FAIRFIELD METHODIST SCHOOL (SECONDARY)

PRELIMINARY EXAMINATION 2024
SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

MATHEMATICS 4052/01

Paper 1

Date: 19 August 2024 **Duration: 2 hours 15 minutes**

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

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

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

If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is 90.

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

Table of Penalties		Question Number		
Presentation	☐ 1 ☐ 2			/ 90
Rounding off	☐ 1		Parent's/Guardian's Signature	

Setter: Mr Alester Tan

This question paper consists of 23 printed pages

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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 $= \pi rl$

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

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Answer **all** the questions.

1 Given that $p : 16 = 3 : 20$, find the value of p.

Answer $p =$..... [1]

---

2 **(a)** Factorise completely $2a^2c - ad - 2abc + bd$.

Answer ..... [2]

(b) Expand and simplify $(7x - 4y)(x + 3y)$.

Answer ..... [2]

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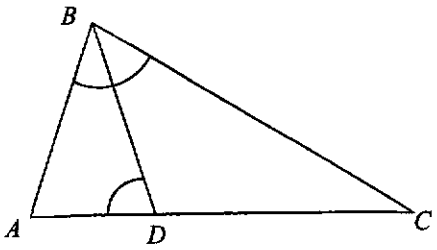
3 Tristen has written five positive integers.
The median of these numbers is 8, the mode is 7 and the mean is 13.
The range of these numbers is 21.

Find the five numbers.

Answer .... [2]

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4 In the diagram, ABC is a triangle. D is the point on AC such that $\angle ABC = \angle ADB$.



(a) Show that triangles ABC and ADB are similar.

Answer

.....

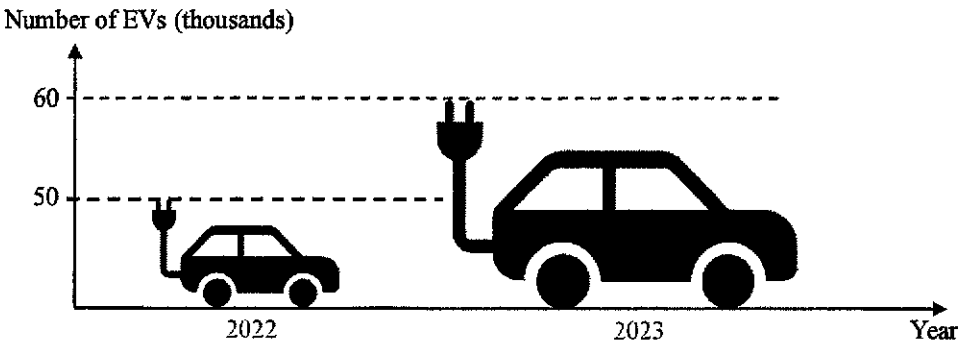
.....[2]

(b) Given that $AB = 8$ m and $AD = 5$ m, find AC.

Answer .....m [1]

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5 The graph shows the number of electric vehicles (EVs) manufactured by a company for the years 2022 and 2023.



Explain how the graph above may be misleading.

Answer

.....

..... [1]

---

6 A map has a scale of 1 : 2 000 000.
The area of Johor Bahru on the map is 0.55 cm^2.
Calculate the actual area, in square kilometres of Johor Bahru.

Answer .....km^2 [2]

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7 In a sequence, the same number is added each time to obtain the next term.
The second term of the sequence is 11 and the fifth term of the sequence is 32.

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

Answer ..... [1]

(b) Explain why 121 is not a term in the sequence.

Answer

.....

..... [1]

---

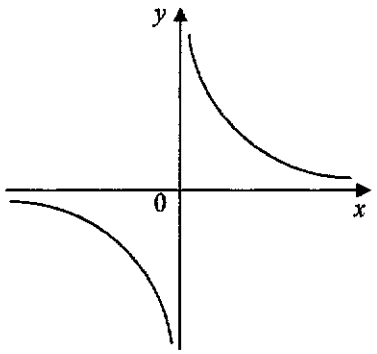
8 The force, F, between two particles is inversely proportional to the square of the distance, d, between them.

Calculate the percentage change in force when the distance between the two particles is increased by 350%.

Answer ..... % [2]

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9 **(a)** The sketch represents the graph of $y = x^n$. Write down a possible value of n.

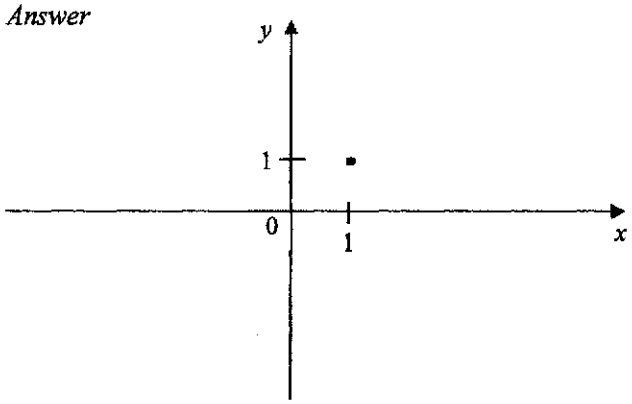


Answer $n =$ ..... [1]

(b) The point (1, 1) is marked on each diagram below.
On these diagrams, sketch the graphs of

(i) $y = 2x + 1$,

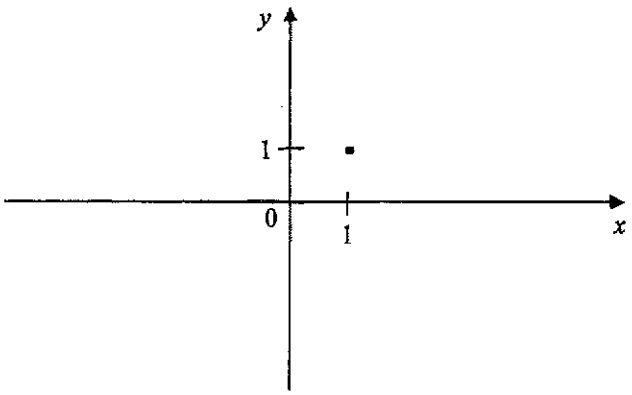
Answer



[1]

(ii) $y = \frac{2}{x^2}$.

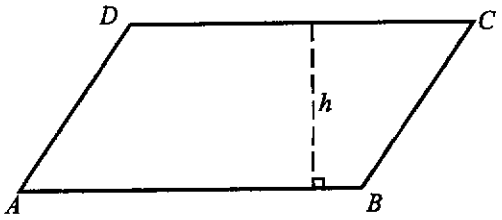
Answer



[1]

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10 The diagram shows a parallelogram $ABCD$. The perpendicular height is h cm.



The area of parallelogram is increased by 150% when AB is reduced by 20% and h is increased by x %. Find the value of x.

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

---

11 The frequency table shows the Mathematics quiz marks of 25 students. The mean marks is 13.8.

Marks	12	13	14	15	16
Number of students	5	5	7	6	2

(a) Find the standard deviation of the marks.

Answer ..... [2]

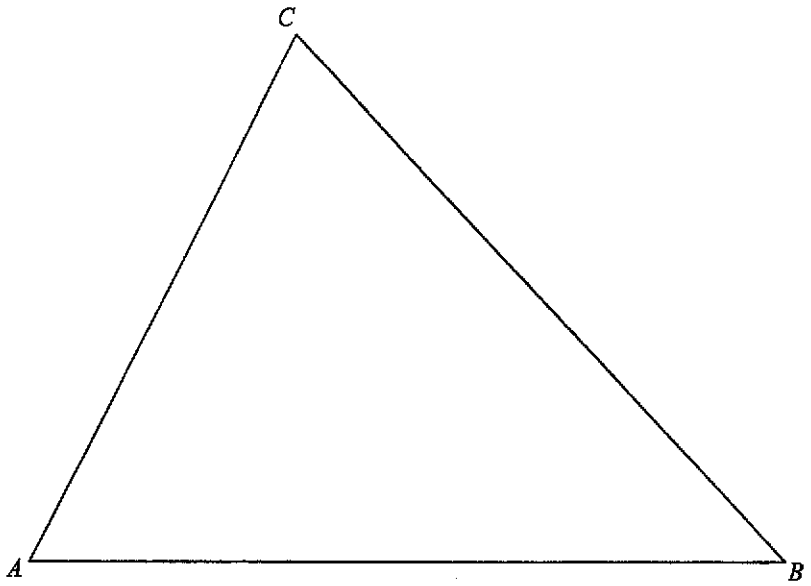
(b) It was discovered that there was a mistake in the recording of the quiz marks. The correct mark for each student was 3 more than the recorded mark.
A student commented that the spread of the quiz marks in the class is now wider after the addition of marks.
Explain why his comment is wrong using mean and standard deviation of the marks.
Answer

.....

..... [1]

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12 Three points A, B and C are shown below.



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

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

(c) These two bisectors meet at P.
Complete the statement below.
Answer

The point P is equidistant from the lines ..... and .....

and equidistant from the points ..... and ..... . [1]

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13 **(a)** Use prime factors to explain why 54×150 is a perfect square.

Answer

.....

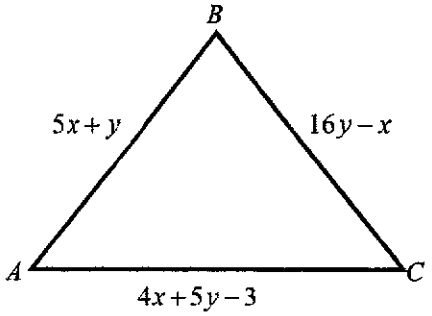
..... [2]

(b) The number $150k$ is a perfect cube.
Find the smallest possible integer value of k.

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

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14 ABC is an equilateral triangle with lengths $(5x+y)$ cm, $(16y-x)$ cm and $(4x+5y-3)$ cm.



(a) Write down two simultaneous equations, in terms of x and y, to represent this information.

Answer .....

..... [2]

(b) Solve the simultaneous equations and hence find the area of triangle ABC.

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

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15 **(a)** Given that $\frac{4^{\frac{1}{2}}}{16^{y+1}} = 8^{2-y}$, find the value of y.

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

(b) Jasmine says that 2^{500} is greater than 5^{250}. Do you agree with her statement? Justify your answer with mathematical working.

Answer

.....

.....

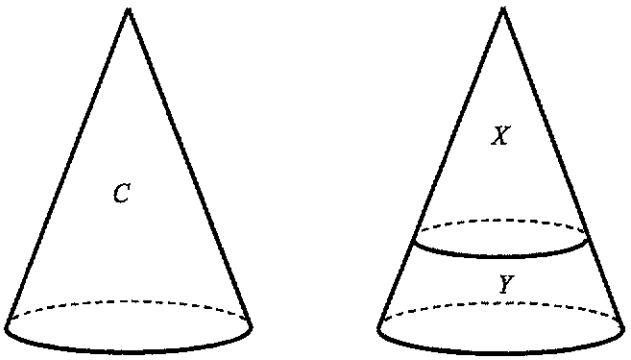
.....

.....

