BENDEMEER SECONDARY SCHOOL
2024 PRELIMINARY EXAMINATION
SECONDARY FOUR NORMAL (ACADEMIC)

CANDIDATE NAME

CLASS

INDEX NUMBER

MATHEMATICS (SYLLABUS A) 4045/01

Paper 1 **30 July 2024**
2 Hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, register number on all the work you hand in.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
The use of an approved scientific calculator is expected, where appropriate.

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 70.

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 ASSESSMENT USE
70

Mathematical Formulae

Compound interest

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

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 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

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

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

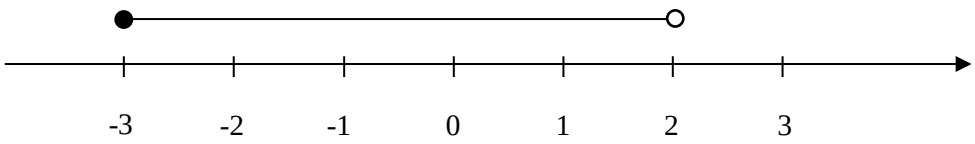
1 **(a)** Simplify $\frac{6x^2y}{8xy^3}$.

Answer …… [1]

(b) Simplify $\left(\frac{x^3}{27}\right)^{-\frac{1}{3}}$.

Answer …… [2]

2 The diagram below shows a solution set for x on a number line.



(a) Write down the range of values of x.

Answer …… [1]

(b) If x is an integer, state the largest value of x.

Answer …… [1]

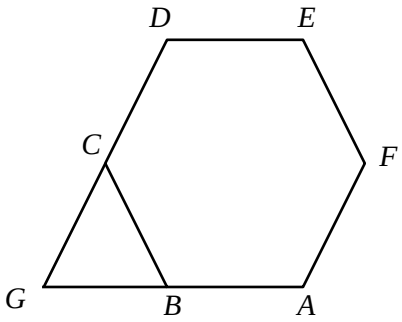
3 In a sale, the price of a handphone is reduced from $388 to $302.
Calculate the percentage decrease in price.

Answer ……% [2]

4 The angles in a triangle are in the ratio 3:4:5.
Calculate the size of each angle in degrees.

Answer ……°**,** ……° and ..…….° [2]

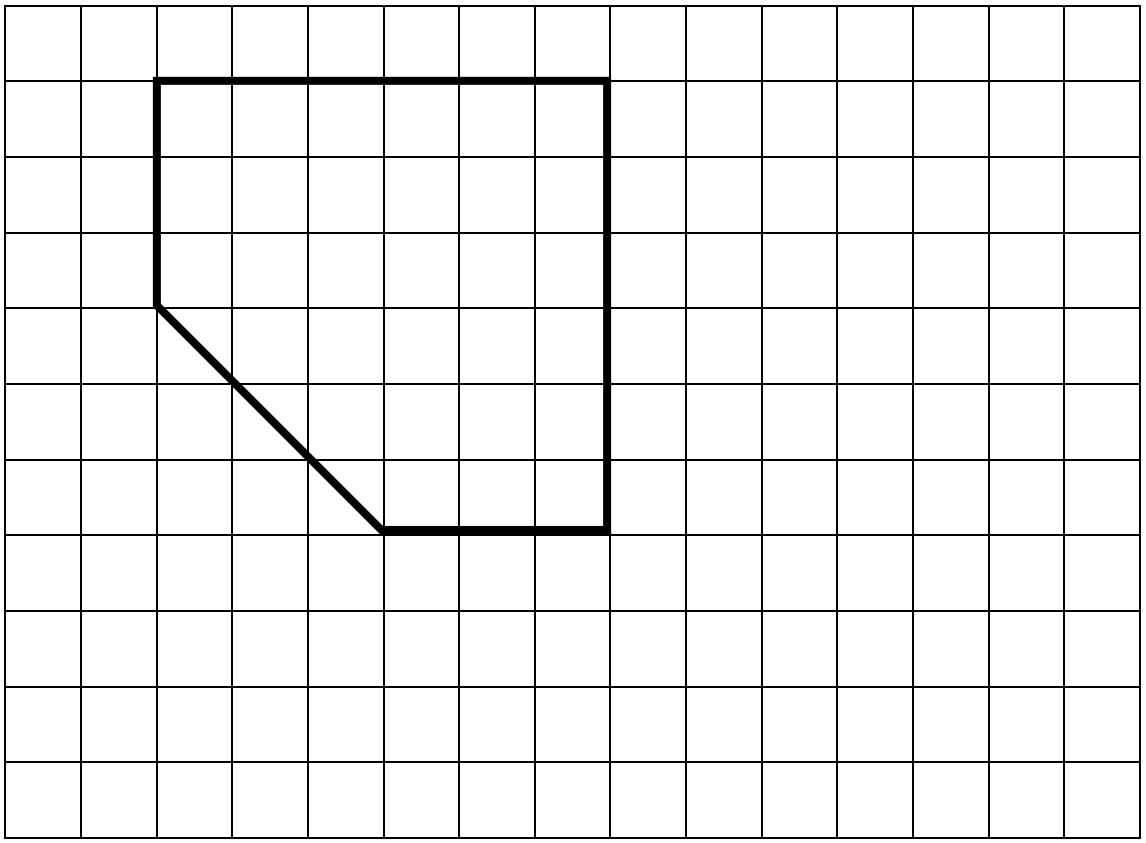
5 The diagram shows a regular hexagon *ABCDEF*.
AB and *DC* are produced to meet at *G*.



Find angle *BGC*.

Answer ……° [2]

6 Use a scale factor of $\frac{2}{3}$ to draw a reduction of the given figure.



[2]

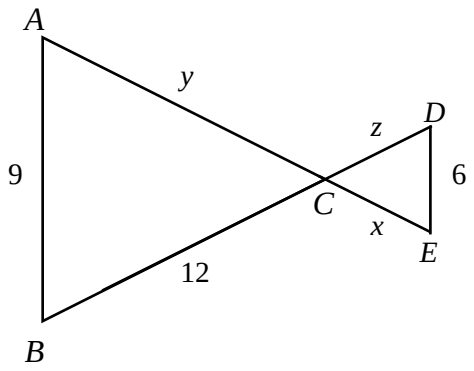
7 **(a)** Solve $\frac{x}{x+3} = 24.$

Answer $x =$ …… [1]

(b) Given that $\frac{5^7 \times 5^{-2}}{5^4} = 5^a,$ find the value of a.

Answer $a =$ …… [2]

8 Triangles *ABC* and *DEC* are similar.
All the lengths are in centimetres.



(a) Calculate *x*.

Answer x =……cm [2]

(b) Find y in terms of z.

Answer …… [2]

9 The first four terms of a sequence are 5, 9, 13 and 17.

(i) Find an expression, in terms of n, for the n^{th} term of the sequence.

