NAME: _____ ( ) CLASS: _____

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.

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 James Quek

This question paper consists of 26 printed pages

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NAME: _____ **( )** **CLASS:** _____

Mathematical Formulae

Compound interest

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

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

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

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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NAME: _____ **( )** **CLASS:** _____

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.

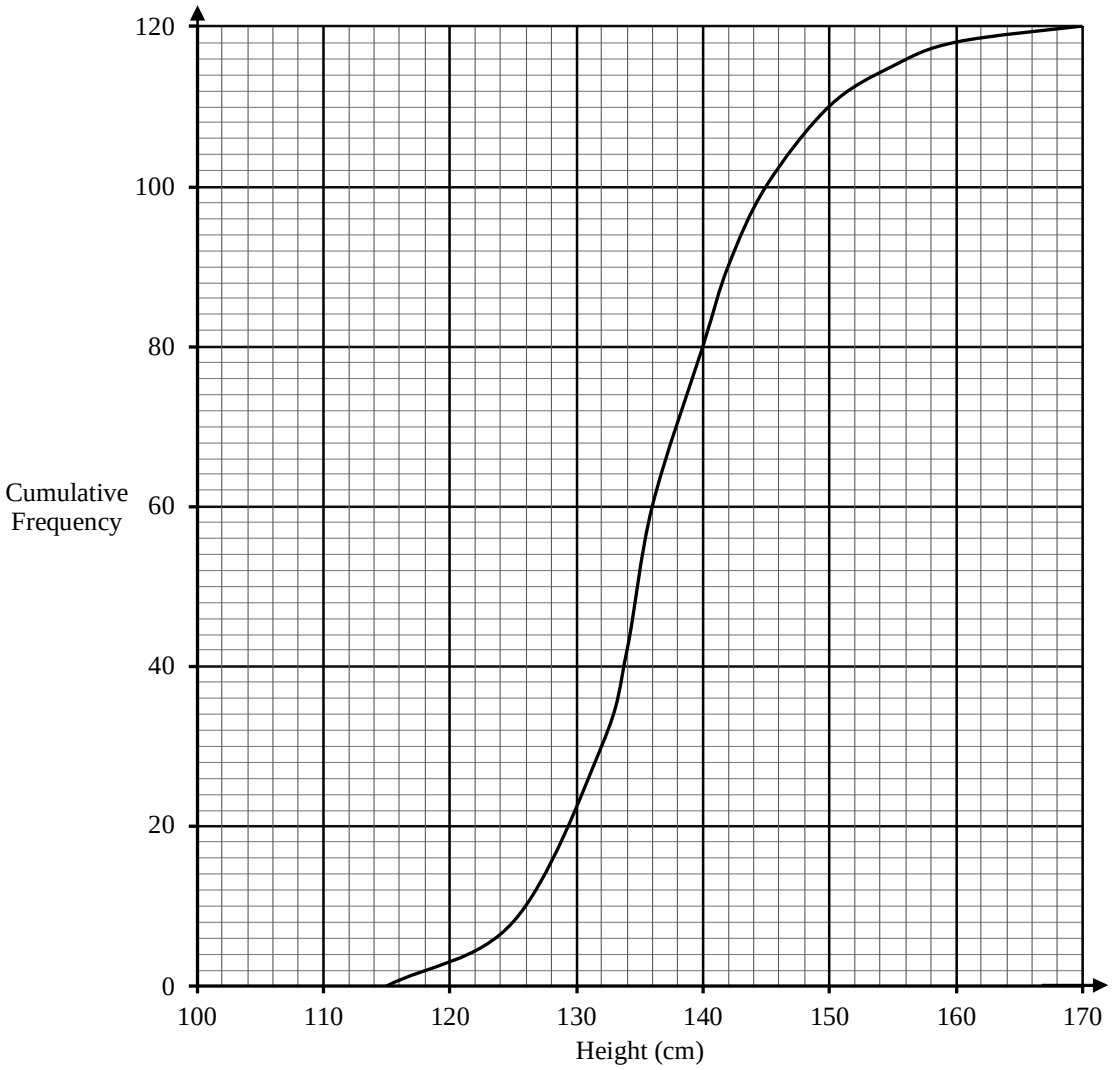
The credit card company will convert the overseas amount to Singapore dollars and there is a currency conversion fee of 1.5%. There is no conversion fee when using Alipay.