.....[2]

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16



A solid cone, C is cut into two parts, X and Y, by a plane parallel to the base.
The ratio of the areas of the bases of X and C is 25 : 49.

(a) Find the ratio of the circumference of the bases of X and C.

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

(b) The mass of C is 36 kg. Find the mass of Y.

Answer .....kg [2]

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17 (a) (i) The expression $x^2 - 12x + 5$ is equivalent to $(x-a)^2 + b$.

Find the value of a and the value of b.

Answer $a =$.....

$b =$..... [2]

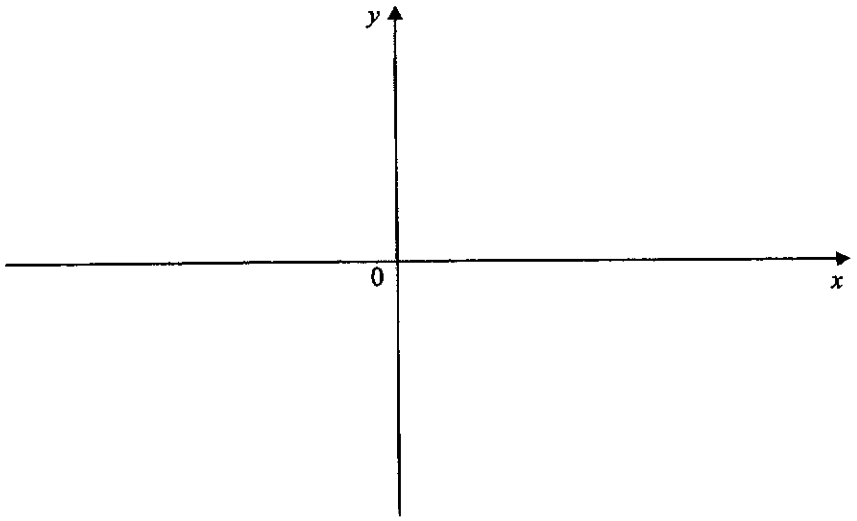
(ii) The curve $y = x^2 - 12x + 5$ is drawn.

Write the equation of the line of symmetry of the curve.

Answer ..... [1]

(b) (i) Sketch the graph of $y = -(x-3)(x+5)$ on the axes below.

Indicate clearly the values where the graph crosses the x- and y-axes.



[2]

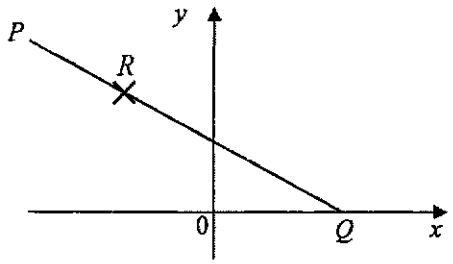
(ii) State the coordinates of the maximum point of the graph of $y = -(x-3)(x+5)$.

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

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18 In the diagram, $R(-3, 4)$ is on PQ such that the midpoint of RQ lies on the y-axis.

Point Q lies on the x-axis.



(a) Find the coordinates of Q.

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

(b) Given that the point P has coordinates $(x, 6)$, find the value of x.

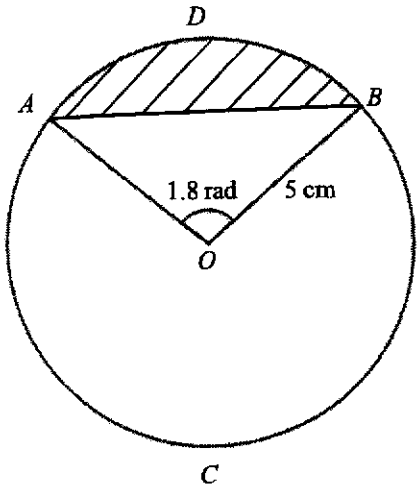
Answer $x =$ ..... [2]

(c) Find the equation of the line PQ.

Answer ..... [1]

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19 A, B, C and D lie on a circle with centre O and radius 5 cm. $\angle AOB = 1.8$ radians.



(a) **(i)** Write down an expression, in terms of π, for the reflex angle AOB.

Answer .....rad [1]

(ii) Find an expression, in terms of π, for the length of the arc ACB.

Answer .....cm [1]

(b) Find the area of the shaded segment ADB.

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

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20 **(a)** $\xi = \{\text{integers } x : 1 \le x \le 18\}$

$A = \{1, 4, 9, 16\}$

$B = \{\text{integers that are divisible by 2}\}$

(i) Describe the elements of set A.

Answer

..... [1]

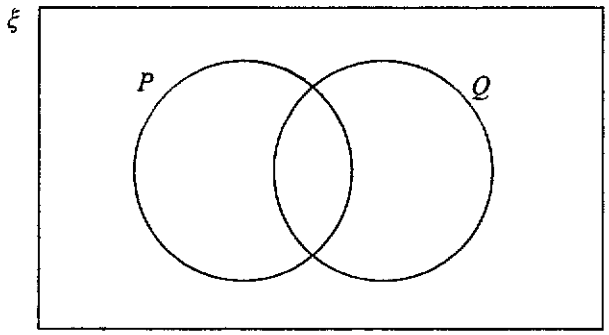
(ii) List the elements contained in the set $A \cap B'$,

Answer ..... [1]

(iii) Write down the number of elements contained in the set $A \cup B$.

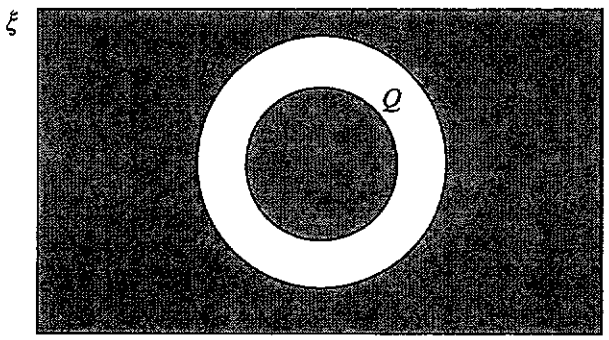
Answer ..... [1]

(b) **(i)** On the Venn diagram, shade the region which represents $(P \cup Q)'$.



[1]

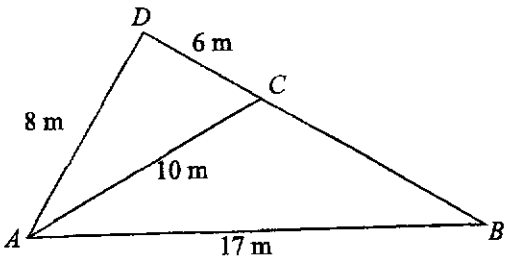
(ii) Using set notation to describe the shaded region.



Answer ..... [1]

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21 **(a)** In the diagram below, DCB is a straight line.
$AD = 8$ m, $AC = 10$ m, $CD = 6$ m and $AB = 17$ m.



(i) Show that $\angle ADC$ is a right angle.
Answer

.....

..... [2]

(ii) Express the value of $\cos \angle ACB$ as a fraction in its lowest term.

Answer ..... [1]

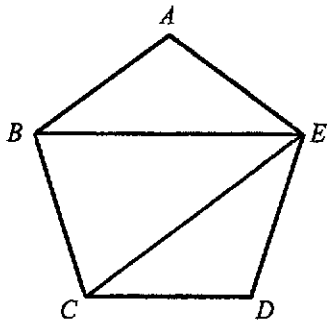
(b) $\sin x° = 0.8929$

Find two possible values of x in the range $0° \leq x \leq 180°$.

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

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22 In the diagram, $ABCDE$ is a regular pentagon.



(a) Calculate

(i) $\angle BAE$,

Answer .....° [1]

(ii) $\angle AEB$,

Answer .....° [1]

(iii) $\angle BEC$.

Answer .....° [1]

(b) Explain why BE is parallel to CD.

Answer

.....

.....

..... [1]

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23 The stem-and-leaf diagram below shows the times, in minutes, taken by 15 students to complete a task.

Stem	Leaf						
1	5	6	8	9	9		
2	0	2	4	p	5	5	7
3	0	0	2				

Key: 1 | 5 represents 15 minutes

(a) The modal time is 25 minutes. Find the value of p.

Answer $p =$ ..... [1]

(b) Find the interquartile range.

Answer ..... minutes [2]

(c) When the time taken for the 16th student is added to the diagram, the median is 23 minutes. What is the possible time taken by this student to complete a task?

Answer ..... minutes [1]

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24 There are 30 blue balls, 20 green balls and 14 yellow balls in a bag.
A ball is chosen at random from the bag and then replaced.

(i) Find the probability of not picking a green ball, express your answer to the lowest term.

Answer ..... [1]

(ii) The probability of picking a green ball from the bag after x number of green balls are removed is $\frac{3}{14}$. Using algebra, find the value of x.

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

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25 Two outlets of a coffee chain sell three different types of coffee: espresso, flat white and mocha. The table shows the number of cups of each type of coffee sold on a particular day.

Outlet	Expresso	Flat White	Mocha
A	30	30	35
B	x	$x+2$	40

This information can be represented by the matrix $\mathbf{P} = \begin{pmatrix} 30 & 30 & 35 \\ x & x+2 & 40 \end{pmatrix}$.

The coffee chain sells a cup of espresso at \$2.50, a cup of flat white at \$4 and a cup of mocha at \$5.50.

This information can be represented by the matrix $\mathbf{Q} = \begin{pmatrix} 2.5 \\ 4 \\ 5.5 \end{pmatrix}$.

(a) Find, in terms of x, the matrix $\mathbf{R} = \mathbf{PQ}$.

Answer $\mathbf{R} =$ ..... [1]

(b) Explain what the elements of the first row of matrix **R** represent.

Answer

.....

..... [1]

(c) Outlet B collected \$100.50 more than Outlet A from the sales of coffee on that particular day. Find x.

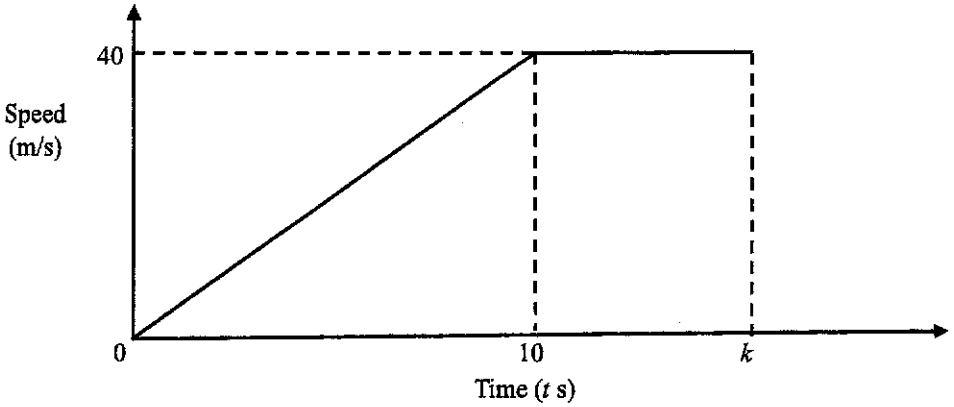
Answer $x =$ ..... [1]

(d) The elements of matrix **T**, where $\mathbf{T} = \mathbf{SR}$, represents the total amount of money, in dollars, collected in outlets A and B on that particular day. Write down the matrix **S**.