Answer …… [1]

(ii) Find the 25th term of the sequence.

Answer …… [1]

(iii) Jane says that 212 is a term in this sequence.
Is she correct? Explain your answer.

Answer ……

…… [1]

10 A map is drawn to scale of 1: 25 000.

(a) The distance on the map between the school and Mary's house is 4 cm.
Find the actual distance, giving your answer in kilometres.

Answer ……km [2]

(b) The area of the playground is 75 000 m^2.
Calculate the area of the playground on the map. Give your answer in cm^2.

Answer ……cm^2 [2]

11 **(a)** Write 90 as the product of its prime factors.

Answer …… [1]

(b) Find the highest common factor (HCF) of 90 and 216.

Answer …… [1]

(c) Find the smallest positive integer value of k such that $90k$ is a perfect square.

Answer k = …… [1]

12 **(a)** Ahmad invested $4500 for 2 years in a savings account of Bank Prosper. He was paid 4 % per annum compound interest. How much did Ahmad have in his savings account after 2 years?

Answer $…… [2]

(b) Ahmad invested another $4500 for 2 years in an endowment fund of Bank Wealthy. The fund pays an interest rate compounded yearly. At the end of 2 years, he received a total of $5100. Find the interest rate per annum.

Answer ……% [2]

13 **(a)** Factorise $x^2 - 49$.

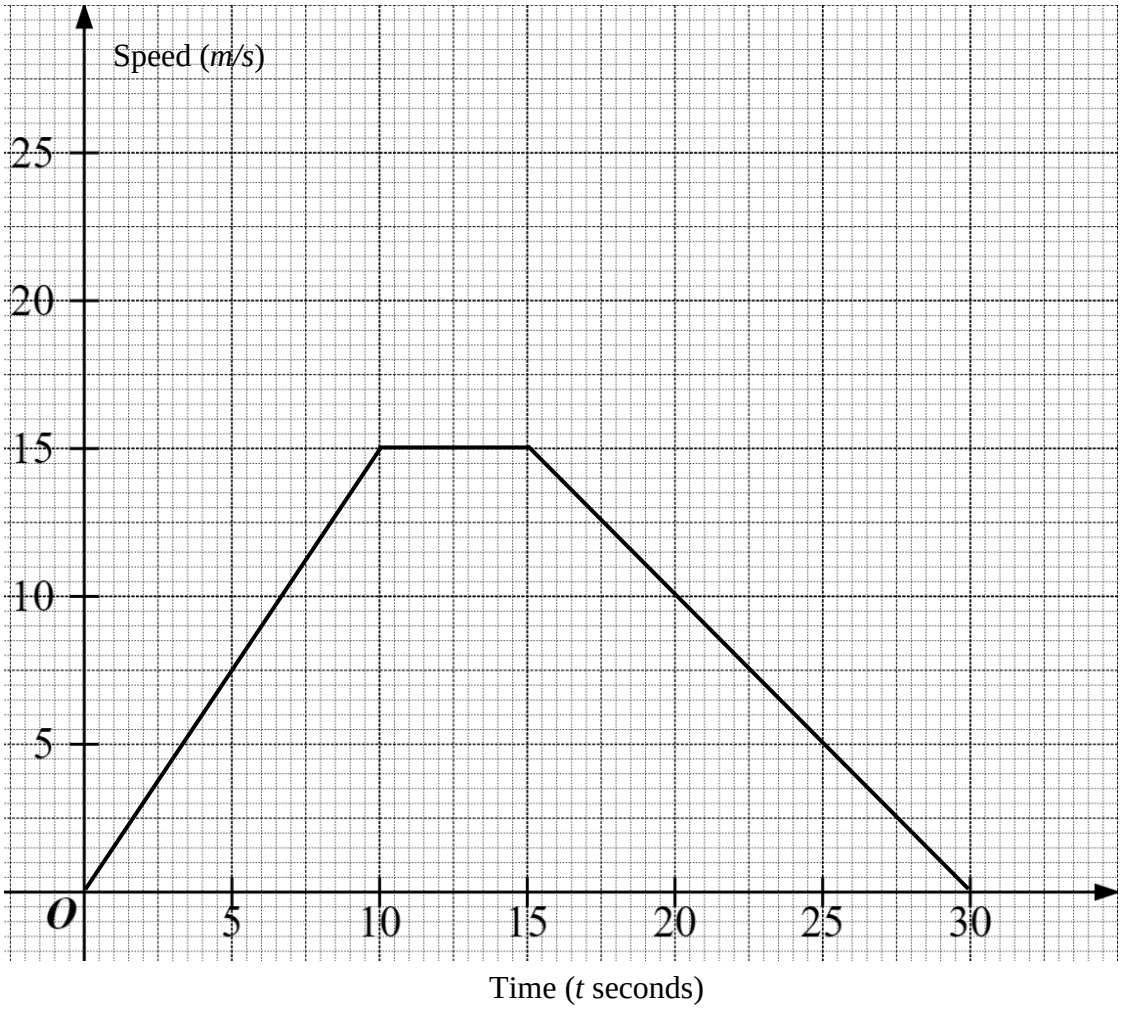
Answer …… [1]

(b) Solve $\frac{11}{x+7} - \frac{2}{x^2-49} = 1$.

You must show all your working clearly.

Answer x = ……or x = …… [4]

14 The speed-time graph shows a travelling journey of Tom.



(a) Describe the motion between $t = 10$ to $t = 15$.

Answer …….. [1]

(b) Calculate the acceleration of the first 10 s.

Answer ……m/s^2 [1]

(c) The area under the graph represents the total distance travelled.
Calculate the total distance travelled.

Answer ……...m [2]

15 The table below shows the distance of some of the asteroids from earth in 2024.

Name of asteroids	Distance from earth (km)
2024 GM	7,160,000
2024 HS	7,450,000
2021 VH2	3,560,000
2024 HD	2,260,000

(a) State the distance from earth of 2024 GM in standard form.

Answer ……...km [1]

(b) What is the distance between 2024 HS and 2021 VH2?
Give your answer in million.

Answer ……...million [2]

(c) The distance between Earth and the moon is about one fifth of the distance between Earth and 2024 HD. Estimate the distance between Earth and the moon, in standard form.

Answer ……...km [2]

16 The points A and B have coordinates (-3, 4) and (1, 8) respectively.

(i) Calculate the length of AB.

