathematical Formulae*Compound Interest*

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

Measurement

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

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

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

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

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

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

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

Trigonometry

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

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

Statistic

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

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

Answer **all** the questions.

- 1 By rounding each number to 1 significant figure, **estimate** the value of

$$\frac{9.81 \times \sqrt{3.52}}{5.39}$$

You must show your working.

Answer [2]

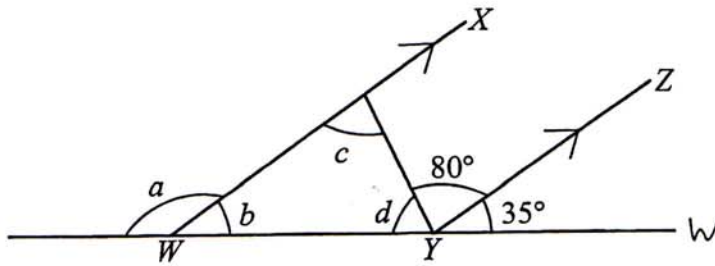
- 2 (a) Solve $\frac{6x}{x-1} = 3$.

Answer $x =$ [2]

- (b) Solve the inequality $-3y \leq 11$.

Answer [1]

3 In the diagram, WX is parallel to YZ .



Show, giving reasons, that the angle a is 145° .

Answer

.....

.....

.....

[2]

4 The first five terms of a sequence are

$7, 13, 19, 25, 31, \dots, \dots$

For this sequence,

(a) find an expression for the n th term,

Answer [1]

(b) show that 153 is **not** a term in the sequence.

Answer

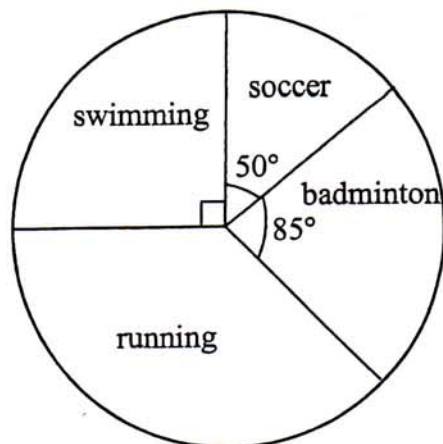
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[1]

- 5 The students from a class were asked to choose their favourite sport. The results are shown in the pie chart below.



A student was chosen at random. Calculate the probability that

- (a) this student's favourite sport is running,

Answer [2]

- (b) this student's favourite sport is **not** badminton.

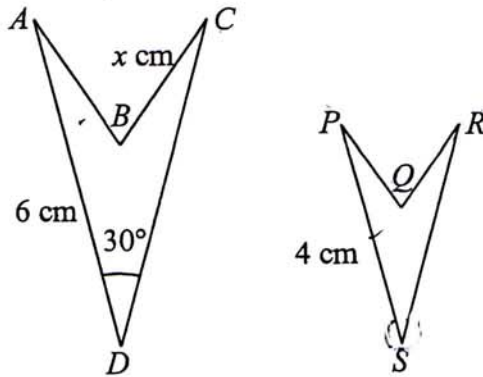
Answer [1]

- 6 Make w the subject of the formula $x = \sqrt{y + wz^2}$.

Answer [2]

7 Quadrilateral $PQRS$ is a reduction of quadrilateral $ABCD$.

Angle $ADC = 30^\circ$, $AD = 6$ cm, $BC = x$ cm and $PS = 4$ cm.



Find

(a) the scale factor,

Answer [1]

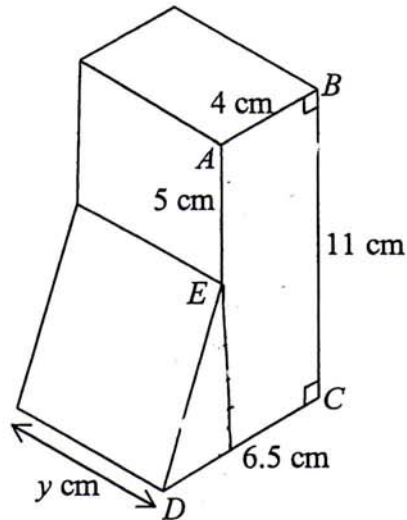
(b) QR in terms of x ,

Answer $QR = \dots\dots\dots$ cm [1]

(c) the reflex angle PSR .

Answer [1]

- 8 A prism has a cross-section $ABCDE$.



$AB = 4$ cm, $BC = 11$ cm, $CD = 6.5$ cm and $AE = 5$ cm.

Angle $ABC =$ angle $BCD = 90^\circ$.

The length of the prism is y cm.

Given that the volume of the prism is 309 cm³, calculate y .

Answer $y = \dots\dots\dots$ [3]

- 9 (a) Simplify $\frac{5f^2g}{2} \div \frac{3f}{4g}$.

Answer $\dots\dots\dots$ [2]

- (b) Write as a single fraction in its simplest form

$$\frac{1}{2x-1} + \frac{3}{x+1}$$

Answer [2]

- 10 The table shows the number of hours spent using the handphone by a class of 20 students in a particular day.

Number of hours	$0 \leq x < 1$	$1 \leq x < 2$	$2 \leq x < 3$	$3 \leq x < 4$	$4 \leq x < 5$
Frequency	3	8	6	p	1

- (a) Find
- p
- .

Answer $p =$ [1]

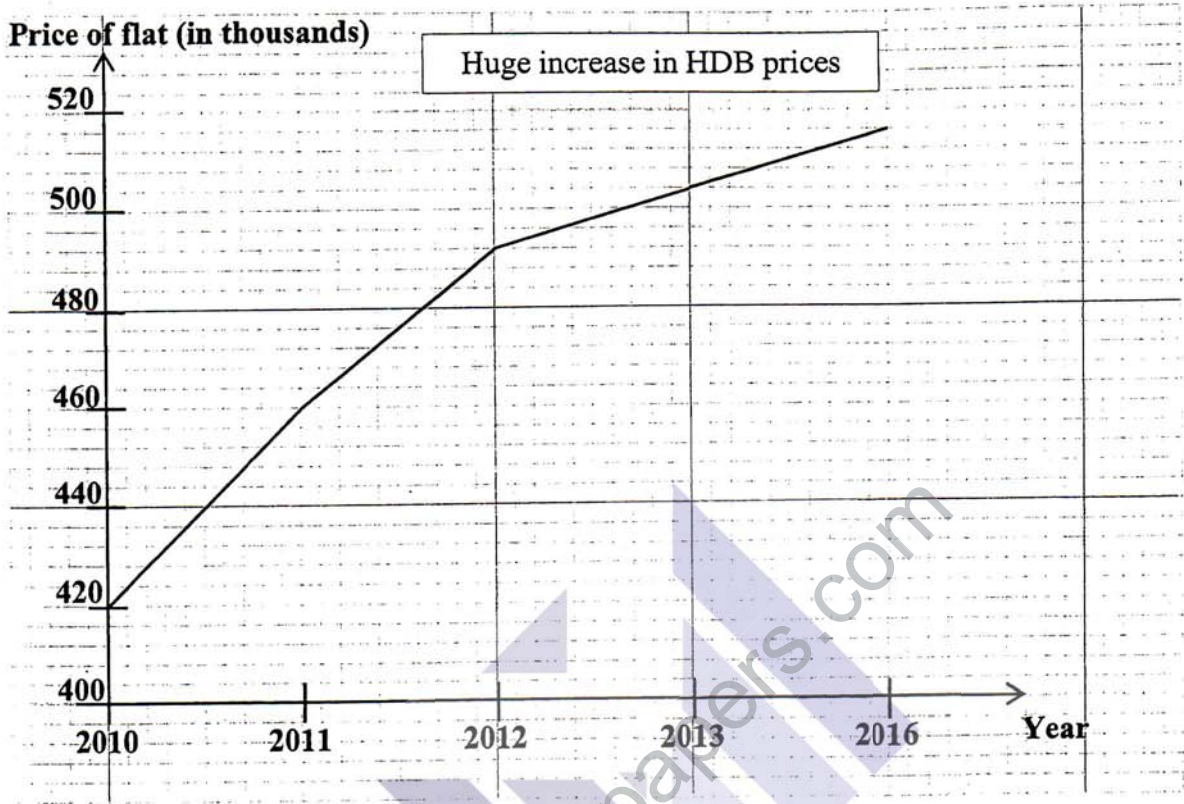
- (b) State the modal class.

Answer [1]

- (c) Calculate an estimate for the mean number of hours spent using the handphone.

Answer hours [3]

- 11 The graph below shows the average price of a 4-room flat in Choa Chu Kang estate over a few years.



State one feature of the graph that may be misleading and explain why.

Answer

.....

.....

.....

[2]

12 Solve the simultaneous equations.

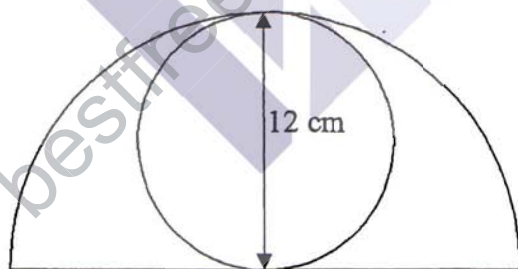
$$2x - y = 4$$

$$3x + 2y = 6$$

Answer $x = \dots\dots\dots$

$y = \dots\dots\dots$ [3]

13 The diagram shows a circle with diameter 12 cm inscribed into a semicircle.



Taking π as $\frac{22}{7}$,

(a) find the area of the semicircle,

Answer $\dots\dots\dots$ cm² [2]

- (b) Convert the area in (a) to m^2 .

Answer m^2 [1]

- 14 Benny bought a new vacuum cleaner. The list price was \$310.
He received a discount of 15%.

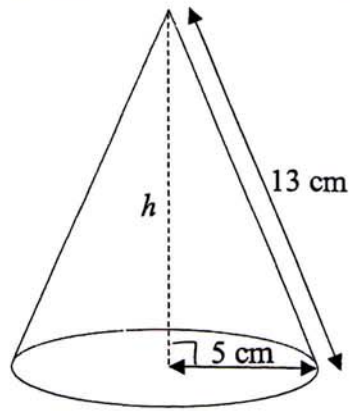
- (a) What was the discounted price he paid for the vacuum cleaner?

Answer \$ [2]

- (b) Benny sold the vacuum cleaner he bought to a friend at \$289.85.
Calculate his percentage profit.

Answer % [2]

- 15 A cone has a circular base of radius 5 cm and a slant height of 13 cm.



Calculate

- (a) the perpendicular height, h , of the cone,

Answer $h = \dots\dots\dots$ cm [2]

- (b) the volume of the cone.

Answer $\dots\dots\dots$ cm³ [2]

16 The following stem-and-leaf diagram shows the marks of some students for a test.

0	9						
1	3	5	5	6	8		
2	0	1	2	4	5	7	9
3	0	0					

Key
2|1 means 21

(a) Find

(i) the median,

Answer [1]

(ii) the range.

Answer [1]

(b) The passing mark for the test was 15.

Emily said that $26\frac{2}{3}\%$ of the students failed the test.

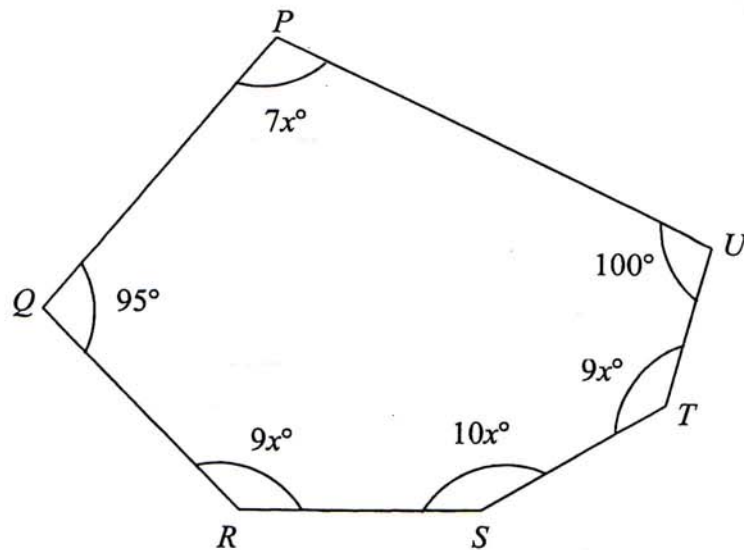
Do you agree with her? Give a reason for your answer.

Answer

.....

..... [1]

17



In the hexagon $PQRSTU$, angle $PQR = 95^\circ$ and angle $PUT = 100^\circ$.

Find

(a) x ,

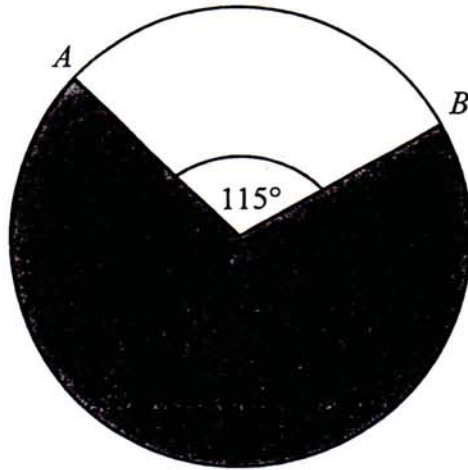
Answer $x = \dots\dots\dots$ [3]

(b) the value of the largest angle.

Answer $\dots\dots\dots$ [1]

18 The diagram shows a circle with centre O and radius 8 cm.

A and B are points on the circumference and angle $AOB = 115^\circ$.



Find, leaving all your answers in terms of π ,

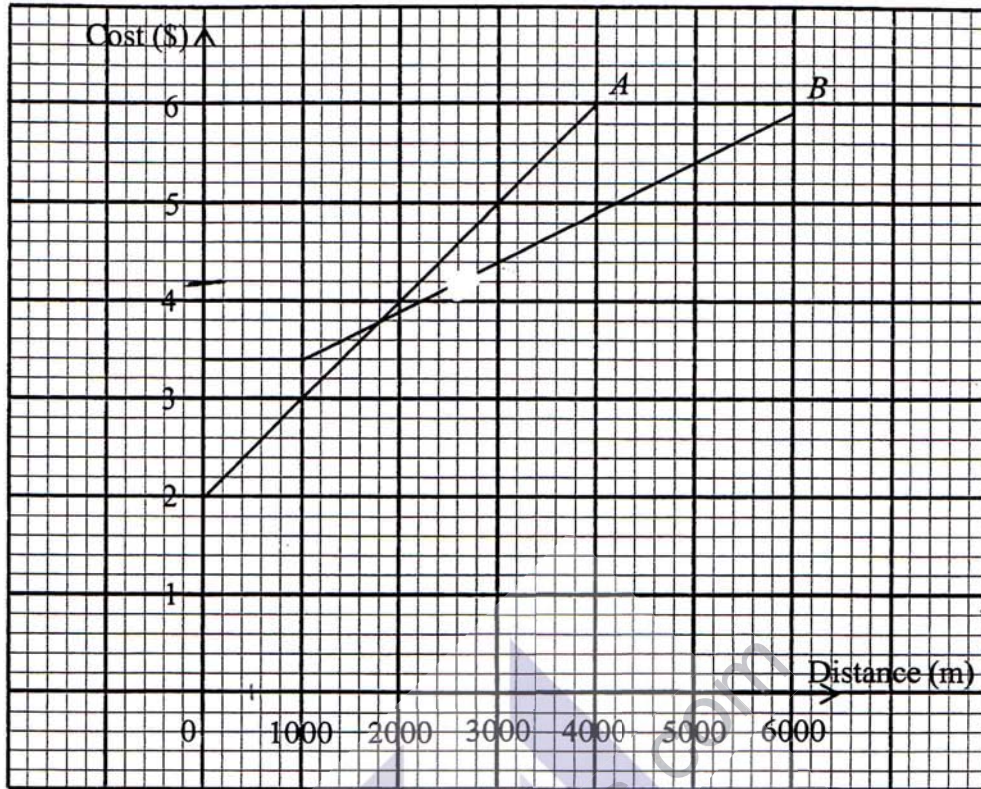
(a) the length of the minor arc AB ,

Answer $AB = \dots\dots\dots$ cm [2]

(b) the area of the shaded region.

Answer $\dots\dots\dots$ cm² [2]

19 The graph shows the charges of two taxi companies, *A* and *B*.



(a) Find the fare charged by company *B* when the distance is 2.6 km.