Answer $\mathbf{S} =$ ..... [1]

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26 The diagram is the speed-time graph for the first k seconds of the motion of an object.



(a) Find the acceleration when $t = 5$.

Answer ..... m/s^2 [1]

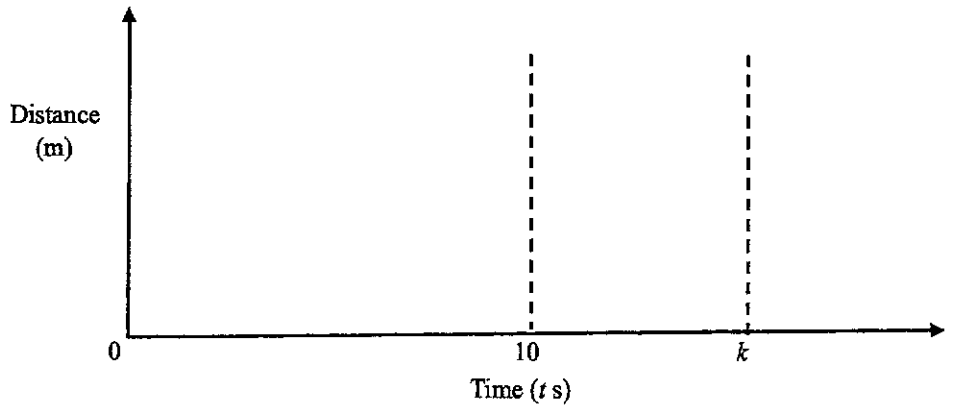
(b) Find the distance travelled in the first 10 seconds.

Answer .....m [1]

(c) The distance travelled in the first k seconds is 520 m. Find the value of k.

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

(d) On the axes in the answer space, sketch the distance-time graph for the first k seconds of the motion of the object.



[2]

~ End of Paper ~

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FAIRFIELD METHODIST SCHOOL (SECONDARY)

PRELIMINARY EXAMINATION 2024
SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

MATHEMATICS 4052/02

Paper 2

Date: 20 August 2024 **Duration: 2 hours 15 minutes**

Candidates answer on the Question Paper.

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For π, use either your calculator value or 3.142.

For Examiner's Use

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Presentation	☐ 1 ☐ 2			
Rounding off	☐ 1		Parent's/Guardian's Signature	90

Setter: Mr James Quek

This question paper consists of 26 printed pages

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Mathematical Formulae

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

Mensuration

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

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

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

Trigonometry

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

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

Statistics

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

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

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Answer **all** the questions.

1 **(a)** $g = f - \dfrac{p}{3+p}$

(i) Find g when $f = -6$ and $p = 2$.

Answer $g =$ ..... [1]

(ii) Rearrange the formula to make p the subject.

Answer $p =$ ..... [2]

(b) Solve the inequality $x - 7 > \dfrac{8x+1}{3}$.

Answer ..... [2]

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1 (c) Solve the equation $\frac{2x-3}{3}+\frac{x}{4}=4$.

Answer x = ... [2]

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1 **(d)** Solve the equation $\frac{7}{x+2} - \frac{4}{3-2x} = 5$.

Give your solutions correct to two decimal places.

Answer $x =$ ..... or $x =$ ..... [5]

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2 **(a)** Susan owns an online shop that sells power banks.
She buys a box of 120 power banks from an overseas warehouse at $1800.
It cost her $150 to ship the power banks.
She plans to sell each power bank at $45.

Calculate the percentage profit Susan makes on each power bank she sells for $45.

Answer .....% [2]

(b) Susan borrows $5000 from a bank to import more products for her online shop.
She is charged with a compound interest of 2.55% per year.
She pays the money back after 2 years.

Calculate the total amount of interest she needs to pay to the bank.
Give your answer correct to the nearest cent.

Answer $ ..... [2]

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2 (c) In the year 2022, Singaporeans spent \$12 163 million on e-commerce.
The population of Singapore in 2022 was 5.637×10^6.

(i) Write \$12 163 million in standard form correct to 3 significant figures.

Answer \$ ..... [1]

(ii) Calculate the mean amount of money spent per Singaporean per month in 2022. Give your answer correct to the nearest dollar.

Answer \$ ..... [2]

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2 **(d)** The exchange rate between Singapore dollars (SGD) and Hong Kong dollars (HKD) is SGD 1 = HKD 5.75.
The exchange rate between Chinese Yuan Renminbi (CNY) and Singapore dollars is CNY 100 = SGD18.64.

Susan is planning for a business trip to Shenzhen (China) and Hong Kong.
She finds these hotel prices from a tour agency.

Shenzhen Hotel CNY 2550 per night plus 10% service charge.
Hong Kong Hotel HKD 2550 per night.

Susan books 3 nights in Shenzhen and 2 nights in Hong Kong.

(i) Calculate the total amount Susan pays for three nights in Shenzhen.

Answer CNY ..... [1]

She uses her credit card for stay in Hong Kong and Alipay to pay for her stay in Shenzhen.

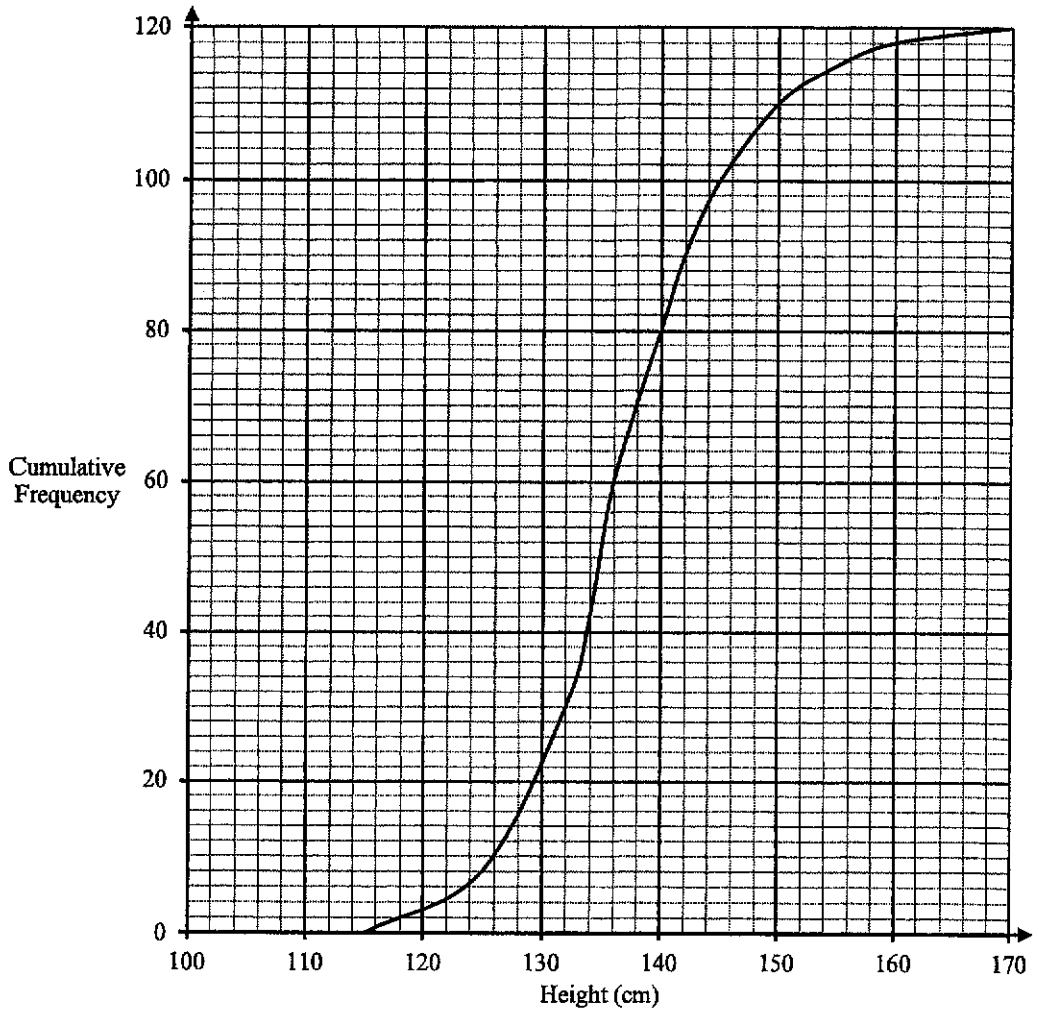
The credit card company will convert the overseas amount to Singapore dollars and there is a currency conversion fee of 1.5%. There is no conversion fee when using Alipay.

(ii) Calculate the total amount Susan pays for the two hotels in Singapore dollars. Give your answer correct to the nearest dollar.

Answer SGD ..... [3]

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3 The cumulative frequency graph shows the height distribution of 120 girls in Secondary One of Casa Secondary School.



(a) Use the graph to estimate

(i) the median height,

Answer ..... cm [1]

(ii) the interquartile range of the heights.

Answer ..... cm [2]

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3 **(b)** For a girl to be selected to join the school's volleyball team, she must be of at least 160 cm in height. Estimate the percentage of the girls who meets the above criteria.

Answer ..... % [2]

(c) The heights of 120 girls in Secondary One from Landmark Secondary School were recorded. The median height is 140 cm and the interquartile range of the height is 13 cm.

Make two comparisons between the height distribution in Casa Secondary School and Landmark Secondary School.

1 .....

.....

.....

.....

2 .....

.....

.....

..... [2]

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3 **(d)** The table summarises the amount of weekly allowance in a class.

Allowance, x (\$)	$15 \leq x < 20$	$20 \leq x < 25$	$25 \leq x < 30$	$30 \leq x < 35$	$35 \leq x < 40$
Number of students	5	13	15	6	6

Two of the students were selected at random.
Find, as a fraction in its simplest form, the probability that

(i) they both had weekly allowance that is less than \$25,

Answer ..... [1]

(ii) one had at least \$30 of weekly allowance and the other had less than \$20 of weekly allowance.

Answer ..... [2]

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4 The table below shows some values of x and corresponding values of y for $y=\frac{6}{x^2}-\frac{3}{2}x-6$.

(a) Complete the table of values, giving your answer correct to 1 decimal place.

x	–3	–2	–1	–0.7	0.6	1	2	3
y	–0.8		1.5	7.3	9.8	–1.5	–7.5	–9.8

[1]

(b) On the grid, draw the graph of $y=\frac{6}{x^2}-\frac{3}{2}x-6$ for $-3\leq x\leq 3$. [3]

(c) **(i)** On the same grid, draw the graph of $2y-5x=10$ for $-3\leq x\leq 2$. [2]

(ii) Write down the x-coordinates of the points where the line intersects the curve.

