Name:	Register Number:	Class:

PRESBYTERIAN HIGH SCHOOL

MATHEMATICS **4052/02**
PAPER 2

16 August 2023 Wednesday 2 hours 15 minutes

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2023 SECONDARY FOUR EXPRESS
PRELIMINARY EXAMINATION

DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.

INSTRUCTIONS TO CANDIDATES:
Write your name, index number and class on the spaces provided above. 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.
If working is needed for any question, it must be shown with the answer.
Omission of essential working will result in loss of marks.
The use of an approved scientific calculator is expected, where appropriate.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

Note that all the diagrams in this paper are not drawn to scale.

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 90.

For Examiner's Use										
Qn	1	2	3	4	5	6	7	8	9	*Marks Deducted*
Marks										

TOTAL MARKS
90

Category	Accuracy	Notations	Others
Question			

Setter: Mr Tan Lip Sing
Vetter: Mrs Joyce Yeo

This paper consists of **25** printed pages (including this cover page) and **1** blank page.

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Mathematical Formulae

Compound Interest

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

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TURN OVER FOR QUESTION 1

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1 **(a)** Rearrange the formula $c = \dfrac{d^2 + 5}{d^2 - 3}$ to make d the subject.

Answer $d =$ ..... [3]

(b) Write as a single fraction in its simplest form $\dfrac{3}{(x-2)^2} - \dfrac{1}{2-x}$.

Answer ..... [2]

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(c) Solve these simultaneous equations.

$5x + 3y = 14$
$3x + 5y = 18$

You must show your working.

Answer $x =$ ……

$y =$ …… [3]

(d) Solve the equation $\frac{2x-1}{5x-6} = \frac{1}{2x-3}$.

Answer $x =$ …… or …… [3]

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2 **(a)** Before departing London for Singapore, Peter bought 3000 Singapore dollars from the bank. The exchange rate between British pounds (£) and Singapore dollars ($) was £1 = $1.71. He also had to pay the bank an additional commission fee of 1.5% for the exchange of currency.
Calculate the total amount of pounds, inclusive of commission, he paid the bank. Give your answer correct to the nearest pound.

Answer £ ……. [2]

(b) Peter bought a laptop while he was in Singapore. He paid $664.20 inclusive of the 8% GST (Goods & Services Tax) for the laptop after getting a discount of A% on the original price. The laptop's original price is $750 before GST.

(i) Find the GST amount paid for the laptop.

Answer $ ……. [2]

(ii) Calculate the value of A.

Answer $A =$ …… [2]

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(c) Mary invests \$20 000 in an endowment plan that offers 4% per year compound interest. How much interest will she receive after 10 years? Give your answer correct to the nearest cent.

Answer \$ ……. [2]

(d) A map of a province has a scale of 1 : 500 000.

(i) The length of an expressway on the map is 25 cm.
Calculate the actual length, in kilometres, of the expressway.