Answer …… [2]

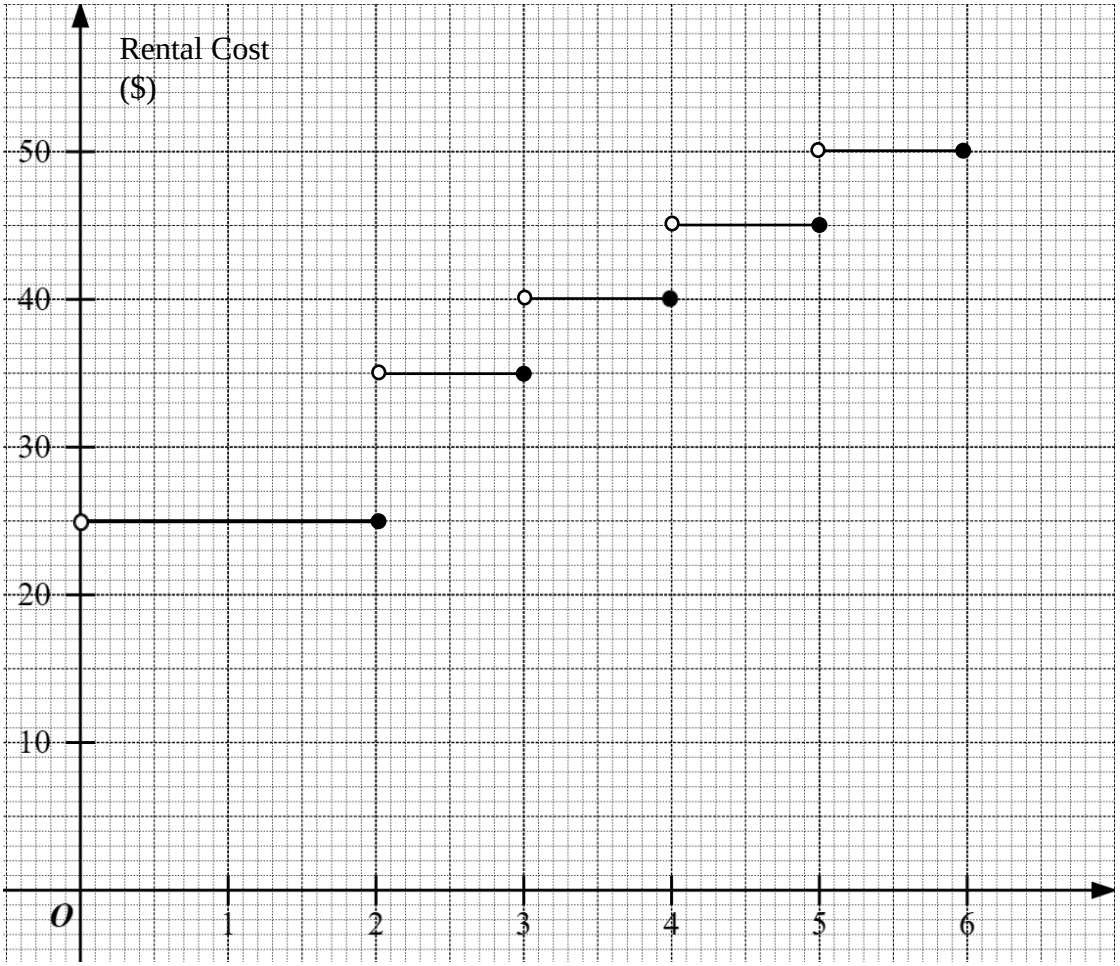
(ii) Find the equation of the line AB.

Answer …… [2]

(iii) Find the coordinates of the point where the line AB cuts the line $y = 9$.

Answer (…… , ……) [1]

17 Jamal plans to rent a candy floss machine for a class event. The graph shows the rental costs from Company A.



(a) How much should she expect to spend if she rent the candy floss machine from 8am to 12.30pm?

Answer $…… [1]

(b) Jamal found Company B who rents candy floss machine with a flat rate of $10 and an additional rate of 25 cents per minute.

(i) Convert 25 cents per minute to dollar per hour.

Answer $……per hour [1]

(ii) Draw the graph of Company B's rental rates for the 1st two hours on the same axes as above. [1]

(iii) From the graph, how long should Jamal rent the candy floss machine for her to be paying the same amount of rental from both Companies.

Answer ……hour [1]

18 **(a)** Given that $x^2 + 4x - 3 = (x + a)^2 + b$, find *a* and *b*, such that *a* and *b* are integers.

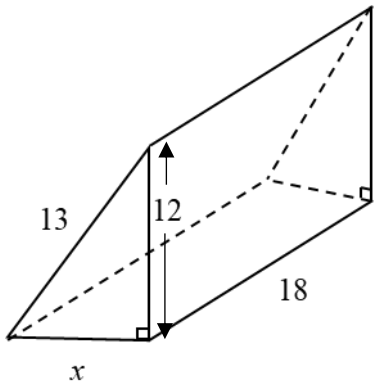
Answer *a* = ……

b = …… [2]

(b) **Hence**, solve $x^2 + 4x - 3 = 0$, giving your answers correct to 2 decimal places.

Answer *x* = ..……or *x* = ..…… [2]

19 The diagram below shows a prism.
Three of its faces are rectangles.
All lengths are given in centimetres.



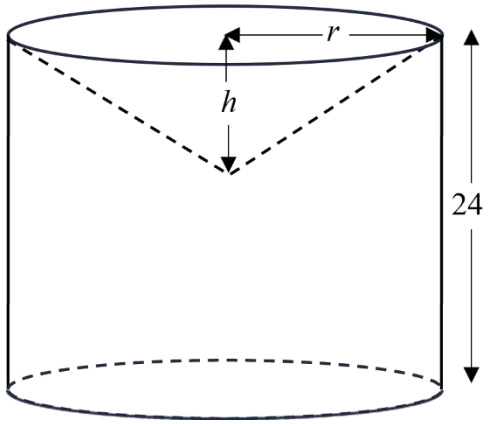
(a) Show that x is 5 cm.

[2]

(b) Calculate the **total** surface area of the prism.

Answer ……..cm^2 [3]

20 A solid is formed by removing a cone of radius r cm from the top of a cylinder of radius r cm. The height of cylinder is thrice the height of the cone, h cm.
The total volume of the solid is $533\frac{1}{3}\pi$ cm^3.



Calculate the exact value of r.

Answer r = ……..cm [4]

End of paper

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

Statistics

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

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

1 **(a)** Simplify $\frac{6x^2y}{8xy^3}$.

$\frac{3x}{4y^2}$ [B1]

Answer ..... [1]

(b) Simplify $\left(\frac{x^3}{27}\right)^{-\frac{1}{3}}$.