(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 ($)	$15 \le x < 20$	$20 \le x < 25$	$25 \le x < 30$	$30 \le x < 35$	$35 \le x < 40$
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]

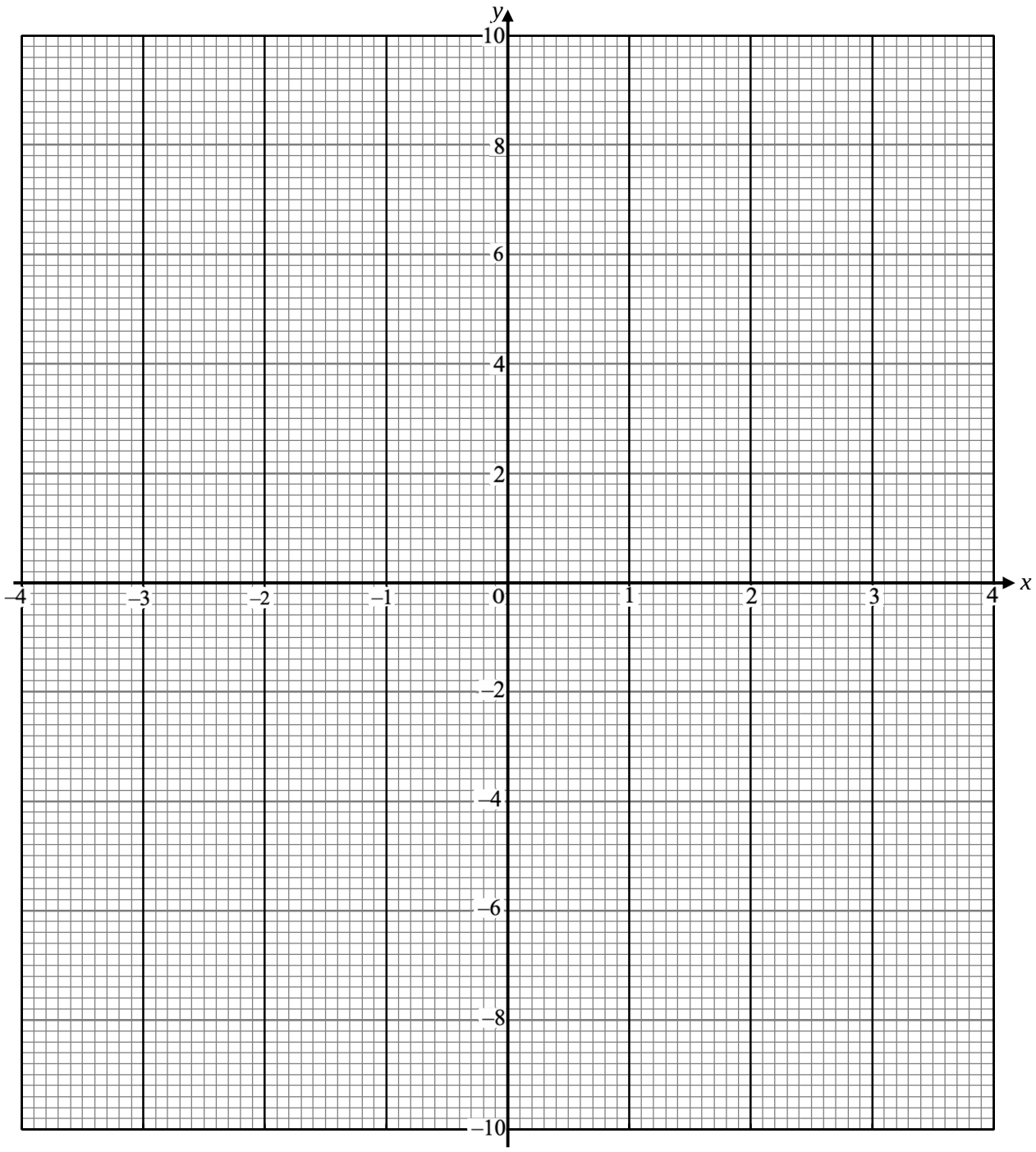
(iii) These values of x are solutions to the equation $4x^3 + Ax^2 + B = 0$.
Find the value of A and the value of B.

Answer A = ……...……...