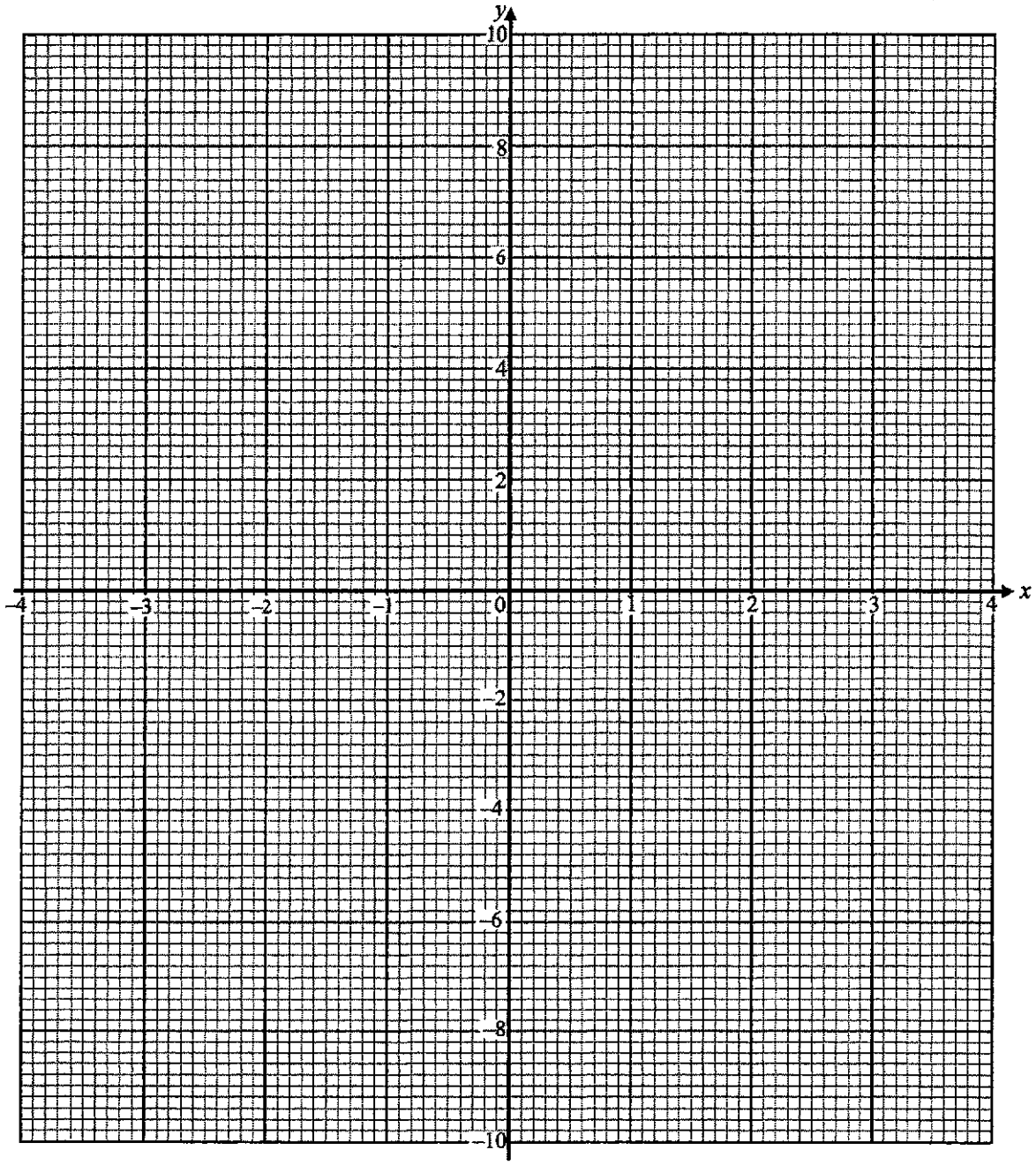
Answer x = ..., ... and ..... [2]

(iii) These values of x are solutions to the equation $4x^3+Ax^2+B=0$.
Find the value of A and the value of B.

Answer A = ...

B = ... [3]

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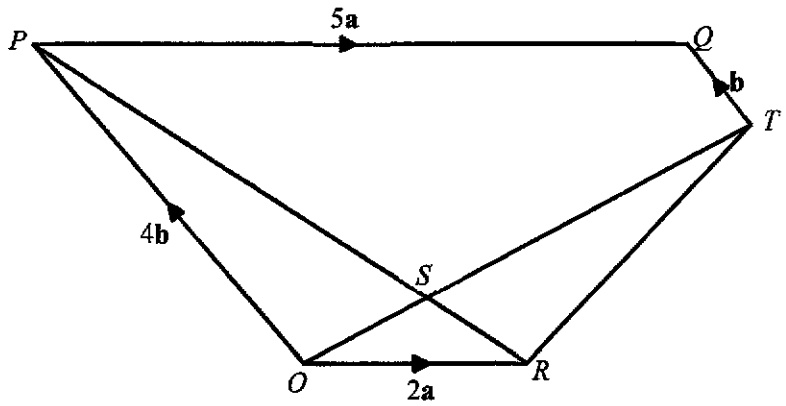
5 **(a)** P is the point $(8, -4)$ and Q is the point $(6, 2)$.
R has the coordinates $(2, h)$. and $\overrightarrow{PQ} = k\overrightarrow{PR}$.
Find the value of h and k.

Answer $h =$ .....

$k =$ .....[3]

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5 (b)



In the diagram, $\overrightarrow{OR} = 2\mathbf{a}$, $\overrightarrow{OP} = 4\mathbf{b}$, $\overrightarrow{TQ} = \mathbf{b}$ and $\overrightarrow{PQ} = 5\mathbf{a}$.
PR and OT intersect at point S such that $PS : PR = m : 13$.

(i) Express $\overrightarrow{OS}$ in terms of **a**, **b** and m as simply as possible.

Answer ..... [2]

(ii) Given that $ST : OS = 9 : 4$, find the value of m.

Answer ..... [3]

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5 (b) (iii) U is the point such that $\overrightarrow{RU} = \frac{2}{3}(7\mathbf{a} + 6\mathbf{b})$.

Explain why O, S and U lies on a straight line.

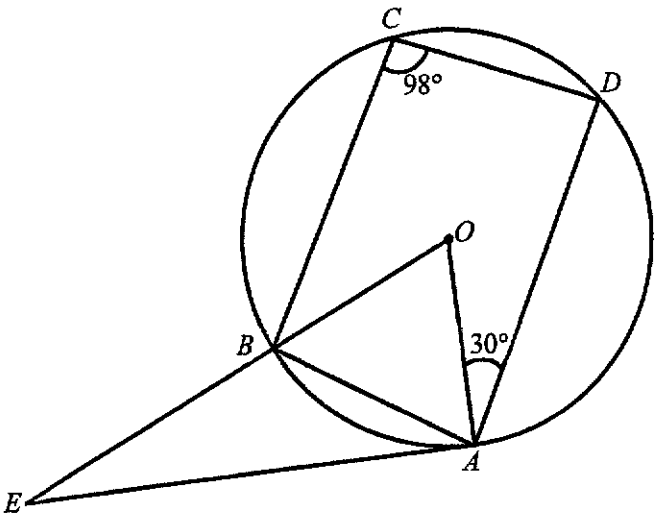
Answer

.....

..... [3]

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6 (a)



A, B, C and D are points on the circumference of a circle with centre O.
AE is a tangent to the circle at A and OE is a straight line that passes through the circle at point B. Angle BCD is 98° and angle OAD is 30°.

(i) Find angle OEA. Give reasons for each step of your working.

Answer .....° [3]

(ii) Explain why a semicircle with OE as diameter, passes through the point A.

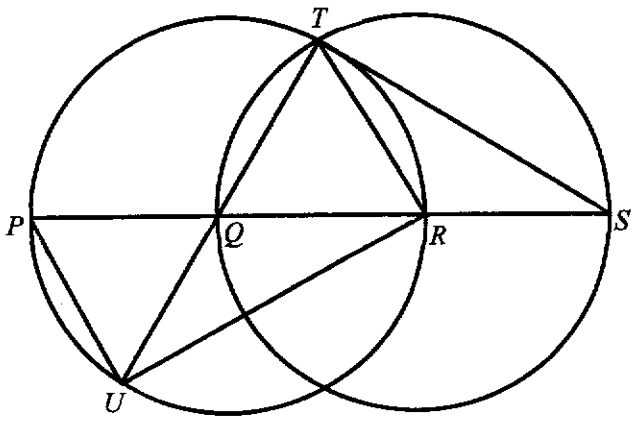
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.....[1]

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6 (b)



The diagram shows two circles with equal radii.
P, R, U and T are points on the circle with centre Q.
Q, T and S are points on the circle with centre R. $PQRS$ and UQT are straight lines.

Show that triangles STQ and URT are congruent.

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..... [3]

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7

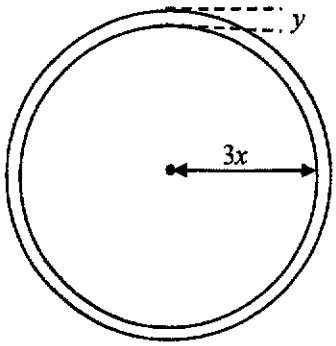


Diagram A

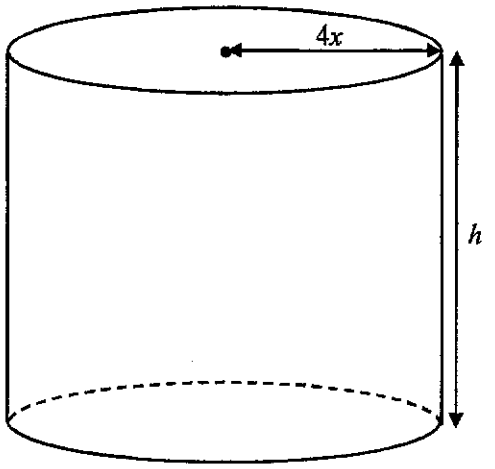


Diagram B

A golf ball is made of a spherical inner rubber core and coated with an exterior layer ionomer resin. Diagram A shows the cross-section of a golf ball. The inner core has a radius of $3x$ mm and the thickness of the resin is y mm.

(a) Show that the volume of the inner core is $36\pi x^3$ mm^3.
Answer

[1]

(b) The inner rubber core is moulded from a cylindrical rubber tube with radius of $4x$ mm and height of h mm as shown in Diagram B. The cylindrical rubber tube can produce 200 inner rubber cores. Find h in terms of x.

Answer $h =$ ..... [2]

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7 (c) The volume of the cylindrical rubber tube is 2024363π mm^3, calculate the value of x.