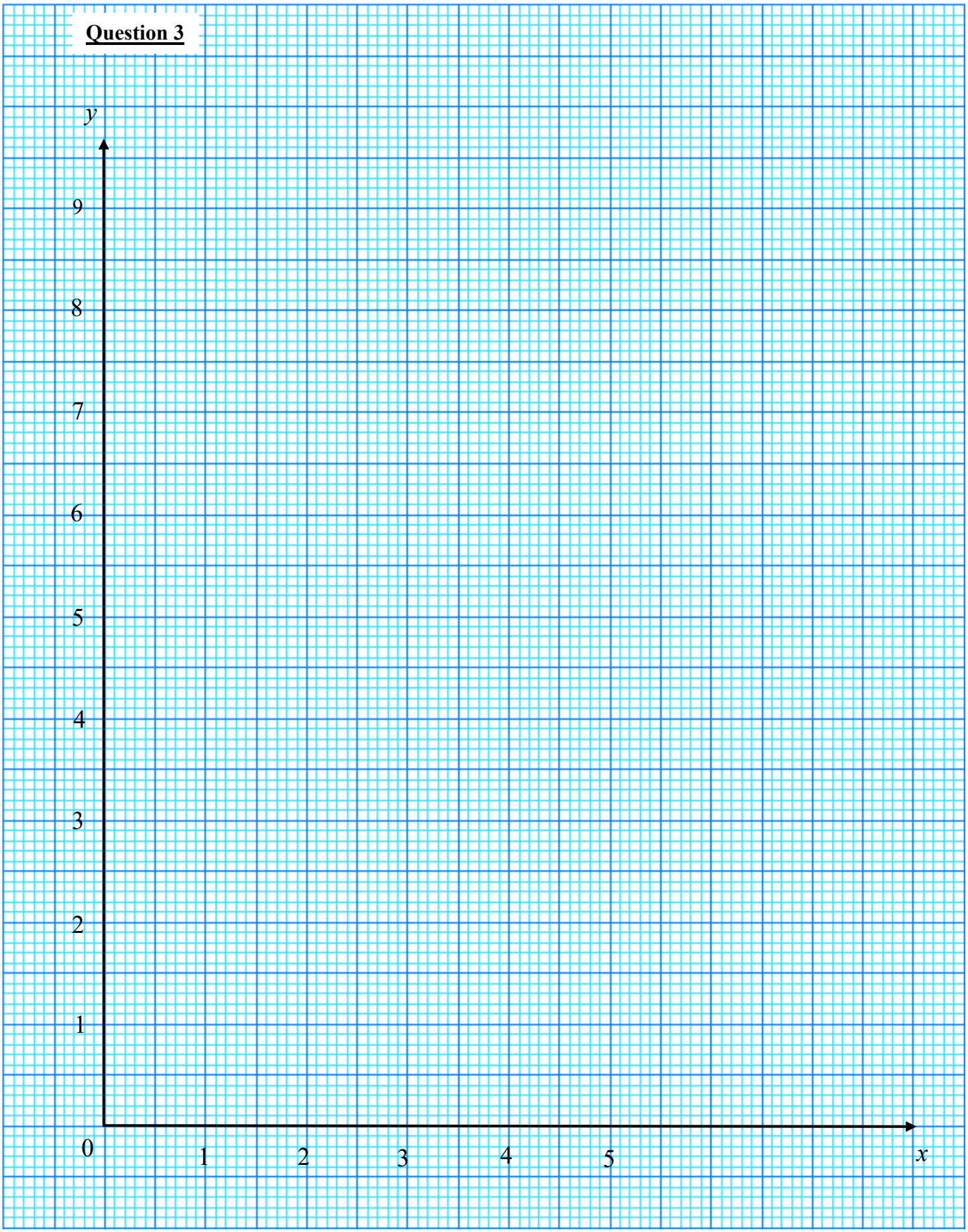
Answer …… km [1]

(ii) The area of a reservoir is 180 km^2.
Calculate the area, in square centimetres, of the reservoir on the map.

Answer …… cm^2 [2]

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Question 3



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3 The variables x and y are connected by the equation $y = \frac{x^2}{5} + \frac{4}{x}$.

The table below shows some corresponding values of x and y, correct to 2 decimal places.

x	0.5	1	1.5	2	2.5	3	4	5
y	8.05	4.20	3.12	2.80	2.85	3.13	4.20	5.80

(a) On the grid provided, draw the graph of $y = \frac{x^2}{5} + \frac{4}{x}$ for $0.5 \le x \le 5$.

Plot the points given in the table and join them with a smooth curve. [3]

(b) By drawing a tangent, find the gradient of the curve at $x = 3$.

Answer ..... [2]

(c) **(i)** On the same grid, draw the line $y = 7 - \frac{1}{2}x$ for $0 \le x \le 5$. [1]

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

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

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(iii) Find the equation, in the form $2x^3 + ax^2 + bx + c = 0$, which is satisfied by the values of x found in **(c)(ii)**.

