TANJONG KATONG SECONDARY SCHOOL
Preliminary Examination 2021
Secondary 4

CANDIDATE NAME			
CLASS		INDEX NUMBER	

MATHEMATICS 4048/01

Paper 1 **Wednesday 18 August 2021**

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

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 80.

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Mathematical Formulae

Compound Interest

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

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[Turn over for Question 1]

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1 Circle the irrational number/s from the list below.

1.5π $\quad 2.\dot{3} \quad$ $\sqrt{12.1}$ $\quad 25.82$ [1]

---

2 Simplify $\sqrt[3]{\left(\frac{a^{15}}{b^6}\right)^{-2}}$, leaving your answer in positive indices.

Answer _____ [2]

---

3 Given that one solution for the equation $\frac{1}{2x^2+kx} = \frac{1}{2}$ is $x = -2$, find

(i) the value of k,

Answer $k =$ _____ [1]

(ii) a second possible value of x.

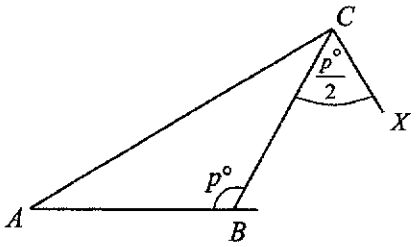
Answer $x =$ _____ [1]

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4 The diagram shows an isosceles triangle ABC where angle $ABC = p°$ and $BA = BC$.

Point X is such that angle $BCX = \frac{p°}{2}$.



D is the intersection of AB extended and CX extended.
John claims that AD will form a diameter of a circle with centre B.
Determine whether John's claim is correct or not.
Answer

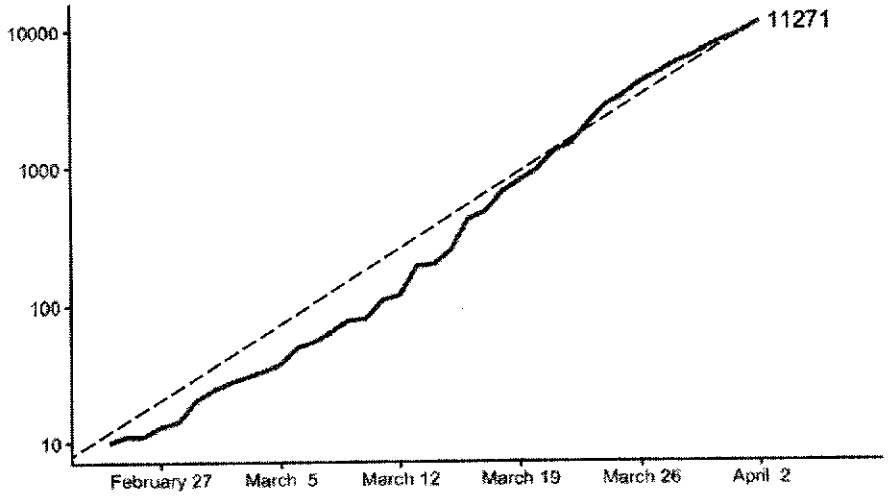
[2]

5 Given that $2m - 1 = (2n + 3)^2$, where n is a positive integer.
Show that m is an integer.
Answer

[2]

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6 The graph below shows the trend in the number of cases of people infected with the coronavirus in a particular country.



Source: Johns Hopkins University (CSSE)

Jamie claims that the trend shown is approximated by a linear equation of the form $y = 320x$, where x is the number of days and y is the number of infections.
Explain why she is wrong.

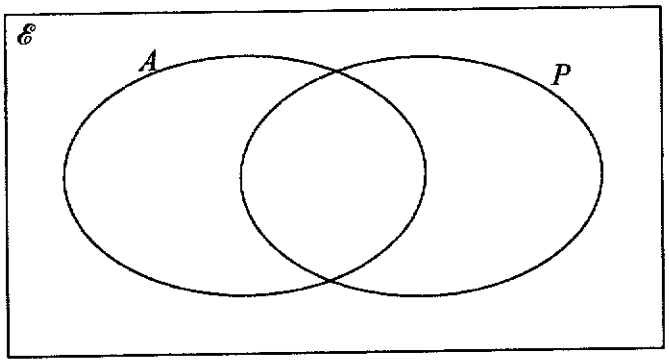
*Answer*_____

_____

_____

_____ [1]

7 There are 30 members in a community club.
All the members take up at least one activity, either aqua aerobics or pickleball.
There are 15 members who take up aqua aerobics and 24 who take up pickleball.
Given that A = {members who take up aqua aerobics} and
P = {members who take up pickleball}
Indicate in the Venn Diagram below, showing clearly, the number of members in each subset.



[2]

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8 The table shows part of a payment plan for Mr Lee who borrowed \$50 000 from a bank when he bought a car.
The bank charges an interest of 2.5% per annum, calculated on a monthly basis.
Mr Lee pays \$1 000 at the end of each month.

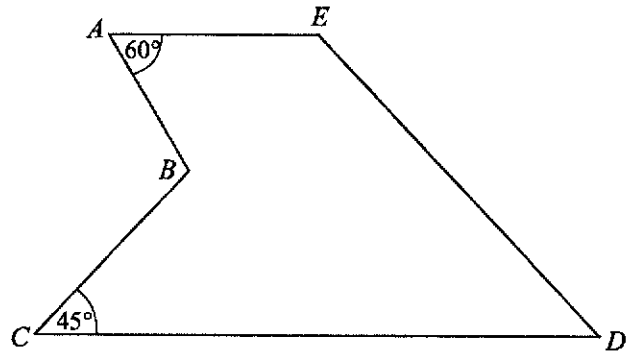
	Amount owed at beginning of month	Interest for the month	Amount paid at end of month	Amount outstanding at end of month
Month 1	\$ 50,000.00	\$ 104.17	\$ 1,000.00	\$ 49,104.17
Month 2	\$ 49,104.17	\$ 102.30	\$ 1,000.00	\$ 48,206.47
Month 3	\$ 48,206.47	*a*		
Month 4	*b*			

Find a and b.

Answer $a =$ \$ _____ $b =$ \$ _____ [2]

---

9 In the pentagon $ABCDE$ shown, angle $BAE = 60°$ and angle $BCD = 45°$.
AE is parallel to CD, E lies on CB extended and $CE = DE$.



Find
(i) angle CED,

Answer _____ ° [1]

(ii) angle ABC.

Answer _____ ° [1]

Given further that $CD = 12$ cm,
(iii) find the area of triangle CDE.

Answer _____ cm^2 [1]

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10 A package will leave Australia on 19 August at 21:15, local time in Australia.
The time taken for the package to arrive at Singapore is 6 hours 30 minutes.
Australia time is 2 hours ahead that of Singapore time.
What is the date and time at which the package arrives in Singapore?

Answer _____ [3]

11 The picture shows a model terracotta warrior.



The model has height of 15 cm and weighs 20 grammes.
A similar terracotta warrior has a height of 1.8 metres. Find the weight of the larger terracotta warrior.
Give your answer in kilogramme, correct to 1 decimal place.

Answer _____ kg [3]

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12 **(a)** The price, P, of an object varies directly as the square of its height, h.
The price is \$3 when the height is 20 cm.
Find the price when the height is 30 cm.

Answer \$ _____ [2]

(b) Given that R varies inversely as the square of T, find the percentage change in R when T is doubled.

Answer _____ % [3]

13 Factorise completely the expressions.

(a) $4(x-y)^2 - 9(x+y)^2$

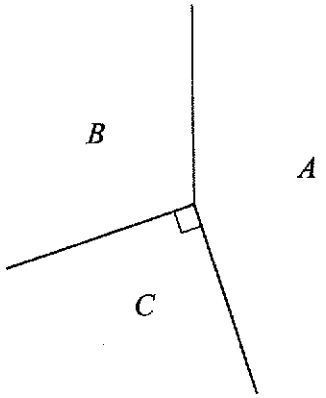
Answer _____ [2]

(b) $10ax + 15ay - 8bx - 12by$

Answer _____ [2]

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14 The diagram shows part of three regular polygons A, B and C fit together at a common vertex. Polygon A is an icosagon, a 20-sided polygon.



What is the special name for polygon B?

Answer _____ [4]

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15 Given that $x_1, x_2, x_3, \ldots, x_{10}$ are 10 unique numbers whose mean, $\tilde{x}$, is 11.8 and standard deviation is 4.729.

Find the value of

(i) $x_1 + x_2 + x_3 + \ldots + x_{10}$

Answer _____ [1]

(ii) $x_1^2 + x_2^2 + x_3^2 + \ldots + x_{10}^2$, giving your answer to the nearest whole number.

Answer _____ [2]

Each of the value of x_n is changed as follows:

If $x_n < \tilde{x}$, then x_n is decreased by 2.
If $x_n > \tilde{x}$, then x_n is increased by 2.

(iii) Explain clearly, how this would affect the value of the standard deviation.

Answer _____

_____

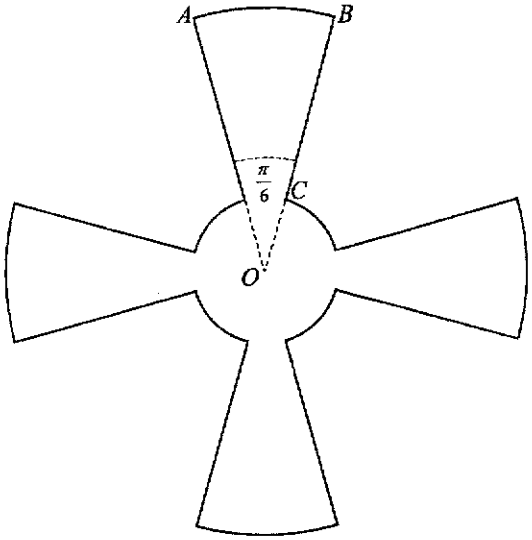
_____

_____ [2]

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16 The diagram shows four identical blades of a fan, whose centre is O. Arc AB on the fan blade forms an angle of $\frac{\pi}{6}$ at the centre O. OC is 5 cm and BC is 25 cm.



(i) Find arc length AB.

Answer _____ cm [1]

(ii) Find the perimeter of the shape.

Answer _____ cm [3]

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17 **(i)** Express $x^2 + 6x + 10$ in the form $(x + p)^2 + q$, where p and q are constants to be found.

Answer _____ [1]

(ii) Given that $y = x^2 + 6x + c$, make x the subject of the formula.

Answer _____ [3]

---

18 The stem-and-leaf diagram shows the daily number of customers over a period of one month at Branch A of a Food Outlet.

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

Key: 4 | 1 means 41 customers

(i) Write down the median of number of customers for Branch A.

Answer _____ [1]

(ii) Find the interquartile range for Branch A.

Answer _____ [2]

(iii) Another branch, Branch B, had a median of 27 customers and an interquartile range of 23 customers. The Food Outlet intends to expand only one of the two branches.
Which one of the two branches should be expanded?
Explain your choice clearly.