B = ……...……..... [3]

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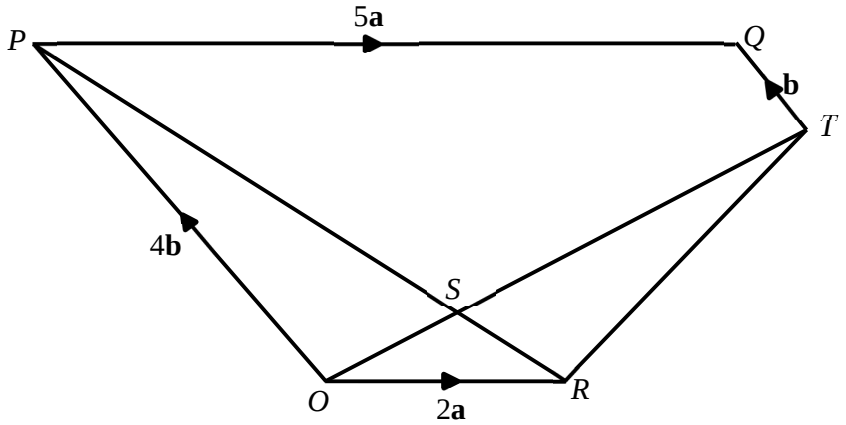
5 **(a)** P is the point (8, –4) and Q is the point (6, 2).
R has the coordinates (2, h). and $\overrightarrow{PQ} = k\overrightarrow{PR}$.
Find the value of h and k.

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.

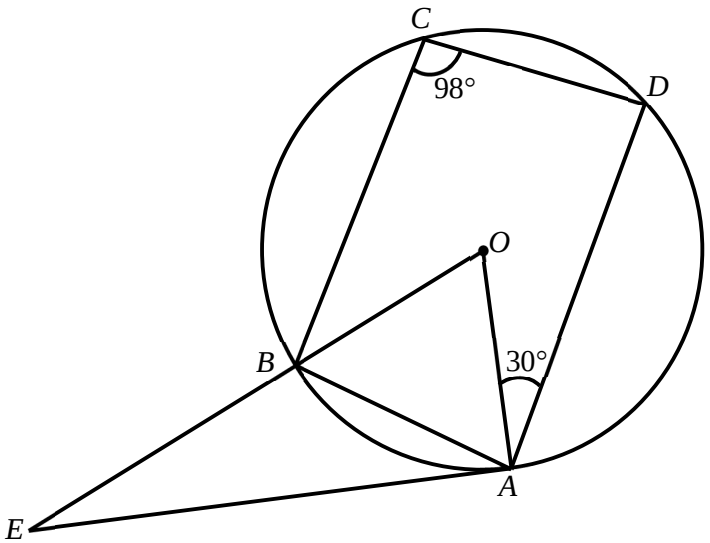
Answer

……...…….

……...…….. [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*.

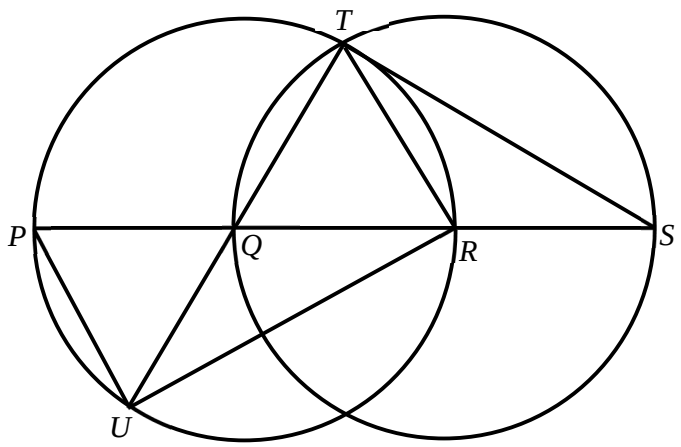
…….

……...……...

……...……...[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.