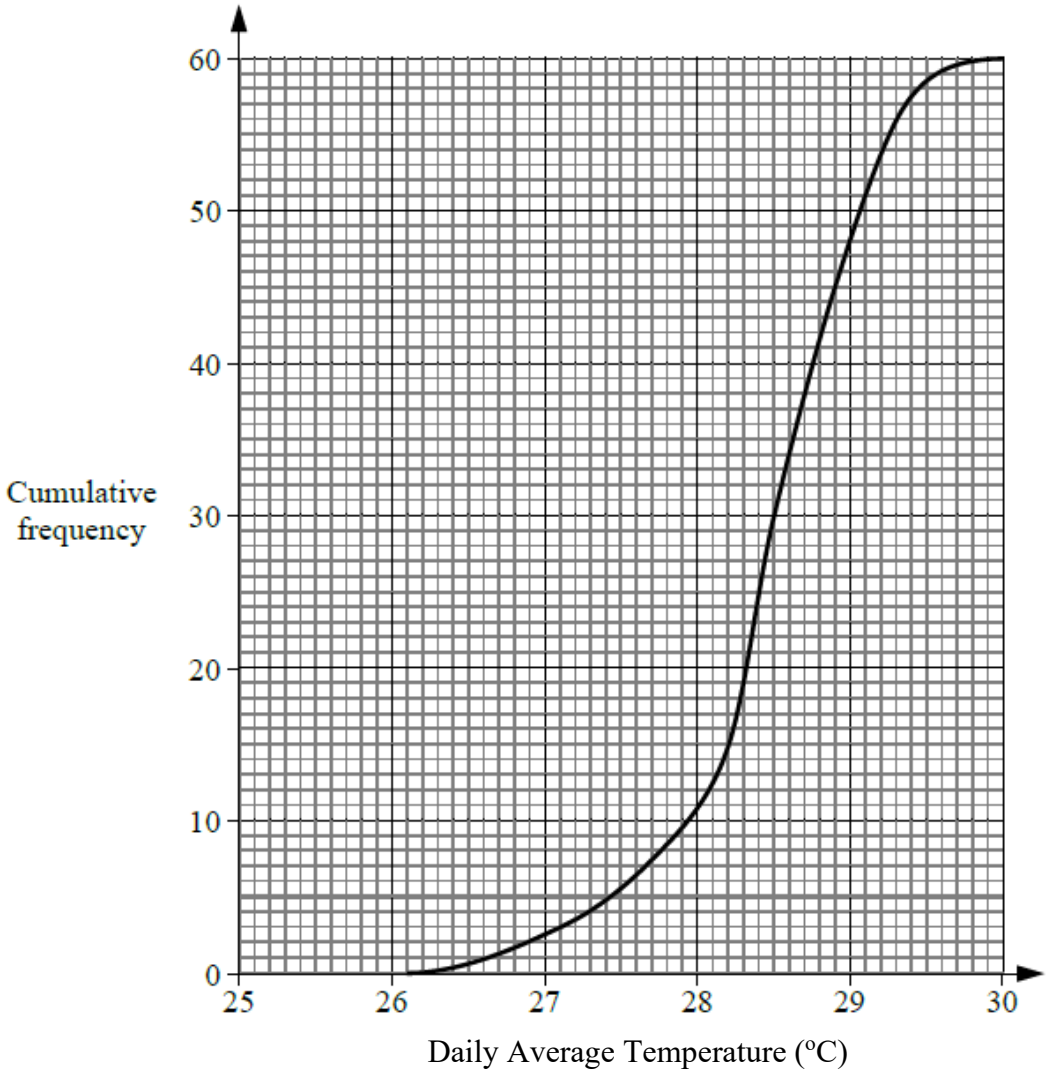
Answer ..... [2]

(d) Use your graph to find the values of x in the range $0 \le x \le 5$ for which $0.2x^2 + \frac{4}{x} - 2 = 3$.

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

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4 **(a)** The daily average temperature at Town *A* was recorded for 60 days.
The cumulative frequency curve below shows the distribution of the temperatures.



(i) Use the curve to estimate

(a) the median temperature,

Answer ..... °C [1]

(b) the interquartile range of the temperatures,

Answer ..... °C [2]

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(c) the number of days that Town *A* had temperatures above 29° C.

Answer ……. days [1]

(ii) The daily average temperature at Town *B* was recorded for the same period. The interquartile range of the temperatures at Town *B* is 1.5°C.
Use this information to comment on one difference between the temperature at Town *A* and at Town *B*.

…….

…….

…….

……. [1]

(b) Box *A* contains 6 red cards, 4 blue cards and 2 green cards.
Box *B* contains 3 red cards and 5 blue cards.
A card is drawn at random from Box *A* and put into Box *B*.
Next, a card is drawn at random from Box *B*.