$\left(\frac{27}{x^3}\right)^{\frac{1}{3}} = \frac{27^{\frac{1}{3}}}{(x^3)^{\frac{1}{3}}}$ [M1]

$= \frac{3}{x}$ [A1]

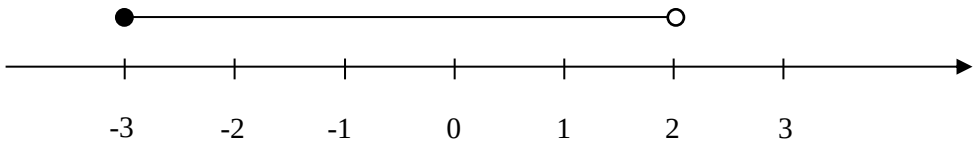
Alternate method

$\left(\frac{x^3}{3^3}\right)^{-\frac{1}{3}} = \frac{x^{-1}}{3^{-1}}$ [M1]

$= \frac{3}{x}$ [A1]

Answer ..... [2]

2 The diagram below shows a solution set for x on a number line.



(a) Write down the range of values of x.

$-3 \leq x < 2$ [B1]

Answer ..... [1]

(b) If x is an integer, state the largest value of x.

1 [B1]

Answer ..... [1]

3 In a sale, the price of a handphone is reduced from $388 to $302.
Calculate the percentage decrease in price.

$388 - $302 = $86 [M1]

$\frac{86}{388} \times 100\% = 22.2\%$ (to 3 s.f) [A1]

Answer ……% [2]

4 The angles in a triangle are in the ratio 3:4:5.
Calculate the size of each angle in degrees.

Total number of units = 3+4+5 = 12

12 units → 180° [M1]

1 unit → $\frac{180^\circ}{12} = 15^\circ$

3 units → 15° x 3 = 45°

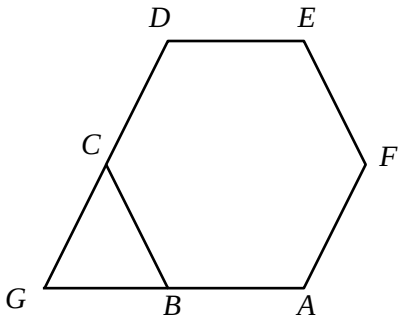
4 units → 15° x 4 = 60°

5 units → 15° x 5 = 75°

Ans: 45°, 60° and 75° [A1]

Answer ……°, ……° and ……° [2]

5 The diagram shows a regular hexagon *ABCDEF*.
AB and *DC* are produced to meet at *G*.



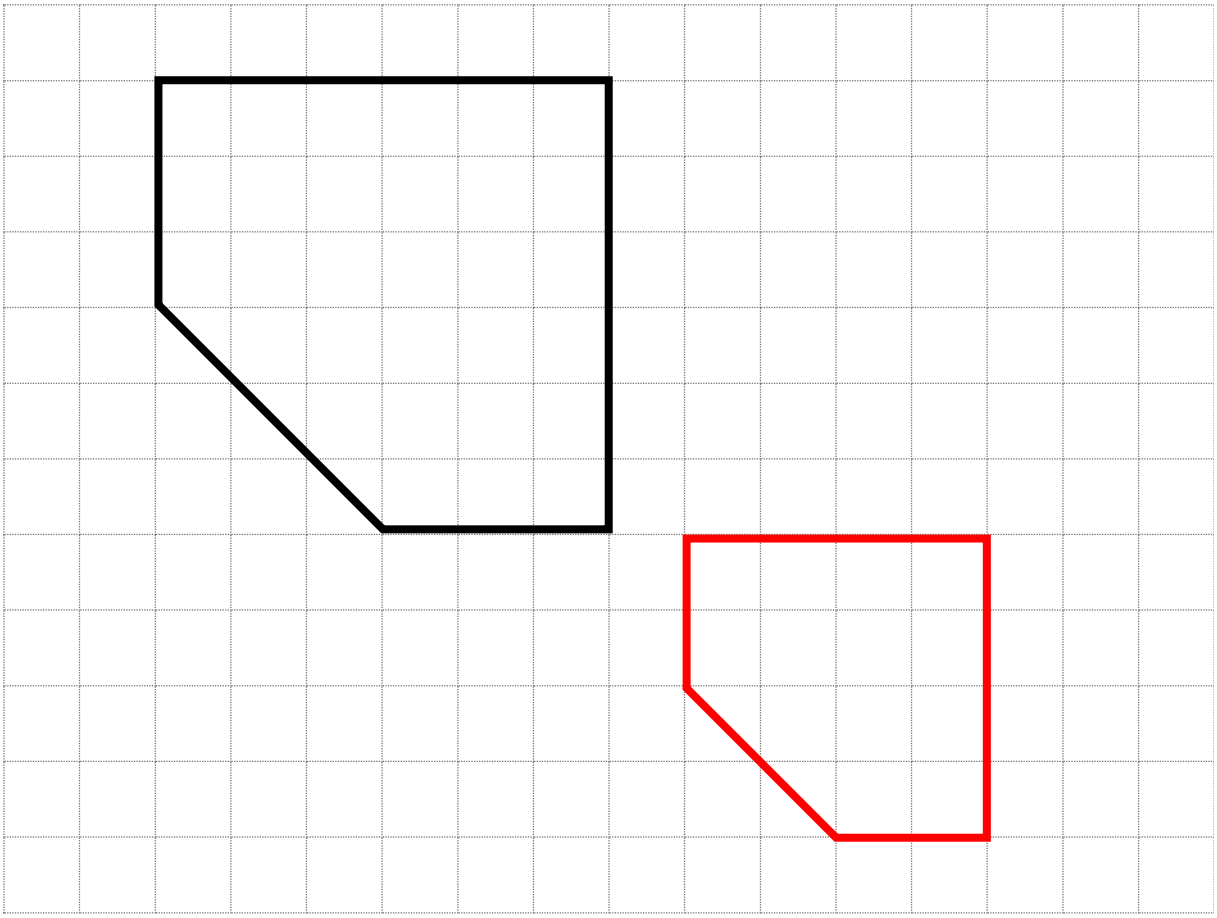
Find angle *BGC*.

Exterior angle of hextagon = $\frac{360}{6} = 60°$ [M1]

angle *BGC* = $180° - 60° - 60° = 60°$ [A1]

Answer ……° [2]

6 Use a scale factor of $\frac{2}{3}$ to draw a reduction of the given figure.



[2]

7 **(a)** Solve $\frac{x}{x+3} = 24$.

$x = 24(x + 3)$

$x = 24x + 72$

$23x = -72$

$x = -3\frac{3}{23}$ *or* $-\frac{72}{23}$. [B1 – No marks if 3 s.f]

Answer $x =$ …… [1]

(b) Given that $\frac{5^7 \times 5^{-2}}{5^4} = 5^a$, find the value of *a*.

$5^{7-2-4} = 5^a$ [M1]

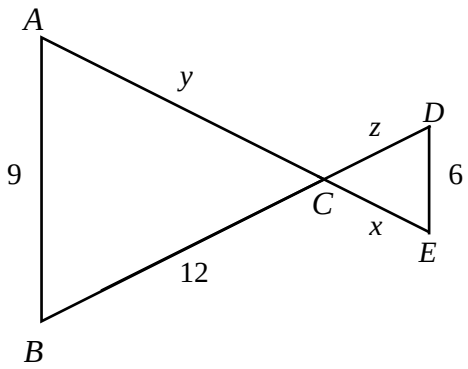
$5^1 = 5^a$

By comparing power

$a = 1$ [A1]

Answer $a =$ …… [2]

8 Triangles *ABC* and *DEC* are similar.
All the lengths are in centimetres.



(a) Calculate *x*.