Answer _____

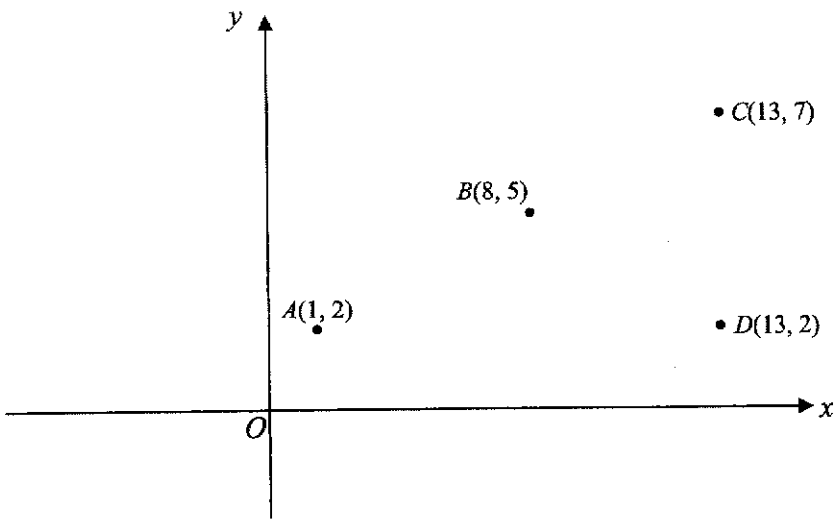
_____

_____

_____ [1]

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19 In the diagram, $A(1, 2)$, $B(8, 5)$, $C(13, 7)$ and $D(13, 2)$ are four points.



(i) Show that $AB + BC = 13.0$, correct to 3 significant figures.
Answer

[2]

(ii) By finding AC, determine the sum of interior angles in figure $ABCD$, justifying your answer.

Answer _____ [3]

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20 **(i)** Express 9801 as a product of its prime factors.

Answer _____ [1]

(ii) Hence, explain why 9801 is a square number.

Answer _____

_____ [1]

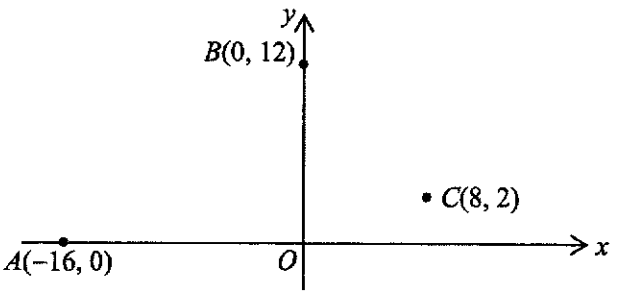
(iii) a and b are both prime numbers.

Find the smallest value of a and b such that $9801 \times \frac{a}{b}$ is a perfect cube.

Answer $a =$ _____ $b =$ _____ [2]

---

21 The diagram shows three points $A(-16, 0)$, $B(0, 12)$ and $C(8, 2)$.



(i) Find the equation of line AB, expressing your answer in the form $ax + by + c = 0$, where a, b and c are constants to be found.

Answer _____ [2]

A circle is drawn with centre C such that AB is a tangent to the circle.
The perpendicular distance of a point (p, q) from a line $ax + by + c = 0$ is given by the formula

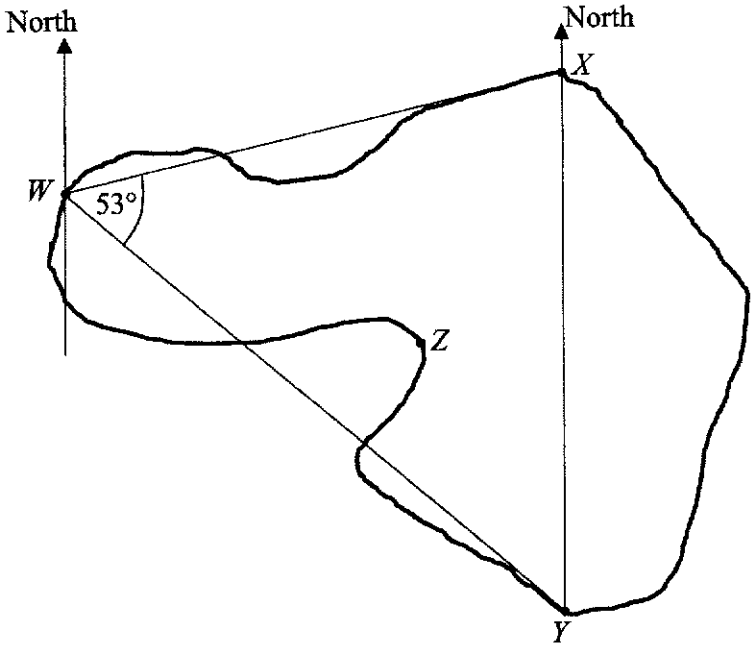
$$\text{Distance} = \frac{ap + bq + c}{\sqrt{a^2 + b^2}}$$

(ii) Using the formula above, determine the radius of the circle.

Answer _____ [2]

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22 The diagram shows the positions of four checkpoints W, X, Y and Z in a jungle reserve area. The checkpoints are connected by the irregular tracks shown.



X is due north of Y and is on a bearing of 077° from W.
Angle $XWY = 53°$ and WY is 60 metres.

(i) Calculate the distance XY.

Answer _____ m [2]

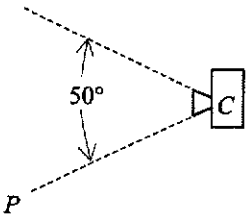
(ii) Given that the bearing of Y from Z is 152°, write down the bearing of Z from Y.

Answer _____ [1]

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(iii) A hidden camera, C, is to be fixed at checkpoint Y to capture animals that move from W to Y via Z, along the irregular track.
The camera has a view angle of 50° and can capture anything within this angle.
as shown in the diagram below.



By measurement, determine the minimum bearing where the line CP must be pointed when the camera is fixed at point Y.

Answer ..... [1]

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23 Points P, Q and R have coordinates (1, 1), (5, 11) and (9, 1) respectively.
M is the midpoint of QR.

(i) Find the coordinates of point M.

Answer _____ [1]

(ii) State the gradient of line segment PM.

Answer _____ [1]

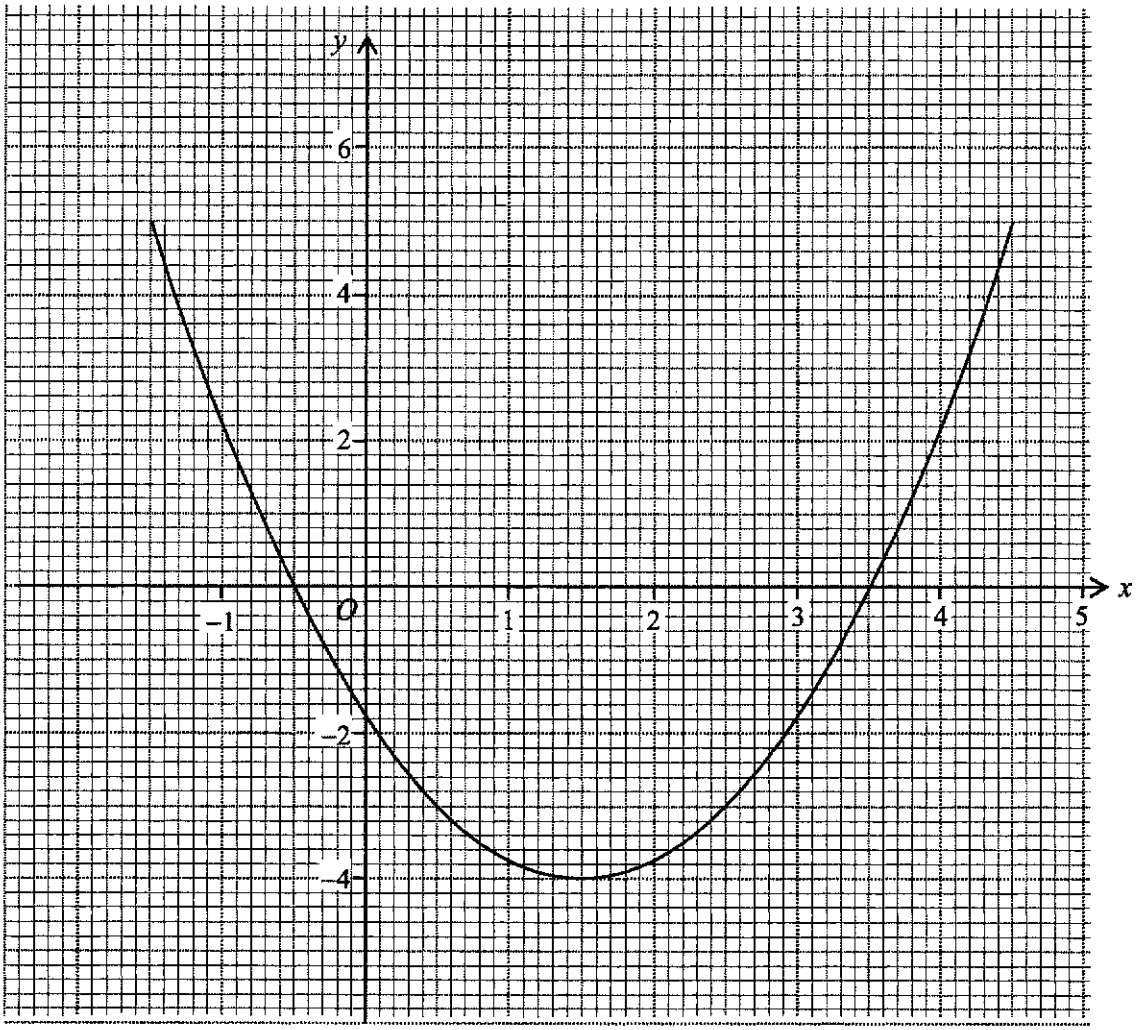
(iii) "The line segment PM bisects angle QPR."
Determine whether the statement above is correct or not.
Answer

[2]

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24 The graph of $y = x^2 - 3x - 1.75$ is shown on the grids below.



(a) Write down the equation of the line of symmetry.

Answer _____ [1]

(b) Draw the line representing $4y = 7x - 16$ for $-1 \leq x \leq 5$ on the grids.

[2]

(c) Using the graphs and showing your working clearly, find the solutions of the equation $4x^2 - 19x + 9 = 0$.

Answer

[3]

End of Paper

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TANJONG KATONG SECONDARY SCHOOL

Preliminary Examination 2021
Secondary 4

CANDIDATE NAME			
CLASS		INDEX NUMBER	

MATHEMATICS

4048/02

Paper 2

Monday 23 Aug 2021

2 hours and 30 minutes

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The total of the marks for this paper is 100.

This document consists of **25** printed pages and **3** blank pages.

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Mathematical Formulae

Compound Interest

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

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

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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

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

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

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Answer all questions.

1 **(a)** Write as a single fraction in its simplest form.