Find, as a fraction in its simplest form, the probability that

(i) two green cards are drawn,

Answer ……. [1]

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(ii) neither of the cards is green,

Answer ……. [1]

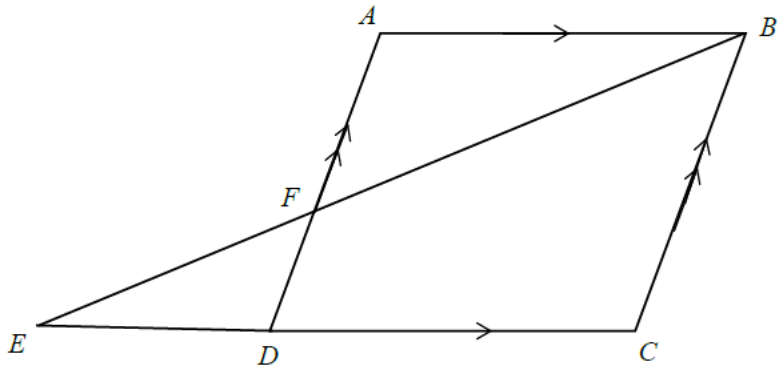
(iii) the two cards are of the same colour.

Answer ……. [2]

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5 **(a)** The diagram shows a parallelogram $ABCD$ with CD produced to E.

F is the point of intersection of BE and AD.



(i) Show that triangle BAF and triangle EDF are similar.

Give a reason for each statement you make.

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……

……

…… [2]

(ii) State another triangle that is similar to BAF and EDF.

Answer Triangle …… [1]

(iii) The ratio $ED : DC = 2 : 3$.
Find the ratio $BC : AF$.

Answer …… : …… [1]

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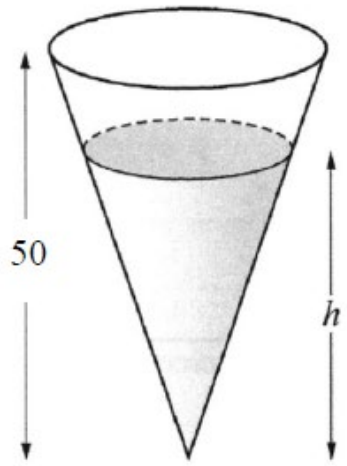
(iv) Given that the area of triangle EDF is 9.5 cm^2, find the area of triangle BAF.

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

(b) The diagram below shows a cone of height 50 cm.

The volume of the liquid in the cone is $\frac{3}{4}$ of the volume of the cone.

Calculate the depth, h cm, of the liquid.

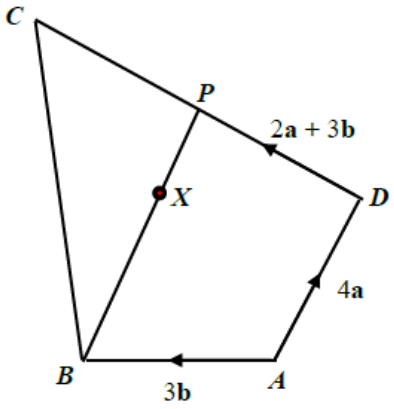


Answer ..... cm [2]

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6 In the diagram below, P is a point on DC, such that $DC = 2DP$ and X is a point on BP such that $3BX = 2BP$.

It is given that $\overrightarrow{AD} = 4\mathbf{a}$, $\overrightarrow{AB} = 3\mathbf{b}$, and $\overrightarrow{DP} = 2\mathbf{a} + 3\mathbf{b}$.



(a) Express, as simply as possible, in terms of **a** and/or **b**,

(i) $\overrightarrow{BP}$,

Answer ..... [1]

(ii) $\overrightarrow{AX}$,

Answer ..... [2]

(iii) $\overrightarrow{AC}$.

Answer ..... [2]

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(b) Explain whether the points A, X and C lie on the same straight line.

