Name: _____ Index No: _____

Anglo-Chinese School (Barker Road)

PRELIMINARY EXAMINATION 2020

SECONDARY FOUR EXPRESS / FIVE NORMAL (ACADEMIC)

MATHEMATICS 4048
PAPER 1

2 HOURS

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your 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 your 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 examinations, fasten 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.

For Examiner's Use

This document consists of 22 printed pages.

Mathematical Formulae

Compound Interest

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

Mensuration

$$\text{Curved Surface area of cone} = \pi rl$$

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

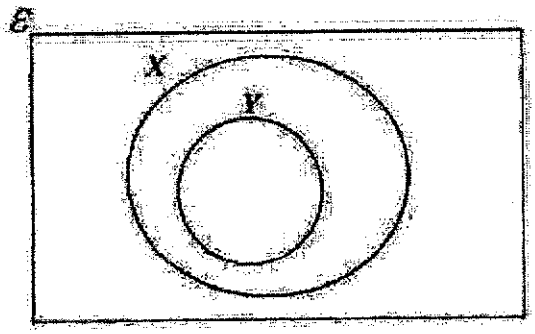
Answer **all** the questions.

For Examiner's Use

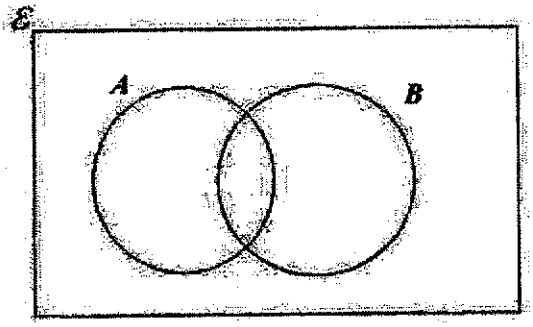
1 Solve $5(x+3)=2x+9$.

Answer $x=$ [2]

2 **(a)** The sets X and Y are shown on the Venn diagram below.
The element g is such that $g \in X$ and $g \notin Y$.
On the diagram, write g in the correct region.
Answer [1]



(b) On the Venn diagram below, shade the region $A' \cup B$.
Answer [1]



For Examiner's Use

For Examiner's Use

3 The first four terms of the sequence are 5, 13, 21 and 29.

(a) Write down an expression, in terms of n, for the nth term.

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

(b) Explain why 199 cannot be a term of this sequence.

Answer (b) [1]

.....

.....

4 On a map, a garden is represented by an area of 375 cm^2.
Given that the actual area is 15 km^2 and that the map is draw to scale of 1: n, find the value of n.

Answer $n =$ ..... [2]

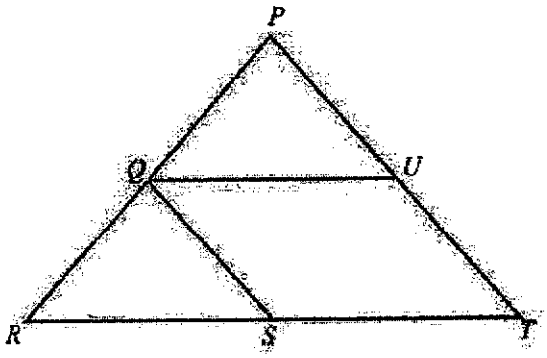
For Examiner's Use

For Examiner's Use

5 T varies inversely with the square of x.
The value of T is 36 units for a particular value of x.
Find the value of T if x is increased by 200%.

Answer $T =$ ..... [2]

6 In the figure below, QU is parallel to RT, QS is parallel to PT and Q is the midpoint of PR.



Prove that triangle QUP is congruent to triangle RSQ.

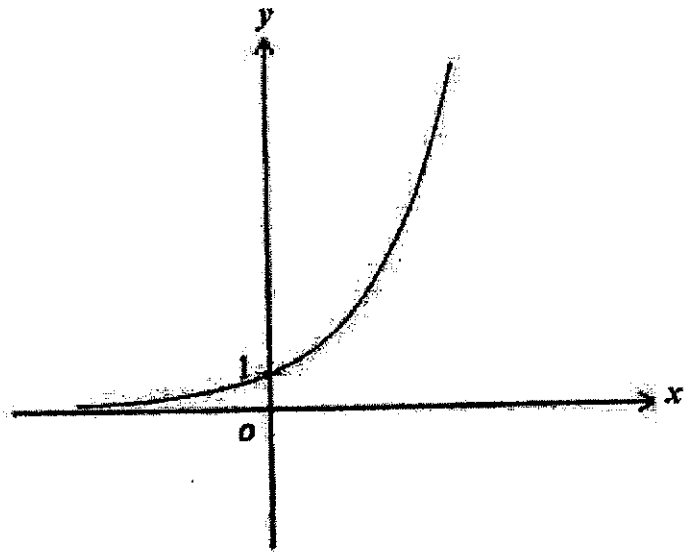
Answer [2]

For Examiner's Use

For Examiner's Use

7 The diagram shows a sketch of $y = \frac{1}{2}a^{x+1}$, where a is a constant.

The graph passes through the points $(0,1)$ and $(q,8)$.



Find the value of a and q.

Answer $a =$ .....

$q =$ ..... [2]

For Examiner's Use

For Examiner's Use

8 Elsa shared that the mean, median and mode of 5 numbers are 20.
The range of these five numbers is 18.
The greatest number is 27.
Find the five numbers and write them in increasing order.

Answer ..... [2]

9 k is a positive integer.
Show that, for all values of k, $(2k+1)^2 - 1$ is a multiple of 4.

Answer [2]

For Examiner's Use

For Examiner's Use

10 **(a)** Express $\sqrt{8}$ as a power of 2.

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

(b) Given that $5^3 \div 5^{-x} = 1$, find the value of x.

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

11 Factorise the following completely.

(a) $7ab^2 - ab$

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

(b) $6px + 5qy - 2py - 15qx$

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

For Examiner's Use

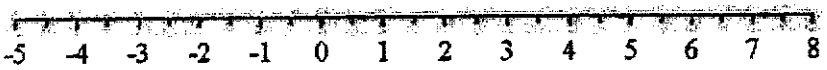
For Examiner's Use

12 **(a)** Solve the inequality $x+2 \leq 2x+1 < 5$.

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

(b) Illustrate your answer in **(a)** on the number line below.

Answer (b) [1]



13 Given that $A = \sqrt{\frac{x}{3n-x}}$, express x in terms of A and n.

Answer $x =$ ..... [3]

For Examiner's Use

For Examiner's Use

14 Desmond invests \$30000 in a savings account with compound interest x% per annum.
After 2 years, the balance in the account is \$31800.
Find the value of x.

Answer $x =$ ..... [3]

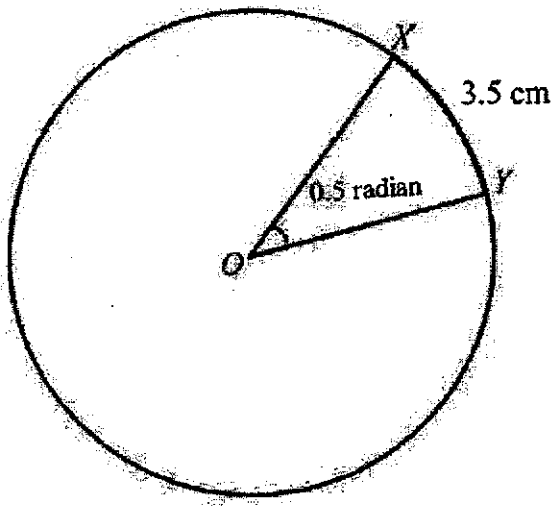
15 Write as a single fraction in its simplest form $\frac{5}{1-x} + \frac{1}{x^2-1}$.