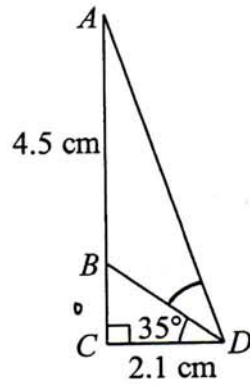
Answer \$ [1]

(b) Company *A* charges a fixed cost of \$2 and a constant rate of *y* cents per 500 m.
Find *y*.

Answer $y =$ [1]

(c) Find the range of distance *d* for which it will be cheaper to use company *A*.

Answer [1]



The diagram shows a right-angled triangle ACD .

$AB = 4.5$ cm, $CD = 2.1$ cm and angle $BDC = 35^\circ$.

(a) Calculate the length of BC .

Answer $BC = \dots\dots\dots$ cm [2]

(b) Find angle ADB .

Answer $\dots\dots\dots$ [2]

21 A is the point $(1, 0.5)$ and B is the point $(-2, 5)$.

(a) Calculate the gradient of the line AB .

Answer [2]

(b) Find the equation of the line AB .

Answer [2]

(c) A point $(3, m)$ lies on the line AB . Find m .

Answer $m =$ [1]

22 The scale of a map is 4 : 200 000.

(a) The scale can be written in the form 1 cm : p km.

Find p .

Answer $p = \dots\dots\dots$ [1]

(b) The actual distance between two towns is 4.5 km.

How far, in cm, is this distance on the map?

Answer $\dots\dots\dots$ cm [2]

(c) A reservoir covers an area of 32 cm^2 on the map.

Calculate the actual area of the reservoir in km^2 .

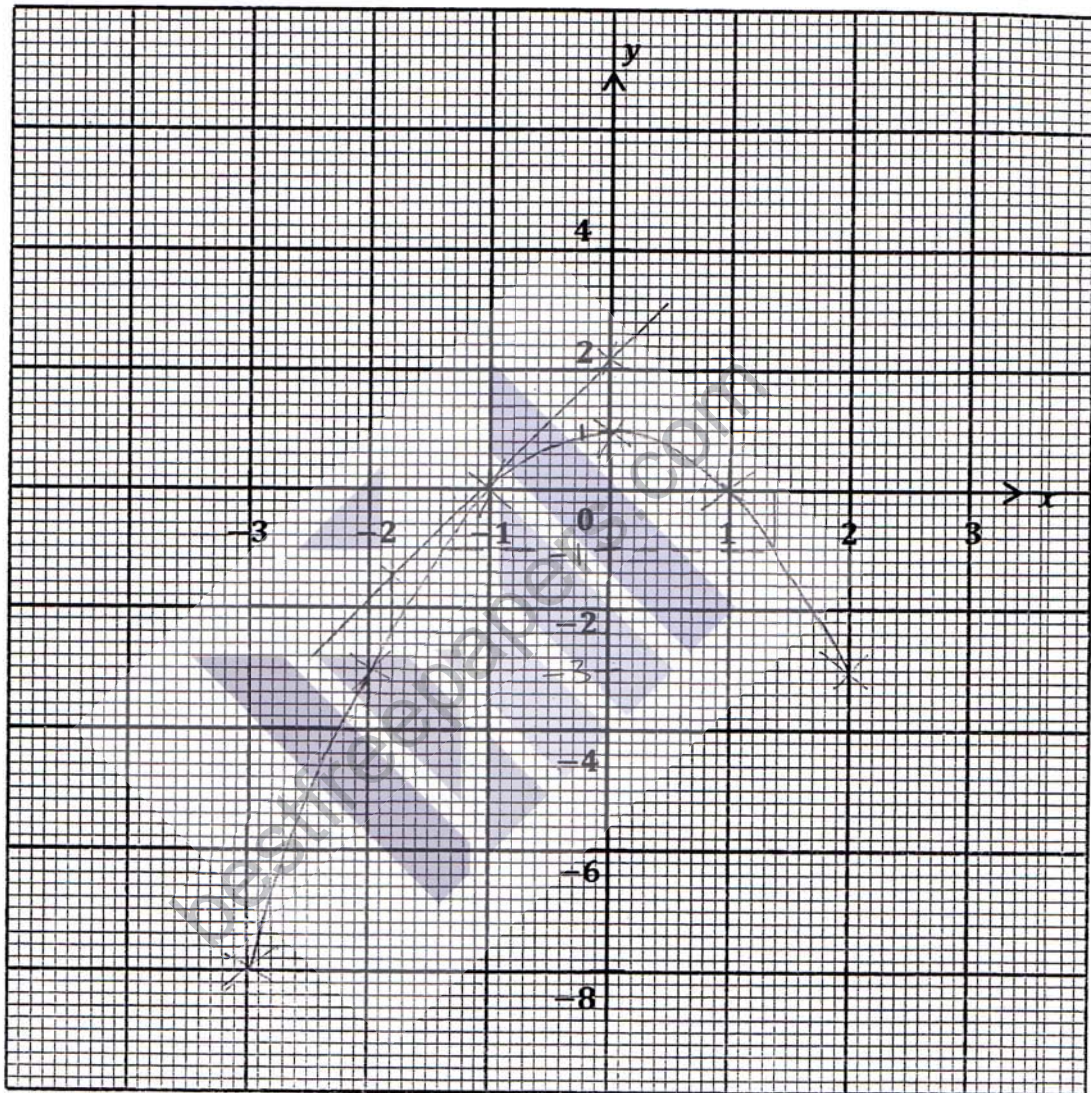
Answer $\dots\dots\dots \text{km}^2$ [2]

- 23 (a) Complete the table for $y = -x^2 + 1$.

x	-3	-2	-1	0	1	2
y	-8		0	1	0	-3

[1]

- (b) Draw the graph of $y = -x^2 + 1$.



[2]

- (c) Find the values of x when $y = -1$.

Answer $x = \dots\dots\dots$ [2]

- (d) By drawing a tangent, find the gradient of the graph when $x = -1$.

Answer $\dots\dots\dots$ [2]

2018 4NA Preliminary Examinations Paper 1
Marking Scheme

1	$\frac{9.81 \times \sqrt{3.52}}{5.39}$ $\approx \frac{10 \times \sqrt{4}}{5}$ $= 4$	[M1] [A1]
2(a)	$\frac{6x}{x-1} = 3$ $6x = 3(x-1)$ $6x = 3x - 3$ $6x - 3x = -3$ $3x = -3$ $x = \frac{-3}{3}$ $x = -1$	[M1] Cross-multiply & expand [A1]
2(b)	$-3y \leq 11$ $3y \geq -11$ $y \geq \frac{-11}{3}$ $y \geq -3\frac{2}{3}$	[B1]
3	$\angle d = 180^\circ - 80^\circ - 35^\circ \text{ (adjacent } \angle\text{s on a straight line)}$ $= 65^\circ$ $\angle a = 80^\circ + 65^\circ \text{ (corresponding } \angle\text{s, } WX \parallel YZ)$ $= 145^\circ$ <p>Alternatively,</p> $\angle b = 35^\circ \text{ (corresponding } \angle\text{s, } WX \parallel YZ)$ $\angle a = 180^\circ - 35^\circ \text{ (adjacent } \angle\text{s on a straight line)}$ $= 145^\circ$ <p>Or any other relevant working</p>	[M1] [A1] [M1] [A1]

4(a)	$T_n = a + (n-1)d$ $= 7 + (n-1)6$ $= 7 + 6n - 6$ $= 1 + 6n$	[B1]
4(b)	<p>Let $1 + 6n = 153$</p> $6n = 152$ $n = \frac{152}{6}$ $n = 25\frac{1}{3}$ <p>Since n is not an integer / whole number, 153 is not a term in the sequence.</p>	[B1]
5(a)	$\frac{360^\circ - 90^\circ - 50^\circ - 85^\circ}{360}$ $= \frac{3}{8}$	[M1] [A1]
5(b)	$\frac{360^\circ - 85^\circ}{360^\circ}$ $= \frac{55}{72}$	[B1]
6	$x = \sqrt{y + wz^2}$ $x^2 = y + wz^2$ $x^2 - y = wz^2$ $\frac{x^2 - y}{z^2} = w$ $w = \frac{x^2 - y}{z^2}$	[M1] [A1]
7(a)	$\frac{4}{6} = \frac{2}{3}$	[B1]
7(b)	$QR = \frac{2}{3}x \text{ cm}$	[B1]

7(c)	$\angle PSR = 30^\circ$ Reflex $\angle PSR = 360^\circ - 30^\circ$ (\angle s at a point) $= 330^\circ$	[B1]
8	Cross-section area = Area of rectangle + Area of trapezium $= (4 \times 5) + \frac{1}{2} \times (4 + 6.5) \times 6$ $= 20 + 31.5$ $= 51.5 \text{ cm}^2$ $y = 309 + 51.5$ $= 6$	[M1] [A1]
9(a)	$\frac{5f^2g}{2} \div \frac{3f}{4g}$ $= \frac{5f^2g}{2} \times \frac{4g}{3f}$ $= \frac{5fg}{1} \times \frac{2g}{3}$ $= \frac{10fg^2}{3}$	[M1] Convert + into \times [A1]
9(b)	$\frac{1}{2x-1} + \frac{3}{x+1}$ $= \frac{1 \times (x+1)}{(2x-1)(x+1)} + \frac{3 \times (2x-1)}{(x+1)(2x-1)}$ $= \frac{x+1}{(2x-1)(x+1)} + \frac{6x-3}{(x+1)(2x-1)}$ $= \frac{x+1+6x-3}{(2x-1)(x+1)}$ $= \frac{7x-2}{(2x-1)(x+1)}$	[M1] Common denominator [A1]
10(a)	$p = 20 - 3 - 8 - 6 - 1$ $= 2$	[B1]

10(b)	$1 \leq x < 2$	[B1]
10(c)	$\frac{(0.5 \times 5) + (1.5 \times 8) + (2.5 \times 6) + (3.5 \times 2) + (4.5 \times 1)}{20}$ $= \frac{40}{20}$ $= 2$	[M2] Midvalue - M1 Formula - M1 [A1]
11	The title of the graph is biased. It does not allow the reader to make his own judgement. OR The prices of the flat for years 2014 and 2015 are missing. The prices may have decreased in these two years OR The vertical axis did not start from zero. The increase in price may be exaggerated.	[B1] I mark for feature, I [B1] mark for reason.
12	$2x - y = 4$(1) $3x + 2y = 6$(2) $(1) \times 2, 4x - 2y = 8$ ---(3) $(2) + (3), 7x = 14$ $x = \frac{14}{7}$ $x = 2$ Substitute $x = 2$ into (1) $2(2) - y = 4$ $4 - y = 4$ $-y = 4 - 4$ $-y = 0$ $y = 0$	[M1] Valid use of substitution or elimination method [A1]
13(a)	Area of semicircle = $\frac{1}{2} \times \frac{22}{7} \times 12^2$	[M1]

	$= 226\frac{2}{7} \text{ cm}^2$	[A1]
13(b)	$226\frac{2}{7} \div 100 \div 100 = 0.02226 \text{ m}^2$	[B1]
14(a)	$\frac{65}{100} \times 310$ $= \$263.50$	[M1] [A1]
14(b)	$\frac{289.85 - 263.50}{263.50} \times 100$ $= 10\%$	[M1] [A1]
15(a)	$h = \sqrt{13^2 - 5^2}$ $= 12 \text{ cm}$	[M1] [A1]
15(b)	$\frac{1}{3} \pi (5)^2 (12)$ $= 314.1593 \text{ cm}^3$ $= 314 \text{ cm}^3 (3 \text{ sf})$	[M1] [A1]
16(a)	21	[B1]
16(b)	$30 - 9 = 21$	[B1]
16(c)	Percentage of students who fail $= \frac{2}{15} \times 100$ $= 13\frac{1}{3}\%$ Therefore, I do not agree.	Correct conclusion with appropriate Mathematical reasoning [B1]
17(a)	Sum of interior angles $= (6 - 2) \times 180^\circ$ $= 720^\circ$ $95^\circ + 7x^\circ + 100^\circ + 9x^\circ + 10x^\circ + 9x^\circ = 720^\circ$ $195^\circ + 35x^\circ = 720^\circ$ $35x^\circ = 720^\circ - 195^\circ$	[M1] [M1] [A1]

	$35x^\circ = 525^\circ$ $x^\circ = \frac{525^\circ}{35}$ $x = 15$	[A1]
17(b)	$10 \times 15^\circ = 150^\circ$	[B1]
18(a)	$\frac{115}{360} \times 2\pi(8)$ $= 5\frac{1}{9} \pi \text{ cm}$	[M1] [A1]
18(b)	$\frac{360^\circ - 115^\circ}{360^\circ} \times \pi(8)^2$ $= 43\frac{5}{9} \pi \text{ cm}^2$	[M1] [A1]
19(a)	\$4.20	[B1]
19(b)	50	[B1]
19(c)	$0 \leq d < 1800$	[B1]
20(a)	$\tan 35^\circ = \frac{BC}{2.1}$ $2.1 \tan 35^\circ = BC$ $BC = 1.47044 \text{ cm}$ $BC = 1.47 \text{ cm} (3 \text{ sf})$	[M1] [A1]
20(b)	$\tan \angle ADC = \frac{1.47044 + 4.5}{2.1}$ $\angle ADC = \tan^{-1} \left(\frac{5.97044}{2.1} \right)$ $= 70.6215^\circ$ $\angle ADB = 70.6215^\circ - 35^\circ$ $= 35.6215^\circ$ $= 35.6^\circ (1 \text{ dp})$	[M1] [A1]

21(a)	$\frac{0.5-5}{1-(-2)}$ $= -1.5$	[M1] [A1]
21(b)	$y = mx + c$ $0.5 = (-1.5)(1) + c$ $c = 2$ $\therefore y = -1.5x + 2$	[M1] [A1]
21(c)	$m = -1.5(3) + 2$ $m = -2.5$	[B1]
22(a)	4 cm : 200 000 cm 1 cm : 50 000 cm 1 cm : 0.5 km $\therefore p = 0.5$	[B1]
22(b)	$4.5 + 0.5$ $= 9$ cm	[M1] [A1]
22(c)	1 cm : 0.5 km $(1 \text{ cm})^2 : (0.5 \text{ km})^2$ 1 cm ² : 0.25 km ² $0.25 \times 32 = 8$ cm ²	[M1] [A1]

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**SWISS COTTAGE SECONDARY SCHOOL
SECONDARY FOUR NORMAL ACADEMIC
PRELIMINARY EXAMINATION**



Name: _____ ()

Class: _____

MATHEMATICS SYLLABUS A

4045/02

Paper 2

Thursday 16 August 2018

2 hours

Additional Materials: Answer paper (8 sheets)

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 HB pencil for any diagrams or graphs.
Do not use staples, paper clips, 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 the 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.

This document consists of **10** printed pages.

Setter: Ms Ng Poh Keow
Vetter: Ms Yeo Koon Koon

[Turn over

*We Nurture Students to **Think, Care and Lead** with **P.R.I.D.E.***

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

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

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

Statistic

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

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

Section A (52 marks)

Answer **all** the questions in this section.