(i) $\frac{3t^2}{w} \div \frac{9t^2}{w^3}$

Answer ..... [1]

(ii) $\frac{3}{y-1} - \frac{5}{y+6}$

Answer ..... [2]

(b) Simplify $\frac{2v^2 - 5v - 12}{16 - v^2}$

Answer ..... [3]

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2 In stall A, one Chicken pie costs \$1.50, one Mushroom pie costs \$1.30 and one Tuna pie costs \$1.80. In stall B, one Chicken pie costs \$0.20 more, one Mushroom pie costs \$0.30 less and one Tuna pie costs \$0.10 less.

The information can be represented by the matrix $\mathbf{P} = \begin{matrix} \\ \text{Stall A} \\ \text{Stall B} \end{matrix} \begin{matrix} \begin{matrix} \text{C} & \text{M} & \text{T} \end{matrix} \\ \begin{pmatrix} 1.5 & 1.3 & 1.8 \\ 0.2 & -0.3 & -0.1 \end{pmatrix} \end{matrix}$

(a) Simon buys 50 Chicken pies and 20 Tuna pies.
Ivy buys 40 Chicken pies, 20 Mushroom pies and 30 Tuna pies.
Represent their purchases in a 3×2 Matrix **Q**.

Answer **Q** = [1]

(b) Evaluate the matrix $\mathbf{R} = \mathbf{PQ}$.

Answer **R** = [2]

(c) Use your answer in **(b)** to explain whether it is better for Simon to buy from stall A or stall B.

Answer

Stall ..... because .....

..... [1]

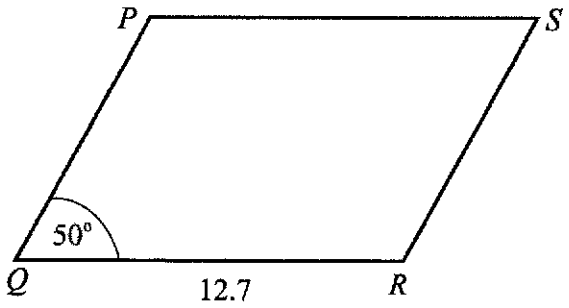
(d) Stall B has a promotion of 30% off on all pies while prices of pies in stall A has increased by 10%.
Using your answer in **(b)** or otherwise, calculate the **lowest** total amount both Simon and Ivy will pay for the pies.

Answer \$ ..... [3]

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3 **(a)** In the parallelogram $PQRS$, $QR = 12.7$ cm and angle $PQR = 50°$.



The area of the parallelogram is 52.6 cm^2.

(i) Show that the length of $RS = 5.407$ cm.

Answer

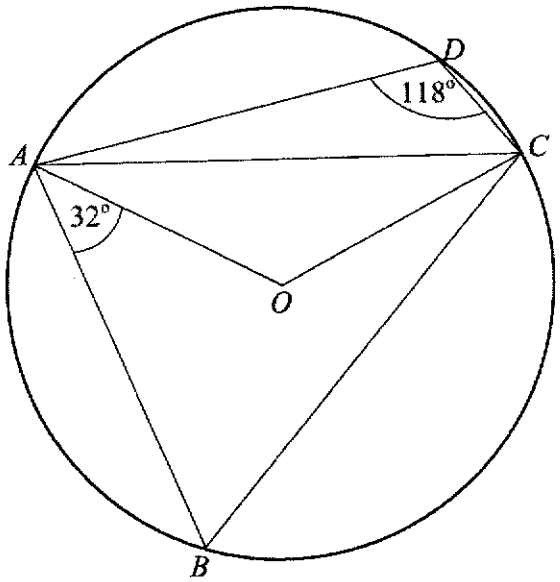
[2]

(ii) Hence or otherwise, calculate the length of the longer diagonal of the parallelogram $PQRS$.

Answer ..... cm [2]

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(b) In the diagram, the points A, B, C and D lie on a circle, centre O.
$\angle ADC = 118°$ and $\angle BAO = 32°$.



Find, giving reasons for each answer,

(i) angle ABC,

Answer ..... ° [1]

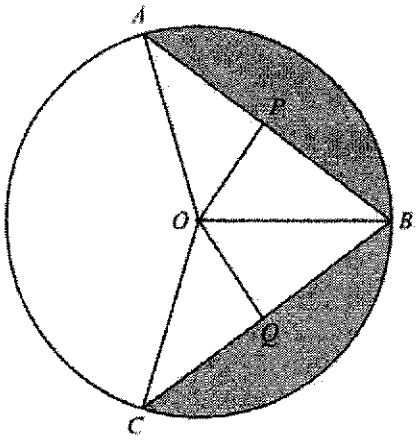
(ii) angle BCO.

Answer ..... ° [2]

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4



A, B and C are points on the circle centre O and $AB = BC$.
P is the midpoint of chord AB and Q is the midpoint of chord BC.

(a) Prove that triangle OAP is congruent to triangle OCQ.
Give a reason for each statement you make.

Answer

.....

.....

.....

..... [3]

(b) Given that the radius of the circle is 6 cm and the obtuse angle $AOC = \frac{7\pi}{9}$, calculate the shaded area.

Answer ..... cm^2 [4]

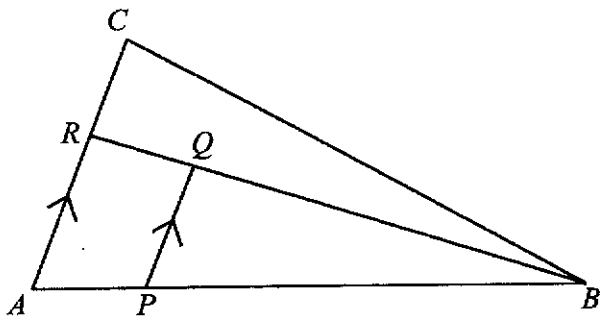
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5 **(a)** A cuboid has a volume of 250 cm^3, correct to the nearest cubic centimetre. The height of the cuboid is 8.4 cm, correct to 1 decimal place.

Calculate the greatest possible base area of the cuboid.

Answer ..... cm^2 [2]

(b) In the figure, AC and PQ are parallel lines. P lies on AB such that $AP : PB = 1 : 5$ and R lies on AC such that $AR : RC = 3 : 2$.



(i) Explain why triangles ABR and PBQ are similar.

Answer

.....

.....

.....

..... [2]

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(ii) Show that the ratio of area of triangle PBQ to the area of trapezium $APQR$ is 25 : 11.

Answer

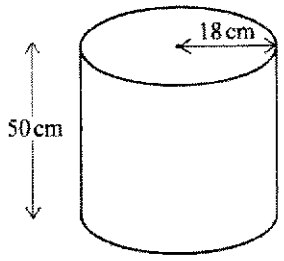
[1]

(iii) If the area of the trapezium $APQR$ is 22 cm^2, calculate the area of triangle ABC.

Answer ..... cm^2 [3]

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6 **(a)** The diagram shows a cylindrical container used to dispense coffee in a hotel.

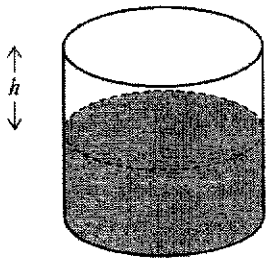


The container has a height of 50 cm and a radius of 18 cm.

(i) Calculate the volume of the cylinder.

Answer ..... cm^3 [1]

(ii) 25 litres of coffee are poured into the empty container.
Work out the height, h, of the empty space in the container.

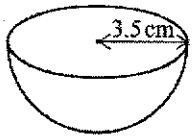


Answer h = ... cm [2]

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(iii) Cups in the shape of a hemisphere of radius 3.5 cm are filled with coffee from the container.

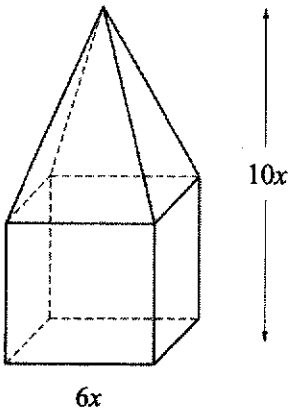


Work out the maximum number of these cups that can be completely filled from the 25 litres of coffee in the container.

Answer ..... [2]

(b) A solid shape consists of a cube with a pyramid on top has a total height of $10x$ cm.
The pyramid sits perfectly on one surface of the cube.

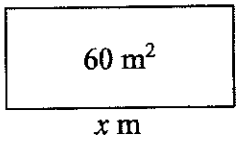
Each side of the cube is $6x$ cm.
Find an expression, in terms of x, for the surface area of the solid.
Give your answer in its simplest form.



Answer ..... cm^2 [4]

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7 Mabel wants to fence off some land as an enclosure for her chickens.
The enclosure will be a rectangle with an area of 60 m^2.



(a) The enclosure is x m long.
Show that the perimeter of fencing, P m, required for the enclosure is given by
$P = 2x + \frac{120}{x}$. [1]

The table below shows some values of x and the corresponding values of P for the fencing.

x	2	4	6	8	10	12	14
P	k	38	32	31	32	34	36.6

(b) Find the value of k.

Answer $k =$ ..... [1]

(c) On the grid, plot the points given and draw the graph of $P = 2x + \frac{120}{x}$ for $2 \le x \le 14$.

(d) Mabel only has 35 m of fencing.
Use your graph to find the **range** of values of x that she can choose.

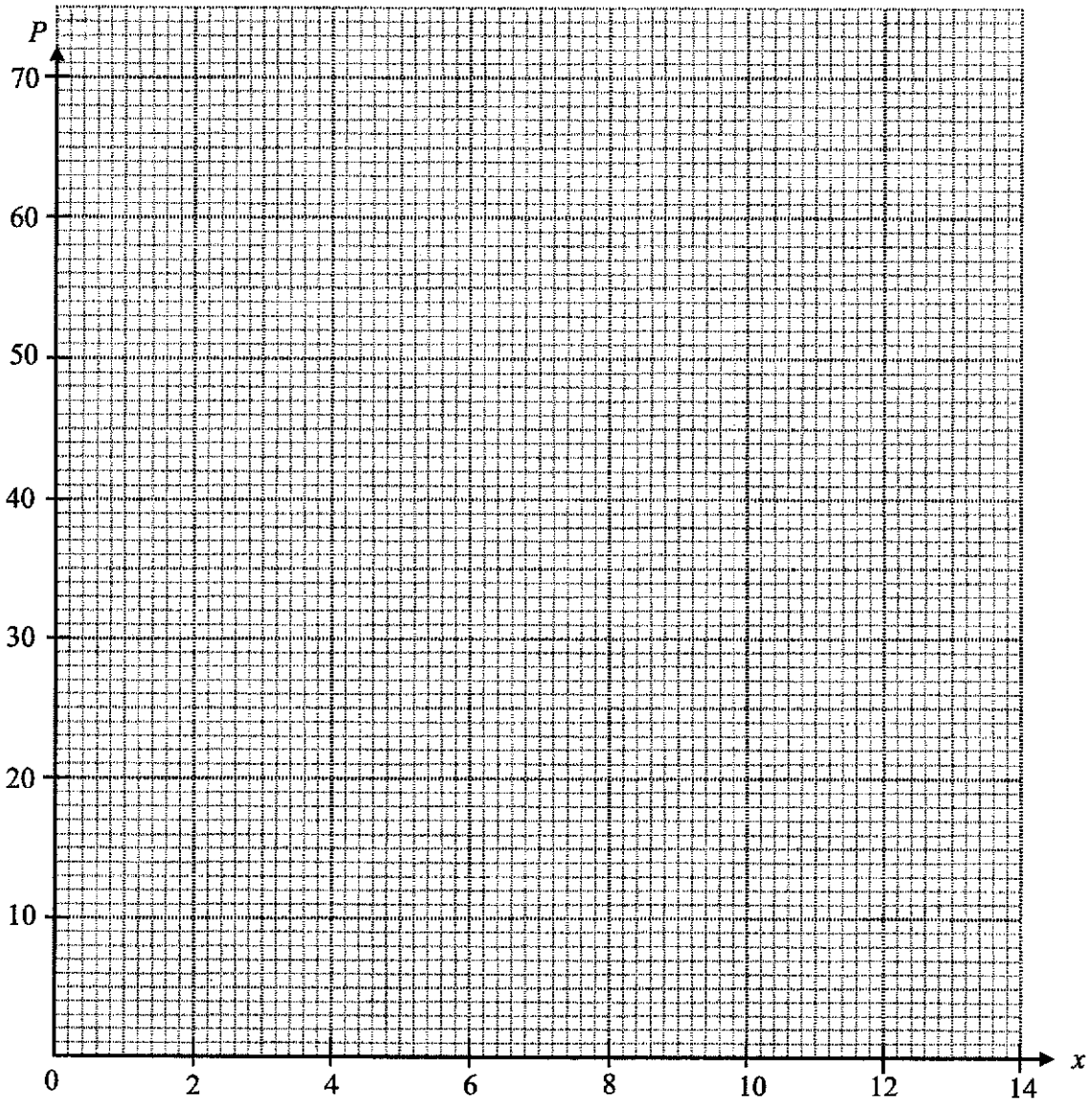
Answer ..... [2]