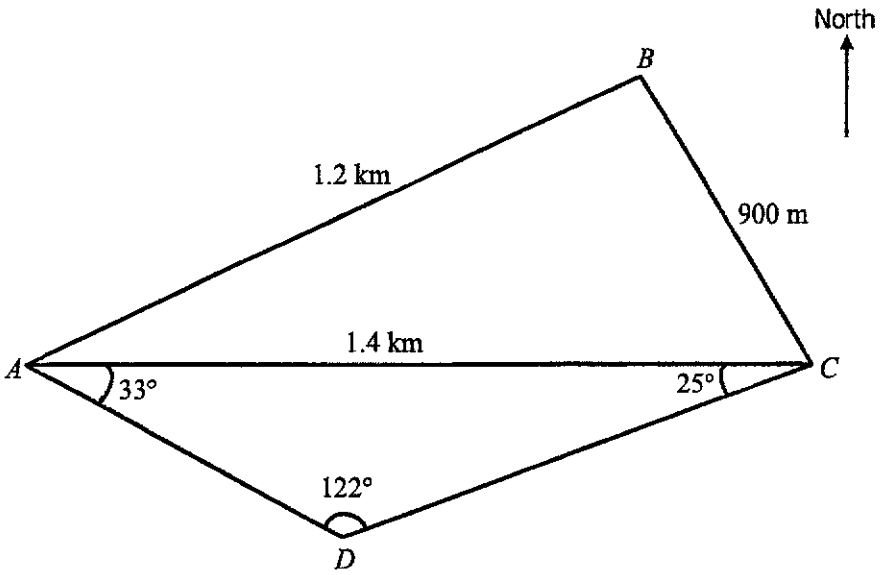
Answer x = ... [2]

(d) Each inner rubber core is coated with 1.8 mm of ionomer resin.
The golf ball then is wrapped round with a plastic sheet.
Given that the dimensions of the plastic sheet are 62 cm × 92 cm, calculate the number of golf balls that can be wrapped from this plastic sheet.

Answer .....golf balls [4]

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8



ABC and ADC are two triangular plots of farmland.
$AB = 1.2$ km, $AC = 1.4$ km and $BC = 900$ m.
Angle $ADC = 122°$, angle $DAC = 33°$ and angle $ACD = 25°$.

(a) Calculate angle BAC.

Answer .....° [3]

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8 **(b)** Find the shortest distance from D to a point along the path AC.

Answer ..... km [3]

(c) A meteorological tower of 300 m tall is installed vertically at point D.
Find the largest angle of depression from the top of the tower to a point along the path AC.

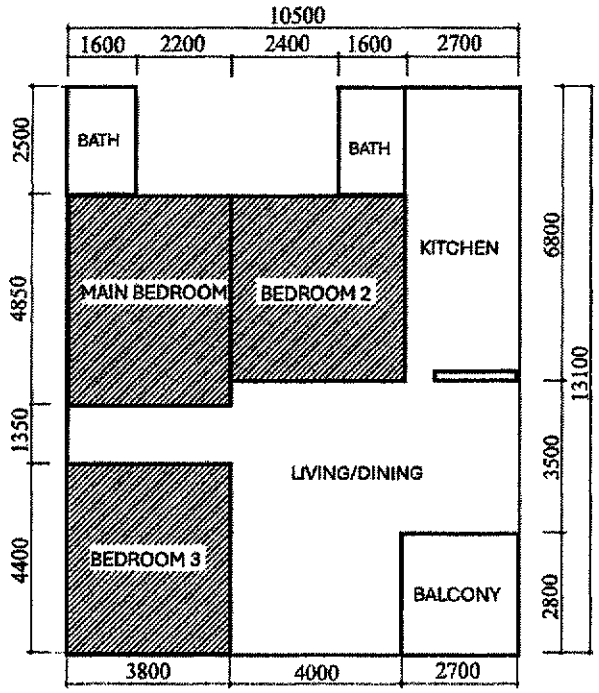
Answer .....° [2]

(d) A is due west of C. Find the bearing of A from B.

Answer .....° [1]

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9 Kent is a new renovation project manager who recently graduated from the University of Singapore.
He wants to promote his company's timber flooring for bedrooms. Below a is floor plan of an apartment.



Dimensions in mm

(a) Calculate the area of the three bedrooms in square metres.

Answer .....m^2 [2]

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9 (b) Kent found out from his colleagues that a cement screed of 0.05 m thickness is needed in each bedroom before the timber planks can be laid on top.
Calculate the total volume of cement screed, in cubic metres, needed for the three bedrooms.

Answer .....m^3 [1]

(c) Kent's colleague also gives him this information.

Construction Materials		
Item	**Description**	**Unit Cost**
Pre-Mixed Cement-Sand Mixture (Local)	Bag of 40 kg Bulk (1 – 49 bags) Bulk (50 – 99 bags) Bulk (100+ bags)	 \$20.00 \$18.50 \$16.50
• 1400 *kg of cement-sand mixture produce to up* 1 *cubic metres of cement screed*		
Timber Planks (Vietnam)	6 cm × 30 cm 50 planks per box	\$35.50
• *Timber planks are fitted so that the number of planks needed depends on the floor area and not on the orientation of the planks.*		

Manpower		
Type	**Description**	**Unit Cost**
General Worker	Mixing/pouring cement screed and finishing surface	\$5 per hour
Skilled Worker	Installation, polishing and repair of timber flooring	\$10 per hour
• *A worker is only allowed to work for 8 hours per day*		

Installation		
Item	**No of workers required**	**No of Days to complete**
Cement Screed Construction	4	1
Timber Flooring Installation	2	3

1 square foot = 0.09203 square metres

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9 (c) Kent needs to decide how much he should charge his customers for the timber flooring installation for three bedrooms. He must make sure that he charges enough money to cover all his costs (Construction Materials, Manpower and Installation).

Suggest a sensible amount in price per square foot to charge his customers.
Justify the decision you made and show your calculations clearly.

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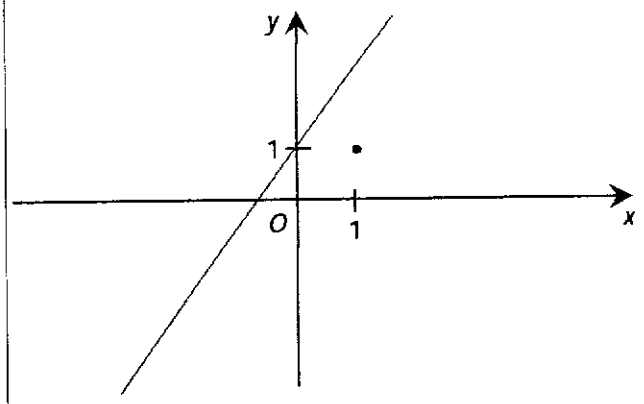
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~ End of Paper ~

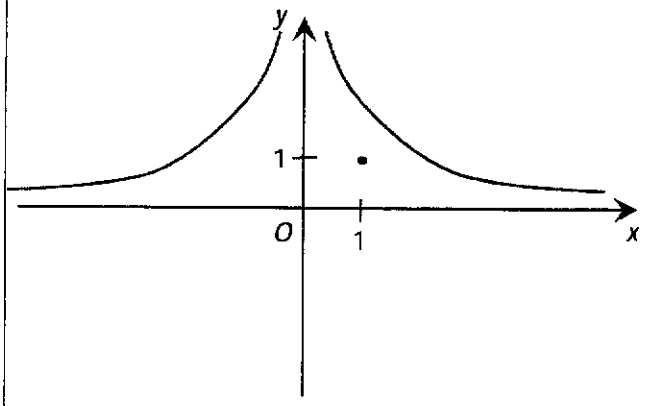
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Sec 4 Exp/5 NA Prelim Paper 1 2024			
Q	**Solution**	**Marks**	**AO**
1	$p:16=3:20$ $\frac{p}{16}=\frac{3}{20}$ $p=\frac{3}{20}\times16$ $=2.4 \text{ or } \frac{12}{5}$	 B1	N3 AO1
2a	$2a^2c-ad-2abc+bd$ $=a(2ac-d)-b(2ac-d)$ $=(a-b)(2ac-d) \text{ or } (b-a)(d-2ac)$	 B1, B1 / B2	N5 AO1
2b	$(7x-4y)(x+3y)$ $=7x^2+21xy-4xy-12y^2$ $=7x^2+17xy-12y^2$	 M1 A1	N5 AO1
3	7, 7, 8, 15, 28	B1 – 7, 7, 8 B1 – 15, 28	S1 AO2
4a	$\angle CAB=\angle BAD \text{ (common angle)}$ $\angle ABC=\angle ADB \text{ (given)}$ Since 2 pairs of corresponding angles are equal, triangle ABC and ADB are similar. OR by AA *Similarity Test*	M1 – show two pairs of corresponding angles are equal AG1 – correct reason	G2 AO3
4b	$\frac{AC}{AB}=\frac{AB}{AD}$ $\frac{AC}{8}=\frac{8}{5}$ $AC=\frac{8}{5}\times8$ $AC=12.8m \text{ or } 12\frac{4}{5}m \text{ o.e.}$	 B1	G2 AO1
5	It may mislead readers thinking the number of EVs manufactured in 2023 is at least twice the number manufactured in 2022 based on the height or size of the picture.	B1 – Accept any similar answers on comparing size of the pictures	S1 AO3
6	$1cm:2000000cm$ $1cm:20km$ $1^2cm^2:20^2km^2$ $1cm^2:400km^2$ $400\times0.55=220km^2$	 M1 either 20^2 or 400 A1	N2 AO1

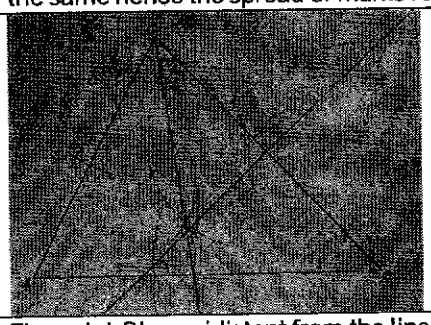
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Q	Solution	Marks	AO
7a	$4+7(n-1)$ or $7n-3$	B1	N5 AO1
7b	If 121 is a term, $7n-3=121$ $7n=124$ $n=17.714$ (5sf) or $\frac{124}{7}$ or $17\frac{5}{7}$ o.e. Since n is **not a positive integer**, 121 is not a term	B1 with working of showing n = 17.714	N5 AO3
8	$F=\frac{k}{d^2}$ $k=Fd^2$ $new\ d=4.5d$ $new\ F=\frac{k}{(4.5d)^2}$ $new\ F=\frac{Fd^2}{20.25d^2}$ $new\ F=\frac{4}{81}F$ $\%change=\frac{\frac{4}{81}-1}{1}\times 100$ $=-\frac{7700}{81}\%\ or\ -95\frac{5}{81}\%\ or -95.1\%(3s.f)$	M1 - show $\frac{1}{20.25}$ or $\frac{4}{81}$ A1	N2 AO2
9a	n = any negative odd integer (-1, -3, -5 etc)	B1	N6 AO1
9bi		B1 – line must cut y = 1	N6 AO1