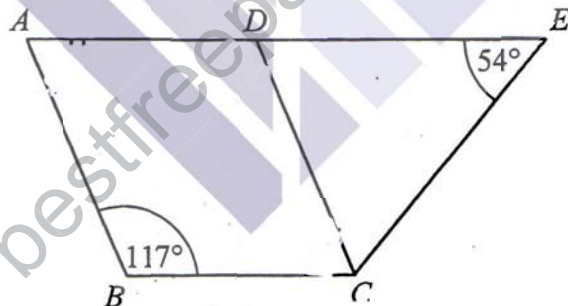
1 (a) Calculate

(i) $\sqrt[3]{(-15)^2 + 4.63 \times 0.28}$, [1]

(ii) $\frac{(0.95)^{-0.25}}{2.7 + 15.63}$. [1]

(b) Given that $8^4 \times (32)^{\frac{1}{5}} = 2^n$, find n . [2]

2 Dexter walks at an average speed of 4 km/h for 15 minutes and then runs 2.6 km in 10 minutes.

Calculate his average speed, in km/h, for the **whole** journey. [4]3 In the diagram, $ABCD$ is a parallelogram. ADE is a straight line.Angle $ABC = 117^\circ$ and angle $CED = 54^\circ$ 

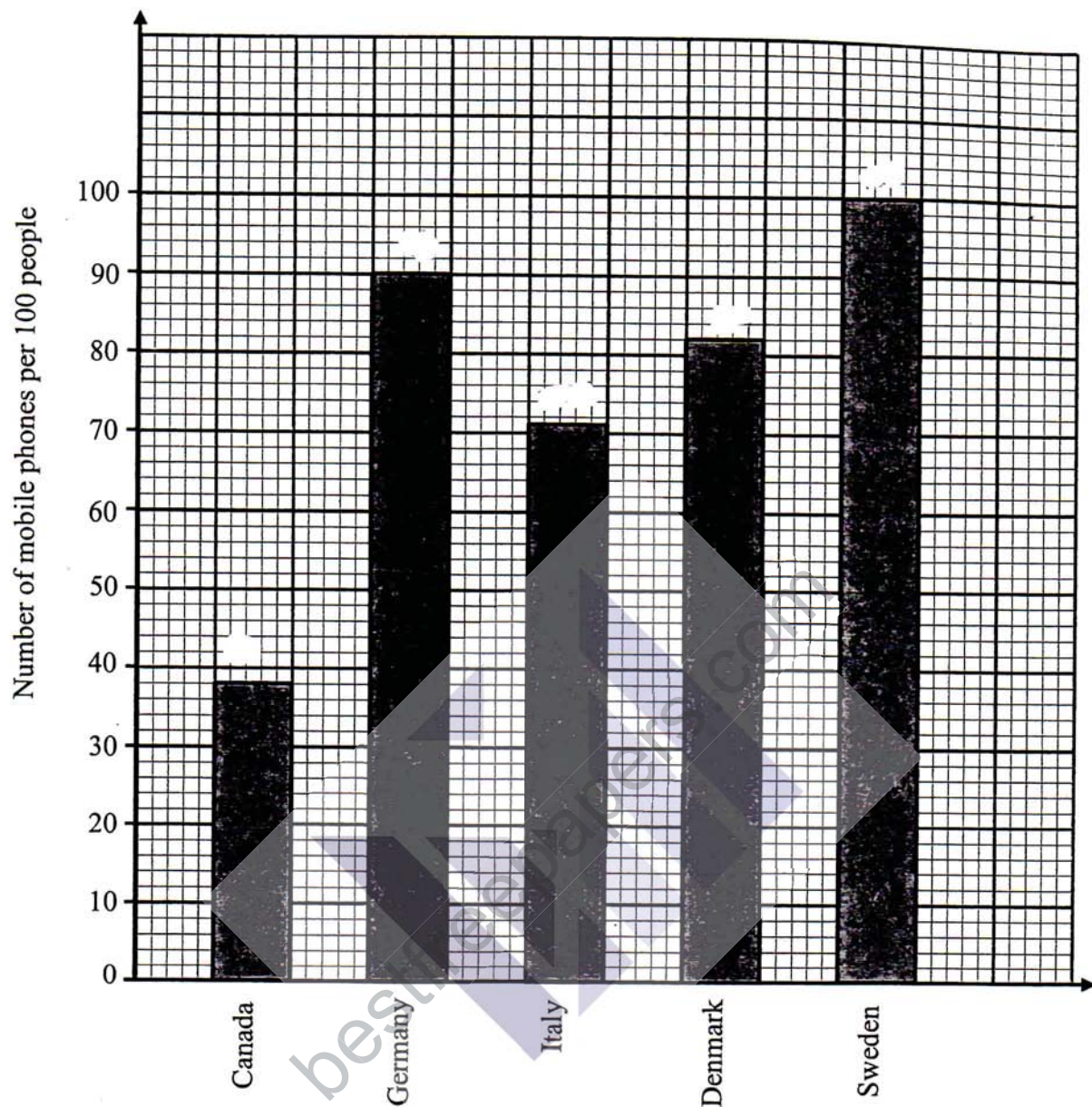
(a) Find, stating your reasons,

(i) angle ADC , [1]

(ii) angle CDE . [1]

(b) Using your answers to part (a), explain why triangle CDE is isosceles. Show all your workings. [2]

- 4 The bar graph shows the number of mobile phones per 100 people in five countries.



(a) How many **more** mobile phones per 100 people are there in Denmark than in Italy? [1]

(b) In Canada, there are 36 800 000 people.

Calculate the number of mobile phones in Canada.

Give your answer in standard form correct to 3 significant figures. [2]

(c) Alvin says, "Everyone has a mobile phone in Sweden."

Is Alvin correct? Explain your answer. [1]

- 5 (a) Express 198 as a product of its prime factors. [2]
(b) Find the highest common factor of 198 and 90. [2]
(c) Explain why a prime number cannot be a perfect cube. [1]
-

- 6 (a) Which of these ratios are equivalent to the ratio $x : y$?

$$x - 2 : y - 2 \quad x^2 : y^2 \quad 5x : 5y \quad \frac{1}{y} : \frac{1}{x} \quad [2]$$

- (b) Jack invested \$30 000 for 5 years at 2.1% compound interest.

Calculate the total interest that Jack will earn. [3]

- 7 PQR is a triangular field.
 $QR = 100$ m and angle $PRQ = 95^\circ$.
The bearing of P from Q is 052° .

- (a) Construct an accurate scale drawing of the field.
Use a scale of 1 cm to represent 10 m. [3]

- (b) A flag pole, F , is situated in the field.
It is on the perpendicular bisector of QR and also on the bisector of angle PQR .

Construct and label the position of the flag pole on your scale drawing. [2]

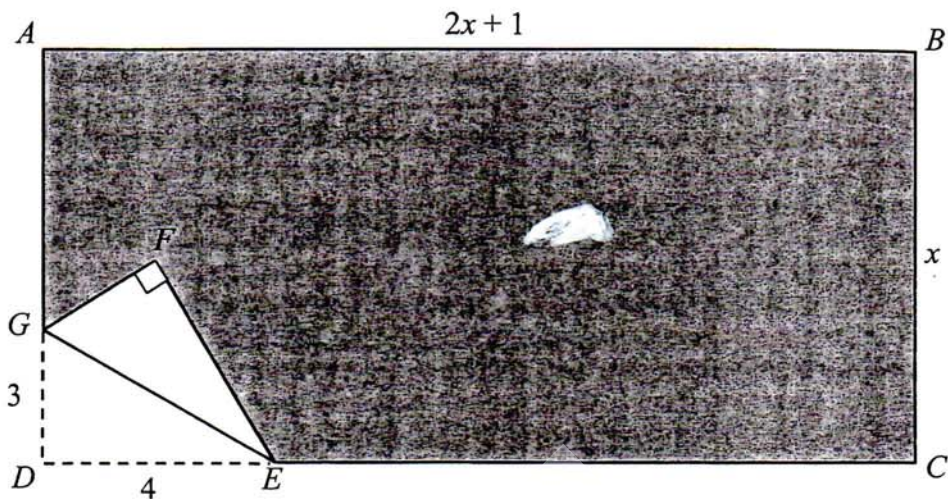
- 8 (a) Simplify $\sqrt{\frac{50x^{14}}{2x^0}}$. [2]

- (b) Factorise completely

(i) $12a^2 - 35a - 3$, [2]

(ii) $243p^2 - 48$. [2]

- 9 The diagram shows a rectangular piece of paper $ABCD$ which has been folded along EG such that D has moved to F .



$AB = (2x + 1)$ cm, $BC = x$ cm, $DE = 4$ cm and $GD = 3$ cm.

The shaded area $ABCEFG$ is 159 cm².

- (a) Write down an equation in x and show that it simplifies to $2x^2 + x - 171 = 0$. [3]
- (b) Solve the equation $2x^2 + x - 171 = 0$ and hence find the length of AB . [4]

- 10 The poster shows the admission ticket prices and the two modes of purchase for admission tickets to a museum.

Admission Ticket Price	
Adult	\$ 33
Child Ages 3 to 12 years old	\$ 22
Senior Citizen Ages 60 years old and above	\$ 16
All prices are inclusive of GST	

Online Purchase

Save 15% when you buy tickets online.

Ticketing Counter Purchase

- **Loyal Gold Card Members' Special Promotion in May and June**
Enjoy 55% off child admission tickets for the period 1 May 2018 to 30 June 2018.
Enjoy 10% off adult admission tickets for the period 1 May 2018 to 31 December 2018.
- **Prestige Rewards Card Members' Promotion**
Enjoy 30% off senior admission tickets for the period 1 June 2017 to 1 August 2018.

- (a) Mr Huang and his wife, both aged 38 years old, planned to bring their three primary school children to the museum on 5 June 2018.

If the family purchased their admission tickets at the ticketing counter/upon arrival, what is the overall percentage discount they could get by using a Loyal Gold card? [4]

- (b) Another group which consists of 10 adults aged 59 years old and below, 5 children and 2 senior citizens aged 60 years old and above visited the museum on 12 June 2018.

Joel claimed that the group will be able to save an amount of at least \$40 if they were to purchase their admission tickets using both Loyal Gold and Prestige Rewards cards at the ticketing counter upon arrival as compared to purchase the tickets online.

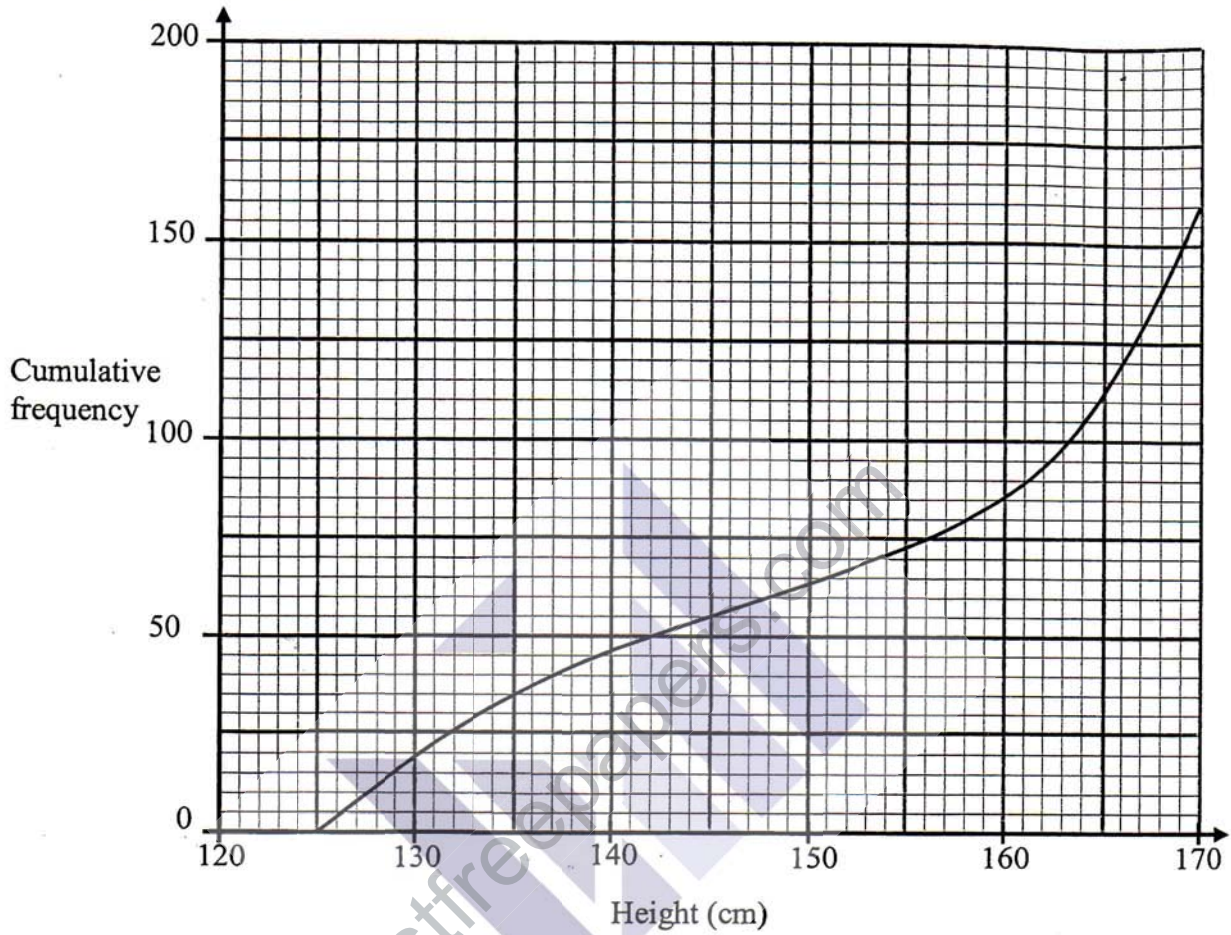
Do you agree with Joel?

Show workings to support your answer. [4]

Section B (8 marks)

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

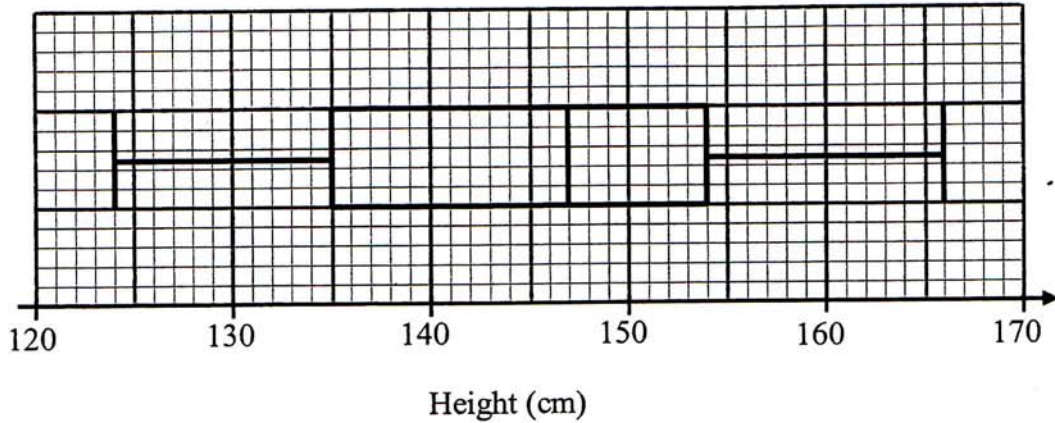
- 11** The heights, in cm, of 160 students from school *A* were measured.
The cumulative frequency graph summarises the results.



(a) Use the graph to estimate

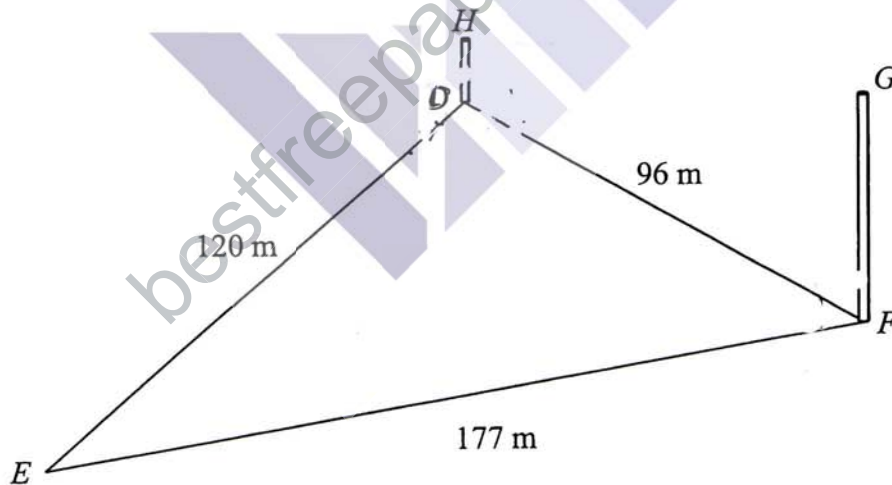
- (i)** the median, [1]
- (ii)** the interquartile range, [2]
- (iii)** the number of students who are taller than 161 cm tall. [1]

- (b) The heights, in cm, of 160 students from school B were measured. The results are summarized in the box-and-whisker plot below.