Since Triangles *ABC* and *DEC* are similar,

$\frac{6}{9} = \frac{x}{12}$ [M1]

$x = \frac{12 \times 6}{9} = 8$ [A1]

Answer x =……cm [2]

(b) Find *y* in terms of *z*.

$\frac{z}{y} = \frac{6}{9}$ [M1]

$y = \frac{9}{6}z$

$y = \frac{3}{2}z$ [A1] – no marks if did not simplify.

Answer …… [2]

9 The first four terms of a sequence are 5, 9, 13 and 17.

(i) Find an expression, in terms of n, for the n^{th} term of the sequence.

Ans: $T_n = 4n + 1$ [B1]
[No marks if not simplified i.e. 5+4(n-1)]

Answer ..... [1]

(ii) Find the 25th term of the sequence.

$T_{25} = 4(25) + 1 = 101$ [B1]

Answer ..... [1]

(iii) Jane says that 212 is a term in this sequence.
Is she correct? Explain your answer.

$$4n + 1 = 212$$
$$4n = 211$$
$$n = \frac{211}{4} = 52.75$$

Since n is not an integer, 212 is not a term in this sequence. Jane is not correct. [B1]

Answer .....

..... [1]

10 A map is drawn to scale of 1: 25 000.

(a) The distance on the map between the school and Mary's house is 4 cm.
Find the actual distance, giving your answer in kilometres.

1cm: 25 000 cm

1km = 1000m = 100, 000cm

1cm : 25000 / 100,000 = 0.25 km [M1]
4cm: 0.25 x 4 = 1 km [A1]

Answer ……km [2]

(b) The area of the playground is 75000 m^2. Calculate the area of the playground on the map. Give your answer in cm^2.

1cm : 250 m
1cm^2: 62 500 m^2 [M1]
1m^2 : $\frac{1}{62500}$ cm^2
75 000 m^2 : $\frac{75000}{62500} = 1.20$ cm^2 [A1]

Answer …… cm^2 [2]

11 **(a)** Write 90 as the product of its prime factors.

2	90
3	45
3	15
5	5
	1

Ans: $2 \times 3^2 \times 5$ [B1]

Answer …… [1]

(b) Find the highest common factor (HCF) of 90 and 216.

$2^3 \times 3^3 = 216$

Ans: $2 \times 3^2 = 18$ [B1]

Answer …… [1]

(c) Find the smallest positive integer value of k such that $90k$ is a perfect square.

Ans: 2 x 5 = 10 [B1]

Answer k = …… [1]

12 **(a)** Ahmad invested $4500 for 2 years in a savings account of Bank Prosper. He was paid 4% per annum compound interest. How much did Ahmad have in his savings account after 2 years?

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

$= 4500\left(1 + \frac{4}{100}\right)^2$ [M1]

$= 4867.20$ [A1]

[-1m if answer in 1 d.p]

Answer $\$\ldots\ldots\ldots\ldots\ldots\ldots$ [2]

(b) Ahmad invested another $4500 for 2 years in an endowment fund of Bank Wealthy. The fund pays an interest rate compounded yearly. At the end of 2 years, he received a total of $5100. Find the interest rate per annum.

$5100 = 4500\left(1 + \frac{r}{100}\right)^2$

$\frac{5100}{4500} = \left(1 + \frac{r}{100}\right)^2$ [M1]

$\sqrt{\frac{5100}{4500}} - 1 = \frac{r}{100}$

$r = 6.46$ [A1]

Answer $\ldots\ldots\ldots\ldots\ldots\ldots\ldots$ [2]

13 **(a)** Factorise $x^2 - 49$.

$(x-7)(x+7)$ [B1]

Answer ..... [1]

(b) Solve $\frac{11}{x+7} - \frac{2}{x^2-49} = 1$.

You must show all your working clearly.

$\frac{11}{x+7} - \frac{2}{x^2-49} = 1$

$\frac{11}{x+7} - \frac{2}{(x-7)(x+7)} = 1$

$\frac{11(x-7)}{(x-7)(x+7)} - \frac{2}{(x-7)(x+7)} = 1$ [M1]

$\frac{11x-77-2}{(x-7)(x+7)} = 1$

$11x - 79 = (x-7)(x+7)$

$x^2 - 49 - 11x + 79 = 0$

$x^2 - 11x + 30 = 0$ [M1]

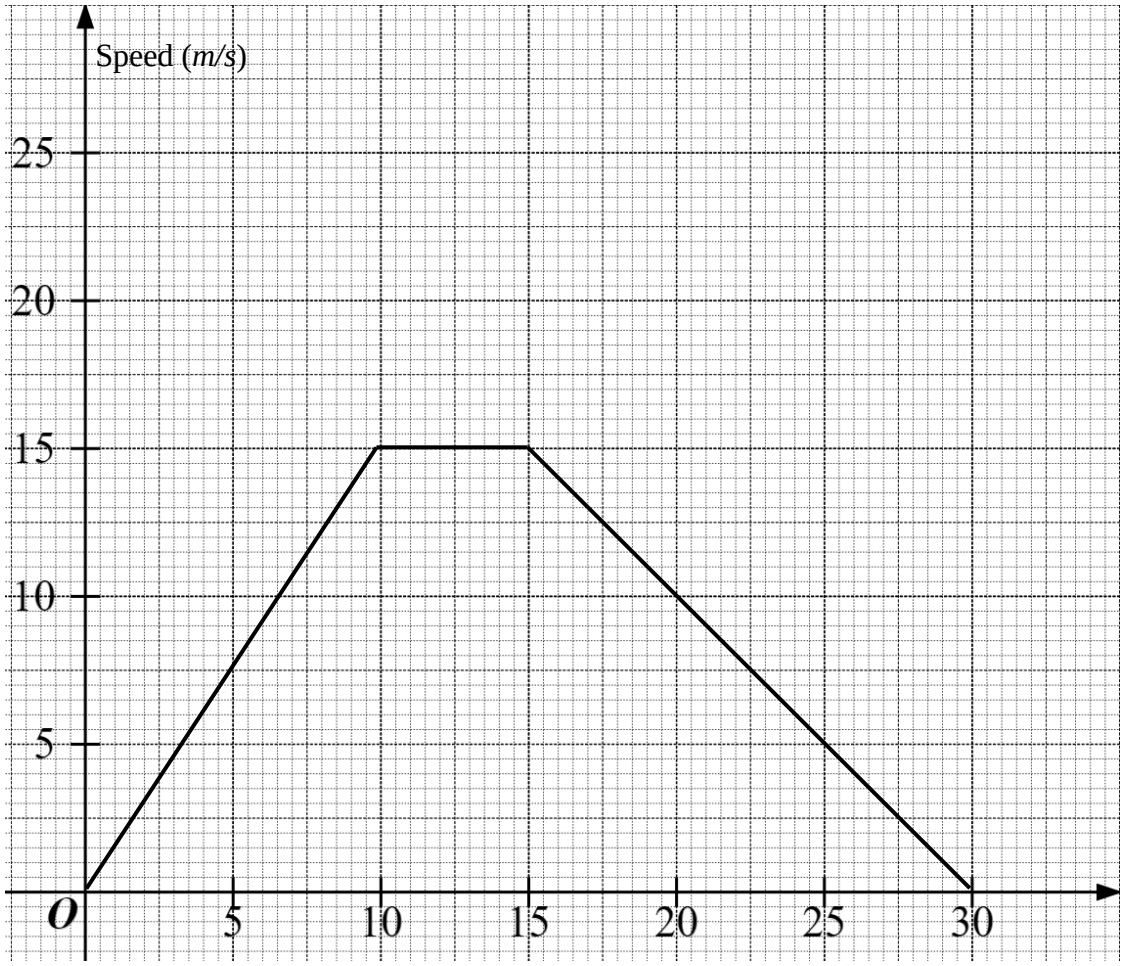
$(x-6)(x-5) = 0$ [M1]