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Q	Solution	Marks	AO
9bii		M1 - The graph must be above (1,1).	N6 AO1
10	$newArea = 2.5 \times oldArea$ $oldArea = AB \times h$ $newArea = \frac{8}{10} AB \times \frac{100+x}{100} h$ $\frac{5}{2} \times oldArea = \frac{4}{5} AB \times \frac{100+x}{100} h$ $\frac{\frac{5}{2} \times oldArea}{oldArea} = \frac{\frac{4}{5} AB \times \frac{100+x}{100} h}{AB \times h}$ $\frac{5}{2} = \frac{4}{5} \times \frac{100+x}{100}$ $\frac{5}{2} = \frac{4(100+x)}{500}$ $\frac{2500}{2} = 4(100+x)$ $2500 = 8(100+x)$ $2500 = 800 + 8x$ $8x = 1700$ $x = 212.5\%$	M1 – form the equation for new Area A1	N3 AO2
11a	SD = 1.23 (3s.f.)	B2	S1 AO1

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Q	Solution	Marks	AO
11b	As all the marks are increased by 3 marks, the mean will also be increased by 3 marks but the standard deviation will remain the same hence the spread of marks remains unchanged.	B1	S1 AO3
12a, b		B1 – construction of perpendicular bisector B1 – construction of angle bisector	G1 AO1 AO1
12c	The point P is equidistant from the lines AC and BC and equidistant from the points B and C .	B1 – all correct	G1 AO1
13a	$54 = 2\times3^3$ $150 = 2\times3\times5^2$ $54\times150 = 2\times3^3\times2\times3\times5^2$ $= 2^2\times3^4\times5^2$ $= \left(2\times3^2\times5\right)^2$ Since $54\times150 = \left(2\times3^2\times5\right)^2$, 54×150 is perfect square. *OR* Since the indices of all prime factors are multiples of 2 (or even), $2^2\times3^4\times5^2$ is a perfect square.	 M1 – show prime factorised expression AG1	N1 AO3
13b	$150k = 2\times3\times5^2\times k$ $k = 2^2\times3^2\times5$ $k = 180$ the smallest possible integer $= 180$.	 B1	N1 AO2
14a	$5x + y = 16y - x$ $5x + y = 4x + 5y - 3$ $16y - x = 4x + 5y - 3$	B1, B1 for forming any 2 equations	N7 AO2

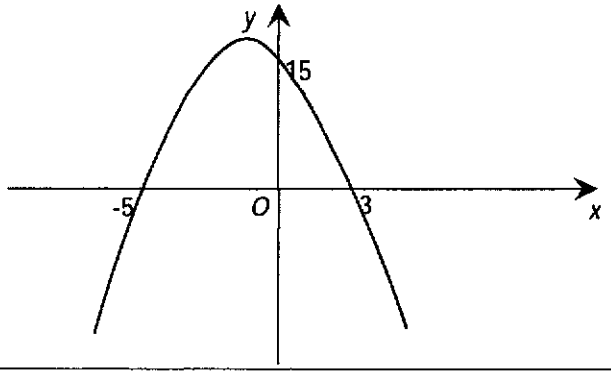
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Q	Solution	Marks	AO
14b	$5x+y=16y-x$		N7
	$6x=15y \quad -(1)$		AO2
	$5x+y=4x+5y-3$		
	$x=4y-3 \quad -(2)$		
	sub (2) into (1)	M1 - Using Substitution or Elimination method	
	$6(4y-3)=15y$		
	$24y-18=15y$		
	$9y=18$		
	$y=2$		
	Sub y = 2 into (2)		
	$x=4(2)-3$		
	$x=5$		
	$\therefore x=5,\ y=2$	A1, A1	
	$AC=4(5)+5(2)-3$		
	$=27cm$		
	Perpendicular ht from B to $AC=\sqrt{27^2-\left(\frac{27}{2}\right)^2}$		
	$=23.382cm$		
	$Area\ of\ ABC=\frac{1}{2}\times 27\times 23.382$		
	$=315.657$		
	$=316cm^2\ (3sf)$	A1	
	OR		
	$\angle ABC=60°\ (angles\ of\ an\ equilateral\ \Delta)$		
	$Area\ of\ ABC=\frac{1}{2}\times 27\times 27\times \sin 60°$		
	$=315.666$	A1	
	$=316cm^2\ (3sf)$		

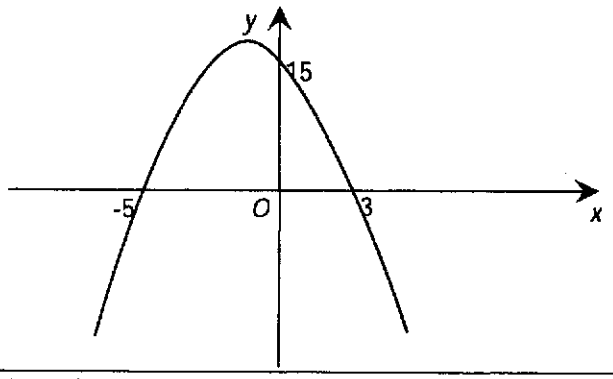
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Q	Solution	Marks	AO
15a	$\frac{4^{\frac{1}{2}}}{16^{y+1}} = 8^{2-y}$ $\frac{2}{2^{4(y+1)}} = 2^{3(2-y)}$ $\frac{2}{2^{4y+4}} = 2^{6-3y}$ $2^{1-(4y+4)} = 2^{6-3y}$ $1-(4y+4) = 6-3y$ $1-4y-4 = 6-3y$ $1-4-6 = y$ $y = -9$	M1 - $(4^{\frac{1}{2}} = 2)$ or $2^{4(y+1)}$ or $2^{3(2-y)}$ or $2^{1-(4y+4)}$ M1 - $1-4y-4 = 6-3y$ A1	N1 AO1
15b	2^{500} $= (2^2)^{250}$ $= 4^{250}$ $4^{250} < 5^{250}$ I disagree with her claim because $4^{250} < 5^{250}$.	M1 - $(2^2)^{250}$ or 4^{250} AG1 – must state $4^{250} < 5^{250}$ o.e.	N1 AO3
16a	5 : 7	B1	G2 AO1
16b	$\frac{Mass\ of\ X}{Mass\ of\ C} = \frac{5^3}{7^3}$ $\frac{Mass\ of\ X}{36} = \frac{125}{343}$ $Mass\ of\ X = \frac{125}{343} \times 36$ $= \frac{4500}{343} kg$ $mass\ of\ Y = 36 - \frac{4500}{343}$ $= 22.8804$ $= 22.9 kg (3sf)$	M1 – finding $\frac{5^3}{7^3}$ A1	G2 AO2

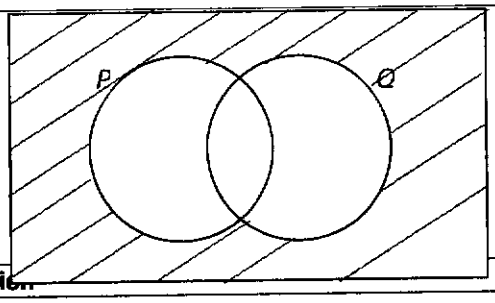
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Q	Solution	Marks	AO
17ai	$x^2-12x+5=x^2-12x+\left(\frac{-12}{2}\right)^2-\left(\frac{-12}{2}\right)^2+5$ $=\left(x^2-12x+36\right)-36+5$ $=(x-6)^2-31$ $a=6,\ b=-31$	B1, B1	N7 AO1
17aii	$x=6$	B1	N7 AO1
17bi		B1 – correct shape of grph B1 – x and y intercepts shown	N6 AO1
17bii	$(-1,16)$	B1	N6 AO1
18a	$Q(3,0)$	B1	G6 AO2
18b	$\frac{0-4}{3-(-3)}$ $=\frac{-4}{6}$ $=-\frac{2}{3}$ $\frac{6-4}{x-(-3)}=-\frac{2}{3}$ $\frac{2}{x+3}=-\frac{2}{3}$ $x=-6$	M1 – finding gradient A1	G6 AO2

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Q	Solution	Marks	AO
17ai	$x^2-12x+5=x^2-12x+\left(\frac{-12}{2}\right)^2-\left(\frac{-12}{2}\right)^2+5$ $=\left(x^2-12x+36\right)-36+5$ $=(x-6)^2-31$ $a=6,\ b=-31$	 B1, B1	N7 AO1
17aii	$x=6$	B1	N7 AO1
17bi		B1 – correct shape of grph B1 – x and y intercepts shown	N6 AO1
17bii	$(-1,16)$	B1	N6 AO1
18a	$Q(3,0)$	B1	G6 AO2
18b	$\frac{0-4}{3-(-3)}$ $=\frac{-4}{6}$ $=-\frac{2}{3}$ $\frac{6-4}{x-(-3)}=-\frac{2}{3}$ $\frac{2}{x+3}=-\frac{2}{3}$ $x+3=-3$ $x=-6$	 M1 – finding gradient A1	G6 AO2
Q	Solution	Marks	AO

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18c	$m=-\frac{2}{3}$ $y=-\frac{2}{3}x+c$ $Sub(-3,4)$ $4=-\frac{2}{3}(-3)+c$ $4-2=c$ $c=2$ $y=-\frac{2}{3}x+2$ *o.e.*	B1	G6 AO1
19ai	$(2\pi-1.8)rad$	B1	G5 AO1
19aii	$(2\pi-1.8)\times 5=(10\pi-9)cm$	B1	G5 AO1
19b	$Area\,sector\,OADB=\frac{1}{2}\times 5^2\times 1.8$ $=22.5cm^2$ $Area\,of\,\Delta AOB=\frac{1}{2}\times 5\times 5\times \sin 1.8rad$ $=12.173cm^2\,(5s.f.)$ $Area\,of\,shaded\,segment=22.5cm^2-12.173cm^2$ $=10.327cm^2$ $=10.3(3sf)cm^2$	M1 M1 A1	G5 AO2
20ai	Integers that are perfect squares.	B1	N8 AO1
20aii	{1,9}	B1	N8 AO1
20aiii	11	B1	N8 AO1
20bi		B1	N8 AO1
Q	**Solution**	**Marks**	**AO**