Answer ..... [3]

For Examiner's Use

For Examiner's Use

16 In the diagram below, O is the centre of the circle.
The arc length of the circle is 3.5 cm.



(a) Find the radius of the circle, OX.

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

(b) Find the area of major sector XOY, leaving your answer in terms of π.

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

For Examiner's Use

For Examiner's Use

17 (a) Express 4410 as a product of its prime factors.

Answer (a) 4410 = ... [1]

(b) Find the smallest integer p such that $4410p$ is a perfect square.

Answer (b) p = ... [1]

(c) Written as a product of its prime factors, $1050 = 2 \times 3 \times 5^2 \times 7$.
Find the greatest positive integer that will divide 4410 and 1050 exactly.

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

For Examiner's Use

For Examiner's Use

18 **(a)** The ratio of an interior angle to an exterior angle of a n-sided regular polygon is 4 : 1.
Find the value of n.

Answer (a) $n =$ ..... [2]

(b) Explain briefly why the interior angle of a regular polygon cannot be 130°.

Answer (b) [1]

.....

.....

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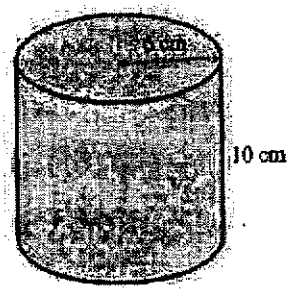
For Examiner's Use

For Examiner's Use

19 Identical cans in the form of open cylinders are of radius 6 cm and height 10 cm.



A tank is filled with 12.96 litres of water to the brim.
If the water in the tank is used to fill up as many cans as possible, calculate

(a) the maximum possible number of cans that can be completely filled,

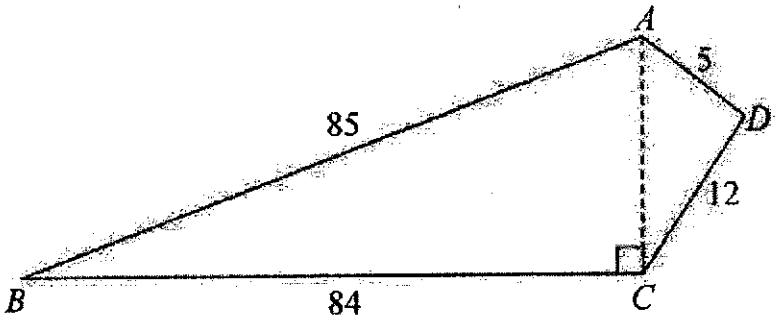
Answer (a) ..... [3]

(b) the amount of remaining water in the tank.

Answer (b) ..... cm^3 [1]

For Examiner's Use

20 In the diagram, $ABCD$ is a piece of plastic with angle $ACB = 90°$, $AB = 85$ cm, $BC = 84$ cm, $AD = 5$ cm and $CD = 12$ cm.



(a) Find angle $\angle ABC$.

Answer (a) ..... ° [2]

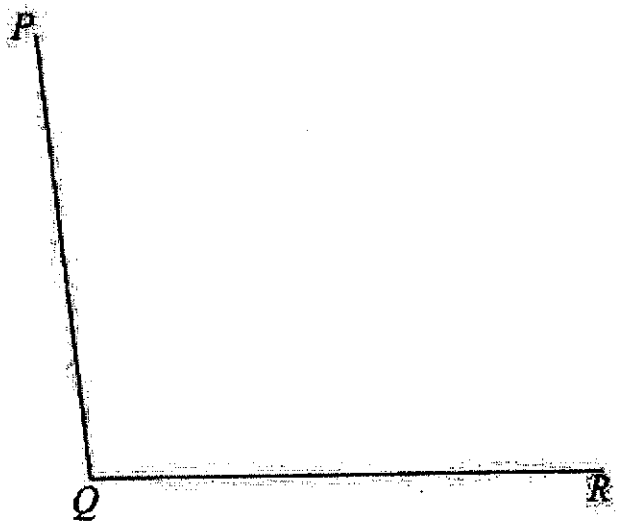
(b) Show that triangle ADC is a right-angled triangle.

Answer (b) [2]

For Examiner's Use

For Examiner's Use

21

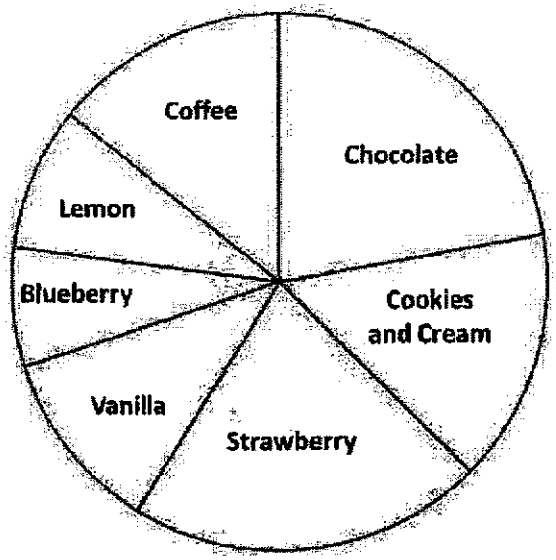


(a) Construct the perpendicular bisector of QR. [1]

(b) Construct the angle bisector of angle PQR. [1]

(c) The point S is such that a quadrilateral $PQRS$ is formed where $PS = 4.6$ cm and S is equidistant from Q and R.
Find the two positions of S and label them S_1 and S_2 [2]

22 (a) An ice cream company conducts a survey on a total number of 300 students in a primary school to find out which flavour is the least popular and most popular.
The pie chart represents the number of votes for each flavour.



Explain why this pie chart is not useful to present the survey results.

Answer (a)

.....

.....

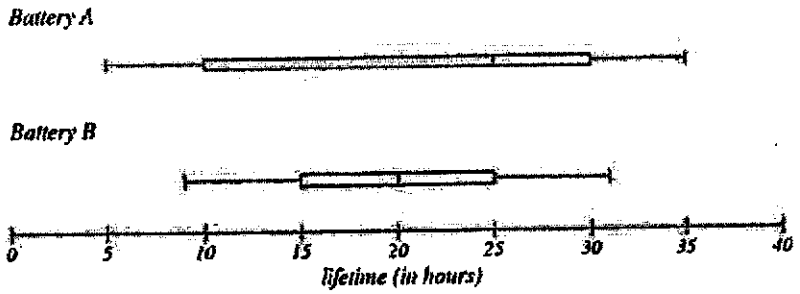
.....

[1]

For Examiner's Use

For Examiner's Use

(b) The box-and-whisker plot shows the distribution of the lifetime of Battery A and B.



(i) Provide a reason why someone might prefer Battery A.

Answer (b)(i)

[1]

(ii) Provide two reasons why someone might prefer Battery B.