Compare the heights of the students from the two schools in two different ways. [4]

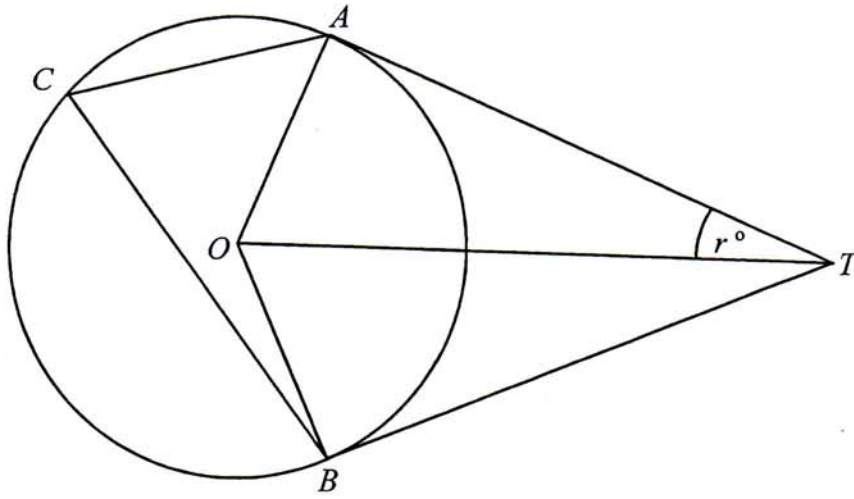
- 12 (a) D, E and F are three points on level ground.
 $DE = 120$ m, $EF = 177$ m and $FD = 96$ m.



- (i) Find angle EDF . [3]
- (ii) D and F are the foot of the vertical masts DH and FG respectively. It is given that $DH = 8$ m and $FG = 12$ m.

Calculate the angle of elevation of G from H . [2]

(b)



A , B and C are points on the circle centre O .
 AT and BT are tangents to the circle.
Angle $OTA = r^\circ$.

Find in terms of r ,

(i) angle AOB ,

[2]

(ii) angle ACB .

[1]

End of Paper

Qn	Marking Point	Marks Awarded	Remarks								
1ai	$6.093\ 861\ 064 = 6.09\ (3sf)$	B1									
1aii	$0.055\ 259\ 459\ 63 = 0.055\ 3\ (3sf)$	B1									
1b	$8^4 \times (32)^{\frac{1}{2}} = 2^n$ $(2^3)^4 \times (2^5)^{\frac{1}{2}} = 2^n$ $2^{12} \times 2^1 = 2^n$ $2^{13} = 2^n$ $n = 13$	M1 A1	Must be indices with base of 2								
2	Distance he walked $= 4 \times \frac{15}{60} = 1\ km$ Total distance = $1 + 2.6 = 3.6\ km$ Total time taken $= \frac{15}{60} + \frac{10}{60}$ $= \frac{25}{60}$ or $\frac{5}{12}\ h$ Average speed $= 3.6 \div \frac{25}{60}$ $= 8.64\ km/h$	M1 M1	Average speed concept								
3ai	angle $ADC = 117^\circ$ (Opposite angles of parallelogram)	B1	Accept equivalent reasons								
3aii	angle $CDE = 180^\circ - 117^\circ = 63^\circ$ (Adjacent angles on a straight line)	B1	Accept equivalent reasons								
3b	angle $DCE = 180^\circ - 54^\circ - 63^\circ = 63^\circ$ Triangle CDE is isosceles as it has a pair of equal angles.	M1 A1	Accept equivalent reasons								
4a	$82 - 71 = 11$	B1									
4b	$\frac{36\ 800\ 000}{100} \times 38$ $= 13\ 984\ 000$ $= 1.40 \times 10^7$	M1 A1 B1	M1 for dividing by 100								
4c	No, because this numerical value of 100 phones per 100 people refers to the average number of phones for the population. or figures given: $\frac{50(0)+50(2)}{100} = 100$ phones per 100 people	B1									
5a	$198 = 2 \times 3^2 \times 11$	B2	B1 - at least 2 correct prime factor								
5b	<table border="1"> <tr><td>2</td><td>90, 198</td></tr> <tr><td>3</td><td>45, 99</td></tr> <tr><td>3</td><td>15, 33</td></tr> <tr><td></td><td>5, 11</td></tr> </table> HCF = $2 \times 3^2 = 18$	2	90, 198	3	45, 99	3	15, 33		5, 11	M1 A1	
2	90, 198										
3	45, 99										
3	15, 33										
	5, 11										

Qn	Marking Point	Marks Awarded	Remarks
5c	A prime number can only have factors which include the number 1 and itself. A perfect cube will have the powers of its prime factors to be divisible by 3. Thus a prime number cannot be a perfect cube. $5x : 5y$ $\frac{1}{x} : \frac{1}{y}$	B1	Accept equivalent reasons
6a	$5x : 5y$ $\frac{1}{x} : \frac{1}{y}$	B2	1 mark for each correct ratio
6b	Amount $= 30000 \left(1 + \frac{2.1}{100}\right)^5$ $= \$ 33\ 285.10759$ $= \$ 33\ 285.11\ (2dp)$ Interest = $\$ 33\ 285.11 - 30\ 000 = \$ 3\ 285.11$	M1 M1 A1	Find interest accrued
7	Refer to attached.	B5	B1 - 10 cm for QR B1 - 95° B1 - 38° B1 - perpendicular bisector B1 - angle bisector
8a	$\sqrt{\frac{50x^{14}}{2x^0}}$ $= \sqrt{25x^{14}}$ $= 5x^7$	M1 A1	zero indices concept
8bi	$12a^2 - 35a - 3 = (12a + 1)(a - 3)$	B2	
8bii	$243p^2 - 48$ $= 3(81p^2 - 16)$ $= 3[(9p)^2 - 4^2]$ $= 3(9p + 4)(9p - 4)$ Area of rectangle $= x(2x + 1)\ cm^2$	M1 A1	1 mark for partial factorisation
9a	Area of 2 triangles = $3 \times 4 = 12\ cm^2$ Shaded area = 159 $x(2x + 1) - 12 = 159$ $2x^2 + x - 12 - 159 = 0$ $2x^2 + x - 171 = 0$ (showm)	M1 M1	
9b	$2x^2 + x - 171 = 0$ $(x - 9)(2x + 19) = 0$ $x = 9$ or $x = -9.5$ $AB = 2(9) + 1 = 19\ cm$	M1 M1 M1, A1	
10a	Ticket cost at counter without Loyal Gold card $= 33 \times 2 + 22 \times 3$ $= \$132$ Ticket cost at counter with Loyal Gold card $= 90 \times 33 \times 2 + \frac{45}{100} \times 22 \times 3$ $= \$59.40 + \29.70 $= \$89.10$	M1 M1	

Qn	Marking Point	Marks Awarded	Remarks
	$\% \text{ discount} = \frac{132 - 89.10}{132} \times 100 \%$ $= 32.5 \%$	M1 A1	
10b	Ticket cost at counter with discount $= \frac{90}{100} \times 33 \times 10 + \frac{45}{100} \times 22 \times 5 + \frac{70}{100} \times 16 \times 2$ $= 297 + 49.50 + 22.40$ $= \$368.90$ Ticket cost via online purchase $= \frac{85}{100} \times (33 \times 10 + 22 \times 5 + 16 \times 2)$ $= \$401.20$ Difference $= \$401.20 - \368.90 $= \$32.30 < \40 Do NOT agree with Joel.	M1 M1 A1 B1 M1, A1 B1	
11ai	158 cm	A1	
11aii	166 - 137 = 29 cm	B1	
11aiii	160 - 90 = 70 students	M1, A1	
11b	School B Median = 147 cm Interquartile range = 154 - 135 = 19 cm Students in school A are generally taller because A has a higher median of 158 cm compared to B's median of 147 cm. The interquartile range of school A, 29 cm is bigger than school B's of 19 cm. This implies the heights of students in school A is of a greater spread (or less consistent).	B1 B1 B1 B1	
12ai	$177^2 = 120^2 + 96^2 - 2(120)(96)\cos EDF$ $\cos EDF = \frac{120^2 + 96^2 - 177^2}{2(120)(96)}$ $\cos EDF = -\frac{857}{2560}$ angle $EDF = \cos^{-1}\left(-\frac{857}{2560}\right)$ angle $EDF = 109.558^\circ = 109.6^\circ$ (1dp)	M1 M1 A1	

Qn	Marking Point	Marks Awarded	Remarks
12aii	12 m - 8 m = 4 m Let θ be the angle of elevation of G from H $\tan \theta = \frac{4}{96}$ $\theta = \tan^{-1} \frac{4}{96}$ $\theta = 2.38594^\circ = 2.4^\circ$ (1dp)	M1 A1	
12bi	angle $AOT = 180^\circ - 90^\circ - r^\circ = 90^\circ - r^\circ$ angle $AOB = 2(90^\circ - r^\circ)$ $= 180^\circ - 2r^\circ$	B2	
12bii	angle $ACB = 0.5(180^\circ - 2r^\circ)$ $= 90^\circ - r^\circ$	B1	

Name	Index Number	Class
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WOODGROVE SECONDARY SCHOOL

N LEVEL PRELIMINARY EXAMINATION 2018

LEVEL & STREAM : SECONDARY 4 NORMAL ACADEMIC

SUBJECT (CODE) : ELEMENTARY MATHEMATICS (4045)

PAPER NO : 01

DATE / DAY : 16 August 2018 (Thursday)

DURATION : 2 Hours

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 soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your class, index number and name on 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, glue or correction fluid.

Answer all questions.

The number of marks in 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 the 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 three significant figures. Give answers in degrees to one decimal place.

For π , use either your calculator value or 3.142.

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 It is estimated that the population of Asia in 2020 will be 4.58 billion.

Express 4.58 billion in standard form.

Answer [1]

- 2 The total cost of an advertisement in a newspaper is obtained by adding together a fixed charge of \$5 and a charge of 15 cents per word

- (a) Calculate the total cost of an advertisement containing 75 words.

Answer \$ [2]

- (b) The total cost of an advertisement containing n words is C cents.

Write the formula for C in terms of n .

Answer [1]

- 3 Simplify

(a) $\left(\frac{2}{7}x^2\right)\left(\frac{1}{2}x^2\right)$,

Answer [1]

(b) $\frac{2}{7}x^2 + \frac{1}{2}x^2$.

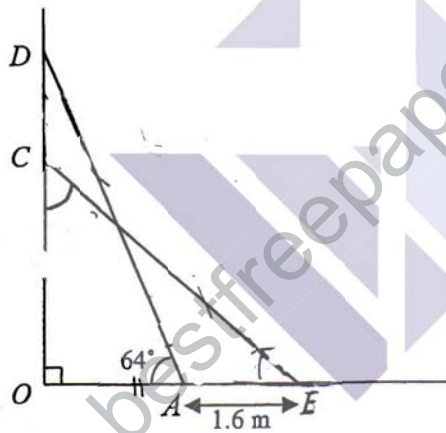
Answer [1]

4. Peter invests \$8500 in a bank which pays compound interest at a rate of 2.75% per annum.

Calculate the amount Peter has in the bank after 3 years.

Answer \$ [2]

A 5 metre ladder, AD , stands on horizontal ground at A and leans against a vertical wall at D . It makes an angle of 64° with the ground. The point O , on the ground, is vertically below D . The ladder slides down the wall to C . As a result, the base of the ladder moves a distance of 1.6 m from A to B .



Find the angle it now makes with the ground.

Answer ° [3]

- 6 Sharon paid \$368.60 for a digital camera.
This amount included the 7% Goods and Services Tax (GST).

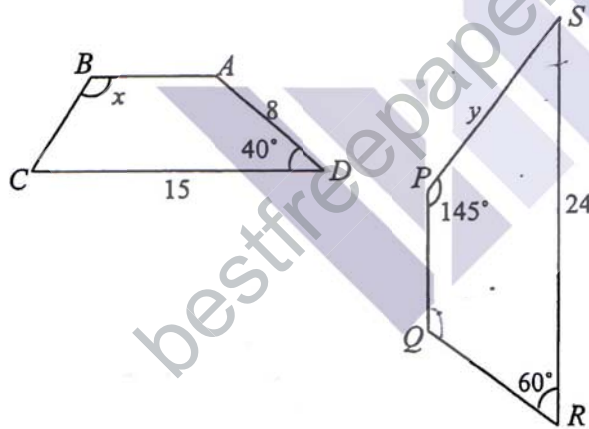
How much GST did Sharon pay?

Answer \$ [2]

- 7 (a) Quadrilateral $ABCD$ is similar to quadrilateral $PQRS$.

Find the values of x and y .

(All the lengths are in centimetres. The diagrams are not drawn to scale.)



Answer $x = \dots\dots\dots^\circ$ [1]

$y = \dots\dots\dots$ cm [1]

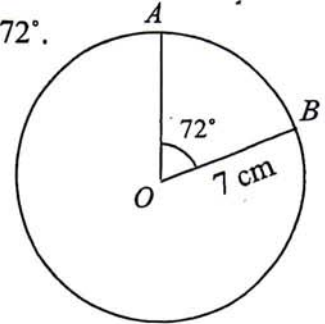
(b) Is quadrilateral $PQRS$ a trapezium? Explain why or why not.

Answer

[1]

8 A circle, centre O , has radius 7 cm.
 A and B are points on the circumference and angle $AOB = 72^\circ$.

Find the perimeter of the **minor sector** AOB .



Answer cm [2]

9 Ahmad either jogs, cycles or swims every Saturday.
The probability that he jogs is $\frac{2}{5}$. The probability that he cycles is $\frac{1}{4}$.

(a) Write down the probability that he does not jog.

Answer [1]

(b) What is the probability that he swims?

Answer [1]

- 10 (a) Express the ratio of 72 minutes to 1.8 hours in its simplest form.

Answer : [1]

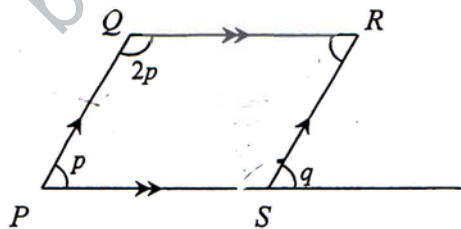
- (b) A plan is drawn to a scale of 1 : 125.

Find the actual length in metres, of a room which is 4.5 cm long on the plan.

Answer m [2]

- 11 $PQRS$ is a parallelogram.

Find the values of p and q .
You **must** show your working and state your reasons.



Answer $p =$ ° [1]

$q =$ ° [1]

12 For angle values between 0° and 180° , write down

(a) the value of x when $\cos x = -0.453$,

Answer $x = \dots\dots\dots^\circ$ [1]

(b) two values of y when $\sin y = 0.745$.

Answer $y = \dots\dots\dots^\circ$ or $\dots\dots\dots^\circ$ [2]

13 By rounding off each number to a value that is most appropriate, estimate, without the use of calculator, the value of

$$\frac{5.32 + \sqrt{9.59}}{\sqrt[3]{508}}$$

You must show your working.

Answer $\dots\dots\dots$ [2]

14 A car travels 256 km along an expressway in 3 hours 42 minutes.

Find the car's average speed in

(a) kilometres per hour.

Answer $\dots\dots\dots$ km/h [1]

(b) metres per second.

Answer $\dots\dots\dots$ m/s [2]

15

5, 8, 11, 14,

For the sequence shown above, find

(a) the next two terms,

Answer and [1]

(b) the n th term,

Answer [1]

(c) the 50th term.

Answer [1]

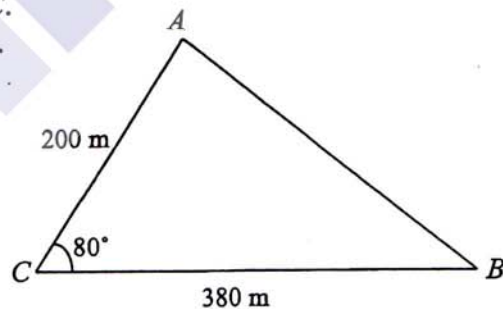
16

A vegetable field is in the shape of triangle ABC .
 $AC = 200$ m, $CB = 380$ m, and angle $ACB = 80^\circ$.

A farmer expects to harvest 2.5 kg of carrots from each square metre of field.

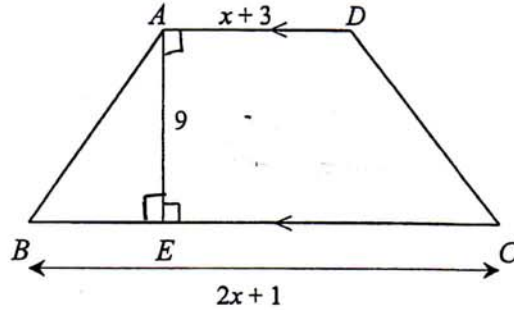
Find the mass of carrots he can harvest if he grows only carrots in the triangular field.

Express your answer in tonnes.



Answer tonnes [3]

- 17 Figure $ABCD$ below is a trapezium, where $AD = (x + 3)$ cm, $BC = (2x + 1)$ cm, $AE = 9$ cm and the area of the trapezium $ABCD$ is 108 cm^2 .



Find the value of x .