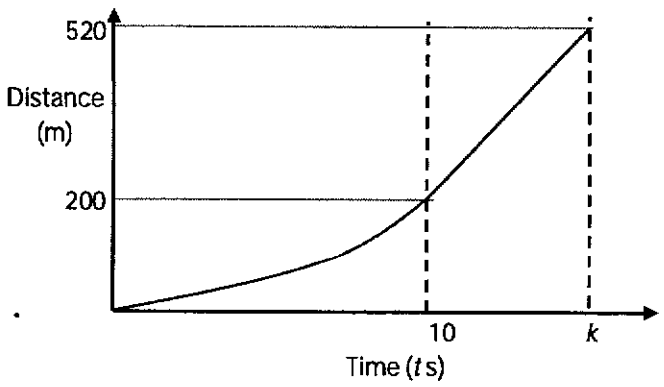
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20bii	$P' \cup Q$ *or* $(P \cap Q')'$ *or* $(P \cap Q) \cup (P \cap Q)'$	B1	N8 AO1
21ai	$AD^2 + DC^2 = 8^2 + 6^2$ $= 100$ $AC^2 = 10^2$ $= 100$ Since $AD^2 + DC^2 = AC^2$ *and* By the converse of Pythagoras' thereom, $\angle ADC = 90°$. OR Using Cosine rule, $\angle ADC = \cos^{-1}\left(\frac{10^2 - 8^2 - 6^2}{-2(8)(6)}\right)$ $= 90°$ (*Shown*)	 M1 – show Pyth Thm AG1 M1 – show Cosine Rule AG1	G4 AO3
21aii	$\cos \angle ACB = -\frac{6}{10}$ $= -\frac{3}{5}$	 B1 – lowest term	G4 AO1
21b	$\sin x° = 0.8929$ $x = \sin^{-1} 0.8829$ $x = 63.239$ *or* $180 - 63.239$ $x = 63.2$ *or* $116.8 (1dp)$	 B1 B1	G4 AO1
22ai	$\angle BAE = \frac{(5-2)180}{5}$ $= 108°$	B1	G1 AO1
22aii	$\angle AEB = \frac{180 - 108}{2} (base \angle s \, of \, isos. \Delta)$ $= 36°$	B1	G1 AO1
22aiii	ΔAEB are congruent to ΔDEC. $\angle BEC = \angle BAE - \angle AEB - \angle DEC$ $\angle BEC = 108 - 36 - 36$ $= 36°$	 B1	G1 AO2

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22b	Since $\angle ECD = \frac{180-108}{2} = 36°$ (*base ∠ of isosceles Δ*), $\angle BEC = \angle ECD = 36°$, *by the property of converse of alternate angles*, *BE is parallel to CD.* *OR* *They form a pair of alternate angles*, *BE is parallel to CD.*	B1 – converse of alternate angles	G1 AO3
23a	$p = 5$	B1	S1 AO1
23b	$LQ = 19$ $UQ = 27$ $IQR = 27 - 19 = 8$	M1, A1	S1 AO1
23c	x is any positive integer ≤ 22	B1	S1 AO1
24i	$\frac{44}{64} = \frac{11}{16}$	B1	S2 AO1
24ii	$\frac{20-x}{64-x} = \frac{3}{14}$ $14(20-x) = 3(64-x)$ $280 - 14x = 192 - 3x$ $11x = 88$ $x = 8$	M1 A1	S2 AO2
25a	$R = \begin{pmatrix} 30 & 30 & 35 \\ x & x+2 & 40 \end{pmatrix} \begin{pmatrix} 2.5 \\ 4 \\ 5.5 \end{pmatrix}$ $R = \begin{pmatrix} 387.5 \\ 2.5x + 4x + 8 + 220 \end{pmatrix}$ $R = \begin{pmatrix} 387.5 \\ 6.5x + 228 \end{pmatrix}$	 B1	N9 AO1
25b	The total amount of money collected from Outlet A selling the three types of drinks on a particular day.	B1	N9 AO3

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Q	Solution	Marks	AO
25c	$6.5x+228)-(387.5)=100.50$ $6.5x-159.5=100.5$ $6.5x=100.5+159.5$ $x=40$	 B1	N9 AO2
25d	(1 1)	B1	N9 AO2
26a	$acceleration=\frac{40}{10}$ $=4ms^2$	 B1	N10 AO1
26b	200 m	B1	N10 AO1
26c	*Area under graph* = Area of triangle and area of rectangle $520=(\frac{1}{2}10\times40)+(k-10)(40)$ $520=200+40k-400$ $40k=720$ $k=18$	 B1	N10 AO1
26d		B1 – before t = 10, label of distance and smooth curve. B1 – after t = 10, label of distance and straight line.	N10 AO2

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2024 Sec 4E/5N Prelim Math Paper 2 Marking Scheme

QN	Solution	Marks	AO Level
1a(i)	$g=-6-\frac{2}{3+2}$ $g=-\frac{32}{5}$ or $-6\frac{2}{5}$ or -6.4	B1	N5 AO1
1a(ii)	$g=f-\frac{p}{3+p}$ $g-f=-\frac{p}{3+p}$ $(g-f)(3+p)=-p$ $3g+gp-3f-fp=-p$ $gp-fp+p=3f-3g$ $p(g-f+1)=3f-3g$ $p=\frac{3f-3g}{(g-f+1)}$ *or* $\frac{3g-3f}{(f-g-1)}$ *o.e*	M1 A1	N5 AO1
1b	$x-7>\frac{8x+1}{3}$ $3x-21>8x+1$ $3x-8x>1+21$ $-5x>22$ $x<-\frac{22}{5}$ *or* $-4\frac{2}{5}$ *or* -4.4	M1 A1	N7 AO1
1c	$\frac{2x-3}{3}+\frac{x}{4}=4$ $\frac{4(2x-3)+3x}{12}=4$ $8x-12+3x=48$ $11x=60$ $x=\frac{60}{11}$ *or* $5\frac{5}{11}$	M1 (common denominator) A1	N7 AO1

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QN	Solution	Marks	AO Level
1d	$\frac{7}{x+2}-\frac{4}{3-2x}=5$ $\frac{7(3-2x)-4(x+2)}{(x+2)(3-2x)}=5$ $21-14x-4x-8=5(3x-2x^2+6-4x)$ $-18x+13=5(-2x^2-x+6)$ $-18x+13=-10x^2-5x+30$ $10x^2-13x-17=0$ $x=\frac{13\pm\sqrt{(-13)^2-4(10)(-17)}}{2(10)}$ $x=\frac{13\pm\sqrt{849}}{20}$ $x=\frac{13+\sqrt{849}}{20}$ *or* $\frac{13-\sqrt{849}}{20}$ $x=2.10688$ *or* -0.80688 $x=2.11\ (2dp)$ *or* $-0.81\ (2dp)$	M1 M1 (Form Quadratic Eqn) M1 A1,A1	N7 AO2
2a	Total Cost $\$1800+\$150=\$1950$ % profit $\frac{120\times45-1950}{1950}\times100\%$ $=176.923\%$ $=177\%\ (3sf)$	B1 B1	N3 AO1
2b	Total Amount $5000\left(1+\frac{2.55}{100}\right)^2$ $=\$5258.25$ Interest $\$5258.25-\$5000=\$258.25$	M1 A1	N10 AO1

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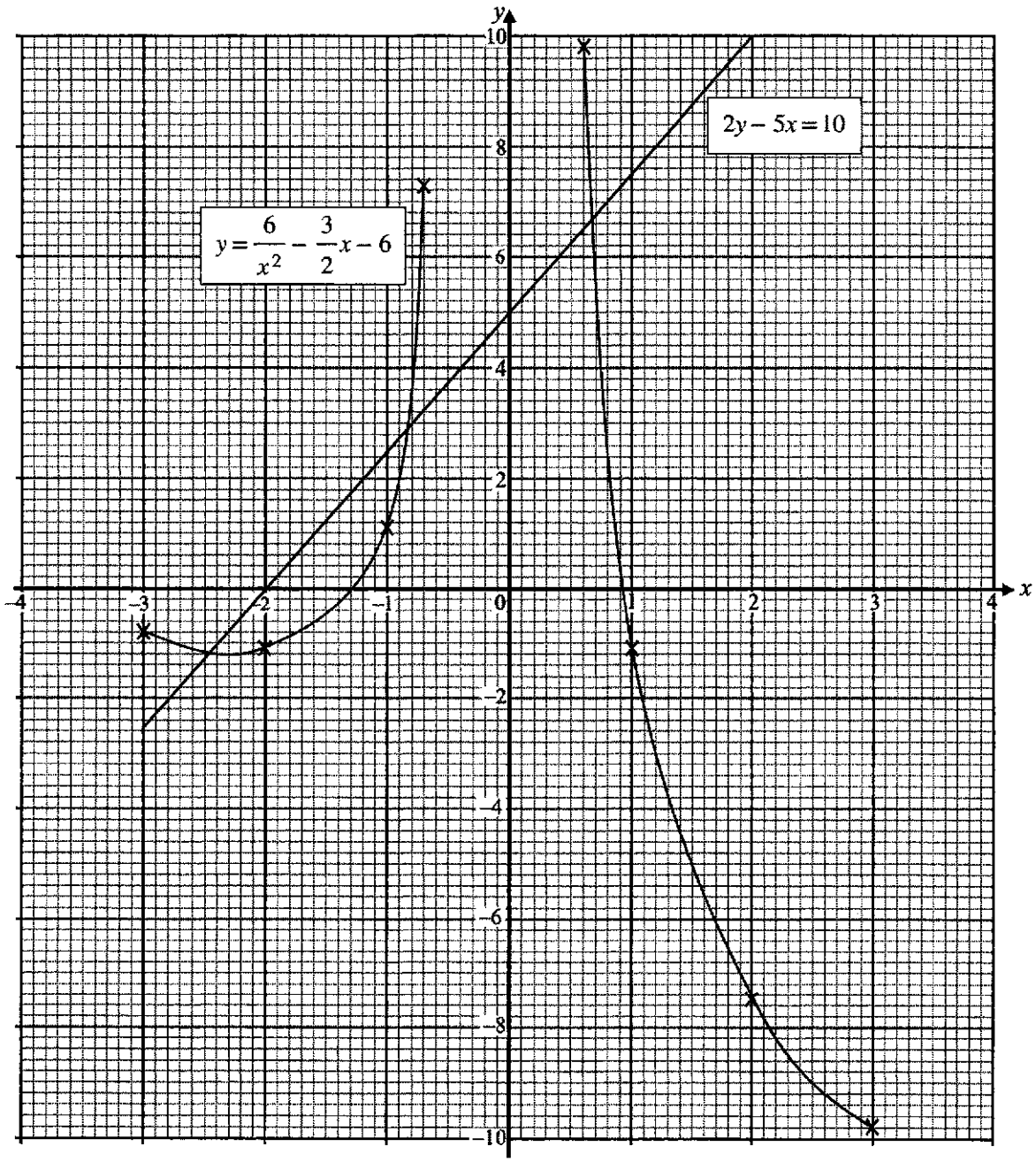
QN	Solution	Marks	AO Level
2c(i)	1.22×10^{10}	B1	N1 AO1
2c(ii)	$\frac{12163000000}{5.637\times 10^{6}} \div 12$ $= \$\ 179.81$ $= \$\ 180$ (*nearest dollar*)	M1 A1	N1 AO1
2d(i)	Shenzhen Hotel (3N) $(2550\times 3)\times 1.1 = CNY8415$	B1	N3 A01
2d(ii)	Shenzhen Hotel in SGD $\frac{8415}{100}\times 18.64 = SGD1568.556$ Hong Kong Hotel(2N) $(2550\times 2) = HKD5100$ In SGD with conversion fees $\frac{5100}{5.75}\times 1.015 = SGD900.260$ Total Cost $SGD1568.556 + 900.260$ $= SGD2468.81$ $= SGD2469$ (*nearest dollar*)	M1 M1 A1	N3 A02