$x - 6 = 0$ or $x - 5 = 0$

$x = 6$ or $x = 5$ [A1]

Answer x = ... or x = ... [4]

14 The speed-time graph shows a travelling journey of Tom.



(a) Describe the motion between $t = 10$ to $t = 15$.

Tom is travelling at a constant speed of 15 m/s. [B1]

Answer …… [1]

(b) Calculate the acceleration of the first 10 s.

$\frac{15}{10} = 1.5$ [B1]

Answer ……..m/s^2 [1]

(c) The area under the graph represents the total distance travelled.
Calculate the total distance travelled.

Method 1	**Method 2**
$\left(\frac{1}{2} \times 10 \times 15\right) + (5 \times 15) + \left(\frac{1}{2} \times 15 \times 15\right)$ [M1] $= 262.5$ [A1]	$\frac{1}{2} \times (5 + 30) \times 15$ [M1] $= 262.5$ [A1]

Answer ……...m [2]

15 The table below shows the distance of some of the asteroids from earth in 2024.

Name of asteroids	Distance from earth (km)
2024 GM	7,160,000
2024 HS	7,450,000
2021 VH2	3,560,000
2024 HD	2,260,000

(a) State the distance from earth of 2024 GM in standard form.

Answer: 7.16×10^6 [B1]

Answer ……...km [1]

(b) What is the distance between 2024 HS and 2021 VH2?
Give your answer in million.

$7450000 - 3560000$ [M1]
$= 3890000 = 3.89$ million [A1]

Answer ……...million [2]

(c) The distance between Earth and the moon is about one fifth of the distance between Earth and 2024 HD. Estimate the distance between Earth and the moon, in standard form.

$\frac{2,260,000}{5}$ [M1]
$= 452000 = 4.52 \times 10^5$ [A1]

Answer ……...km [2]

16 The points *A* and *B* have coordinates (-3, 4) and (1, 8) respectively.

(i) Calculate the length of *AB*.

length of $CD = \sqrt{(8-4)^2 + (1-(-3))^2} = \sqrt{4^2 + 4^2}$ [M1]
$= \sqrt{16+16} = \sqrt{32} = 5.66$ [A1]

Answer ..... [2]

(ii) Find the equation of the line *AB*.

Gradient, m = $\frac{8-4}{1-(-3)} = \frac{4}{4} = 1$ [M1]

Sub. (-3, 4) into $y = mx + c$

$4 = 1(-3) + c$
$c = 4 + 3$
$c = 7$

Ans: $y = x + 7$ [A1]

Answer ..... [2]

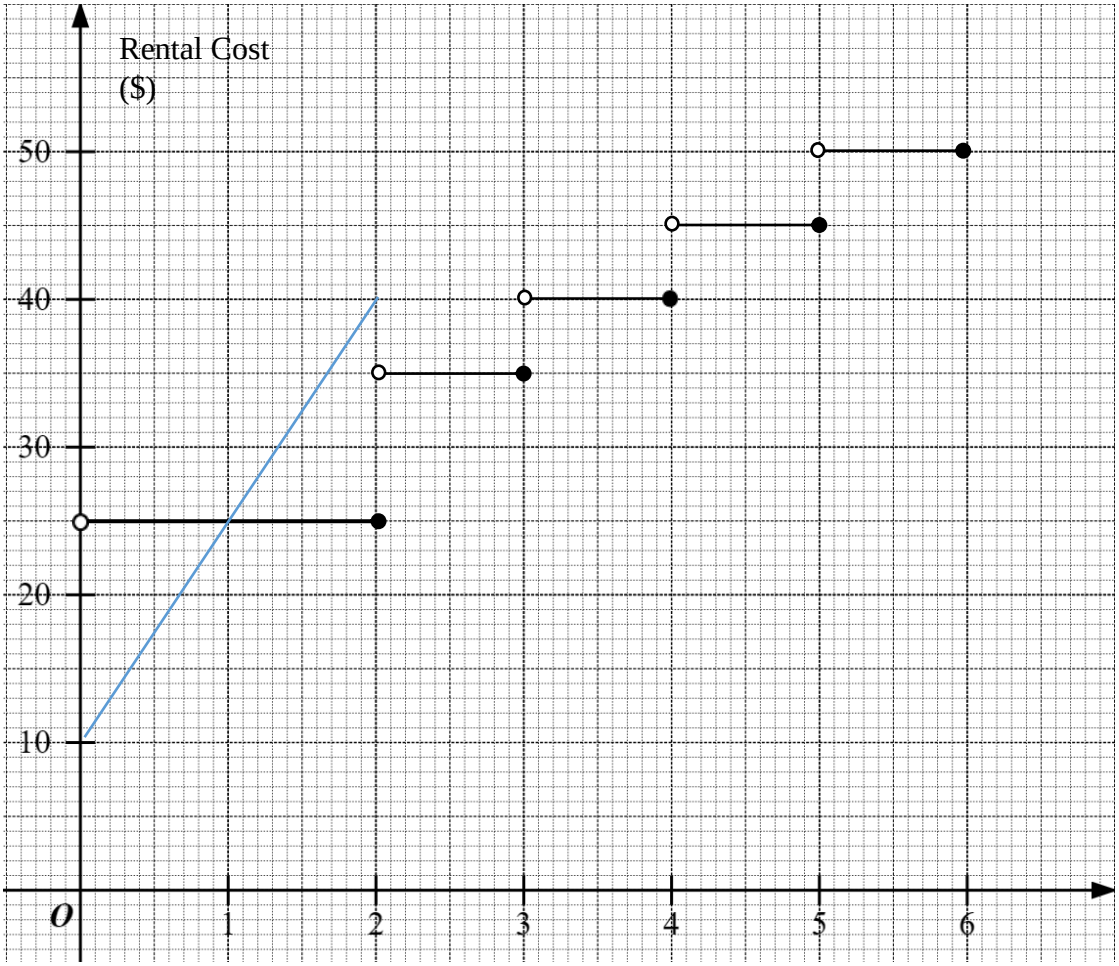
(iii) Find the coordinates of the point where the line *AB* cuts the line $y = 9$