Answer cm [2]

- 18 A garden in a school is in the shape of a sector of a circle. On a plan drawing of the school, the length of the straight side of the garden is drawn to be 2 cm. On the actual ground, the length of this side of the garden is 10 m.

(a) Find the scale factor of the reduction represented on the plan drawing.

Answer [2]

(b) Show that the angle of the vertex of the sector is 1 rad if the curve side of the garden has the same length as the straight side.

Answer

[1]

(c) Hence, find the area of the actual garden.

Answer m^2 . [2]

19 The number 72, written as the product of its prime factors, is $2^3 \times 3^2$.

(a) Write 84 as the product of its prime factors.

Answer [1]

(b) Use the results of part (a) to find

(i) the highest common factor of 72 and 84,

Answer [1]

(ii) the lowest common multiple of 72 and 84,

Answer [1]

(iii) the smallest integer k such that $84k$ is a perfect square.

Answer [1]

- 20 (a) Write down the size of one exterior angle of a regular 10-sided polygon.

Answer ° [1]

- (b) Three angles in a hexagon are 110° each.
The size of the remaining three angles are in the ratio 2 : 5 : 6.

Find the smallest of these three angles.

Answer ° [3]

- 21 (a) Factorise $15x + 15$.

Answer [1]

- (b) Expand $(3x - 7)(2x + 5)$ and simplify your answer.

Answer [2]

- (c) Express the following as a single fraction in its simplest form.

$$\frac{3}{(y-2)} - \frac{4}{y}$$

Answer [2]

- 22 The stem-and-leaf diagram below shows the heights, in cm, of a group of boys and girls in a class.

Boys						Girls				
			4	2	13	8				
9	8	2	1	1	14	2	3	4	5	6
				1	15					
		9	8	2	16	2	3	3	3	3
				4	17	0	5			
Key (Boys)						Key (Girls)				
4 17 means 174						16 3 means 163				

- (a) How many boys are there in the class?

Answer [1]

- (b) Complete the cumulative frequency table using the data above.

Height of students, h	Cumulative frequency
$h \leq 140$	3
$h \leq 150$	
$h \leq 160$	
$h \leq 170$	
$h \leq 180$	

[2]

- (c) Find the percentage of students who are taller than 170 cm.

Answer % [2]

23 x is a positive number and y is a negative number.

(a) It is given that $0.5x < 21$.

Find the largest possible value of integer x .

Answer [1]

(b) The difference between x and y is 34.

Write down an equation relating x and y .

Answer [1]

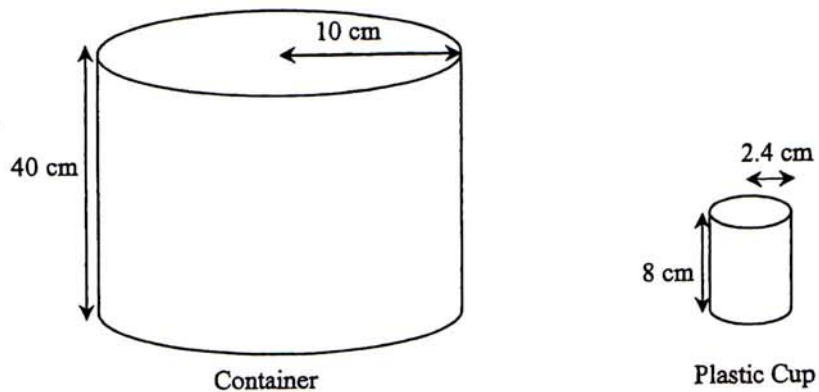
(c) It is also known that the sum of three times of x and seven times of y is 32.

Write down another equation and solve them simultaneously to find the two numbers.

Answer $x =$

$y =$ [4]

- 24 Orange juice is stored in a large cylindrical container. The radius of the container is 10 cm and its height is 40 cm.



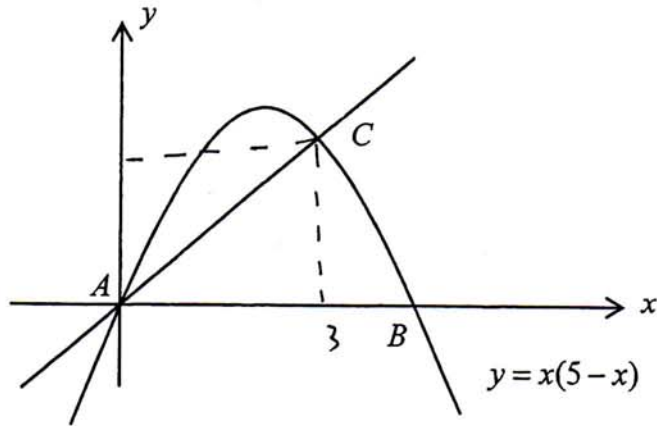
- (a) Find the volume of orange juice in the large container.
Express your answer in litres.

Answer litres [2]

- (b) All of the orange juice is used to fill cylindrical plastic cups with radius, 2.4 cm and height 8 cm.
What is the maximum number of cups that can be filled?

Answer cups [3]

- 25 The diagram shows the curve $y = x(5 - x)$ intersecting the x -axis at A and B . A straight line intersects the curve at C .



- (a) Find the coordinates of A and B .

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

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

- (b) Given that the x -coordinate of C is 3,

- (i) find the coordinates of C ,

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

- (ii) the length of AC .

Answer cm [2]

END OF PAPER

Solutions for Sec 4NA EM Prelim 2018 Paper 1
 Setter: Mr Manson Yip

1	4.58×10^9	BI
2 a	$75 \times 0.15 = \$11.25$ Total cost = $5 + 11.25$ = $\$16.25$	M1 A1
b	$C = 500 + 15n$	BI
3 a	$\frac{x^4}{7}$	BI
b	$\frac{4x^2 + 7x^2}{14}$ $= \frac{11x^2}{14}$	M1 BI
4	Amount = $8500 \left(1 + \frac{2.75}{100}\right)^3$ = 9220.7111 = $\$9220.71$ (to nearest cent)	M1 A1
5	$\cos 64^\circ = \frac{OA}{5}$ $OA = 5 \times \cos 64^\circ = 2.1918$ m $OB = 2.1918 + 1.6 = 3.7918$ m $\cos \angle CBO = \frac{3.7918}{5}$ $\angle CBO = \cos^{-1} \left(\frac{3.7918}{5} \right)$ = 40.7° (1dp)	M1 M1 A1
6	$GST = \frac{7}{107} \times 368.60$ = 24.114 = $\$24.11$ (nearest cent)	M1 A1
7 a	$x = 360 - 145 - 60 - 40$ = 115° $\frac{y}{8} = \frac{24}{15}$ $y = 12.8$ cm	BI BI

b Not a trapezium.
 $\angle Q + \angle R = 115^\circ + 60^\circ \neq 180^\circ$

8	Arc length $AB = \frac{72}{360} \times 2 \times \pi \times 7$ = 8.7965 cm Perimeter = $7 + 7 + 8.7965$ = 22.7965 cm = 22.8 cm (3sf)	BI A1
9 a	$P(\text{does not jog}) = 1 - \frac{2}{5}$ = $\frac{3}{5}$ $P(\text{swims}) = 1 - \frac{2}{5} - \frac{1}{4}$ = $\frac{7}{20}$	BI
10 a	$72 \text{ min} : 1.8 \times 60 \text{ min}$ = $2 : 3$ b $1 \text{ cm} : 1.25 \text{ m}$ $4.5 \text{ cm} : 1.25 \times 4.5 \text{ m}$ = 5.625 m	BI M1 A1
11	$2p + p = 180^\circ$ (Interior $\angle s$) $p = 60^\circ$ $p = q = 60^\circ$ (Corresponding $\angle s$)	Deduct 1 mark if any one reason not shown. BI BI
12 a	$x = 116.9$ b $y = 48.2,$ 131.8	BI BI BI
13	$\frac{5 + \sqrt{9}}{\sqrt[3]{512}}$ = 1	M1
14 a	Average Speed = $256 + 3 \frac{42}{60}$ = 69.189 = 69.2 km/h (3sf)	BI

b Ave Speed = $\frac{256 \times 1000}{222 \times 60}$
 = 19.219
 = 19.2 m/s (3sf)

MI

15 a 17 and 20
b $2+3n$
c $2+3(50) = 152$

BI

BI

BI

16 Area of field = $\frac{1}{2}(200)(380)\sin 80^\circ$
 = 37 422.694 m²

MI

Mass of carrots = $2.5 \times 37\ 422.694$
 = 93 556.7 kg
 = 93.6 tonnes (3sf)

MI

A1

17 $\frac{1}{2}(x+3+2x+1)(9) = 108$
 $x = 6\frac{2}{3}$ or 6.67 (3sf)

MI

A1

Accept 6.67

18 a $\frac{2}{1000}$
 $\frac{1}{500}$

MI

A1

b $s = r\theta$
 $10 = 10\theta$
 $\theta = 1$ rad

BI

c Area = $\frac{1}{2}(10)^2(1)$
 = 50 m²

MI

A1

19 a $84 = 2^2 \times 3 \times 7$
b (i) HCF = 12
 (ii) LCM = 504
 (iii) $k = 21$

BI

BI

BI

BI

20 a One Exterior $\angle = \frac{360}{10} = 36^\circ$

BI

b Sum of interior $\angle s = 720^\circ$
 $720 - (3 \times 110) = 390^\circ$
 Smallest $\angle = \frac{2}{13} \times 390$
 = 60°

MI

MI

21 a $15(x+1)$

A1

BI

b $(3x-7)(2x+5)$
 = $6x^2 - 14x + 15x - 35$
 = $6x^2 + x - 35$

MI

A1

c $\frac{3}{(y-2)} - \frac{4}{y}$
 = $\frac{3y-4(y-2)}{y(y-2)}$
 = $\frac{3y-4y+8}{y(y-2)}$
 = $\frac{y(y-2)}{8-y}$
 = $\frac{y(y-2)}{y(y-2)}$

MI

A1

22 a Number of boys = 12

BI

Height of students, h	Cumulative frequency
$h \leq 140$	3
$h \leq 150$	13
$h \leq 160$	14
$h \leq 170$	23
$h \leq 180$	25

b

c $\frac{2}{25} \times 100\%$
 = 8%

MI

A1

23 a $x < 42$
 Largest integer = 41

BI

b $x - y = 34$

BI

c $3x + 7y = 32$

BI

$3(34+y) + 7y = 32$
 $102 + 10y = 32$
 $y = \frac{32-102}{10} = -7$
 $y = -7, x = 27$

MI

A1

A1

24 a Volume = $\pi \times 10^2 \times 40$
 = 12568 cm³
 = 12.568 litres

M1

A1

b Volume of cup = $\pi \times 2.4^2 \times 8$
 = 144.78 cm³

M1

Number of cups = $12568 \div 144.78$
 = 86.807

M1

Max. number of filled cups = 86

A1

25 a A(0, 0)

B1

B(5, 0)

B1

b (i) C(3, 6)

B1

(ii) AC = $\sqrt{3^2 + 6^2}$

M1

= 6.71 units (3sf)

A1

bestfreepapers.com

Mathematical Formulae

Compound Interest

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

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

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

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

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

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

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

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

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

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

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

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

Mensuration

Trigonometry

Statistics

Calculator Model:

Index Number

Class

Name



WOODGROVE SECONDARY SCHOOL N LEVEL PRELIMINARY EXAMINATION 2018

LEVEL & STREAM : SECONDARY 4 NORMAL (ACADEMIC)
 SUBJECT (CODE) : ELEMENTARY MATHEMATICS (4045)
 PAPER NO : 02
 DATE / DAY : 15 AUGUST 2018 / WEDNESDAY
 DURATION : 2 HOURS

READ THESE INSTRUCTIONS FIRST

Write your answers and working on the separate writing paper provided.
 Write your class, index number and name on 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, glue or correction fluid.

Section A
Answer all questions.

Section B
Answer one question.

The number of marks in 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 correct to three significant figures. Give answers in degrees to one decimal place.

For π , use either your calculator value of 3.142.

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

DO NOT TURN OVER THE QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.

Section A (53 marks)

Answer all the questions in this section.

- 1 (a) Factorise $3p^2 - 27$ completely. [2]
 (b) It is given that $r = \frac{2p-5}{q}$. [1]
 (i) Find the value of r when $p = 8$ and $q = 12$. [1]
 (ii) Express p in terms of q and r . [2]

- 2 The scale of a map is 1 : 40 000. [2]
 (a) Find, in cm, the length of a line on the map representing a road of 12.5 km. [2]
 (b) Find the actual area of a plot of land, in km^2 , which when represented on the map is 45 cm^2 . [2]

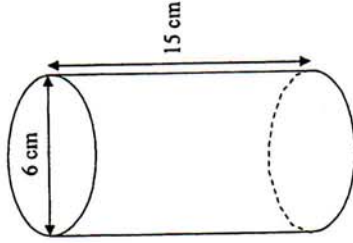
- 3 Nolan wanted to find out the mean height of adult Singaporean males. He obtained the heights of seven of his adult male colleagues to calculate the mean height. Their heights (in metres) are shown below.

1.53 1.57 1.63 1.67 1.72 1.74 1.82

- (a) Explain why Nolan's method is not a good method for obtaining the mean height of adult Singaporean males. [1]
 (b) Calculate the mean height of Nolan's seven colleagues. [2]
 (c) Calculate the standard deviation of the heights of Nolan's seven colleagues. [2]

- 4 The quadrilateral $PQRS$ has $PQ = 5 \text{ cm}$, $QR = 7 \text{ cm}$, $RS = 6 \text{ cm}$, $SP = 8 \text{ cm}$ and $\angle PQR = 110^\circ$. [2]
 (a) Construct the quadrilateral $PQRS$. [1]
 (b) Construct the angle bisector of $\angle PQR$. [1]
 (c) Construct the perpendicular bisector of PQ . [1]
 (d) At the point where the two lines from (b) and (c) intersect, mark the point with M . Measure and write down the length of PM . [2]

- 5 The diagram below shows a closed cylinder with diameter of 6 cm and height of 15 cm.



Taking $\pi = 3.142$, find

- (a) the volume of the cylinder, [2]
 (b) the total surface area of the cylinder. [2]

- 6 Mr Dawson sold 10 cars valued at \$150 000 each and received a commission of 1.5% on each of his sales. He spent \$3000 on advertisements and 20% of the remainder of his commission on petrol.

- (a) How much was his total commission? [2]
 (b) How much did he spend on petrol? [2]

- 7 A straight line passes through the points (0, 3) and (1, 8). Find

- (a) the gradient of the line, [2]
 (b) the equation of the line. [1]

- 8 Timothy started his journey at 0730. He travelled from Town A to Town B which was 36 km apart at an average speed of 48 km/h. He continued his journey travelling at an average speed of 54 km/h from Town B and arrived at Town C 1 hour 30 minutes later.

Calculate

- (a) the time, in hours, he took to arrive at Town B, [2]
 (b) the distance between Town B and C, [2]
 (c) the average speed, in km/h, for the whole journey. [2]

5

- 9 (a) Given that $v^2 = u^2 + 2as$, express s in terms of u , v and a . [2]
 (b) Solve the equation $\frac{x}{x-1} + \frac{2}{5} = \frac{3}{2}$ [3]
 (c) Solve $x^2 + 2x - 15 = 0$. [3]

10 The table below shows part of the PUB bill incurred for electricity, gas and water for the household use by Mr Waryce'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 Pre 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 Mr Waryce'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. [2]
 (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]

6

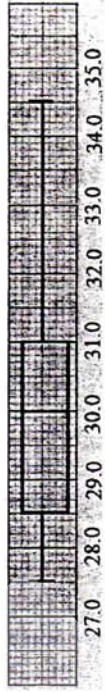
Answer one question in this section. Each question carries 7 marks.

11 The average daily temperature, in degrees Celsius ($^{\circ}\text{C}$), of City A measured for 11 days are shown below.

29.5	32.1	33.2	30.1	33.9	32.7	29.9	33.0	30.7	33.6	29.9
------	------	------	------	------	------	------	------	------	------	------

- (a) Find
 (i) the range, [1]
 (ii) the median temperature, [1]
 (iii) the interquartile range. [3]

(b) The box-and-whisker diagram shows the average temperature of City B in the same period.