Answer (b)(ii)

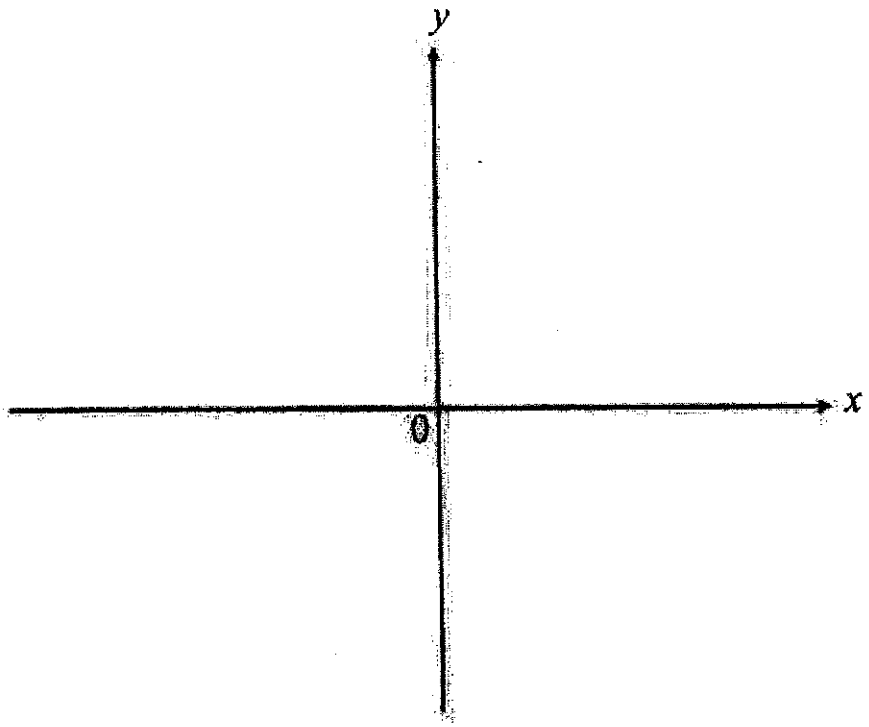
[2]

For Examiner's Use

For Examiner's Use

23 **(a)** Sketch the graph $y = -(x+3)(x-1)$, indicating clearly the value where the graph crosses the x- and y-axes.

Answer (a) [3]



(b) Write down the equation of the line of symmetry of the graph $y = -(x+3)(x-1)$.

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

(c) Using the diagram in part (a), find the range of values of q for which the line, $y = q$ would intersect $y = -(x+3)(x-1)$ exactly two times.

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

For Examiner's Use

For Examiner's Use

24 A line l passes through the points $B(-6, 2)$ and $C(-14, 4)$.

(a) Find the length of BC.

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

Another line z passes through the point $(-10, 0)$ and has the same gradient as line l.

(b) Find the equation of the line z.

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

For Examiner's Use

25 Three similar bottles A, B and C have heights in the ratio 5 : 3 : 2.

(a) Find the height of bottle C if the height of bottle A is 12cm.

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

The bottles are filled with cooking oil.
Bottle A is priced at \$25, bottle B at \$10 and bottle C at \$8.50.

(b) Which is the best value for money?
Show your workings clearly.

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

For Examiner's Use

For Examiner's Use

26 (a) In 2018, Julie was paid a salary of $108000 per annum. This salary was an increase of 20% of her salary in 2016. Calculate her salary per annum in 2016.

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

(b) The table below shows the income tax rate in 2018.

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	2800

Given that Julie received a total of $46750 tax reliefs, calculate the amount of income tax she had to pay in 2018.

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

End of Paper

Name: _____ Index No: _____

Anglo-Chinese School (Barker Road)

PRELIMINARY EXAMINATIONS 2020

SECONDARY FOUR EXPRESS/ FIVE NORMAL (ACADEMIC)

MATHEMATICS 4048 PAPER TWO

2 hours 30 minutes

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For Examiner's Use

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

Mensuration

$$\text{Curved Surface area of cone} = \pi rl$$

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

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

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

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

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Trigonometry

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

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

Statistics

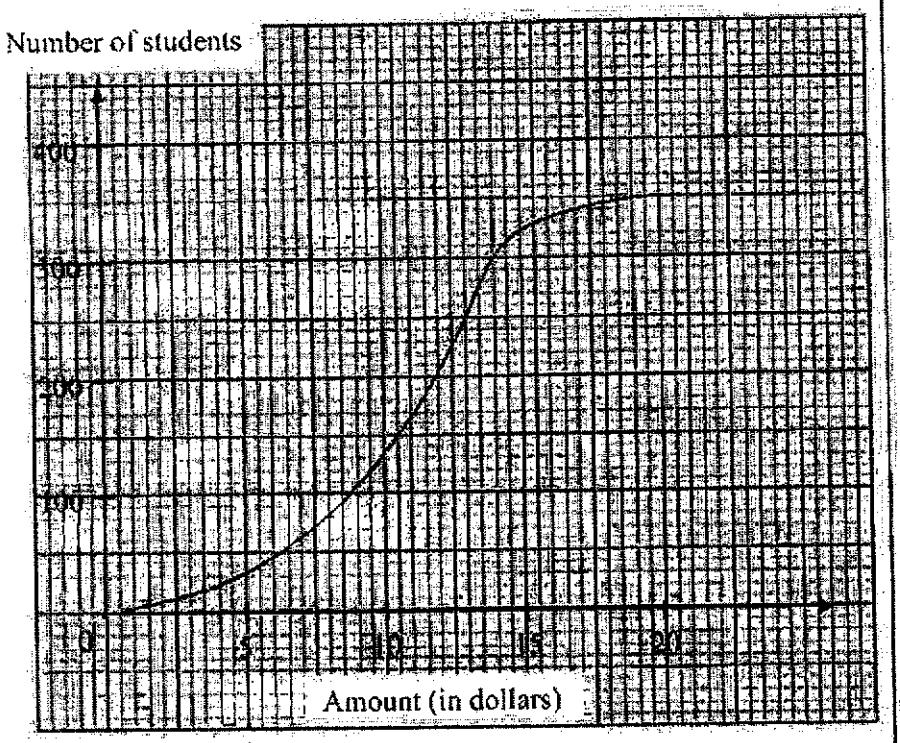
$$\text{Mean} = \frac{\sum fx}{\sum f}$$

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

Answer **all** the questions

For Examiner's Use

1 The graph below shows a cumulative frequency curve showing the daily pocket money of 350 secondary pupils.



Use the graph to estimate

(a) the largest amount of pocket money received by a student,

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

(b) the median pocket money,

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

(c) the 60th percentile,

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

(d) the number of students whose pocket money is more than $5.50.

Answer (d) ..... [2]

For Examiner's Use

For Examiner's Use

2 At a warehouse sale, Sherry paid \$400 for x number of surgical masks. When she returned home, she kept 50 of them for her own personal use. She then went online and sold the rest of the masks, making a profit of \$1.30 on each mask.

(a) Write down, in terms of x, for

(i) the amount of money that Sherry paid for each mask, and

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

(ii) the price at which she sold each mask.

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

(b) After selling all the surgical masks, she found that she made \$2925 in sales. Form an equation in x and simplify it to $13x^2 - 25900x - 200000 = 0$.

Answer (b) [3]

For Examiner's Use

(c) Solve the equation $13x^2 - 25900x - 200000 = 0$.

For Examiner's Use

Answer (c) $x =$ ..... or ..... [3]

(d) Explain why one of the answers in (c) has to be rejected.

Answer (d) .....