$9 = x + 7$
$x = 2$

Ans: (2, 9) [A1]

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

17 Jamal plans to rent a candy floss machine for a class event. The graph shows the rental costs from Company A.



(a) How much should she expect to spend if she rent the candy floss machine from 8am to 12.30pm?

Duration of rental 4 hours 30mins
From graph, rental cost $45

Answer $..... [1]

(b) Jamal found Company B who rents candy floss machine with a flat rate of $10 and an additional rate of 25 cents per minute.

(i) Convert 25 cents per minute to dollar per hour.
$0.25 \times 60 = 15$ [B1]

Answer $.....per hour [1]

(ii) Draw the graph of Company B's rental rates for the 1st two hours on the same axes as above. [1]

(iii) From the graph, how long should Jamal rent the candy floss machine for her to be paying the same amount of rental from both Companies.

Answer ……1…… hour [1]

18 **(a)** Given that $x^2 + 4x - 3 = (x + a)^2 + b$, find *a* and *b*, such that *a* and *b* are integers.

$x^2 + 4x - 3 = \left(x + \frac{4}{2}\right)^2 - \left(\frac{4}{2}\right)^2 - 3$ [M1]
$(x + 2)^2 - 4 - 3 = (x + 2)^2 - 7$
$a = 2, b = -7$ [A1]

Answer a = ……..
b = ……. [2]

(b) **Hence**, solve $x^2 + 4x - 3 = 0$, giving your answers correct to 2 decimal places.

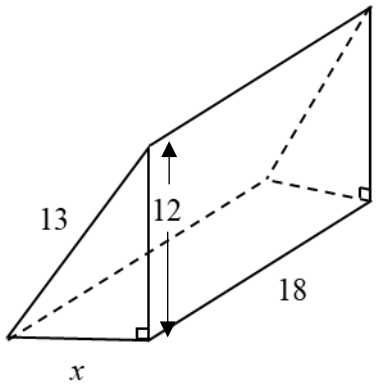
Method 1
$(x + 2)^2 - 7 = 0$
$(x + 2)^2 = 7$
$x + 2 = \pm\sqrt{7}$ [M1]
$x = -2 \pm \sqrt{7}$
$x = -4.65$ or $x = 0.65$ (to 2 d.p) [A1]

Method 2
$(x + 2)^2 - \left(\sqrt{7}\right)^2 = 0$
$\left(x + 2 - \sqrt{7}\right)\left(x + 2 + \sqrt{7}\right) = 0$ [M1]
$x = -2 + \sqrt{7}$ or $x = -2 - \sqrt{7}$ [A1]

[1 M if got the answer correct by other methods.]
[1 M ecf]

Answer …… [2]

19 The diagram below shows a prism.
Three of its faces are rectangles.
All lengths are given in centimetres.



(a) Show that x is 5 cm.

By Pythagoras Theorem [M1]

$x^2 = 13^2 - 12^2$ [A1]
$x = \pm\sqrt{25}$
$x = 5$ (Since length is positive)
[no marks deducted if did not state to reject -5]

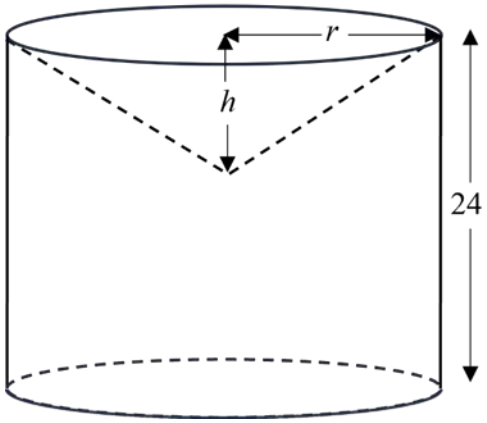
[2]

(b) Calculate the **total** surface area of the prism.

Total surface area = $\left(2 \times \frac{1}{2} \times 5 \times 12\right) + (13 + 12 + 5) \times 18$ [M2]
= 600 [A1]

Answer ……cm^2 [3]

20 A solid is formed by removing a cone of radius r cm from the top of a cylinder of radius r cm. The height of cylinder is thrice the height of the cone.
The total volume of the solid is $533\frac{1}{3}\pi$ cm^3.



Calculate the exact value of r.

Height of cone = $\frac{24}{3} = 8$ cm
Volume of cone = $\frac{1}{3}\pi r^2 h = \frac{8}{3}\pi r^2$ [M1]
Volume of cylinder = $\pi r^2 h = 24\pi r^2$ [M1]

Volume of solid: $533\frac{1}{3}\pi = 24\pi r^2 - \frac{8}{3}\pi r^2$
$533\frac{1}{3}\pi = \frac{64}{3}\pi r^2$ [M1]
$r^2 = 25$
$r = 5$ (length is positive) [A1]

Answer r = ……..cm [4]

End of paper

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BENDEMEER SECONDARY SCHOOL
2024 PRELIMINARY EXAMINATION
SECONDARY FOUR NORMAL (ACADEMIC)

CANDIDATE NAME

CLASS

INDEX NUMBER

MATHEMATICS (SYLLABUS A) 4045/02

Paper 2 **5 August 2024**

2 Hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, register number on all the work you hand in.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
The use of an approved scientific calculator is expected, where appropriate.

Section A
Answer **all** the questions.

Section B
Answer **one** 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 70.

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 ASSESSMENT USE
70

Mathematical Formulae

Compound interest

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

Section A (62 Marks)

Answer all the questions in this section.

1 **(a)** Calculate $\left(\frac{4}{5}\right)^{-\frac{1}{2}} - \sqrt{5\frac{1}{2}}$.