(e) Mabel would like to use the graph to estimate the length and width of the enclosure when it is a square. Suggest an equation of the straight line that Mabel should draw.

Answer ..... [1]

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[3]

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8 The table below shows part of Ahmad's personal income tax bill.

	S'PORE ($)	OTHER COUNTRIES ($)	TOTAL ($)
EMPLOYMENT	123, 419.00		123, 419.00
TOTAL INCOME	**123, 419.00**		**123, 419.00**
LESS: Approved Donations			1, 543.00
ASSESSABLE INCOME			*p*
LESS: PERSONAL RELIEFS			
Earned Income		1, 000.00	
NS-man/wife/parent		1, 500.00	
Life Insurance		19, 318.00	
TOTAL PERSONAL RELIEFS			*q*
CHARGEABLE INCOME			**100, 058.00**

(a) Calculate the values of p and q.

Answer p = ...

q = ... [2]

(b) The tax rate for the year is given in the table below.

	Chargeable Income ($)	Rate (%)	Gross Tax Payable ($)
On the first	20,000	0	0
On the next	10,000	2.0	200
On the first	30,000		200
On the next	10,000	3.5	350
On the first	40,000		550
On the next	40,000	7.0	2,800
On the first	80,000		3,350
On the next	40,000	11.5	4,600
On the first	120,000		7,950
On the next	40,000	15	6,000

https://www.iras.gov.sg/irashome/Individuals/Locals/Working-Out-Your-Taxes/Income-Tax-Rates/

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(i) Show that Ahmad's income tax payable is $5656.67.

Answer

[2]

(ii) In the same year of tax assessment, Angie's income tax payable is 0.55 of Ahmad's. Angie claims that her chargeable income is also 0.55 of Ahmad's chargeable income. Do you agree? Support your stand with calculations.

.....

..... [5]

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9 Small triangles are formed by placing rods between dots as shown in the diagrams.

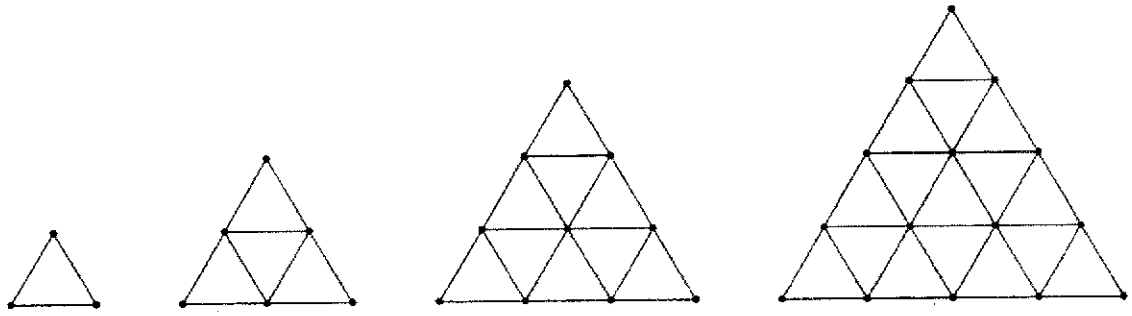


Diagram 1 Diagram 2 Diagram 3 Diagram 4

(a) Complete the table below.

Diagram n	1	2	3	4	5
Number of small triangles (T)	1	4	9	16	
Number of dots (D)	3	6	10	15	
Number of rods (R)	3	9	18	30	45

[2]

(b) Explain why it is not possible to have 1025 small triangles.

.....

..... [1]

(c) Given that $R = D + T - 1$, find the value of n when $D = 561$ and $R = 1584$.

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

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(d) A sequence is 1, 3, 6, 10, 15 ...

(i) The nth term of the above sequence is $\frac{1}{2}n(n+1)$.

Write an expression for R in terms of n.

Answer ..... [1]

(ii) How many rods are there in Diagram 16?

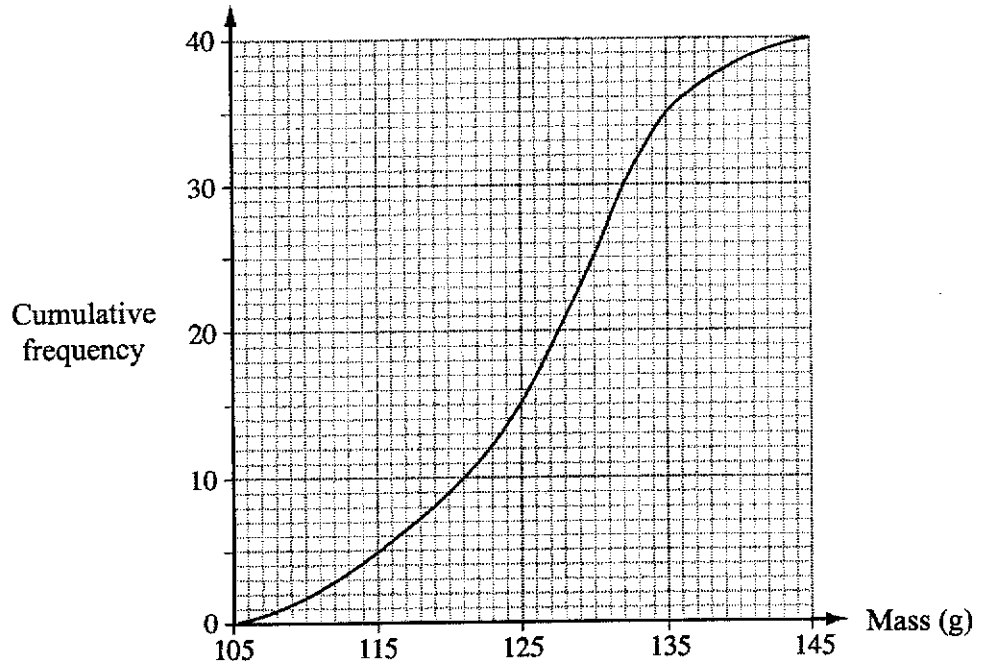
Answer ..... [1]

(e) Find an expression for D in terms of n.

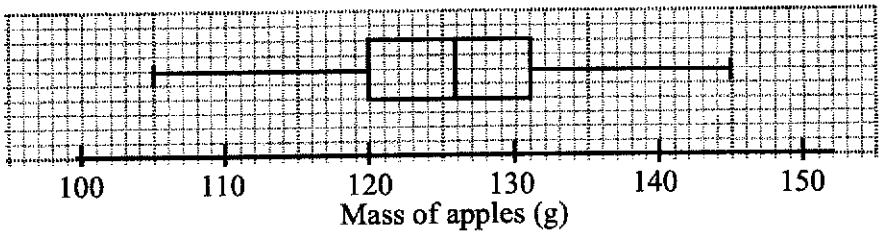
Answer ..... [1]

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10 The masses of 40 oranges were measured.
The cumulative frequency curve below shows the distribution of the masses.



The box-and-whisker below shows the distribution of the masses of 40 apples.



(a) Use the two diagrams to complete this table for the two types of fruits.

Type	Lower quartile	Median	Upper quartile	Inter-quartile range
Orange	g	g	g	11 g
Apple	g	126 g	g	11 g

[3]

(b) Describe how the cumulative frequency curve for the apples may differ from the curve for the oranges.

.....

..... [1]

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(c) Below are two statements comparing the distributions of the masses of oranges and apples.

For each statement, write **True** or **False**. Give a reason for each answer, stating clearly which statistics you use to make your decision.

(i) The apples are heavier than the oranges.

..... because .....

..... [1]

(ii) A greater percentage of oranges weigh more than 131g than apples.

..... because .....

..... [1]

(d) The grouped frequency table for the masses of the oranges is given below.

Mass (m g)	$105 \leq m < 115$	$115 \leq m < 125$	$125 \leq m < 135$	$135 \leq m < 145$
Frequency	5	10	20	5

(i) Calculate an estimate of the mean mass.

Answer ..... g [1]

(ii) Calculate an estimate of the standard deviation.

Answer ..... g [1]

(iii) 2 oranges are chosen at random without replacement.
Calculate the probability that at least one of the oranges weigh at least 125 g.

Answer ..... [2]

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11 (a) On Monday, Dev goes on a 3.6 km run.

(i) His average speed for the first 1.2 km is x km/h.

Simplify and write down an expression, in terms of x, for the time taken for the first 1.2 km.

Answer ..... minutes [1]

(ii) His average speed for the last 2.4 km of the run is 2 km/h slower than the first 1.2 km.

Simplify and write down an expression, in terms of x, for the time taken for the final 2.4 km.

Answer ..... minutes [1]

(iii) Dev takes 25 minutes to complete the full 3.6 km run.
Form an equation in x and show that it simplifies to $25x^2 - 266x + 144 = 0$.

[2]

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(iv) Solve the equation $25x^2 - 266x + 144 = 0$, leaving your answers correct to 3 decimal places.