A report commented that the average temperature of City B during these 11 days is generally higher than that of City A. Do you agree? Give a reason to support your answer. [2]

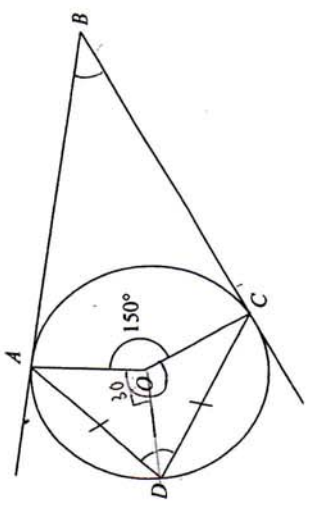
Section B (7 marks)

12 In the diagram below, AB and BC are tangents to the circle, with centre O , $AD = DC$ and

2

7

$\angle AOC = 150^\circ$.



(a) Stating the reasons clearly, find

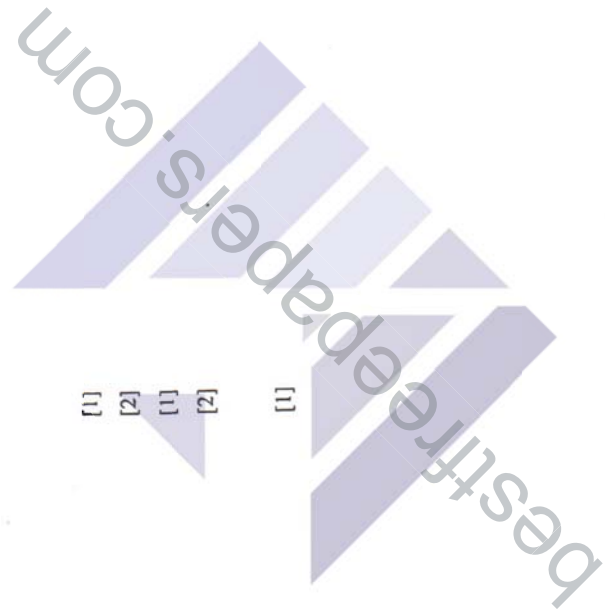
- (i) $\angle OAB$.
- (ii) $\angle ABC$.
- (iii) $\angle ADC$.
- (iv) $\angle DAO$.

[1] [2] [1] [2]

(b) Name the quadrilateral $ABCD$.

[1]

END OF PAPER 2




Woodgrove Secondary School

2018 Sec 4NA Prelim Mark Scheme
Paper 2

Section A

Qn.	Solution	Marks	Remarks
1(a)	$3(p^2 - 9)$ $= 3(p - 3)(p + 3)$	M1 A1	1 mark common factor 1 mark $a^2 - b^2$
1(b)(i)	$r = \frac{11}{12}$	B1	
1b(ii)	$rq = 2p - 5$ $p = \frac{rq+5}{2}$	M1 A1	
2(a)	Actual : Map 40 000 : 1 40 000 cm : 1 cm 0.4 km : 1 cm 12.5 km : 0.4 cm 12.5 km : 31.25 cm Map length = 31.25 cm	M1 A1	
2(b)	Map : Actual 1 cm : 0.4 km 1 cm ² : 0.16 km ² 45 cm ² : 0.16 × 45 km ² 45 cm ² : 7.2 km ²	M1 A1	
3(a)	Sample size is too small; Should consider a wider range of Singaporeans, from other workplaces; His colleagues may not be Singaporeans	B1	Accept any appropriate answer
3(b)	Mean = $\frac{1.53 + 1.57 + 1.63 + 1.67 + 1.72 + 1.74 + 1.82}{7}$ $= \frac{11.68}{7}$ ≈ 1.67 m (3 s.f) or $1 \frac{117}{175}$	M1 A1	Accept B2

Qn.	Solution	Marks	Remarks
3(c)	$S.D = \sqrt{\frac{19.55}{7} - \left(\frac{11.68}{7}\right)^2}$ $= 0.093415913$ ≈ 0.0934 m (3 s.f)	M1 A1	Accept B2
4a/b/c	 4 sides of a quadrilateral drawn - B1 $\angle PQR$ measured and drawn correctly - B1 Perpendicular bisector constructed correctly - B1 Angle bisector constructed correctly - B1	B1 B1	4.1 - 4.5 cm
4(d)	4.3 cm Mark and label M	B1 B1	4.1 - 4.5 cm
5(a)	Volume = $3.142(3)^2(15)$ $= 424.17$ cm ³	M1 A1	Penalise for D.O.A if exact answer is not given.
5(b)	Curved surface area = $(3.142)(6)(15)$ $= 282.78$ Total surface area = $282.78 + 2(3.142)(3)^2$ $= 339.336$ cm ²	M1 A1	Penalise for D.O.A if exact answer is not given.

Qn.	Solution	Marks	Remarks
6a	Total commission = $\frac{1.5 \times 100 \times 150000}{100}$ = \$22500	M1 A1	
6b	Amount spent on petrol = $\frac{20}{100} \times (22500 - 3000)$ = \$3900	M1 A1	
7a	Gradient of the line = $\frac{8-3}{1-0}$ = 5 Hence, the gradient of the line is 5. Equation of line: $y = 5x + 3$	M1 A1 B1	
8a	Time = $\frac{36}{48}$ = $\frac{3}{4}$ h or 0.75h	M1 A1	
8b	1 h 30 min = 1.5 h Distance = 54×1.5 = 81 km	M1 A1	
8c	Total distance = $36 + 81$ = 117 km Total time = $0.75 + 1.5$ = 2.25 h Average speed = $\frac{117}{2.25}$ = 52 km/h	M1 A1	
9(a)	$v^2 = u^2 + 2as$ $v^2 - u^2 = 2as$ $s = \frac{v^2 - u^2}{2a}$	M1 A1	

Qn.	Solution	Marks	Remarks
9(b)	$\frac{x}{x-1} + \frac{2}{5} = \frac{3}{2}$ $\frac{x(5)}{5(x-1)} + \frac{2(x-1)}{5(x-1)} = \frac{3}{2}$ $\frac{5x+2(x-1)}{5(x-1)} = \frac{3}{2}$ $\frac{5x+2x-2}{5(x-1)} = \frac{3}{2}$ $\frac{7x-2}{5x-5} = \frac{3}{2}$ $\frac{2(7x-2)}{5x-5} = \frac{3(5x-5)}$ $14x-4 = 15x-15$ $14x-15x = -15+4$ $-x = -11$ $x = 11$	M1	
9(c)	$x^2 + 2x - 15 = 0$ $(x+5)(x-3) = 0$ $x+5=0$ or $x-3=0$ $x=-5$ $x=3$	M1 A1/A1	
10(a)	Amount = $13 \times 1.17 = \$15.21$	B1	
10(b)	Total = $(234 \times 0.2728) + (12 \times 0.1799) + 15.21$ = 81.204 GST = $\frac{7}{100} \times 81.204$ = \$5.68 (2.d.p)	M1 A1	
10(c)	Decrease = $12 - 10$ = 2kWh Percentage = $\frac{2}{12} \times 100\%$ = 16.7% (3 s.f)	M1 A1	

5

Qn.	Solution	Marks	Remarks
10(d)	Electricity = $1.2 \times 234 \times 0.2728$ = \$76.602 Total bill = $76.602 + (10 \times 0.1799) + 15.21$ = 93.611 With GST = 93.611×1.07 = \$100.16 (2d.p)	M1 M1 A1	
Section B			
11(a)(i)	$33.9 - 29.5 = 4.4^\circ\text{C}$	B1	
11a(ii)	32.1°C	B1	
11a(iii)	$Q_1 = 29.9^\circ\text{C}$	M1	
	$Q_3 = 33.2^\circ\text{C}$	M1	
	interquartile range = $33.2 - 29.9$ = 3.3°C	A1	
11(b)	No. Median of City A is 32.1°C , higher than that of B, 30.0°C .	B1 B1	
12a	$\angle OAB = 90^\circ$ (tangent \perp radius of circle)	B1	Minus 1 mark if reasons not stated
12a(ii)	$\angle AOB = 75^\circ$ (OB bisects $\angle AOB$)	M1	
	$\angle ABO = 15^\circ$ (sum of angles in triangle) $\angle ABC = 30^\circ$	A1	
12a(iv)	$\angle ADC = \frac{150}{2}$ = 75°	B1	
	(\angle at centre = twice \angle at circumference)		
12a(iv)	$\angle AOD = \frac{360 - 150}{2} = 105^\circ$	M1	
	$\angle DAO = \frac{180 - 105}{2} = 37.5^\circ$ (isosceles Δ)	A1	
12b	Kite	B1	



YUYING SECONDARY SCHOOL

PRELIMINARY EXAMINATION Secondary 4 Normal (Academic)

NAME

CLASS

REG. NO

MATHEMATICS SYLLABUS A

4045/01

Paper 1

15 August 2018

2 hours

Candidates answer on the Question Paper.

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.

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 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.

Answer **all** the questions.

1

(a) Calculate the exact value of $\frac{1.5^2 \times 8}{10.2 + 1.8}$.

Answer [1]

(b) Evaluate $\sqrt{9.3^3 - 1.55}$.
Give your answer correct to 2 decimal places.

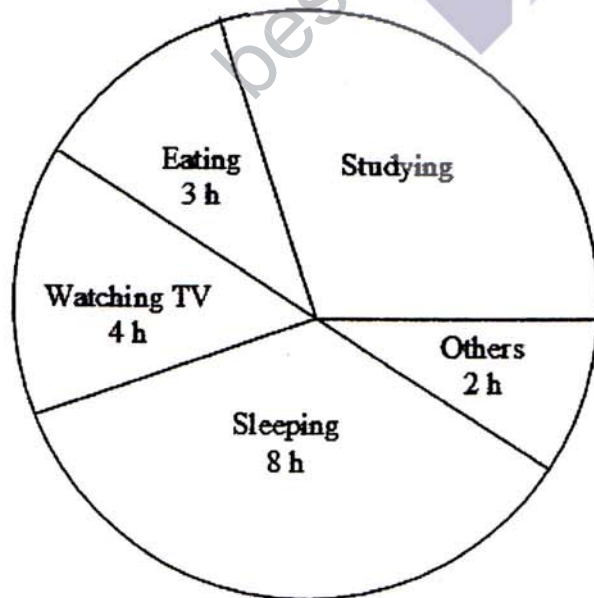
Answer [1]

2

A straight line passes through the points $A(1, -2)$ and $B(3, 4)$. Calculate the gradient of the line AB .

Answer [2]

3 The following pie chart shows the number of hours Peter spent on a particular day. Calculate the angle of the sector representing 'Studying'.

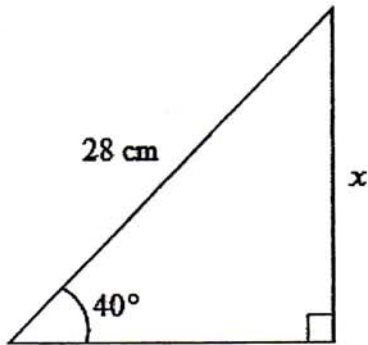


Answer° [2]

- 4 A bank charges 2.5% simple interest per year. Johnson borrowed a sum of money from the bank for 3 years and paid a total interest of \$412.50. How much did Johnson borrow?

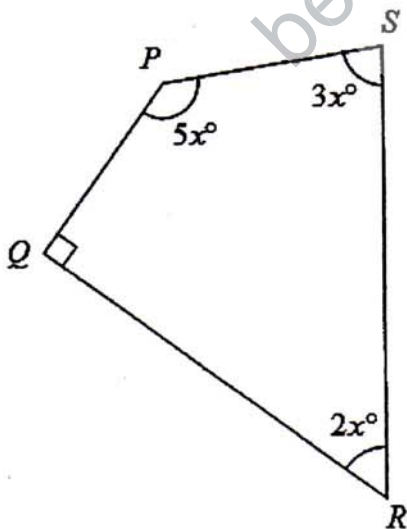
Answer \$ [2]

- 5 Find the value of x in the right-angled triangle below.



Answer $x =$ cm [2]

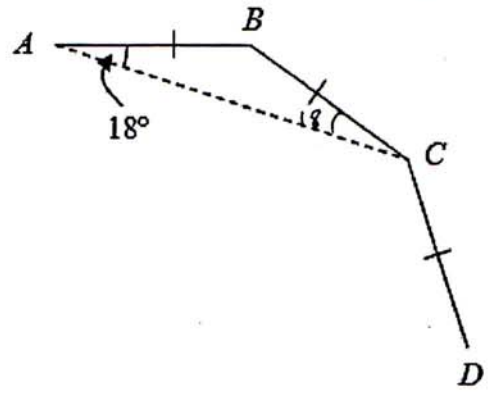
- 6 In the figure, PQRS is a quadrilateral and $\angle PQR$ is a right angle. Find the value of x .



Answer $x =$ [2]

[Turn over

7 *AB, BC and CD* are adjacent sides of a regular polygon, where $\angle CAB = 18^\circ$. Find the number of sides that this polygon has.



Answer [3]

8

5, 8, 9, 11, 14, 18, 25, 30

(a) From the above list, write down a number which is a perfect cube.

Answer [1]

(b) From the list above, write down a prime number.

Answer [1]

(c) Calculate the smallest number as a percentage of the largest number.

Answer% [1]

- 9 The diagram shows the travel itinerary of Alex's trips between Singapore and Melbourne. For both trips, the duration of the flight is the same. The time in Melbourne is 2 hours ahead of Singapore time.

FLIGHT	DEPARTURE	ARRIVAL
TZ 26 Scoot	Singapore (SIN) 06 Jun 2016 01:20am	Melbourne (MEL) 06 Jun 2016 10:40am
TZ 25 Scoot	Melbourne (MEL) 03 Jul 2016 11:20am	

- (a) Calculate the duration of the flight from Singapore to Melbourne. Give your answer in hours and minutes.

Answer h mins [1]

- (b) On 3 July, Alex was supposed to have a dinner appointment with his colleague at Changi City Point, Singapore at 7 pm. Determine if Alex was able to make it for the dinner. Justify your answer with clear reasoning.

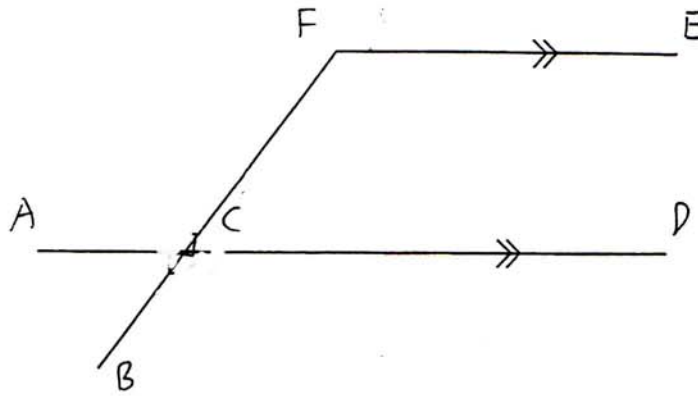
Answer [1]

- 10 The diameter of a circular cell is 2500 nanometres. Giving your answer in standard form, find the area of each cell.

Answerm² [3]

[Turn over

- 11 Given that the lines ACD and FE are parallel, BCF is a straight line and $\angle ACF = 100^\circ$.



Stating your reasons clearly, calculate

- (a) $\angle BCD$,

Answer° [1]

- (b) reflex angle, $\angle BFE$.

Answer° [2]

- 12 A fair six-sided die is rolled. The sides are labelled the numbers 1, 2, 3, 4, 5 and 6.

Find the probability of getting

- (a) a number more than 3,

Answer [1]

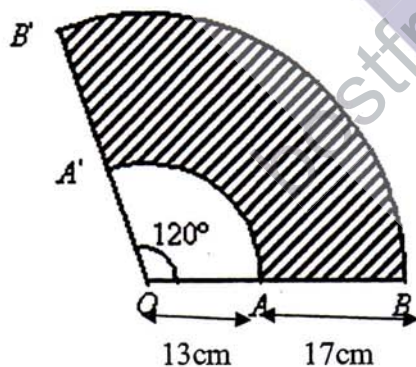
- (b) a number which is a multiple of 4,

Answer [1]

- (c) 2 or 5.

Answer [1]

- 13 The shaded area in the diagram represents the part of the flat windscreen of a car which is being wiped by the windscreen wiper AB . The wiper rotates through 120° about O and $OA = OA' = 13$ cm and $AB = A'B' = 17$ cm.



Calculate the area of the screen which is wiped.