..... [1]

For Examiner's Use

For Examiner's Use

3 A rice distributor supplies Thai rice to two minimarts at two locations, Balmoral Plaza and Chancery Esquire.
The rice are packed in bags of 3 kg, 5 kg and 10 kg.
The sales for month of January and February are given in the table below.

	January			February		
	3 kg	5 kg	10 kg	3 kg	5 kg	10 kg
Balmoral Plaza	10	43	35	13	37	41
Chancery Esquire	12	32	21	11	45	48

The information for the January's sales can be represented by matrix $\mathbf{A} = \begin{pmatrix} 10 & 43 & 35 \\ 12 & 32 & 21 \end{pmatrix}$. The information for February is represented by matrix **B**.

(a) Write down matrix **B**.

Answer (a) $\mathbf{B} =$ ..... [1]

(b) Calculate $\frac{1}{2}(\mathbf{A}+\mathbf{B})$.

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

(c) Describe, in words, what is represented by $\frac{1}{2}(\mathbf{A}+\mathbf{B})$.

Answer (c) .....

..... [1]

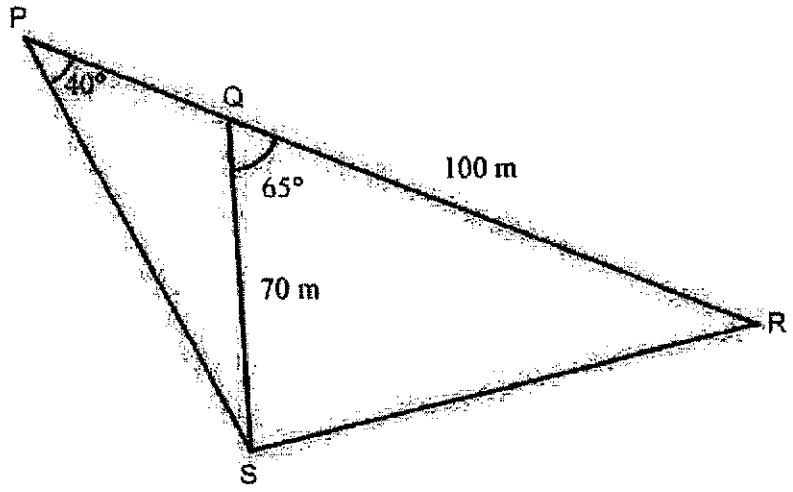
(d) Using matrix multiplication, find the total weight of Thai rice supplied to each minimart in January.

Answer (d) ..... [2]

(e) State a matrix N such that when N is multiplied to the matrix A, the answer will give you the total number of bags of rice supplied to Balmoral Plaza and Chancery Esquire respectively in the month of January.

Answer (e) ..... [1]

4



The diagram shows the cycling path $PQRS$ of a park.
Angle $SQR = 65°$, Angle $SPR = 40°$, $QS = 70$ m and $QR = 100$ m.

(a) Calculate the length of PQ.

Answer (a) ..... m [3]

For Examiner's Use

(b) Calculate the length of RS.

For Examiner's Use

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

(c) Calculate the area of triangle QRS.

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

(d) A tree of height 50 m is at point Q. Kai is walking along SR. Calculate the greatest angle of elevation of the top of the tree when viewed by Kai.

Answer (d) ..... ° [4]

For Examiner's Use

(e) Given that the bearing of S from P is 150°, find the bearing of S from Q.

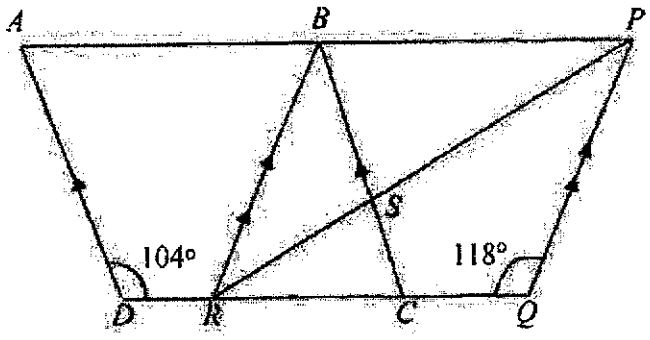
Answer (e) ..... ° [2]

5 (a) Find the total surface area of the figure shown below.

Answer (a) ..... cm^2 [3]

For Examiner's Use

(b)



In the diagram, $ABCD$ and $BPQR$ are two rhombuses.
If angle $PQR = 118°$ and angle $ADR = 104°$, calculate,

(i) angle QPR,

Answer (b)(i) ..... ° [1]

(ii) angle QCB,

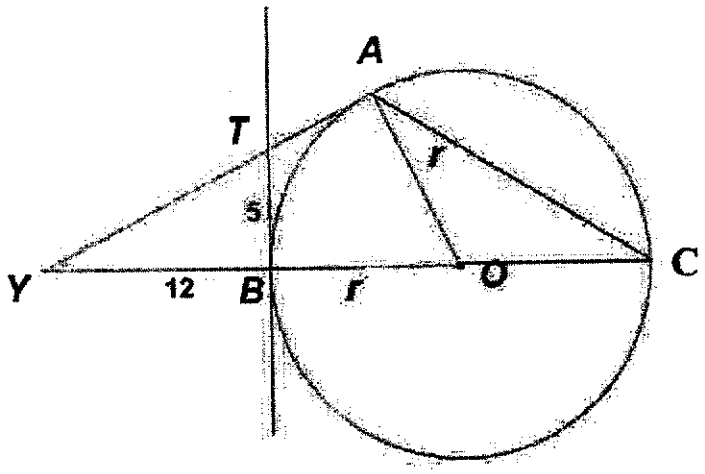
Answer (b)(ii) ..... ° [1]

(iii) angle RSC.

Answer (b)(iii) ..... ° [2]

For Examiner's Use

6 TA and TB are tangents to a circle centre O and AT produced meets OB produced at Y. BC is the diameter of the circle.
$YB = 12$ cm, $TB = 5$ cm, $OA = r$ cm and angle $AOB = 67.4°$.



(a) Find angle ACO.

Answer (a) _____° [1]

(b) Prove that triangles BTY and AOY are similar.
Answer (b) [2]

(c) Write down the length of TA.

Answer (c) _____ cm [1]

For Examiner's Use

(d) Calculate the length of TY.

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

(e) State the value of $\frac{OA}{AY}$.

Answer (e) ..... [1]

(f) Calculate the value of r.

Answer (f) $r =$ ..... [2]

For Examiner's Use

7 (a) There are three identical balls in each of the two bags.
The balls in Bag A are marked with numbers 1, 3 and 5 respectively, while the balls in Bag B are marked with numbers -1, 0 and 1 respectively.
One ball is selected from each bag at random and the numbers of the two balls are added up.

(i) Complete the possibility diagram below. [2]

Bag B

Bag A	+	−1	0	1
	1			
	3			
	5			

(ii) Find the probability that
(a) the sum will be lesser than 4,

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

(b) the sum is a prime number.