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

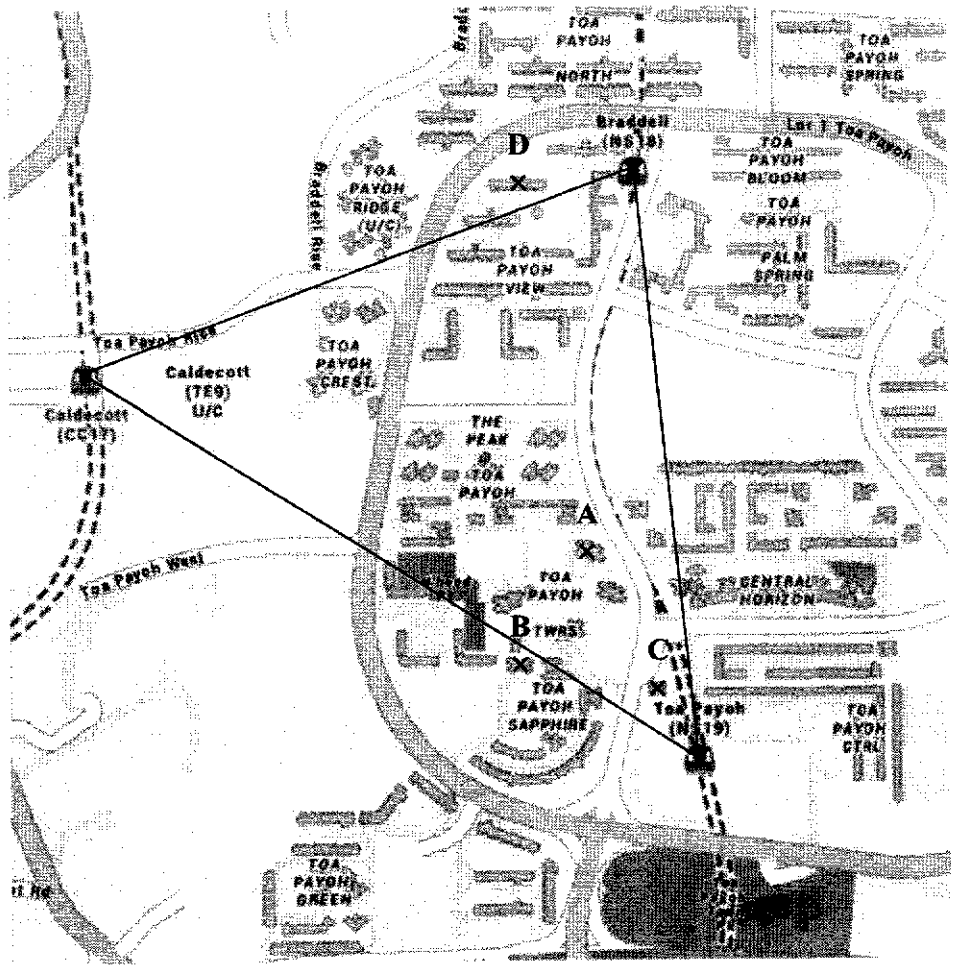
(b) On Friday, Dev completed a 4 km run on the same average speed that he ran for the last 2.4 km of the 3.6 km run on Monday.

Calculate the time Dev took to run 4 km on Friday.
Give your answer in minutes and seconds, correct to the nearest seconds.

Answer ..... [2]

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12 (a) On the map, 3 MRT stations, Braddell (NS18), Caldecott (CC17) and Toa Payoh (NS19) are joined to form a triangle.



On the map,

(i) construct the perpendicular bisector of the line connecting NS18 and NS19. [1]

(ii) construct the angle bisector at NS18. [1]

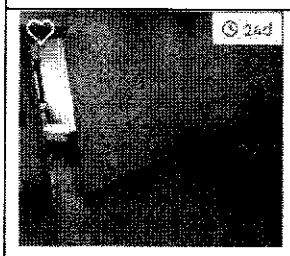
(iii) shade the region inside the triangle that is closer to the line joining NS18 and CC17 and is closer to NS18 than NS19. [1]

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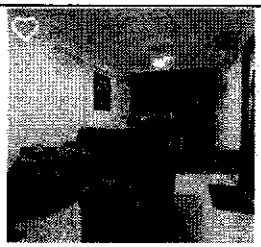
John and Chieh, both Singaporeans, are looking at buying a re-sale unit in Toa Payoh.
They found the following units below and marked them **A**, **B**, **C** and **D** on the map on page 22.

A



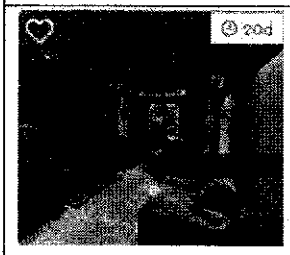
Blk 153 Toa Payoh Sapphire
4 Room • Model A
101 sqm / $770 psf(Built)
$838,000 3 2

B



Blk 163 Lorong 1 Toa Payoh
3 Room • Improved
67 sqm / $483 psf(Built)
$348,338 2 1

C



Blk 175 Lorong 2 Toa Payoh
4 Room • Improved
84 sqm / $514 psf(Built)
$465,000 3 2

D



Blk 116 Lorong 2 Toa Payoh
3 Room • Improved
63 sqm / $457 psf(Built)
$310,000 2 2

Adapted from: https://www.srx.com.sg/singapore-property-listings/hdb-for-sale

Note: sqm = square metre (m^2)
psf = per square foot (psf)

(b) Which unit is the most value for money? Explain.

.....

..... [1]

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(c) Both John and Chieh are first-time HDB applicants as a married couple, they want to purchase a unit that is closest to the MRT station. Their combined monthly income is $7 500 and they wish to complete financing their home in 15 years' time using the HDB loan.

John's friend, Janet, also Singaporean, is looking at purchasing unit **B**, which is 2 km away from her mum's place, under the Single's scheme. Janet is 38 this year and her monthly salary is $6 500.

Assuming that they receive **all** the relevant grants and take up the maximum loan amount, suggest the number of years Janet should take to service the bank loan such that her interest paid is lower than John's and Chieh's.

Justify any decisions you make and show your calculations clearly.

.....

.....

..... [8]

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Table 1: Comparison between HDB and Bank Loan

	HDB Loan	Bank Loan
Maximum loan	90% of purchase price	75% of purchase price
Interest Rate (p.a)	2.6%	1.8%

Table 2: Grants that can be used to offset the purchase price of the flat

Enhanced CPF Housing Grant (EHG) [Only for Singaporeans]

Who is Eligible?	Income Ceiling	Grant Amount
Singles	$4,500	$40,000
Couples/ families	$9,000	$80,000

Proximity Housing Grant (PHG) [stay within 4km from parents*]

Who is Eligible?	Income Ceiling	Grant Amount
Singles	No income ceiling!	$10,000 — $20,000*
Couples/ families		$15,000 — $30,000*

Singles Grant

Who is Eligible?	Income Ceiling	Grant Amount
Singles *(35 years old and above)*	$7,000 *(purchase under Single Singapore Citizen Scheme)*	2 to 4-room $50,000
	$14,000 *(purchase under Non-Citizen Family Scheme)*	Min 5-room $40,000

Family Grant

Who is Eligible?	Income Ceiling	Grant Amount
Couples/ families	$14,000	2 to 4-room $50,000
	$21,000 *(if buy with extended family)*	Min 5-room $40,000

Adapted from: https://www.homerenoguru.sg/articles/tips-advice/hdb-resale-grant/

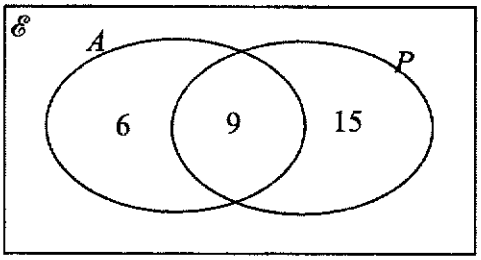
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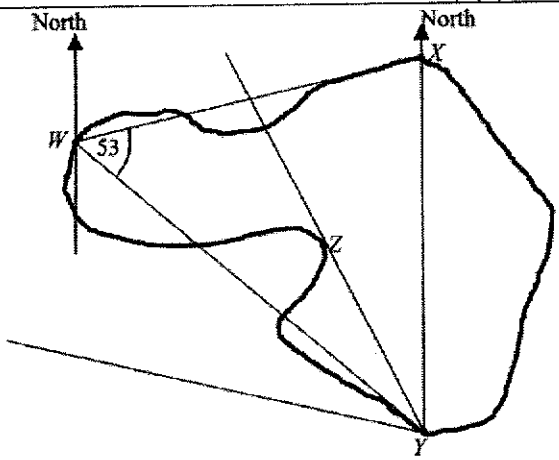
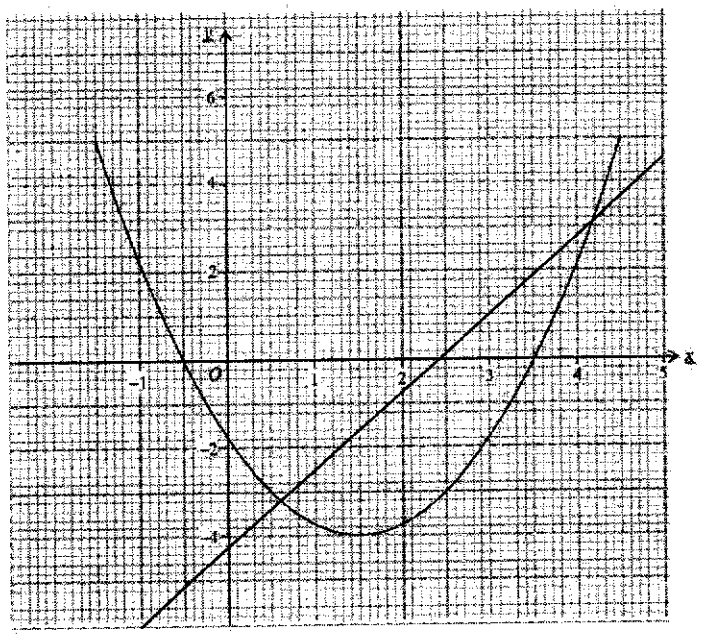
Answers:

		Key Steps		
1	1.5π $\sqrt{12.1}$	2. $\frac{b^4}{a^{10}}$	3(i) $k=3$	(ii) $x=\frac{1}{2}$
4	$\angle ACB = \frac{180-p}{2} = 90° - \frac{p}{2}$ $\therefore \angle ACD = 90° - \frac{p}{2} + \frac{p}{2} = 90°$ John is correct (angle in semicircle)	5. $(2n+3)^2 = (\text{even} + \text{odd})^2$ $= (\text{odd})^2$ $= \text{odd}$ $\therefore 2m = \text{odd} + 1$ $= \text{even}$ $m = \text{even} \div 2 = \text{integer}$		
6	The scale on vertical axis is not uniform, hence the graph cannot be linear.			
7				
8	$a = \$\ 100.43$, $b = \$\ 47\,306.90$			
9	(i) $\angle CED = 90°$	(ii) $\angle ABC = 105°$	(iii) Area of $\Delta CDE = 36\ \text{cm}^2$	
10	20 Aug at 01 45	11. 34.6 kg	12(a) $6.75	(b) Percentage change = −75%
13	(a) $-(5x+y)(x+5y)$	(b) $(5a-4b)(2x+3y)$	14. Pentagon	
15	(i) 118	(ii) 1616	(iii) Each value would differ more from the mean. Hence, the standard deviation will increase.	
16	(i) arc $AB = 5\pi$ or 15.71	(ii) Perimeter = 283.76 cm		
17	(i)	$(x+3)^2 + 1$		
	(ii)	$y = x^2 + 6x + c$ $x^2 + 6x = y - c$ $x^2 + 6x + 3^2 = y - c + 3^2$ $(x+3)^2 = y - c + 9$ $x + 3 = \pm\sqrt{y-c+9}$ $x = \pm\sqrt{y-c+9} - 3$		
18	(i) 33.5	(ii) 20	(iii) Expand Branch A because Branch A has consistently more customers.	
19	(ii)	360°		
20	(i)	$3^4 \times 11^2$		
	(ii)	All powers are even.		
	(iii)	$a = 11$, $b = 3$		
21	(i)	$3x - 4y + 48 = 0$		
	(ii)	radius $= \frac{3\times 8 + (-4)2 + 48}{\sqrt{3^2 + (-4)^2}} = 12.8$		