Answercm² [3]

[Turn over

14 Solve

(a) $7y = 2y - 15$,

Answer $y = \dots\dots\dots$ [1]

(b) $x(x+2) = 8$

Answer $x = \dots\dots\dots$ or $\dots\dots\dots$ [3]

15 The mass ratio of nuts, chocolate chips and raisins in a fruit bar is 4 : 1 : 3.

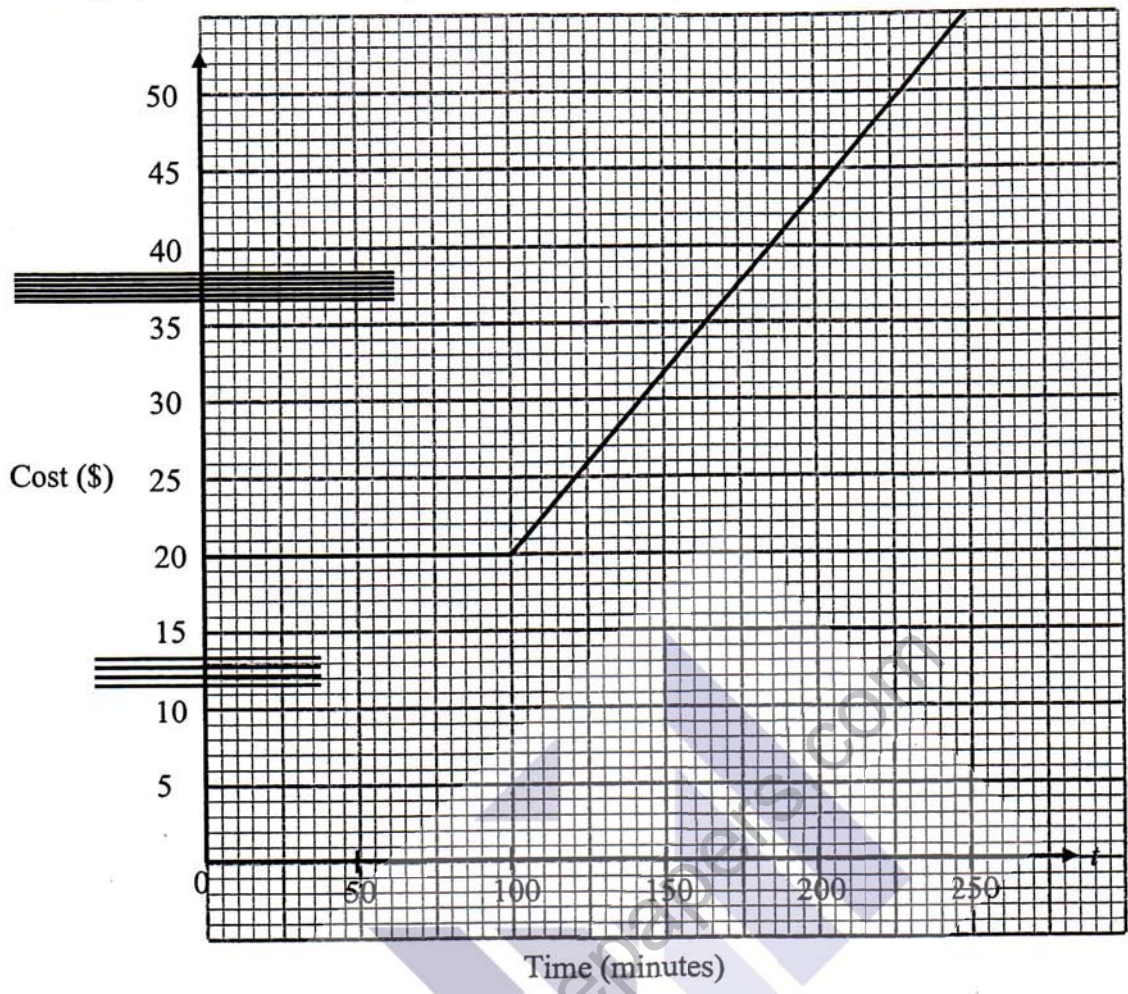
(a) Calculate the mass of nuts in a 50 g fruit bar.

Answer $\dots\dots\dots$ g [1]

(b) Nuts cost \$4.50 per kg, chocolate chips cost \$8.60 per kg and raisins cost \$4 per kg. Calculate the cost price of each 50 g fruit bar, correct to the nearest cent.

Answer \$ $\dots\dots\dots$ [3]

16 The graph shows the monthly cost of the mobile phone talk time supplied by StarTel.



(a) Pat used up 85 minutes of talk time by StarTel. Use the graph to find the amount she was charged.

Answer \$..... [1]

(b) SingHub charges a basic fee of \$25 per month for the first 50 minutes and \$5 for every subsequent 50 minutes. On the above graph, draw the line to represent the cost of talk time supplied by SingHub. [2]

(c) Pat's monthly cost on phone bill will be cheaper using SingHub if she uses more than a certain amount of call time. Use your graph to find the call time.

Answermin [1]

[Turn over

17 The first four terms of a sequence are 17, 14, 11, 8.

(a) Write down the next two terms in the sequence.

Answer, [1]

(b) Find an expression for the n th term of the sequence.

Answer [1]

(c) The n th term of the sequence is -88 . Find the value of n .

Answer $n =$ [2]

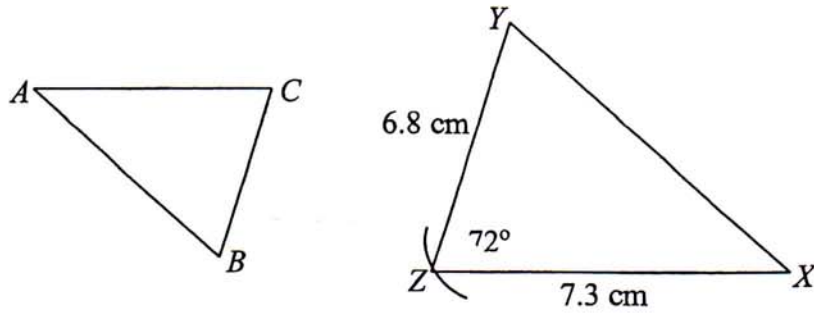
18 (a) Ace and Ben agreed to split the cost of buying a toy car in the ratio 3 : 4 respectively. If Ben paid \$25 for his share, calculate the cost of the toy car.

Answer \$ [2]

(b) Ace and Ben paid together \$480 to buy a present for Carl. If Ace paid \$120 more than Ben, write the amount of money paid by Ace to Ben as a ratio in its simplest form.

Answer : [2]

19 ABC and XYZ are similar triangles.



(a) ABC is a reduction of XYZ . If the scale factor is 0.6 , find the length of BC .

Answer $BC = \dots\dots\dots\text{cm}$ [1]

(b) Find the area of triangle XYZ .

Answer $\dots\dots\dots\text{cm}^2$ [2]

- 20 The table below shows the distribution of the timing taken by 20 students to complete a quiz.

Time (min)	$0 < t \leq 5$	$5 < t \leq 10$	$10 < t \leq 15$
Frequency	6	11	3

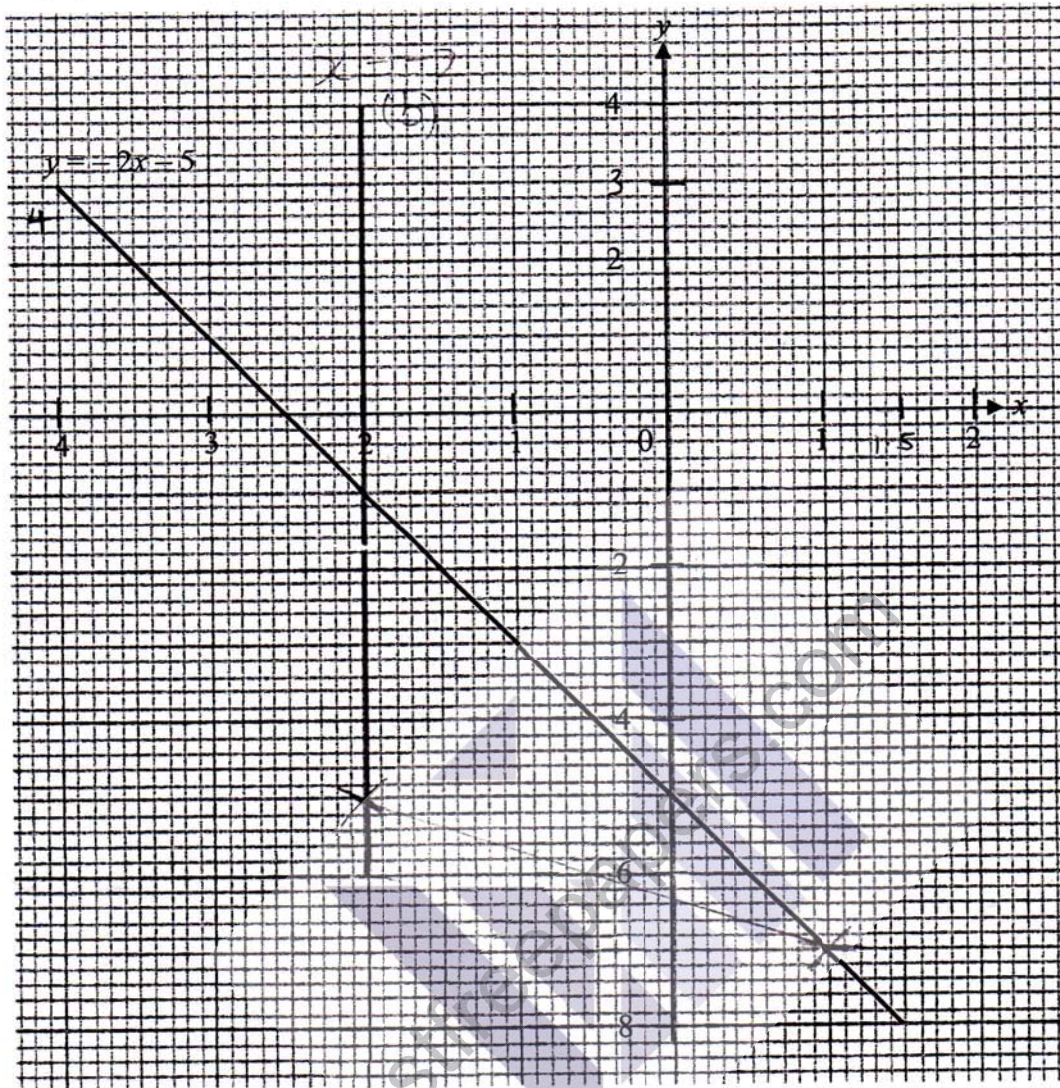
- (a) Calculate an estimate of the mean time taken by the 20 students.

Answermin [3]

- (b) Explain why this is only an **estimate** of the mean.

Answer
 [1]

21 The graph below shows the line $y = -2x - 5$.



(a) State the gradient of this line.

Answer [1]

(b) Draw the line $x = -2$. [1]

(c) The points $(-2, -5)$ and $(1, -7)$ lie on a straight line l .

(i) Plot these points. [1]

(ii) Calculate the area enclosed between $y = -2x - 5$, $x = -2$ and l .

Answer square units [2]

[Turn over

22 A fruit shop sells apples at \$ a and bananas at \$ b each.

- (a) The seller sold 2 apples and 16 bananas for a total of \$12 in the morning.
Show that $a + 8b = 6$.

[1]

Answer

- (b) In the afternoon, the seller sold 12 apples and 6 bananas to earn \$9.
Show that $4a + 2b = 3$.

[1]

Answer

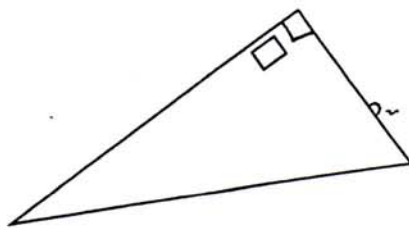
- (c) Solve these simultaneous equations.

$$a + 8b = 6$$

$$4a + 2b = 3$$

Answer $a = \dots\dots\dots, b = \dots\dots\dots$ [3]

- 23 The lengths of the sides of a right-angled triangle are $2x$, $(3x - 1)$ cm and $(2x + 4)$ cm.



- (a) Write down and simplify an expression for the perimeter of the triangle.

Answercm [1]

- (b) Given that the perimeter is 24 cm, find x .

Answer $x =$ [2]

- (c) Find the area of the triangle.

Answercm² [2]

24 Given $x = 3a + 1$ and $y = a - 2$

(a) Write an expression in its simplest form, in terms of a , for

(i) $x - y$,

Answer [2]

(ii) $\frac{x}{3} + \frac{y}{2}$

Answer [2]

(b) Write down, then expand and simplify, an expression for xy in terms of a .

Answer [2]

- End of Paper -

Marking Scheme
 Sec 4NA_EM_P1_YYS_PRELIM_2018

Qn	Solution	Marking Scheme
1(a)	1.5	A1
1(b)	28.33 (2 decimal places)	A1
2	Gradient = $\frac{4 - (-2)}{3 - 1} = 3$	A1
3	Time spent on Studying = $24 - 4 - 3 - 8 - 2 = 7$ hours	
	Angle of sector = $\frac{7}{360} \times 360 = 105$	M1 A1
4	$412.50 = \frac{p \times 2.5 \times 3}{100}$ $p = \$5500$	M1 A1
5	$\sin 40^\circ = \frac{x}{28}$ $x = 17.9980 \dots$ $x = 18.0$ cm	A1 M1
6	$5x + 3x + 2x + 90 = 360$ $10x = 270$ $x = 27$	A1
7	$\angle ABC = 180 - 18 \times 2 = 144$ (Interior angle) Each exterior angle = $180 - 144 = 36^\circ$ Number of sides = $\frac{360}{36} = 10$	M1 M1 M1 A1
8(a)	8	A1
8(b)	5 or 11 (either answer is accepted)	A1
8(c)	$\frac{5}{30} \times 100 = 16\frac{2}{3}\%$	A1
9(a)	7h 20 min	A1
9(b)	Alex was able to make it for the dinner as his flight reached Singapore at 4.40 pm.	A1
10	Radius of cell = $\frac{2500 \times 10^{-9}}{2} = 1.25 \times 10^{-6}$ m Area of cell = $\pi \times (1.25 \times 10^{-6})^2$	M1 A1

11(a)	$\approx 4.91 \times 10^{-12} \text{ m}^2$	A1
11(b)	$\angle BCD = 100^\circ$ (vertically opp angles) $\angle BFE = 100^\circ$ (corresponding angles) Reflex $\angle BFE = 360 - 100 = 260^\circ$	M1 A1 A1
12(a)	$\frac{1}{2}$	A1
12(b)	P (a number more than 3) = 2	A1
12(c)	P (a number which is a multiple of 4) = $\frac{1}{6}$	A1
13	$P(2 \text{ or } 5) = \frac{1}{3}$ $\frac{120}{360} \times \pi \times 30^2 - \frac{120}{360} \times \pi \times 13^2$ Area = $765.5014099 \approx 766 \text{ cm}^2$	M2 A1
14(a)	$y = -3$	A1
14(b)	$x^2 + 2x - 8 = 0$ $(x+4)(x-2) = 0$ $x = -4$ $x = 2$	M1 M1
15(a)	25g	A1
15(b)	Nuts = 25g Choc Chips = 6.25g Raisins = 18.75 g $\text{Cost} = \frac{4.5}{1000} \times 25 + \frac{8.60}{1000} \times 6.25 + \frac{4}{1000} \times 18.75 = 0.24125 \approx \0.24 (nearest cents)	M1 M1 A1
16(a)	\$20	B1

(b)			
(c)			
17(a)	5, 2	BI	
(b)	$20 - 3n$	BI	
(c)	$20 - 3n = -88$ $3n = 108$ $n = 36$	MI AI	
18(a)	$\frac{25}{4} \times 7$ $= \$43.75$	MI AI	
(b)	$\frac{480 - 120}{2} = 180$ $180 : 300$ $3 : 5$	MI AI	
19(a)	4.08 cm	BI	

(b)	$\frac{1}{2} \times 6.8 \times 7.3 \times \sin 72^\circ$ $\approx 23.6 \text{ cm}^2$ (3 s.f.)	MI AI	
20(a)	$\frac{6 \times 2.5 + 11 \times 7.5 + 3 \times 12.5}{20}$ $\frac{135}{20}$ $= 6.75 \text{ min}$	MI MI AI BI	
(b)	The exact time taken by every student is not known, so we take the mid-value of each class interval as the time taken by the child.	BI	
21(a)	-2	BI	
(b)		BI	
(c)(i)	$y = -2x - 5$	BI	
(c)(ii)			
(c)(ii)			$\frac{1}{2} \times 4 \times 3$ $= 6 \text{ square units}$

22(a)	$2a + 16b = 12$ $a + 8b = 6$	BI
(b)	$12a + 6b = 9$ $4a + 2b = 3$	BI
(c)	$4(6 - 8b) + 2b = 3$ $b = 0.7,$ $4a + 2(0.7) = 3$ $a = 0.4 \text{ and } b = 0.7$	M1 M1 A1
23(a)	$(7x + 3) \text{ cm}$	BI
(b)	$7x + 3 = 24$ $x = 3 \text{ cm}$	M1 A1
(c)	$\frac{1}{2} \times 6 \times 8$ $= 24 \text{ cm}^2$	M1 A1
24(a)(i)	$\frac{3a + 1 - (a - 2)}{3a + 1 - a + 2}$ $= \frac{2a + 3}{2a + 3}$	M1 A1
(ii)	$\frac{3a + 1}{3} + \frac{a - 2}{2}$ $= \frac{6a + 2}{6} + \frac{3a - 6}{6}$ $= \frac{9a - 4}{6}$	M1 A1
(b)	$\frac{(3a + 1)(a - 2)}{3a^2 - 6a + a - 2}$ $= \frac{3a^2 - 5a - 2}{3a^2 - 5a - 2}$	M1 A1

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YUYING SECONDARY SCHOOL

PRELIMINARY EXAMINATION

Secondary 4 Normal (Academic)

For Examiner's Use	
Total	

NAME

CLASS

REG. NO

MATHEMATICS SYLLABUS A
 Paper 2
 4045/02
 16 August 2018
 2 hours

Additional Materials: Answer Paper

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.