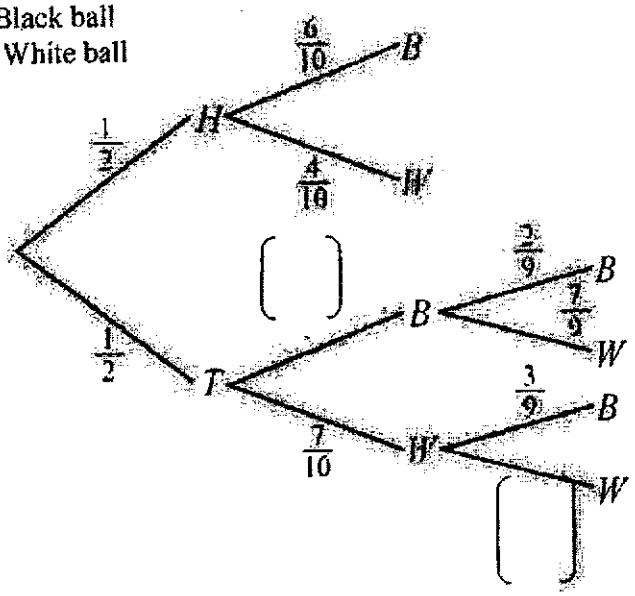
Answer (a)(ii)(b) ..... [1]

For Examiner's Use

(b) Bag X contains 6 black balls and 4 white balls. Bag Y contains 3 black balls and 7 white balls. A ball from either bag is selected by tossing a fair coin. If a head appears, a ball from bag X is selected. If a tail appears, 2 balls are selected from bag Y, one after another without replacement.

(i) Complete the following tree diagram. [2]

H – Head
T – Tail
B – Black ball
W – White ball



(ii) Find the probability of selecting

(a) two black balls,

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

(b) at least one black ball.

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

For Examiner's Use

For Examiner's Use

8 (a) (i) Simplify $\frac{3m-n}{4}-\frac{5m}{6}$,

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

(ii) (a) Factorise x^2-9.

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

(b) Hence, simplify $\frac{x^2-9}{2x^2-12x+18}$.

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

For Examiner's Use

(b) Solve the simultaneous equations.

$$3x-2y=-18$$
$$5x+4y=-8$$

Answer (b) $x=$ .....

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

(c) **(i)** Express x^2-5x-9 in the form of $(x+p)^2+q$ where p and q are constants.

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

(ii) Hence, solve the equation $x^2-5x-9=0$, giving your answers to 3 decimal places.

Answer (c)(ii) $x=$ ..... or ..... [3]

For Examiner's Use

9 The table below gives some values of x and the corresponding values of y, correct to 2 decimal places, for $y = \frac{x(x-2)(x-4)}{4}$.

x	-1	-0.5	0	0.5	1	1.5
y	-3.75	-1.41	0	0.66	0.75	k

x	2	2.5	3	3.5	4	4.5	5
y	0	-0.47	-0.75	-0.66	0	1.41	3.75

(a) Calculate the value of k, correct to 2 decimal places.

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

(b) Using a scale of 2 cm to represent 1 unit on each axis, draw a horizontal x-axis for $-1 \le x \le 5$ and a vertical y-axis for $-4 \le y \le 4$ on the grids provided. On your axes, plot the points given in the table and join them with a smooth curve.

[3]

For Examiner's Use

(c) By drawing a tangent, find the gradient of the curve at the point $(4,0)$.

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

(d) (i) Using your graph, find the solution of

$$\frac{x(x-2)(x-4)}{4}=2$$

Answer (d)(i) $x=$ ..... [1]

(ii) Hence, find the values of x for which $\frac{x(x-2)(x-4)}{4} \geq 2$.

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

For Examiner's Use

For Examiner's Use

10 **(a)** Joshua takes 40 minutes to drive from his home to a shopping mall. The distance between his home and the shopping mall is 40 km.

(i) Find Joshua's average speed in km/h.

Answer (a)(i) ..... km/h [2]

Mitchel, drives from his home to the same shopping mall at an average speed of 72.6 km/h.
Mitchel takes 20 minutes and arrives at 1412 h.

(ii) Find the distance, in metres, between Mitchel's home and the shopping mall.

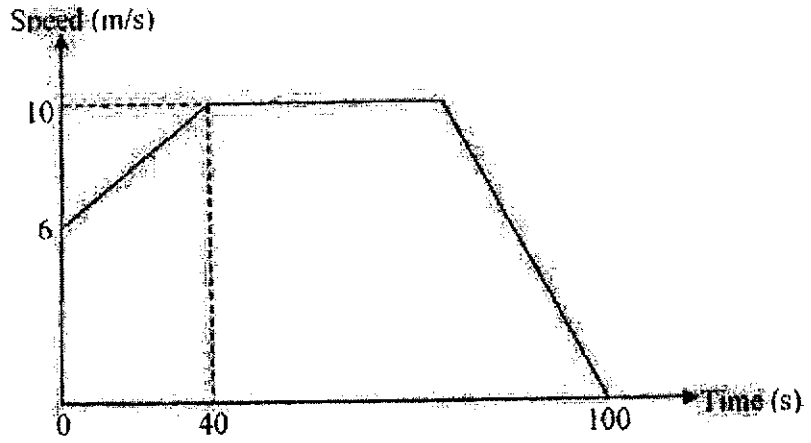
Answer (a)(ii) ..... m [2]

(iii) Find the time at which Mitchel leaves home.

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

For Examiner's Use

(b) The diagram shows the speed time graph of an object over a period of 100 seconds. The object traveled 0.5 km in the last 60 seconds.



(i) Calculate the acceleration of the object during the first 40 seconds.

Answer (b)(i) _____ m/s^2 [2]

(ii) Calculate the duration, in seconds, when the object was travelling at a constant speed.

Answer (b)(ii) _____ s [2]

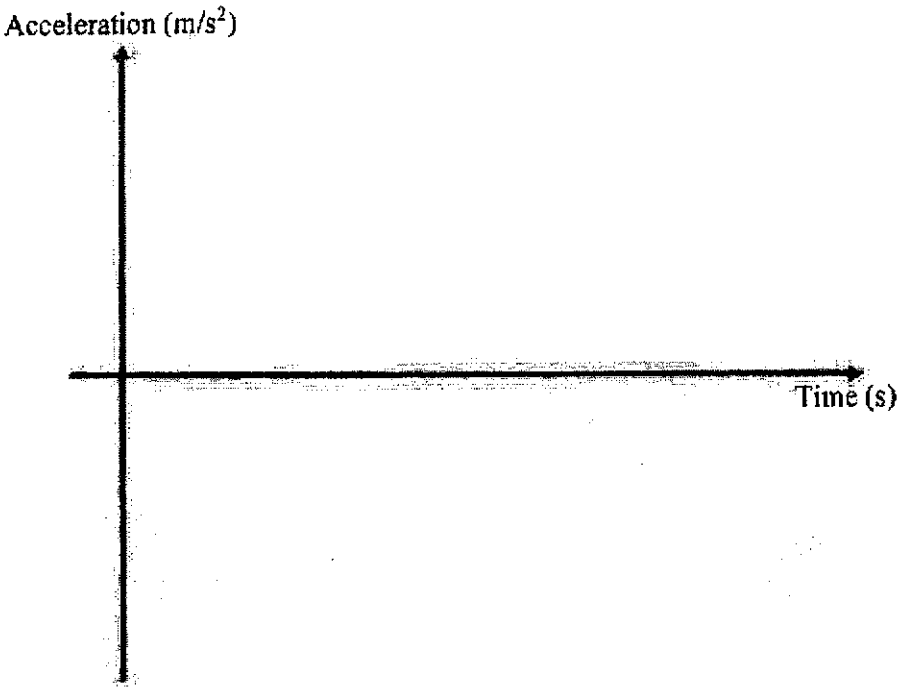
(iii) Calculate the average speed, in m/s, of the car in the 100 seconds.