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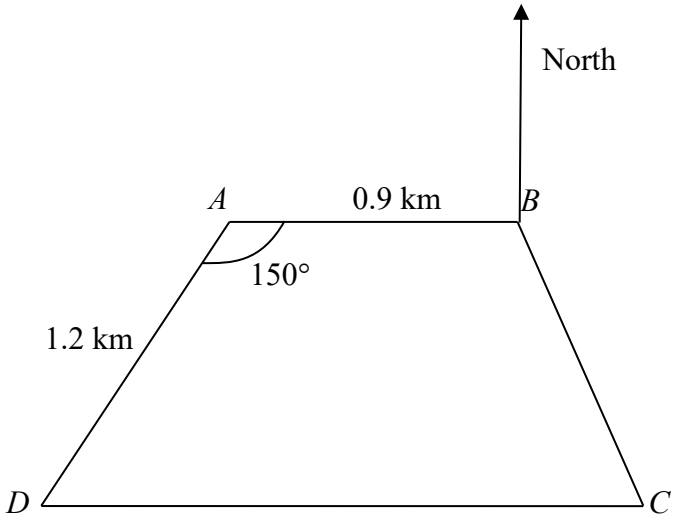
…… [2]

(c) Given that the area of triangle $BCP = 24\,\text{cm}^2$, find the area of triangle CXP.

Answer ……cm^2 [2]

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7



The diagram shows four towns A, B, C and D on a piece of horizontal land. Town A is due west of Town B. $ABCD$ is a trapezium such that $AB = 0.9$ km, $AD = 1.2$ km and angle $BAD = 150°$.

(a) Calculate the distance between Town B and Town D.

Answer …… km [3]

(b) Find angle BDC.

Answer ……° [2]

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(c) Calculate the bearing of D from B.

Answer …….° [2]

(d) A tower is standing at Town B.
The greatest angle of elevation of the top of the tower, T, from the path CD is 18°. Find the height of the tower in metres.

Answer ……. m [3]

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8 James bought some essential oil for \$720 at \$$x$ per litre.

(a) Write an expression, in terms of x, for the number of litres of essential oil he bought.

Answer ……..…… litres [1]

(b) Due to a leakage in the container, 5 litres of essential oil were lost.
James sold the remaining essential oil at \$2 per litre more than what he had paid for. Write an expression, in terms of x, for the amount of money he received from the sale of essential oil.

Answer \$ ……..……. [1]

(c) Given that James made a profit of \$100, write down an equation in x to represent this information and show that it reduces to $x^2 + 22x - 288 = 0$.

[3]

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(d) Solve the equation $x^2 + 22x - 288 = 0$.

Answer $x =$ ……. or $x =$ ……. [3]

(e) Find, to the nearest litre, the amount of essential oil James sold.

Answer ……. litres [2]

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9 The table below shows the Income Tax Rate in Singapore.

Table 1: Income Tax Rate

Chargeable Income	**Rate (%)**	**Gross Tax Payable ($)**
On the first $120,000	-	7,950
On the next $40,000	15	6,000
On the first $160,000	-	13,950
On the next $40,000	18	7,200
On the first $200,000	-	21,150
On the next $40,000	19	7,600
On the first $240,000	-	28,750
On the next $40,000	19.5	7,800

(a) Henry enjoyed a total tax relief of $15 000 and paid $14 130 of income tax for the year of assessment 2022. Calculate his annual income in 2022.
[Annual income = Chargeable income + tax relief]

Answer $ ……. [2]

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TURN OVER FOR QUESTION 9(b) and 9(c)

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Henry recently got a pay rise and his income is now $15 500 per month.
He is keen to buy a private condominium which is priced at $1 200 000. To afford this condominium, he needs to apply for a bank loan of $800 000.

(b) The maximum duration of a housing loan for private properties is up to 35 years or 65 years of age, whichever is lower.

Given that Henry is 45 years old, find the maximum number of years Henry can loan from the bank.

Answer …… years [1]

(c) Henry decides to apply for a loan for the maximum duration allowed for his age. The loan from the bank is subject to a simple interest of 3.5% per annum.

The government introduced the Total Debt Servicing Ratio (TDSR) to prevent individuals from over-borrowing.

Information about TDSR

- Total Debt Servicing Ratio = $\frac{\text{Total monthly debt repayment}}{\text{Monthly income}}$
- Total monthly debt repayment includes repayments for car loans, personal loans, credit card expenditure, home loans and other loans.
- The maximum TDSR allowed is 55%.

His current monthly debt repayment is shown in the table below:

Type	**Amount ($)**
Car loan	1000
Credit card Expenditure	1000
Personal loans	1000

By considering the TDSR ratio, will the bank approve his loan request?
Justify your answer and show your calculations clearly.

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Answer

……..

…….. [7]

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