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.

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

Mathematical Formulae

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

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

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

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

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

Compound interest

Mensuration

Trigonometry

Statistics

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

Section A (52 marks)

Answer all the questions in this section.

- 1 (a) Simplify $\frac{8p^7q}{24pq^2}$. [1]
- (b) Without using a calculator, simplify $\left(\frac{3}{2}\right)^{-2} \times 2^{-1}$. [2]
-
- 2 A map of Singapore has a scale of 1 : 200 000.
- (a) Rewrite the scale in the form 1 cm to x km. [1]
- (b) The length of Yio Chu Kang Road on the map is 4.7 cm. Calculate the actual length, in kilometres, of Yio Chu Kang Road. [1]
- (c) The area of Singapore largest island, PulauTekong, is 24.43 km². Calculate the area, in square centimetres, of PulauTekong, on the map. Leave your answer to 2 decimal places. [2]
-
- 3 In triangle ABC , $AB = 6$ cm, $BC = 9$ cm and angle $ABC = 65^\circ$.
- (a) Construct a full-size accurate drawing of triangle ABC . [2]
- (b) Construct the bisector of angle BCA . [1]
- (c) Construct the perpendicular bisector of AB . [1]
-
- 4 Jo and Kai both drive their cars from Hougang to Kuala Lumpur. Jo started his journey at 0815 and reach Kuala Lumpur at 1255. The distance from Hougang to Kuala Lumpur is 350 km.
- (a) Find the average speed of Jo's car in km/h. [2]
- (b) Jo's car average speed is 6% faster than Kai's. Find the average speed of Kai's car. [2]

5 The table shows the test score of 15 students from Eastland Secondary School.

40	52	60	77	63
80	46	58	73	82
55	71	65	54	69

The table is then converted into a Stem and Leaf Diagram.

Stem	Leaf
4	0 6
5	2 a 5 8
6	0 3 5 b
7	c 3 7
8	0 2

Key: 4 | 0 represents 40 marks.

Find

- (a) the values of a , b , and c , [2]
 - (b) the fraction of students who passed the test if the pass score is 60 marks, [1]
 - (c) the mean score. [1]
 - (d) When the test score of one more student is included, the mean score of 16 students becomes 62.75 marks. [2]
- Did this student pass the test? Explain your answer.

6 Stanley wants to buy a new car which costs \$98 000. He is given 2 payment options by the car dealer.

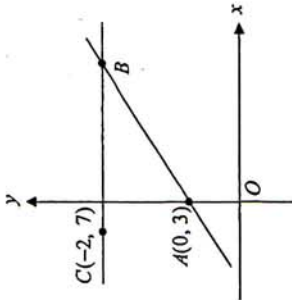
Option A Pay the \$98 000 in one lump sum.

Option B Enjoy a 2% discount.

Loan of \$80 000 at a simple interest of 3% per annum for 7 years and pay by monthly instalments.

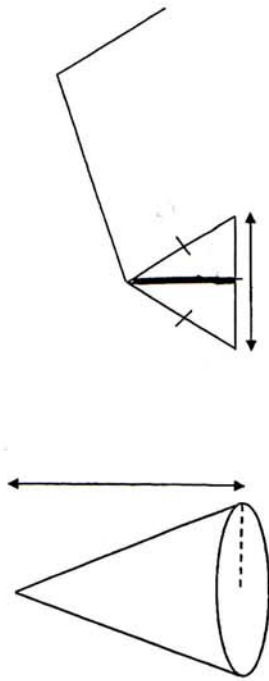
Down payment = Discounted price – Loan

- (a) If he chooses Option B, calculate
 - (i) the down payment for the new car, [2]
 - (ii) the monthly instalments. [3]
- (b) Which option is better for him? Justify your answer. [2]



In the diagram, the gradient of AB is $\frac{1}{3}$. BC is parallel to the x -axis. A is the point $(0, 3)$, C is the point $(-2, 7)$. The line BC meets the line AB at point B . Find

- (a) the equation of the line AB , [2]
- (b) the equation of the line BC , [1]
- (c) the coordinates of B . [2]



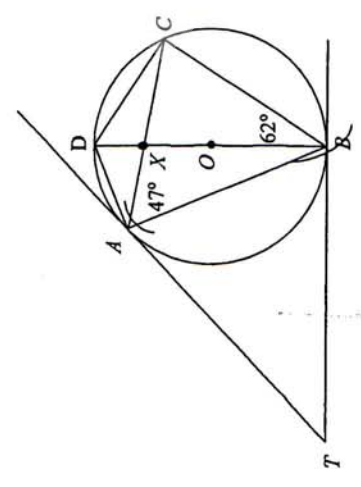
A solid cone with a height of 12 cm and base radius of 5 cm, is melted and recast into a prism with an equilateral triangular base of side 6 cm. Find

- (a) the volume of the cone, [2]
- (b) the length of the prism. [3]

- 9 (a) Make k the subject of $nk = 3k - j$. [2]
- (b) Solve $\frac{2x-5}{4} - \frac{4x-3}{3} = 2$. [3]
- (c) Solve $4x^2 - 7x + 2 = 0$. Write the answers correct to 3 decimal places. [3]

10 A, B, C and D are points on a circle, centre O . The lines AC and BD meet at X . TA and TB are tangents to the circle at A and B respectively. Angle $BAC = 47^\circ$ and angle $ABC = 62^\circ$. Find

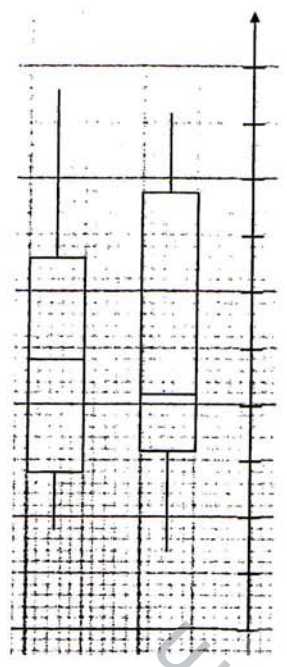
- (a) angle ADC , [1]
- (b) angle BDC , [1]
- (c) angle ACD , [2]
- (d) angle ABT . [2]



Section B (8 marks)

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

11 A Math teacher is tabulating the score obtained from a recent class test. He recorded the score of students from two classes. The results of the two classes are summarized below in the box-and-whisker plots.

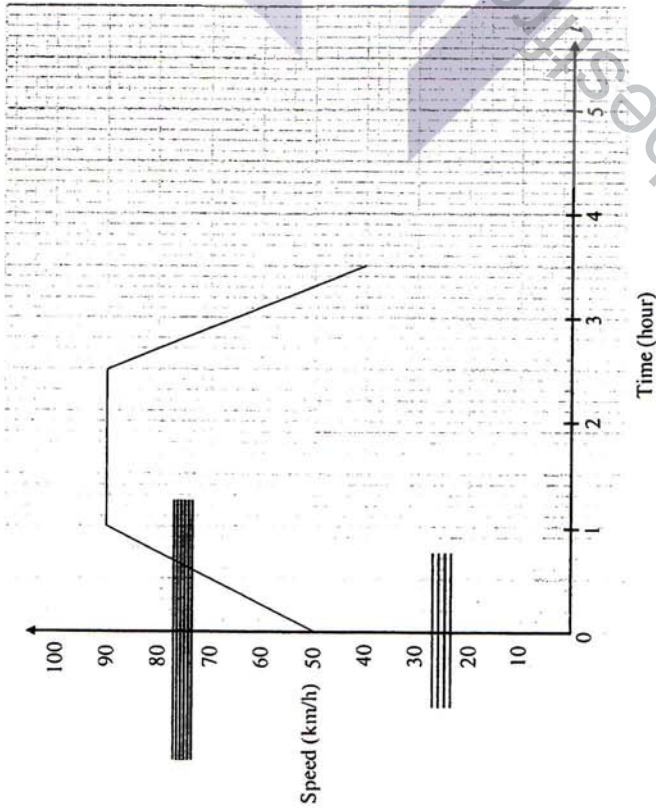


- (a) (i) Write down the median mark for class B. [1]
- (ii) Find the interquartile range for class A. [2]
- (iii) Which class scored better? Give a reason for your answer. [1]
- (iv) One of the classes had more consistent results than the other. Which class? Give a reason for your answer. [1]
- (b) 4 students from class A and 16 students from class B were interested in a Math program. Two students from these 20 were selected at random for the program. Find the probability that both students were from the same class. [3]

12 (a) Answer part (a) on lined paper.

Sketch the graph of $y = (x - 3)^2 - 3$. Do not make an accurate plot but show, on your sketch, the coordinates of the point where the value of y is a minimum. [2]

(b) The graph below shows part of the speed-time graph of a train's journey.



- (i) Find the acceleration for the first hour of the train's journey. [1]
- (ii) Describe what is happening between $t = 2.5$ and $t = 3.5$. [1]
- (iii) After $t = 3.5$, the train travelled a further 26 km with constant deceleration for x hours before coming to a complete stop. Find the value of x . [2]
- (iv) Calculate the total distance travelled in the first 3.5 hours. [2]

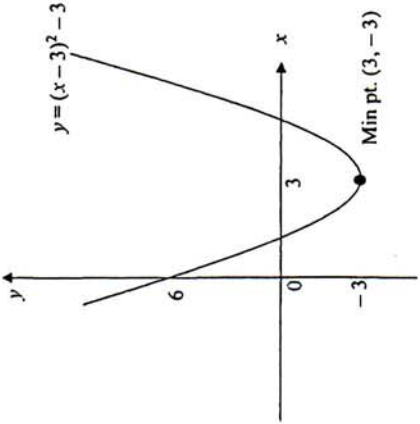
- End of Paper -

Qn	Solution	
1(a)	$\frac{p^2}{3q}$	A1
1(b)	$\left(\frac{3}{2}\right)^2 \times 2^{-1}$ $\frac{4}{9} \times \frac{1}{2}$ $= \frac{2}{9}$	M1 A1
2(a)	1 cm : 2 km	A1
2(b)	4.7 cm : 9.4 km	A1
2(c)	$(2 \text{ km})^2 : (1 \text{ cm})^2$ $4 \text{ km}^2 : 1 \text{ cm}^2$ 24.43 $24.43 \text{ km}^2 : 4$ $: 6.11 \text{ cm}^2$	M1 A1
3(a) (b) (c)		B2 A1 A1

4(a)	$\frac{350}{\frac{2}{4} - \frac{3}{3}}$ Average speed of Jo's car = $\frac{350}{\frac{2}{4} - \frac{3}{3}}$ $= 75 \text{ km/h}$	M1 A1
4(b)	$\frac{75}{106} \times 100$ Average speed of Kai's car = $\frac{75}{106} \times 100$ $= 70.8 \text{ km/h}$	M1 A1
5(a)	$a = 4, b = 9, c = 1$	B2 [B1 for 2 correct or together with the tens]
5(b)	$\frac{3}{5}$	A1
5(c)	$40 + 46 + 52 + 54 + 55 + 58 + 60 + 63 + 65 + 69 + 71 + 73 + 77 + 80 + 82$ $= 63$	A1
5(d)	$16 \times 62.75 - 945 = 59$ The student did not pass the test as his score is 59.	M1 A1
6(a)	$\frac{88}{100} \times 98000$ Discounted price = $\frac{88}{100} \times 98000$ $= \$86240$ Down payment = $\$86240 - \80000 $= \$6240$	M1 A1
6(b)	$\frac{3}{100} \times 80000 \times 7$ Interest = $\frac{3}{100} \times 80000 \times 7$ $= \$16800$ $\frac{16800 + 80000}{7 \times 12}$ Monthly instalments = $\frac{16800 + 80000}{7 \times 12}$ $= \$1152.38$	M1 M1 A1
6(c)	Total payment for option B = $\$6240 + \$16800 + \$80000$ $= \$103040$ He should take Option A as the total payment is lower.	M1 A1

7(a)	$y = \frac{1}{3}x + c$ $3 = \frac{1}{3}(0) + c$ $c = 3$ $y = \frac{1}{3}x + 3$	M1 A1
7(b)	$y = 7$	BI
7(c)	$7 = \frac{1}{3}x + 3$ $x = 12$ $B(12, 7)$	M1 A1
8(a)	$\text{Vol. of cone} = \frac{1}{3}\pi(5)^2(12)$ $= 314.15927$ $= 314 \text{ cm}^2$	M1 A1
8(b)	$\text{Area of triangular base}$ $= \frac{1}{2}(6)(6)\sin 60^\circ$ $= 9\sqrt{3} \text{ or } 15.58846 \text{ cm}^2$ Length of prism $= \frac{314.15927}{9\sqrt{3}}$ $= 20.2 \text{ cm}$	M1 M1 A1
9(a)	$nk = 3k - j$	

	$nk - 3k = -j$ $k(n - 3) = -j$ $k = \frac{-j}{n - 3} \text{ or } \frac{j}{3 - n}$	M1 A1
9(b)	$\frac{2x - 5}{4} - \frac{4x - 3}{3} = 2$ $\frac{6x - 15}{12} - \frac{16x - 12}{12} = 2$ $\frac{6x - 15 - 16x + 12}{12} = 2$ $-10x = 27$ $x = -2.7 \text{ or } -2.7$	M1 M1 A1
9(c)	$4x^2 - 7x + 2 = 0$ $x = \frac{-(-7) \pm \sqrt{(-7)^2 - 4(4)(2)}}{2(4)}$ $\approx 1.390 \text{ or } 0.360 \text{ (3 d.p.)}$	M1 A2 (1 mark each)
10(a)	118°	BI
10(b)	47°	BI
10(c)	$\text{Angle } ACB = 180 - 47 - 62$ $= 71^\circ$ $\text{Angle } ACD = 90 - 71$ $= 19^\circ$	M1 A1
10(d)	$\text{Angle } DBA = 19^\circ$ $\text{Angle } ABT = 90 - 19$ $= 71^\circ$	M1 A1
11(a)(i)	21 marks	BI

11(a)(ii)	33 - 14 = 19 marks	M1 A1
11(a)(iii)	Class A scored better as it has a higher median score.	B1
11(a)(iv)	Class A had more consistent results as it has a lower interquartile range than class B.	B1
11(b)	$\left(\frac{4}{20}\right)\left(\frac{3}{19}\right)$ $+ \left(\frac{16}{20}\right)\left(\frac{15}{19}\right)$ $= \frac{63}{95}$	M1 M1 A1
12(a)	 <p>$y = (x - 3)^2 - 3$</p> <p>Min pt. (3, -3)</p>	M1 (graph shape) A1 (min. point)
12(b)(i)	40 km/h ²	B1
12(b)(ii)	The train is slowing down, with a deceleration of 50 km/h ² .	B1
12(b)(iii)	$\frac{1}{2} \times 40 \times 40 = 26$ $\frac{26 \times 2}{40}$ $x = 1.3 \text{ hours}$	M1 A1
12(b)(iv)	$\frac{1}{2}(50 + 90)(1) + (90)(1.5) + \frac{1}{2}(90 + 40)(1)$ $= 148.5 \text{ km}$	M1 A1