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		Key Steps
22	(i) $XY = 49.18$ m	(ii) 332°
	(iii)  Minimum bearing = 281° to 283°	
23	(i) (7, 6)	(ii) Gradient $PM = \frac{5}{6}$ (iii) $\tan QPR = \frac{10}{4} = \frac{5}{2}$, $\angle QPR = 68.2°$ $\tan MPR = \frac{5}{6}$, $\angle MPR = 39.8°$ $\angle QPR \neq 2 \times \angle MPR$ Hence statement is wrong.
		Other possible approaches: Showing that $PQ \neq PR$ and stating that ΔPQR is not isosceles. Hence statement is wrong. Showing that PM and QM are not perpendicular and stating that ΔPQR is not isosceles. Hence statement is wrong.
24	(a)	$x = 1.5$
	(b)	Correct line seen within the domain $-1 \leq x \leq 5$ 
	(c)	$x = 0.5$ to 0.55, 4.2 to 4.25

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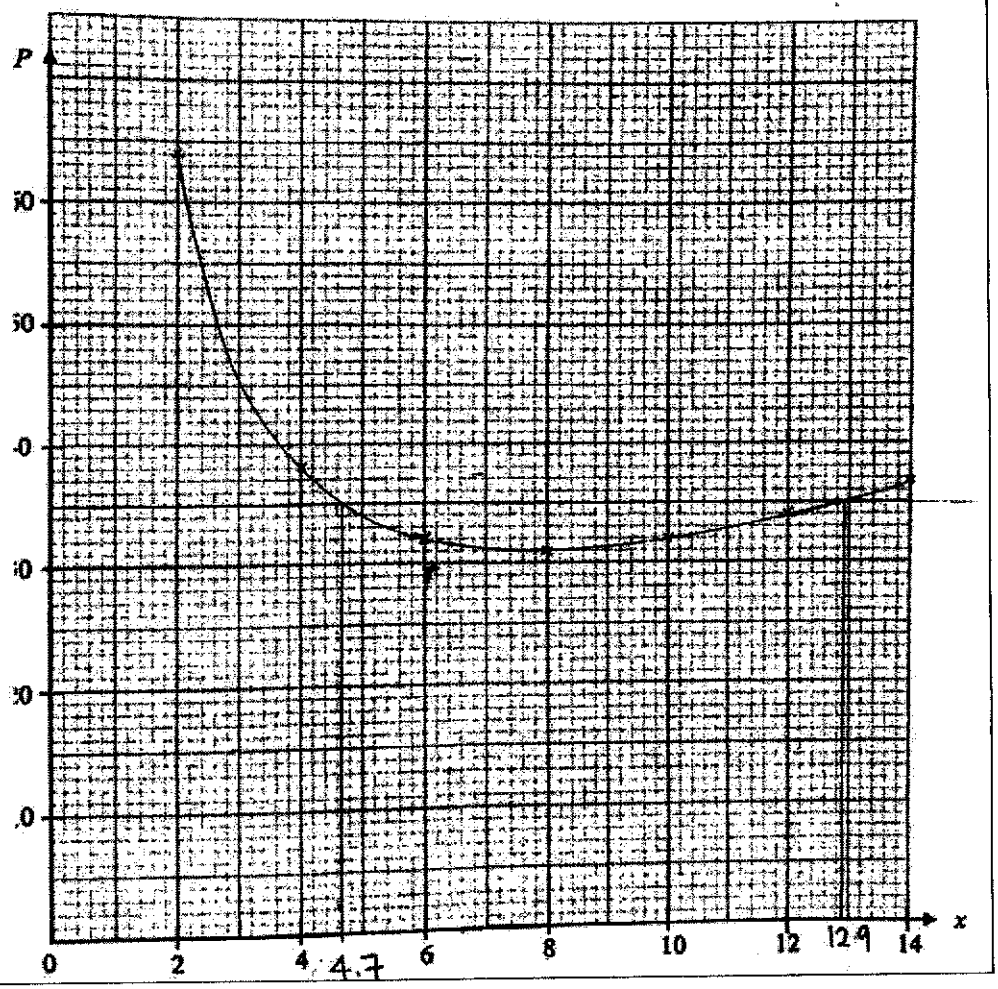
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2021 Secondary 4 Mathematics Prelim Paper 2 Marking Scheme

No.	Solution
1ai	$\frac{w^2}{3}$
1aii	$\frac{-2y+23}{(y-1)(y+6)}$
1aiii	$-\frac{2v+3}{v+4}$
2a	$\begin{pmatrix} 50 & 40 \\ 0 & 20 \\ 20 & 30 \end{pmatrix}$
2b	$\begin{pmatrix} 111 & 140 \\ 8 & -1 \end{pmatrix}$
2c	Stall A because he would pay \$8 more in stall B
2d	\$180.60
3ai	Height $= \frac{52.6}{12.7}$ $= 4.1417$ Sin $50 = \frac{4.1417}{RS}$ $RS = 5.4066$ $= 5.407$ (shown)
3aii	16.7
3bi	62
3bii	30
4a	$OP = OQ$ (equal chords; $AB = BC$) $\angle OPA = \angle OQC = 90$ (perpendicular bisector of chord) $AO = OC$ (radii of circle) Triangle $OAP \equiv$ triangle OCQ (RHS)
4b	35.3

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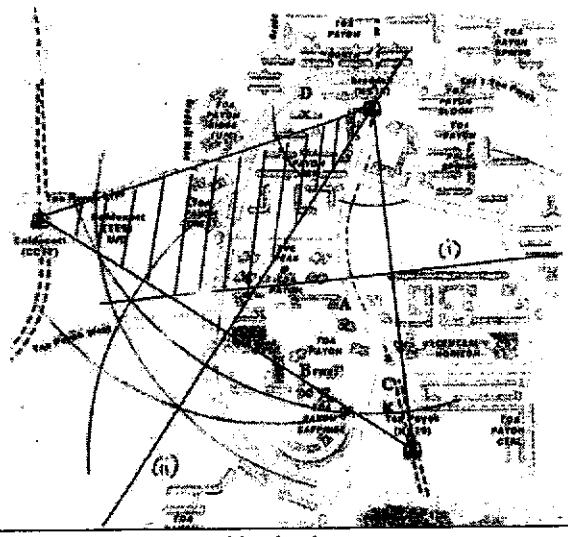
5a	30
5bi	$\angle RAB = \angle QPB$ (corresponding $\angle$) $\angle ARB = \angle PQB$ (corresponding $\angle$) $\angle RCA$ is shared/common Triangles ABR and PBQ are similar (AA)
5bii	Area PBQ : Area of Trapezium = 25 : 36 – 25 = 25 : 11
5biii	120
6ai	50900
6aii	25.4
6aiii	278
6b	$240x^2$
7a	$P = 2x + \left(\frac{60}{x}\right) \times 2$ $= 2x + \frac{120}{x}$
7b	64
7c	

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7d	$4.7 \leq x \leq 12.9$
7e	$p = 4x$
8a	$p = 121876.00$ $q = 21818.00$
8bi	3350 + 0.115 (100058 – 80000) = \$5656.67 (shown)
8bii	$\frac{76588.12}{100058} \times 100\% = 76.5\%$ Disagree as Angie's is 0.44 times Ahmad's chargeable income. or 100058 ×55% = \$55 031.90 Disagree as Angie's income is less than \$55 031.90.
9a	25 21
9b	1025 isn't a perfect square
9c	32
9di	$R = \frac{3}{2}n(n+1)$
9dii	408
9e	$D = \frac{1}{2}(n+1)(n+2)$
10a	121, 128.5, 132 120 and 131
10b	The median of the cumulative curve will be on the left.
10ci	False because the median mass for apples is lower.
10cii	True because upper quartile for mass of oranges is higher
10di	126.25 or $126\frac{1}{4}$
10dii	8.57
10diii	$\frac{45}{52}$
11ai	$\frac{72}{x}$

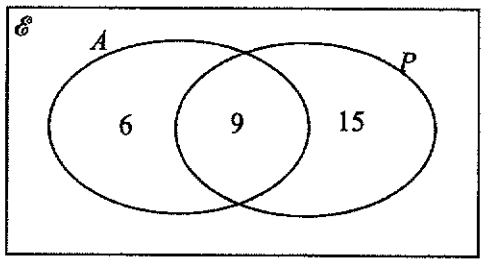
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11aii	$\frac{144}{x-2}$
11aiii	$\frac{72}{x}+\frac{144}{x-2}=25$ $72(x-2)+144x=25(x-2)$ $216x-144=25x^2-50x$ $25x^2-266x+144=0$ (shown)
11aiv	$x = 10.068$ or 0.572
11b	29 mins 45 secs
12ai 12aii 12aiii	
12b	D because the psf is the lowest
12c	Janet should finish servicing her loan in 20 years to incur less interest. I took the average of the grant for PHG as I am unsure if she would receive the full grant or not.