Answer (b)(iii) _____ m/s [2]

For Examiner's Use

(iv) In the space below, sketch the acceleration-time graph for the 100 seconds.

Answer [2]



For Examiner's Use

11 To help alleviate financial problems caused by the COVID-19 pandemic, Deputy Prime Minister Heng Swee Keat introduced the S$48.4 billion Resilience Budget.
This follows the S$4 billion Stabilisation and Support Package for workers and firms, which was part of the S$6.4 billion Unity Budget.

(a) (i) Express 48.4 billion in standard form.

Answer (a)(i) _____ [1]

(ii) What is the **total** amount of money the Singapore government has placed in so far to help alleviate the financial problems Singaporeans may face.
Give your answer in millions.

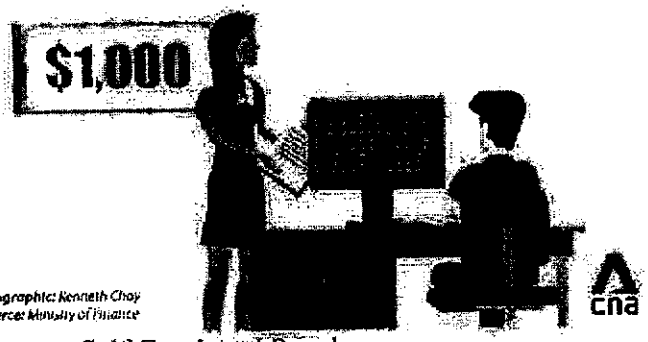
Answer (a)(ii) S$ _____ million [2]

RESILIENCE BUDGET FOR COVID-19 PANDEMIC

HELP FOR THE SELF-EMPLOYED

The Singapore Government will provide direct cash assistance to more self-employed people, to help them tide over this difficult period

- Introduce a **S$1.2 billion SEP Income Relief Scheme (SIRS)** to provide eligible self-employed people with **S$1,000** a month for 9 months
- **Extend the SEP Training Support scheme to Dec 2020**
- **Enhance the SEP Training Support scheme's hourly training allowance** from S$7.50 to **S$10**, with effect from May 1, 2020



Infographic: Kenneth Choy
Source: Ministry of Finance

Note: SEP means Self-Employed People

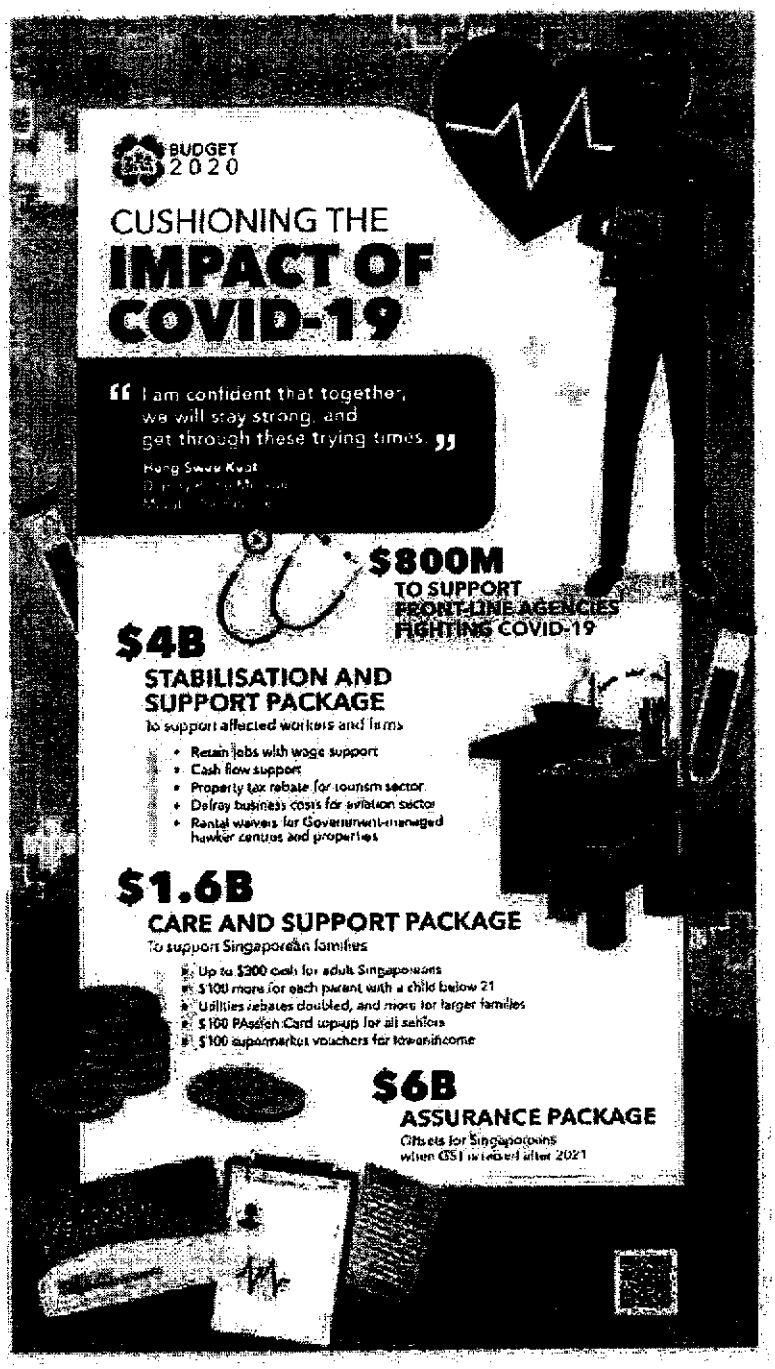
(b) (i) Using the information above, estimate the number of eligible self-employed people the Resilience Budget will be able to help?
Give your answer to the nearest whole number.

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

(ii) As of September 2019, there is a total of 4026200 Singaporeans and Permanent residents.
What is the percentage of Singapore Residents who will receive aid from the Resilience budget?

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

For Examiner's Use



For Examiner's Use

For Examiner's Use

As part of the utilities rebate given to Singaporeans, all households with at least 1 Singapore citizen will receive a $100 Solidarity Utilities Credit. In addition to that, they will also receive further rebates depending on their housing type which is illustrated in the table below.

Housing Type	Rebate received in April 2020	Rebate received in July 2020	Rebate to be received in October 2020
1- and 2-Room	$300	$300	$100 or $200
3-Room	$270	$270	$90 or $180
4-Room	$240	$240	$80 or $160
5-Room	$210	$210	$70 or $140
Executive/ Multi-Generation	$180	$180	$60 or $120

	Adam's family	Sherman's family
Number of working adults (inclusive of both parents who are working)	2	3
Number of seniors	2	0
Number of children below 21	2	2
Type of household	5-room HDB flat	Executive Mansionette

The table above shows the number of people living in Adam and Sherman's household.

(c) Find out which set of family will receive more aid and by how much more by September 2020. Both sets of family are not considered as lower income and are not considered as large families as well.