……...……...……

……...……...……

……...……...…… [3]

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7

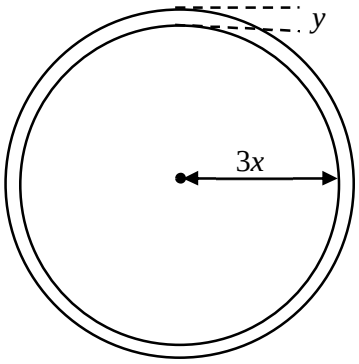


Diagram A

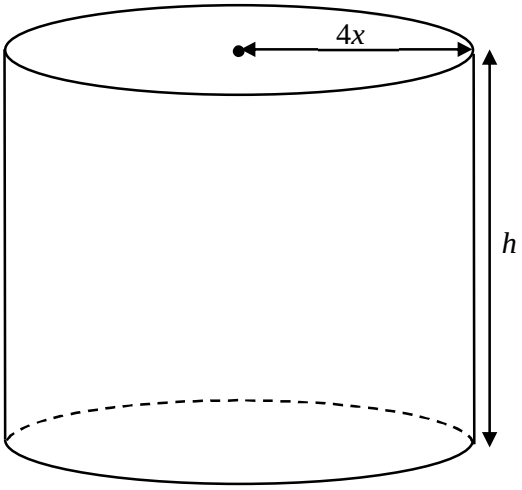


Diagram B

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.

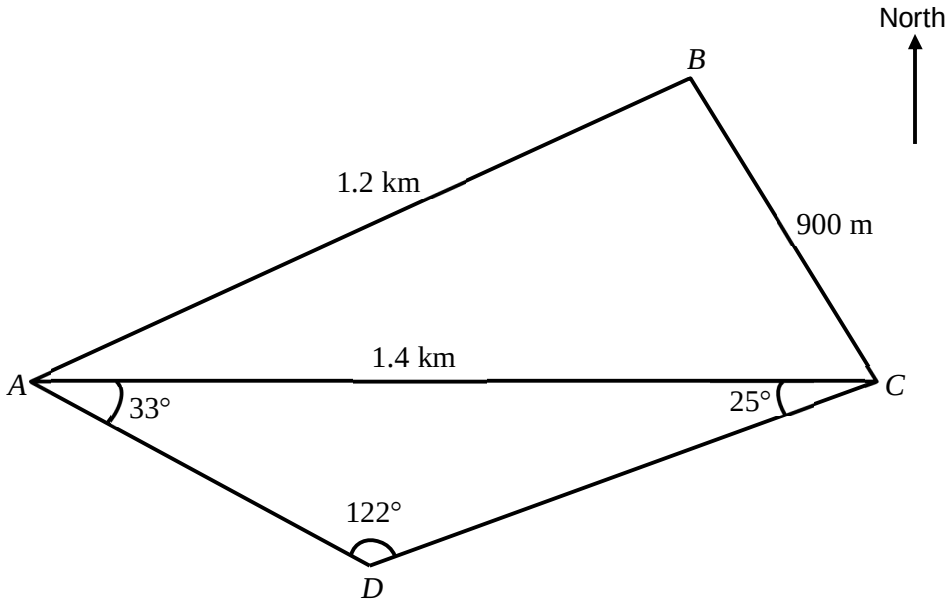
Answer x = ……..…..…….. [2]

(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*.

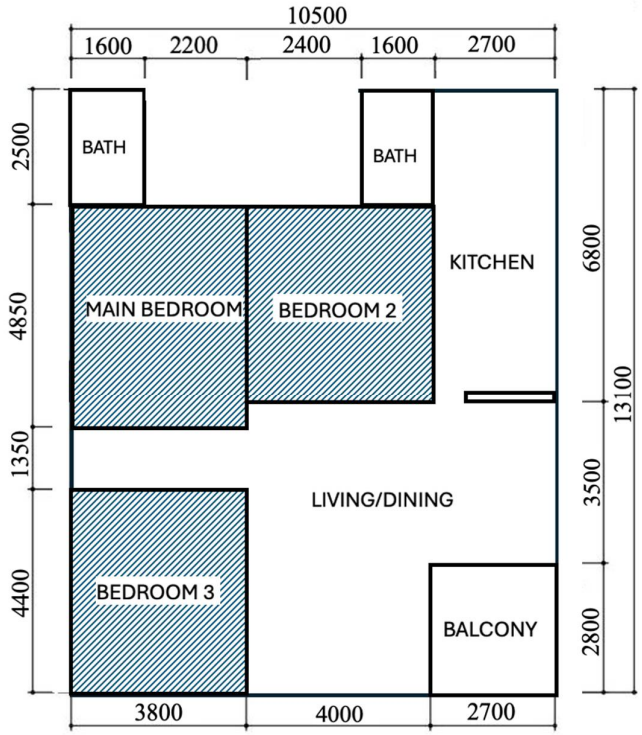
Answer ……° [2]

(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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……...……...

……...……...

……...…….. [7]

~ End of Paper ~

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