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		Key Steps	Mark allocation / Remarks	
1		$1.5\pi \quad \sqrt{12.1}$	B1 Both correct,	1
2		$\sqrt[3]{\left(\frac{a^{15}}{b^6}\right)^{-2}} = \left(\frac{a^{15}}{b^6}\right)^{-2\times\frac{1}{3}}$ $= \left(\frac{b^6}{a^{15}}\right)^{2\times\frac{1}{3}}$ $= \frac{b^4}{a^{10}}$	B1 Either root/reciprocal rule seen B1 cao	2
3	(i)	$\frac{1}{2(-2)^2+k(-2)} = \frac{1}{2}$ $k = 3$	B1	
	(ii)	$2x^2 + 3x = 2$ $2x^2 + 3x - 2 = 0$ $(2x-1)(x+2) = 0$ Another solution is $x = \frac{1}{2}$	B1	2
4		$\angle ACB = \frac{180-p}{2} = 90° - \frac{p}{2}$ $\therefore \angle ACD = 90° - \frac{p}{2} + \frac{p}{2} = 90°$ John is correct (angle in semicircle)	B1 90° seen B1 with reason	2
5		$(2n+3)^2 = (\text{even} + \text{odd})^2$ $= (\text{odd})^2$ $= \text{odd}$ $\therefore 2m = \text{odd} + 1$ $= \text{even}$ $m = \text{even} \div 2 = \text{integer}$	B1 Showing $(2n+3)^2$ is odd, any method Zero mark for qn. if use specific nos. B1 Conclusion with clear reasons	2
6		The scale on vertical axis is not uniform, hence the graph cannot be linear.	B1 o.e.	1
7			B2, B1, B0 −1 m for each error	2
8		$a = \frac{2.5}{100}\times\frac{1}{12}\times 48206.47 = \$\ 100.43$ $b = 48206.47 + 100.43 - 1000 = \$\ 47\ 306.90$ ✓	B1 Must be 2 d.p. B1 Must be 2 d.p.	2

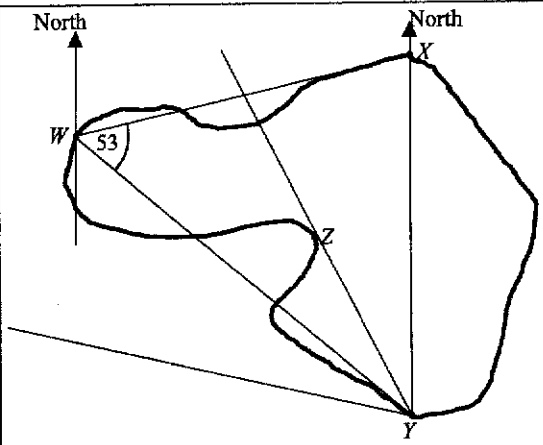
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		Key Steps	Mark allocation / Remarks	
9	(i)	$\angle CED = 90°$	B1	
	(ii)	$\angle ABC = 60° + 45° = 105°$	B1	
	(iii)	Area of $\Delta CDE = (12 \times 12) \div 4 = 36\ cm^2$	B1	**3**
10		19:15 + 6:30 = 25:45 20 Aug 01 45 Accept 01:45 Reject 1:45	B1 25:45 soi B1 Correct Date B1 Correct Time	**3**
11		$\left(\frac{180}{15}\right)^3 \times 20$ g = 34.6 kg	B1 (ratio)^3 seen accept $\left(\frac{1.8}{15}\right)^3$ B1 × 20 seen B1 Ans (one d.p.)	**3**
12	(a)	$P = k h^2$ $\quad 3 = k(20)^2$ $k = \frac{3}{400}$ $\therefore P = \frac{3}{400} \times 30^2 = \$6.75$	M1 A1	
	(b)	$R = k\left(\frac{1}{T}\right)^2$ or $k\frac{1}{T^2}$ $T \to 2T$; $\quad R \to k\left(\frac{1}{2T}\right)^2$ $\to \frac{1}{4} \times k\left(\frac{1}{T}\right)^2$ Hence, percentage change = –75%	B1 reciprocal square seen or implied B1 $\frac{1}{4}$ seen B1 accept "decrease by 25%"	**5**
13	(a)	$4(x-y)^2 - 9(x+y)^2$ $= [2(x-y)]^2 - [3(x+y)]^2$ $= [2x-2y]^2 - [3x+3y]^2$ $= [2x-2y+3x+3y][2x-2y-3x-3y]$ $= [5x+y][-x-5y]$ $= -[5x+y][x+5y]$	B1 Use of diff of 2 sq seen B1 –ve also factorised	
	(b)	$10ax + 15ay - 8bx - 12by$ $= 5a(2x+3y) - 4b(2x+3y)$ $= (5a-4b)(2x+3y)$	B1 Use of grouping seen B1	**4**
14		One angle in icosagon $= \frac{18 \times 180°}{20} = 162°$ One angle in polygon B $= 360° - 162° - 90° = 108°$ Let $(n-2)180° = 108n$ $n = 5$ B is a pentagon	M1 Finding angle in icosagon M1 Finding angle in polygon B A1 Sides in polygon B, soi A1	**4**

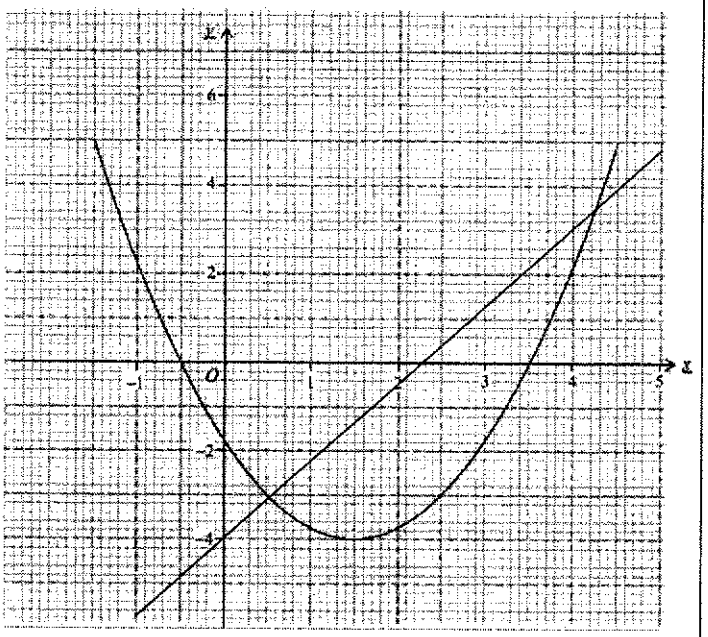
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		Key Steps	Mark allocation / Remarks		
15	(i)	$x_1 + x_2 + x_3 + \ldots + x_{10} = 11.8 \times 10$ $= 118$	B1		
	(ii)	$\sqrt{\frac{x_1^2 + \ldots + x_{10}^2}{10} - 11.8^2} = 4.729$ $\rightarrow x_1^2 + \ldots + x_{10}^2 = 1616$	B1 B1	Correct subs into formula	
	(iii)	Each value would differ more from the mean. Hence, the standard deviation will increase.	B1 B1	Correct reasoning only if reason is correct	5
16	(i)	arc $AB = 30 \times \frac{\pi}{6}$ $= 5\pi$ or 15.71	B1	accept either (min 3 s.f.)	
	(ii)	Perimeter $= (4 \times 5\pi) + \left(4 \times 5 \times \frac{\pi}{3}\right) + 8 \times 25$ $= 283.76$ cm	B1 B1 B1	$\frac{\pi}{3}$ seen Expression for perimeter min 3 s.f. (rej if in terms of π)	4
17	(i)	$(x+3)^2 + 1$	B1		
	(ii)	$y = x^2 + 6x + c$ $x^2 + 6x = y - c$ $x^2 + 6x + 3^2 = y - c + 3^2$ $(x+3)^2 = y - c + 9$ $x + 3 = \pm\sqrt{y - c + 9}$ $x = \pm\sqrt{y - c + 9} - 3$	B1 B1 B1	Use of completing square method seen $\pm$ seen	4
18	(i)	median = 33.5	B1		
	(ii)	LQ = 22, UQ = 42 Interquartile range = 20	B1 B1	At least LQ or UQ seen or implied	
	(iii)	Expand Branch A because Branch A has a more consistent flow of customers. or Expand Branch A because Branch A has more customers. or Expand Branch A because Branch A has consistently more customers.	B1	Branch A, with any logical supporting reason based on the central measure or dispersion measure.	4
19	(i)	$AB + BC = \sqrt{7^2 + 3^2} + \sqrt{5^2 + 2^2}$ $= 13.0009$ $= 13.0$	B1 B1 AG	Use of PT or distance formula Min of 4 sf **must** be seen	
	(ii)	$AC = \sqrt{12^2 + 5^2} = 13$ Sum angle of $ABCD = 360°$ because $ABCD$ is a 4-sided figure. OR Sum angle of $ABCD = 360°$ because ABC is not a straight line.	B1 B1 B1 Accept $AC \neq AB + BC$ Accept A, B and C are not collinear.	Use of PT or distance formula correct angle correct reason	
20	(i)	$3^4 \times 11^2$	B1		
	(ii)	All powers are even.	B1	o.e.	
	(iii)	$a = 11, b = 3$	B2		4

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		Key Steps	Mark allocation / Remarks		
21	(i)	$y = \frac{3}{4}x + 12$	B1	equation s.o.i.	
		$3x - 4y + 48 = 0$	B1	General form	
	(ii)	$= \frac{3\times 8 + (-4)2 + 48}{\sqrt{3^2 + (-4)^2}}$	B1	Subs into given formula seen	
		radius $= 12.8$	B1		4
22	(i)	$\frac{XY}{\sin 53°} = \frac{60}{\sin 77°}$	B1	Sine Rule with subs	
		$XY = 49.18$ m	B1		
	(ii)	332°	B1	Any method	
	(iii)				
		Minimum bearing = 281° to 283°	B1	Bearing stated.	4
23	(i)	(7, 6)	B1		
	(ii)	Gradient $PM = \frac{5}{6}$	B1	reject 0.833 or $0.8\dot{3}$	
	(iii)	$\tan QPR = \frac{10}{4} = \frac{5}{2}$, $\angle QPR = 68.2°$	B1	Finding $\angle QPR$ or $\angle MPR$	
		$\tan MPR = \frac{5}{6}$, $\angle MPR = 39.8°$			
		$\angle QPR \neq 2 \times \angle MPR$ Hence statement is wrong.	B1	Conclusion	4
		Other possible approaches: Showing that $PQ \neq PR$ and stating that ΔPQR is not isosceles.	B1		
		Hence statement is wrong.	B1		
		Showing that PM and QM are not perpendicular and stating that ΔPQR is not isosceles.	B1		
		Hence statement is wrong.	B1		

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		Key Steps	Mark allocation / Remarks	
24	(a)	$x = 1.5$	B1	
	(b)	Correct line seen within the domain $-1 \le x \le 5$	B1 B1	
				
	(c)	$x^2 - 3x - \frac{7}{4} = \frac{7}{4}x - 4$ $4x^2 - 12x - 7 = 7x - 16$ $4x^2 - 19x + 9 = 0$ $x = 0.5$ to 0.55, 4.2 to 4.25	B1 Form equation B2	**6**
		or $4x^2 - 19x + 9 = 0$ $4x^2 - 12x - 7 = 7x - 16$ $x^2 - 3x - \frac{7}{4} = \frac{7}{4}x - 4$ $x = 0.5$ to 0.55, 4.2 to 4.25	B1 Rearrange to the equations of the two graphs B2	

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2021 Secondary 4 Mathematics Prelim Paper 2 Marking Scheme