Answer (c) _____ family by $_____ [3]

End of Paper

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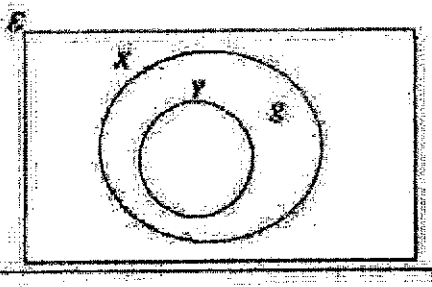
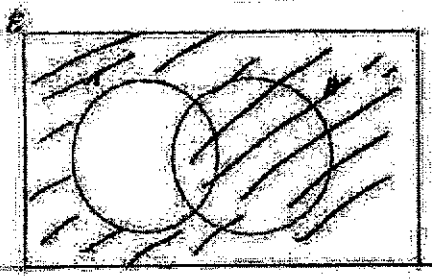
Answer Key (Paper 1)

1	$5x+15=2x+9$ $x=-2$			
2(a)				
2(b)				
3(a)	$8n-3$			
3(b)	$8n-3=199$ $n=25.25$ Since n is not an integer, 199 cannot be a term of this sequence.			
4	$375cm^2 : 15km^2$ $1cm^2 : 0.04km^2$ $1cm : 0.2km$ $0.2km = 0.2\times100000 = 20000cm$ $n=20000$			

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5	$T = \frac{k}{x^2}$ $36 = \frac{k}{x^2}$ $T = \frac{k}{(3x)^2}$ $T = \frac{1}{9}\left(\frac{k}{x^2}\right)$ $T = 36 \times \frac{1}{9}$ $= 4$			
6	$\angle PQU = \angle QRS$ (corr $\angle$s, $QU // RT$) $\angle$QUP=$\angle$RSQ (corr $\angle$s, $QS // PT$) $RQ = QP$ (Q is midpoint of PR) $\therefore \Delta$QUP $\equiv \Delta$RSQ(AAS)			
7	$y = \frac{1}{2}a^{x+1}$ $1 = \frac{1}{2}a^{0+1}$ $a = 2$ $y = \frac{1}{2} \times 2^{x+1}$ $8 = \frac{1}{2} \times 2^{q+1}$ $q = 3$			
8	The smallest number is 27-18 =9 Since mode is 20, at least two of the numbers will be 20. $\frac{9+20+20+27+x}{5} = 20$ $x = 24$ The five numbers are 9, 20, 20, 24, 27.			

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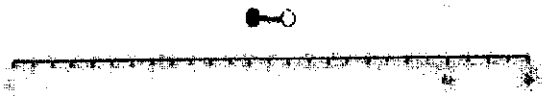
9	$(2k+1)^2-1$ $=4k^2+4k+1-1$ $=4k^2+4k$ $=4(k^2+k)$ Since $(2k+1)^2-1=4(x^2+x)$, $(2k+1)^2-1$ is a multiple of 4 for all values of k.			
10(a)	$2^{\frac{1}{2}}$			
10(b)	$5^3\div 5^{x}=1$ $5^{3-(-x)}=1$ $5^{3+x}=5^0$ $3+x=0$ $x=-3$			
11(a)	$ab(7b-1)$			
11(b)	$(2p-5q)(3x-y)$ or $(5q-2p)(y-3x)$			
12(a)	$x\geq 1$ and $x<2$ $1\leq x\leq 2$			
12(b)				
13	$(A)^3=\left(\sqrt{\frac{x}{3n-x}}\right)^3$ $A^3=\frac{x}{3n-x}$ $A^3(3n-x)=x$ $3A^3n-A^3x=x$ $x+A^3x=3A^3n$ $x=\frac{3A^3n}{1+A^3}$			

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14	$30000(1+\frac{x}{100})^2 = 31800$ $x = 2.9563...$ $= 2.96 (3sf)$			
15	$\frac{5}{1-x} + \frac{1}{x^2-1}$ $= \frac{5}{1-x} + \frac{1}{(x-1)(x+1)}$ $= \frac{-5}{x-1} + \frac{1}{(x-1)(x+1)}$ $= \frac{-5(x+1)+1}{(x-1)(x+1)}$ $= \frac{-5x-5+1}{(x-1)(x+1)}$ $= \frac{-5x-4}{(x-1)(x+1)}$			
16(a)	$s = r\theta$ $3.5 = r \times 0.5$ $r = 7$			
16(b)	Angle of major sector $= 2\pi - 0.5$ Area of major sector $= \frac{1}{2} r^2\theta$ $= \frac{1}{2} \times 49 \times (2\pi - 0.5)$ $= 49\pi - 12.25$			
17(a)	$4410 = 2 \times 3^2 \times 5 \times 7^2$			
17(b)	10			
17(c)	210			
18(a)	$(n-2) \times 180 =$ $n = 10$			
18(b)	If the interior angle is 130°, the exterior angle will be 50°.			

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(Bukit Panjang)

	$\frac{360}{n} = 50$ $n = 7.2$ The number of sides should be a natural number or the number of sides should be a positive integer.			
	Volume of a can $=\pi(6)^2(10)$ $=1130.9733$ Maximum possible number of cans $=\frac{12960}{1130.9733}$ $=11.4591$ $=11$(max)			
19(b)	Remaining water in the tank $= 12960 - 1130.9733 \times 11$ $= 519.2937$ $= 519\ cm^3$			
	$\sqrt{85^2 - 84^2} = 13$ Since $AD^2 + DC^2 = 5^2 + 12^2 = 13^2 = AC^2$, by the converse of Pythagoras' Theorem, triangle ABC is a right-angled triangle.			
	[redacted]			
21(b)				
21(c)				

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22(a)	This pie chart is not useful as it does not show clearly the difference between the number of votes for each flavour. Or this pie chart is not useful as it is hard to determine which is the most popular or least popular flavour.			
22(b)(i)	Someone might prefer Battery A as the median lifetime of the battery is longer than the median lifetime of Battery B. Or some might prefer Battery A as the maximum lifetime of the battery is longer than Battery B.			
22(b)(ii)	Someone might prefer Battery B as the minimum lifetime is longer than Battery A. Secondly, the interquartile range is smaller than Battery A which means Battery B's lifetime is more consistent and reliable.			
23(a)	[redacted]			
23(b)	$x = -1$			
23(c)	$q < 4$			

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	$\sqrt{(-6-(-14))^2+(2-4)^2}$ $=\sqrt{68}$ $=8.25 units (3sf)$			
24(b)	$=-\frac{1}{4}$ Intercept = -2.5 Equation: $y=-\frac{1}{4}x-\frac{5}{2}$			
25(a)	4.8 cm or $4\frac{4}{5}$ cm			
25(b)	$125:27:8$ $A: 125u = \$25$ $1u = \$0.184$ $B: 27u = \$10$ $1u = \$0.37037$ $C: 8u = \$8.50$ $1u = \$1.0625$ Bottle A is more value for money.			
	$108000 \div 1.2$ $= 90000$			
26(b)	108000-46570=61250 First 40000, pays \$550. Next 21250 pays 7% which is \$1487.50 Total tax payable = 550 + 1487.50 = \$2037.50			

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Paper 2 Answers

1	(a)		\$20			
	(b)		\$11.25 to \$11.50			
	(c)		\$12 to \$12.15			
	(d)		350 – 40 310			
2	(a)	(i)				
		(ii)	$\frac{400}{x}+1.30$			
	(b)		$\left(\frac{400}{x}+1.3\right)(x-50)=2925$ $400x-20000+1.3x^2-65x=2925x$ $1.3x^2-2590x-20000=0$ $13x^2-25900x-200000=0$ (Shown)			
	(c)		$(13x+100)(x-2000)=0$ $x=2000$ or $-\frac{100}{13}$			
	(d)		As the number of masks has to be a whole number / positive integer so $x=-\frac{100}{13}$ has to be rejected.			