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QN	Solution	Marks	AO Level
3a(i)	136 cm	B1	S1/AO1
3a(ii)	LQ = 132 UQ = 142 IQR = 142 – 132 = 10	 M1 for LQ/UQ A1	S1 AO1
3b	No of girls = 2 $\frac{2}{120} \times 100\% = 1.67\% \ (3sf) \ or \ 1\frac{2}{3}\% \ o.e$	 B2	S1 AO1
3c	1. Casa Sec Sch girls **<u>are shorter</u>** as the median height is lesser than Landmark Sec Sch or vice versa 2. Casa Sec Sch has a **<u>smaller/larger spread of height</u>** as the interquartle range is lesser than Landmark Sec Sch or vice versa	A1 Must state median A1 Must state spread. Accept more consistent if smaller spread is stated	S1 AO3
3di	Prob both had weekly allowance that is less than $25 $\frac{18}{45} \times \frac{17}{44} = \frac{17}{110}$	 B1	S2 AO1
3dii	Prob one had at least $30 of weekly allowance and the other had less than $20 of weekly allowance $\frac{12}{45} \times \frac{5}{44} + \frac{5}{45} \times \frac{12}{44}$ $= \frac{2}{33}$	 M1 A1 or B2	S2 AO2
4a	–1.5 (1dp)	B1	N6/AO1
4b	See page 5	P2 all points plotted correct P1 for 7 points plotted correct else P0 C1	N6/AO1
4c(i)	See page 5	P1 L1	N6/AO1

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4b and 4c(i)



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QN	Solution	Marks	AO Level
4cii	$x=-2.45\pm0.2,-0.85\pm0.1,0.65\pm0.1$	B2 for all B1 for 2 correct	N6 AO1
4c(iii)	$2\left(\frac{6}{x^2}-\frac{3}{2}x-6\right)-5x=10$ $\frac{12}{x^2}-3x-12-5x=10$ $\frac{12}{x^2}-8x-22=0$ $12-8x^3-22x^2=0$ $8x^3+22x^2-12=0$ $4x^3+11x^2-6=0$ $A=11, B=-6$	M1 B1, B1	N7 AO2
5a	$\overrightarrow{PQ}=\begin{pmatrix}6\\2\end{pmatrix}-\begin{pmatrix}8\\-4\end{pmatrix}=\begin{pmatrix}-2\\6\end{pmatrix}$ $\overrightarrow{PR}=\begin{pmatrix}2\\h\end{pmatrix}-\begin{pmatrix}8\\-4\end{pmatrix}=\begin{pmatrix}-6\\h+4\end{pmatrix}$ $\begin{pmatrix}-2\\6\end{pmatrix}=k\begin{pmatrix}-6\\h+4\end{pmatrix}$ $-2=-6k$ $k=\frac{1}{3}$ $6=\frac{1}{3}(h+4)$ $h=14$	 M1 A1 A1	G7 AO1

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QN	Solution	Marks	AO Level
5b(i)	$\overrightarrow{OS}=\overrightarrow{OP}+\overrightarrow{PS}$ $\overrightarrow{OS}=4\mathbf{b}+\frac{m}{13}\overrightarrow{PR}$ $\overrightarrow{OS}=4\mathbf{b}+\frac{m}{13}(-4\mathbf{b}+2\mathbf{a})$ $\overrightarrow{OS}=\frac{2m}{13}\mathbf{a}+\left(4-\frac{4m}{13}\right)\mathbf{b}$	M1 A1	G7 AO1
5(ii)	$\overrightarrow{OS}=\frac{4}{13}\overrightarrow{OT}$ $\overrightarrow{OS}=\frac{4}{13}(4\mathbf{b}+5\mathbf{a}-\mathbf{b})$ $\overrightarrow{OS}=\frac{20}{13}\mathbf{a}+\frac{12}{13}\mathbf{b}$ $2m=20$ $m=10$	M1 A1 A1	G7 AO2
5b(iii)	$\overrightarrow{OU}=\overrightarrow{OR}+\overrightarrow{RU}$ $\overrightarrow{OU}=2\mathbf{a}+\frac{2}{3}(7\mathbf{a}+6\mathbf{b})$ $\overrightarrow{OU}=2\mathbf{a}+\frac{14}{3}\mathbf{a}+\frac{12}{3}\mathbf{b}$ $\overrightarrow{OU}=\frac{20}{3}\mathbf{a}+\frac{12}{3}\mathbf{b}$ $\overrightarrow{OU}=\frac{4}{3}(5\mathbf{a}+3\mathbf{b})$ $\overrightarrow{OS}=\frac{4}{13}(5\mathbf{a}+3\mathbf{b})$ Since vector OU and OS are scalar multiple of each other with the common point O, therefore O, S, *and* U lies on a straight line.	M1 A1 –1M from whole qn if there is no vector notation B1	G7 AO3

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QN	Solution	Marks	AO Level
6(a)(i)	angle BAD = 180° – 98° (angles in the opp segment) = 82° angle BAO = 82° – 30° = 52° angle BOA = 180° – 2(52°) (angle sum of isos triangle) = 76° angle OAE = 90° (tangent perpendicular to radius) angle OEA = 180° – 90° – 76° (angle sum of triangle) = 14°	B1 B1 B1 minus 1 mark if no/wrong reason given	G3 AO1
6(a)(ii)	Since angle OAE = 90° (tangent perpendicular to radius), it formed **a right angle in a semicircle** therefore a circle with diameter OE will passes through A.	AG1	G3 AO3
6(b)	R: angle QTS = angle TRU (rt angle in semicircle) H: QS = TU (diameter of 2 equal circles) S: QT = TR (radii of 2 equal circles) By RHS, triangles STQ and URT are congruent OR A: angle QTS = angle TRU (rt angle in semicircle) S: QT = TR (radii of 2 equal circles) A: angle TQS = angle RTU (equilateral triangle TQR) By ASA, triangles STQ and URT are congruent OR A: angle QTS = angle TRU (rt angle in semicircle) A: angle TQS = angle RTU (equilateral triangle TQR) S: QS = TU (diameter of 2 equal circles) By AAS, triangles STQ and URT are congruent	M2 for RHS –1 if no/wrong reason AG1	G2 AO3

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QN	Solution	Marks	AO Level
7a	Volume of inner core $\frac{4}{3}\pi(3x)^3$ $=\frac{4}{3}\pi(27x^3)$ $=36\pi x^3$ (shown)	Must show AG1	G5 AO3
7b	Volume of cylinder $\pi(4x)^2 h = 16\pi h x^2$ $16\pi h x^2 = 200 \times 36\pi x^3$ $h = 450x$	M1 A1	G5 AO2
7c	$16\pi h x^2 = 2024363\pi$ $16(450)x^3 = 2024363$ $x = \sqrt[3]{\frac{2024363}{16 \times 450}}$ $x = 6.551166413$ $x = 6.55$ ($3sf$)	M1 A1	G5 AO2
7d	Radius golf ball $=3x + y$ $=19.6534 + 1.8$ $=21.4534\ mm$ Surface Area of golf ball $=4\pi(21.4534)^2$ $=5783.6516\ mm^2$ Number of golf balls $=\frac{(620 \times 920)}{5783.6516}$ $=98.622$ $=98$ *golf balls* (*round down*)	B1 M1 M1 for area of plastic sheet A1	G5 AO2

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QN	Solution	Marks	AO Level
8a	$0.9^2 = 1.2^2 + 1.4^2 - 2(1.2)(1.4)\cos\angle BAC$ $\cos\angle BAC = \dfrac{0.9^2 - 1.2^2 - 1.4^2}{-2(1.2)(1.4)}$ $\angle BAC = \cos^{-1}\left(\dfrac{0.9^2 - 1.2^2 - 1.4^2}{-2(1.2)(1.4)}\right)$ $\angle BAC = 39.57121$ $\angle BAC = 39.6°\ (1dp)$	M1 M1 A1	G4 AO1
8b	$\dfrac{AD}{\sin 25°} = \dfrac{1.4}{\sin 122°}$ or $\dfrac{CD}{\sin 33°} = \dfrac{1.4}{\sin 122°}$ $AD = \dfrac{1.4}{\sin 122°} \times \sin 25°$ or $CD = \dfrac{1.4}{\sin 122°} \times \sin 33°$ $AD = 0.697679$ $CD = 0.899117$ Let DX be the shortest distance from the foot of D to AC. $\sin 33° = \dfrac{DX}{0.697679}$ $\sin 25° = \dfrac{DX}{0.899117}$ $DX = \sin 33° \times 0.697679$ or $DX = \sin 25° \times 0.899117$ $DX = 0.379983$ $DX = 0.379983$ $DX = 0.380\ (3sf)$ $DX = 0.380\ (3sf)$	M1 M1 A1	G4 AO2
8c	Let θ be the angle of depression $\tan\theta = \dfrac{0.3}{0.379983}$ $\theta = \tan^{-1}\left(\dfrac{0.3}{0.379983}\right)$ $\theta = 38.2914$ $\theta = = 38.3°\ (1dp)$	M1 A1	G4 AO2
8d	Bearing of A from B $180° + (90° - 39.57°)$ $270° - 39.57°$ $= 230.43°$ or $= 230.43°$ $= 230.4°\ (1dp)$ $= 230.4°\ (1dp)$	B1	G4 AO1

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QN	Solution	Marks	AO Level
9(a)	Area of 3 bedrooms: = Master Bedroom + Bedroom 2 + Bedroom 3 = 3800×4850 +(2400+1600)(6800–2500) + 3800×4400 = 52 350 000 mm^2 = 52.35 m^2 Or $(3.8)(4.85) + (2.4+1.6)(6.8-2.5) + (3.8)(4.4)$ $=52.35\ m^2$	 M1 A1 M1 A1	G5 AO1
9b	Volume 52.35× 0.05 $=2.6175\ m^3$	 B1/FT1	G5 AO1
9c	Amount of cement-sand mixture 2.6175× 1400 $=3664.5\ kg$ Number of pre-mix bags 3664.5÷ 40 =91.6125 =92 (*roundup*) Cost of Pre-mix bags 92× 18.50= $ 1702 Number of planks required $\frac{52.35}{0.06\times 0.3}$ =2908.33 =2909 (*roundup*) Number of boxes required $\frac{2909}{50}$ =58.18 =59 (*round up*) Cost of Planks 59× 35.50= $ 2094.50	SC1 for both# *their*× 1400# *their*÷ 40# SC1 *their*× 18.50 PC1 for both* $\frac{their}{60\times 300}$* $\frac{their}{50}$* PC1 *their*× 35.50	G8 AO3

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QN	Solution	Marks	AO Level
	<u>Cost of Manpower</u> Cement screed construction = $4 \times 1 \times 8 \times \$5 = \$160$ Timber construction = $2 \times 3 \times 8 \times \$10 = \$480$ Total = $\$160 + \$480 = \$640$ Total Cost = $\$1702 + \$2094.50 + \$640 = \$4436.50$ Total Floor size (sq foot) $= 52.35 \div 0.09203$ $= 568.836\ sq\ ft$ Cost per sq ft =$\$4436.50 \div 568.836 = \$7.80$ Kent should charge at \$10 per sq ft	MC1 (must be \$640) SF1 *their* $\div 0.09203$ SP1 (any amount more than total cost)	

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