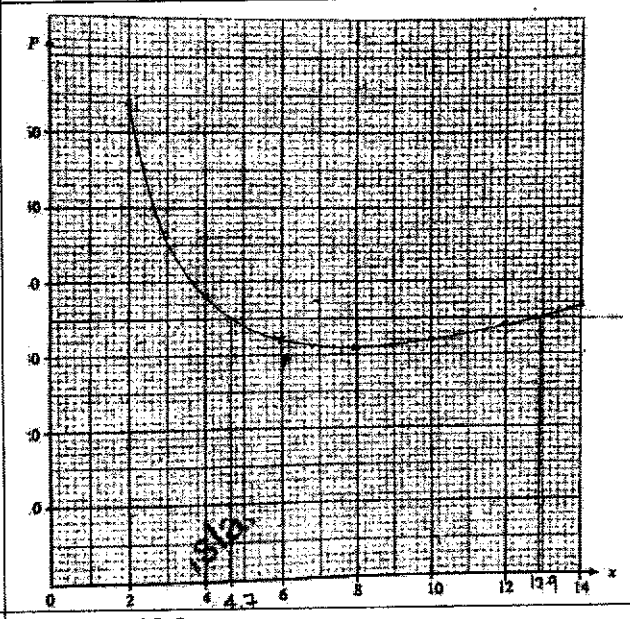
No.	Solution	Mark	Remarks
1ai	$\frac{w^2}{3}$	B1	
1aii	$\frac{3}{y-1}-\frac{5}{y+6}$ $=\frac{3y+18-5y+5}{(y-1)(y+6)}$ $=\frac{-2y+23}{(y-1)(y+6)}$	M1 A1	Combine fraction
1aiii	$\frac{2v^2-5v-12}{16-v^2}$ $=\frac{(2v+3)(v-4)}{(4+v)(4-v)}$ $=-\frac{2v+3}{v+4}$	M1 B1 A1	Factorise numerator $(4+v)(4-v)$ seen o.e
			Total: 6 marks
2a	$\begin{pmatrix}50 & 40\\ 0 & 20\\ 20 & 30\end{pmatrix}$	B1	cao
2b	$\begin{pmatrix}111 & 140\\ 8 & -1\end{pmatrix}$	B1 B1	−1 for each error
2c	Stall A because he would pay $8 more in stall B	B1	
2d	$[(111+8)+(140-1)]\times 0.7$ $= 83.3 + 97.3$ $= \$180.60$	B1 M1 A1	119 or 139 seen $\times 0.7$ 2 d.p
			Total: 7 marks
3ai	Height $= \frac{52.6}{12.7}$ $= 4.1417$ Sin $50 = \frac{4.1417}{RS}$ $RS = 5.4066$ $= 5.407$ (shown)	B1 B1	Height $= QR\sin 130$ 5.4066
3aii	$QS^2 = 12.7^2 + 5.407^2 - 2(12.7)(5.407)\cos 130$ $QS = 16.7$	M1 A1	Apply Cosine rule, cos130
3bi	$\angle ABC = 180 - 118$ ($\angle$s in opposite segment) $= 62$	B1	with reason
3bii	reflex $\angle AOC = 236$ ($\angle$ at centre $= 2\angle$ at circumfe $\angle BCO = 360 - 32 - 236 - 62$ $= 30$	B1 B1	
			Total: 7 marks

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No.	Solution	Mark	Remarks
4a	$OP = OQ$ (equal chords; $AB = BC$) $\angle OPA = \angle OQC = 90$ (perpendicular bisector of ch $AO = OC$ (radii of circle) Triangle $OAP \equiv$ triangle OCQ (RHS) **Alternatively,** $AP = CQ$ ($AB = BC$, $AP = \frac{1}{2}AB$, $CQ = \frac{1}{2}BC$) $OP = OQ$ (equal chords; $AB = BC$) $AO = OC$ (radii of circle) Triangle $OAP \equiv$ triangle OCQ (SSS)	B1 B1 B1 B1 B1 B1	 −1 for test not stated
4b	Shaded area = $2 \times \left[\frac{1}{2}(6)^2\left(\frac{11\pi}{18}\right) - \frac{1}{2}(6)^2 \sin\frac{11\pi}{18}\right]$ $= 35.3$ **Alternatively,** Shaded area = $\pi(6)^2 - \left(2 \times \frac{1}{2}(6)^2 \sin\frac{11\pi}{18}\right) - \frac{1}{2}(6)^2\frac{7\pi}{9}$	B1 M1 M1 A1	$\frac{11\pi}{18}$ seen Area of sector Area of triangle
			Total: 7 marks
5a	greatest possible area = $\frac{250.5}{8.35}$ $= 30$	B1 B1	250.5 seen cao
5bi	$\angle RAB = \angle QPB$ (corresponding $\angle$) $\angle ARB = \angle PQB$ (corresponding $\angle$) $\angle RCA$ is shared/common Triangles ABR and PBQ are similar (AA)	B1 B1	
5bii	Area PBQ : Area of Trapezium = 25 : 36 − 25 = 25 : 11	 B1 AG	 36 − 25 seen
5biii	Area of $ABR = \frac{22}{11} \times 36 = 72$ Area of $ABC = \frac{72}{3} \times 5$ $= 120$	B1 M1 A1	72 soi $\frac{\text{Their area } ABR}{3} \times 5$
			Total: 8 marks

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6ai	50 900	B1	50 893.8 50 900.4
6aii	$h = \dfrac{25893.8}{\pi(18)^2}$ $\qquad$ their ans $-25\,000$ / $\pi(18)^2$ $= 25.4$	M1 A1	
6aiii	Number of cups $= \dfrac{25000}{\frac{2}{3}\pi(3.5)^3}$ $= 278$	M1 A1	Volume of hemp cao
6b	Surface area $= 6x(6x)\times 5 + \frac{1}{2}(5x)(6x)\times 4$ $= 240x^2$	M1 B1 M1 A1	$6x6x$ (area of sq) Slant $h = 5x$ $\frac{1}{2}$(Their slant height)$(6x)\times 4$ cao
			Total: 9 marks
7a	$P = 2x + \left(\dfrac{60}{x}\right)\times 2$ $= 2x + \dfrac{120}{x}$	B1	$\left(\dfrac{60}{x}\right)\times 2$ seen
7b	64	B1	
7c		P2 C1	–1 mark for every wrong point plotted
7d	$4.7 \le x \le 12.9$	B1 B1	4.6 to 4.8 and 12.8 to 13.0 $4.68 \le x \le 12.82$
7e	$p = 4x$	B1	
			Total: 8 marks

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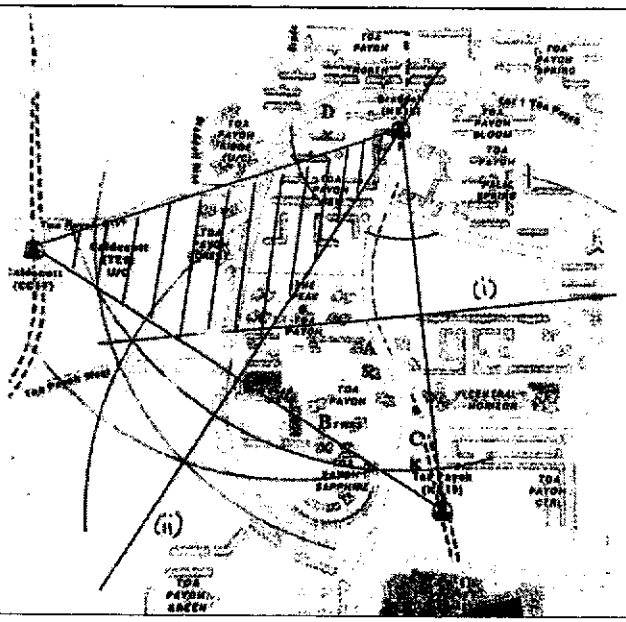
8a	$p = 121876.00$ $q = 21818.00$	B1 B1	Accept $p = 121876$ $q = 21818$
8bi	$3350 + 0.115\ (100058 - 80000)$ $= \$5656.67$ (shown)	B1 B1	3350 seen 20058 soi
8bii	Angie's income tax $= 0.55 \times 5656.67$ $= \$3111.1685$ Let x be the remaining income. $550 + x\ (7\%) = 3111.1685$ $x = \$36588.1214$ Angie's chargeable income $= 40\ 000 + 36588.1214$ $= \$76588.\ 12$ $\frac{76588.12}{100058} \times 100\% = 76.5\%$ Disagree as Angie's is 0.44 times Ahmad's chargeable income. **or** $100058 \times 55\% = \$55\ 031.90$ Disagree as Angie's income is less than \$55 031.90.	M1 M1 B1 A1 A1 A1	Finding Angie's income tax Formulate 550 or 40000 seen \$76588. 12 Express Angie's income as percentage Finding what 55% of Ahmad's income is
			Total: 9 marks

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9a	25 21	B1 B1	
9b	1025 isn't a perfect square	B1	oe
9c	$1584 = 561 + n^2 - 1$ $n^2 = 1024$ $n = 32$	M1 A1	
9di	$R = \frac{3}{2}n(n+1)$	B1	oe
9dii	408	B1	
9e	$D = \frac{1}{2}(n+1)(n+2)$	B1	oe
			Total: 8 marks
10a	121, 127.5, 132 120 and 131	B1 B1 B1	*LQ UQ* Median *LQ UQ*
10b	The median of the cumulative curve will be on the left.	B1	
10ci	False because the median mass for apples is lower.	B1	
10cii	True because upper quartile for mass of oranges is higher	B1	
10di	126.25 or $126\frac{1}{4}$	B1	Accept 3s.f and above (126, …)
10dii	8.57	B1	cao
10diii	$1 - \frac{15}{40} \times \frac{14}{39}$ $= \frac{45}{52}$ Or $\frac{25}{40} \times \frac{24}{39} + \frac{25}{40} \times \frac{15}{39} \times 2$ $= \frac{45}{52}$	M1 A1 M1 A1	When all weight less than 125g
			Total: 10 marks
11ai	$\frac{72}{x}$	B1	
11aii	$\frac{144}{x-2}$	B1	
11aiii	$\frac{72}{x} + \frac{144}{x-2} = 25$ $72(x-2) + 144x = 25(x-2)$ $216x - 144 = 25x^2 - 50x$	B1 B1	Their ai + aii = 25

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	$25x^2 - 266x + 144 = 0$ (shown)		
11aiv	$x = \dfrac{22 \pm \sqrt{266^2 - 4(25)(144)}}{2(25)}$ $x = 10.068$ or 0.572	M1 A1A1	Ignore rejection
11b	Time = $\dfrac{4}{10.068 - 2}$ = 29 mins 45 secs	M1 A1	Replace 11aii by x = 10.068
			Total: 9 marks
12ai 12aii 12aiii		B1 B1 B1	
12b	D because the psf is the lowest **Or** D because price per metre square is the lowest.	B1	
12c	**John and Chieh** Purchase price = 46 500 – 80 000 – 50 000 = 46 500 – 130 000 = $335 000 Interest = (their purchase price) [redacted] = $117 585 **Janet** Purchase price = 348 338 – 50 000 – 15 000* = 283 338 (their purchase price) [redacted] < 117585 $n < 30.7$ Janet should finish servicing her loan in 20 years to incur less interest. I took the average of the grant for PHG as I am unsure if she would receive the full grant or not.	 B1 M1 B1 M1 M1 M1 B1 B1	[choosing **C**] 46 500 seen Find purchase price – grant 130 000 seen Find Int. (HDB) *10000 – 20000 Find Int. (Bank) State the no of years. State assumption
			Total: 12 marks

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