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3	(a)	$\begin{pmatrix} 13 & 37 & 41 \\ 11 & 45 & 48 \end{pmatrix}$			
	(b)	$\begin{pmatrix} 11.5 & 40 & 38 \\ 11.5 & 38.5 & 34.5 \end{pmatrix}$			
	(c)	The average number of bags of 3 kg, 5 kg and 10 kg supplied to each minimart in January and February respectively.			
	(d)	$\begin{pmatrix} 10 & 43 & 35 \\ 12 & 32 & 21 \end{pmatrix}\begin{pmatrix} 3 \\ 5 \\ 10 \end{pmatrix}$ $= \begin{pmatrix} 595 \\ 406 \end{pmatrix}$			
	(e)	$\begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$			

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4	(a)	$\angle PSQ = 25°$			
		$\frac{PQ}{\sin 25°} = \frac{70}{\sin 40°}$			
		$PQ = 46.02341096$ $= 46.0$ m (3sf)			
	(b)	$RS^2 = 100^2 + 70^2 - 2(100)(70)\cos 65°$			
		$RS = \sqrt{100^2 + 70^2 - 2(100)(70)\cos 65°}$			
		$RS = 94.7805061$ $= 94.8$ m (3sf)			
	(c)	Area $= \frac{1}{2}(100)(70)\sin 65°$			
		$= 3172.077255 = 3170$ m^2 (3sf)			
	(d)	$\frac{1}{2}(94.7805061)d = 3172.077255$			
		$d = 66.93522509$			
		$\tan\theta = \frac{50}{d}$			
		$\theta = \tan^{-1}\left(\frac{50}{d}\right)$ $= 36.8°$ (1dp)			
	(e)	Bearing $= (150° - 40°) + 65°$			
		$= 175°$			

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5	(a)		Surface area $= 2\times\frac{1}{2}(8+6)(4)+(8+5+5+6)(15)$ $= 416\ \text{cm}^2$
	(b)	(i)	31
		(ii)	104
		(iii)	$104-31$ 73
6	(a)		33.7°
	(b)		$\angle Y$ is a common angle $\angle BTY = \angle AOY = 90°$(tangent perpendicular to radius) By AA test, triangles BTY and AOY are similar
	(c)		5
	(d)		13
	(e)		$\frac{5}{12}$
	(f)		$\frac{r}{12+r}=\frac{5}{13}$ alternatively $\frac{r}{18}=\frac{5}{12}$ $r = 7.5$

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7 (a) (i)

+	−1	0	1
1	0	1	2
3	2	3	4
5	4	5	6

(ii) (a) $\frac{5}{9}$

(b) $\frac{4}{9}$

(b) (i) $\frac{3}{10}, \frac{6}{9}$

(ii) (a) $\frac{1}{30}$

(b) $1-\frac{1}{2}\times\frac{4}{10}-\frac{1}{2}\times\frac{7}{10}\times\frac{6}{9}$ or

$\frac{1}{2}\times\frac{6}{10}+\frac{1}{2}\times\frac{3}{10}+\frac{1}{2}\times\frac{7}{10}\times\frac{3}{9}$

$=\frac{17}{30}$

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8	(a)	(i)	$\frac{3(3m-n)}{12}-\frac{2(5m)}{12}$ or $\frac{6(3m-n)}{24}-\frac{4(5m)}{24}$ $=\frac{-m-3n}{12}$			
		(ii)	(a) $(x+3)(x-3)$ (b) $\frac{(x+3)(x-3)}{2(x-3)^2}$ $=\frac{x+3}{2(x-3)}$			
	(b)		Sub $y=\frac{3x+18}{2}$ into $5x+4y=-8$ $x=-4$ and $y=3$			
	(c)	(i)	$(x-2.5)^2-15.25$ or $\left(x-\frac{5}{2}\right)^2-\frac{61}{4}$			
		(ii)	$(x-2.5)^2-15.25=0$ $x=2.5\pm\sqrt{15.25}$ $x=6.405,-1.405$			

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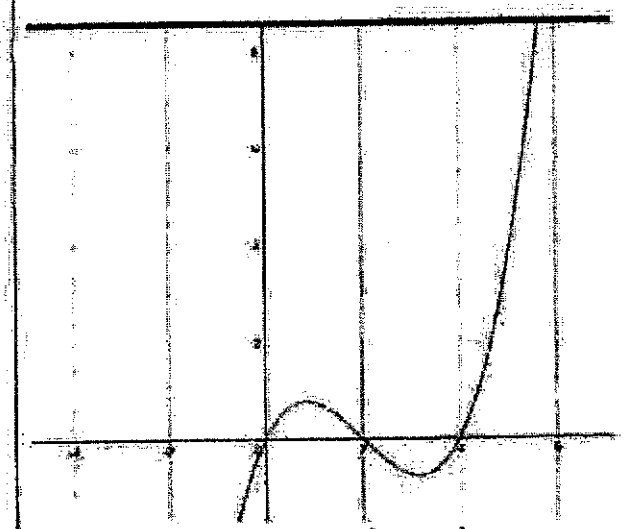
PRELIM 2020

9	(a)		0.47		
	(b)				
	(c)		Draw a suitable tangent on the graph 2 ± 0.2		
	(d)	(i)	Line of $y = 2$ must be seen on graph 4.6 ± 0.1		
		(ii)	$x \geq 4.6 \pm 0.1$		

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PRELIM 2020

10 (a) (i) $40 \div \frac{40}{60}$

$= 60$ km/h

(ii) $72.6 \times \frac{20}{60} \times 1000$

$= 24200$ m

1352 h

$\frac{10-6}{40}$

$= 0.1$ m/s^2

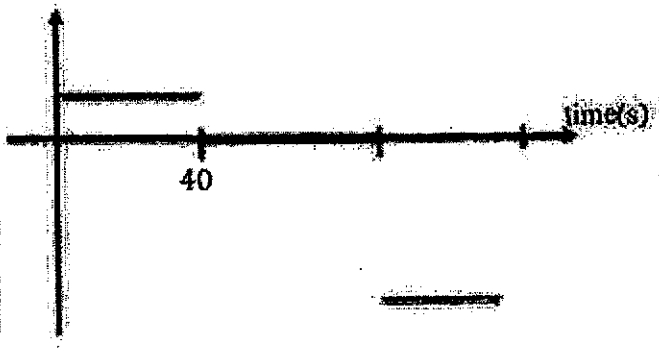
(ii) $\frac{1}{2} \times 10 \times (x+60) = 500$

$x = 40$ s

(iii) Average speed = $820 \div 100$

$= 8.2$ m/s

(iv) acceleration (m/s^2)



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PRELIM 2020

11	(a)	(i)	4.84×10^{10}			
		(ii)	$48.4\times10^{9}+6.4\times10^{9}$ $=5.48\times10^{10}=54800$ million			
	(b)	(i)	133333			
		(ii)	$\frac{133333}{4026200}\times100\%$ $=3.31\%$			
	(c)		Amount received by Adam's family $=2(400)+2(100)+100+2(210)+2(300)$ $=\$2120$ Amount received by Sherman's family $=2(400)+(300)+100+2(180)$ $=\$1560$ Adam's family received more aid by \$560			