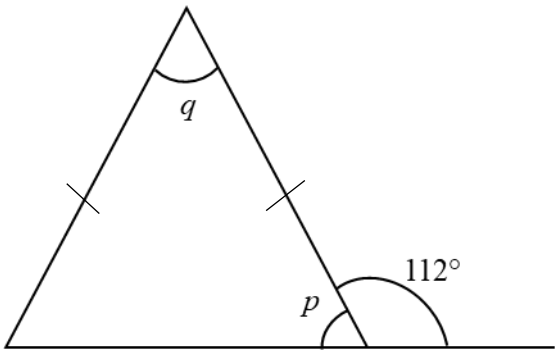
Answer …… [1]

(b) By writing each number correct to 1 significant figure, estimate the value of

$$\frac{\sqrt{9.103}\times 284}{13}.$$

Answer …… [1]

2 **(a)**



(i) Find *p*.

Answer p = ……° [1]

(ii) Find *q*.

Answer q = ……° [1]

(b) Given that $\sin x° = 0.5$ and $x°$ is an obtuse angle, find $x°$.

Answer ……° [1]

3 Solve the simultaneous equations.

$$5x - 3y = 11$$
$$3x - y = 9$$

Answer x = ……

y = …… [3]

4 Faris owns a furniture shop.

(a) The cost of a sofa was $1200.
He made a profit of 25% on the cost price when he sold it.

Find the selling price.

Answer $…… [2]

(b) He sold a cupboard at $188 with a loss of 10%.
How much was the cost of the cupboard?

Answer $…… [2]

5 **(a)** Write these numbers in order of size, starting with the smallest.

4^3 4^0 $4^{\frac{1}{3}}$ 4^{-3}

Answer ……, ……., ……, …… [1]
smallest *largest*

(b) Write $\frac{a^2 \times a^1}{a^{-2}}$ as a single power of a.

Answer …… [1]

(c) Simplify $7p^5 \times 2p^{-\frac{1}{2}}$.

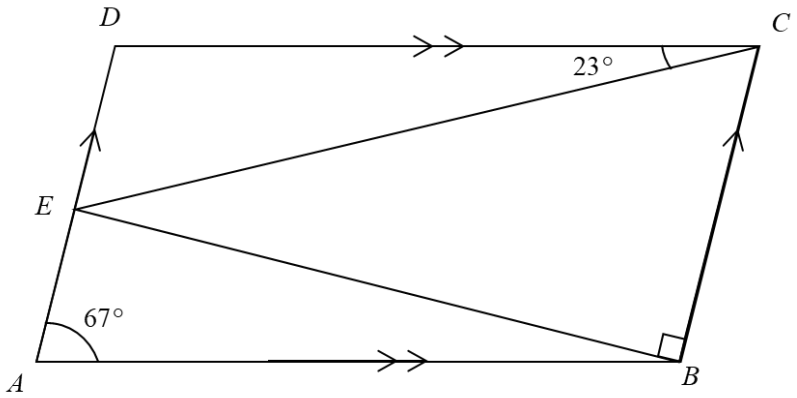
Answer …… [1]

6 It is given that y is inversely proportional to the square of x.
When $x = 1$, $y = 64$.

Find the value(s) of x when $y = 25$.

Answer $x =$ …… [3]

7 $ABCD$ is a parallelogram in which angle $DAB = 67°$ and angle $DCE = 23°$.
Given that BE is perpendicular to CB, find



(a) angle BCE,

Answer ……° [1]

(b) angle CEB,

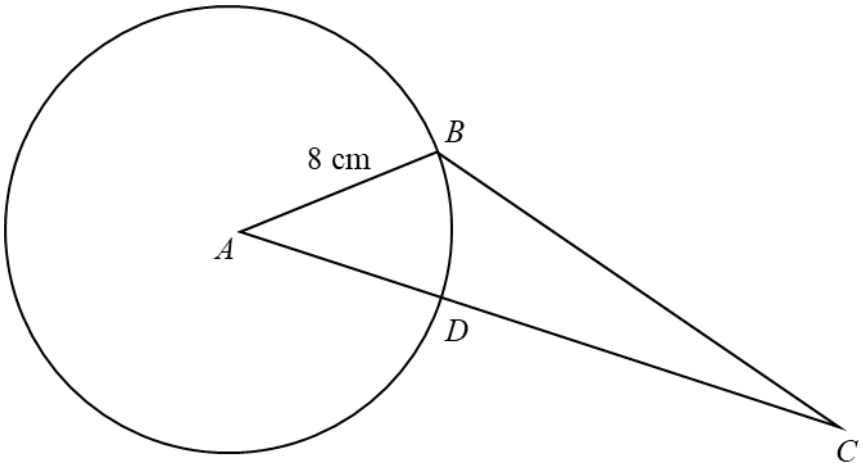
Answer ……° [1]

(c) angle EDC.

Answer ……° [1]

8 The diagram shows a triangle *ABC* and a circle with centre *A*.
The points *B* and *D* lie on the circumference of the circle.

The radius of the circle is 8 cm.
The length of the line *AC* is 17 cm.
The area of triangle *ABC* is 44 cm^2.



.

(a) Calculate the area of sector *ABD*.

Answer ……cm^2 [4]

(b) Calculate major arc length *ABD* if the reflex angle *BAD* is 5.6 rad.

Answer ……cm [1]

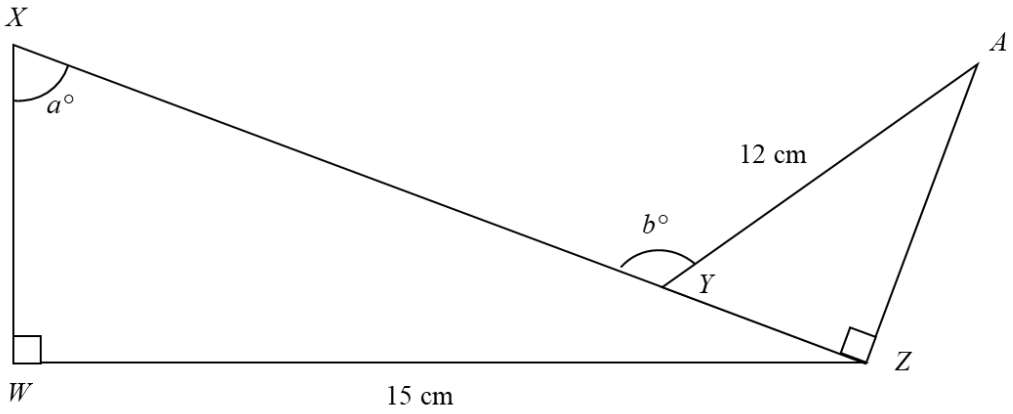
9 **(a)** Simplify $2x - 3(x - 4)$.

Answer …… [1]

(b) Solve $\frac{8}{x+1} = 3x - 5$, leave your answer in 2 decimal places.

Answer x = ……or …… [4]

10 In the diagram below, *XYZ* is a straight line. *XZ* is 5 times *YZ*.
AY = 12 cm, *WZ* = 15 cm and $\sin a° = \frac{3}{5}$.



(a) Find *XZ*.

Answer *XZ* = ……cm [1]

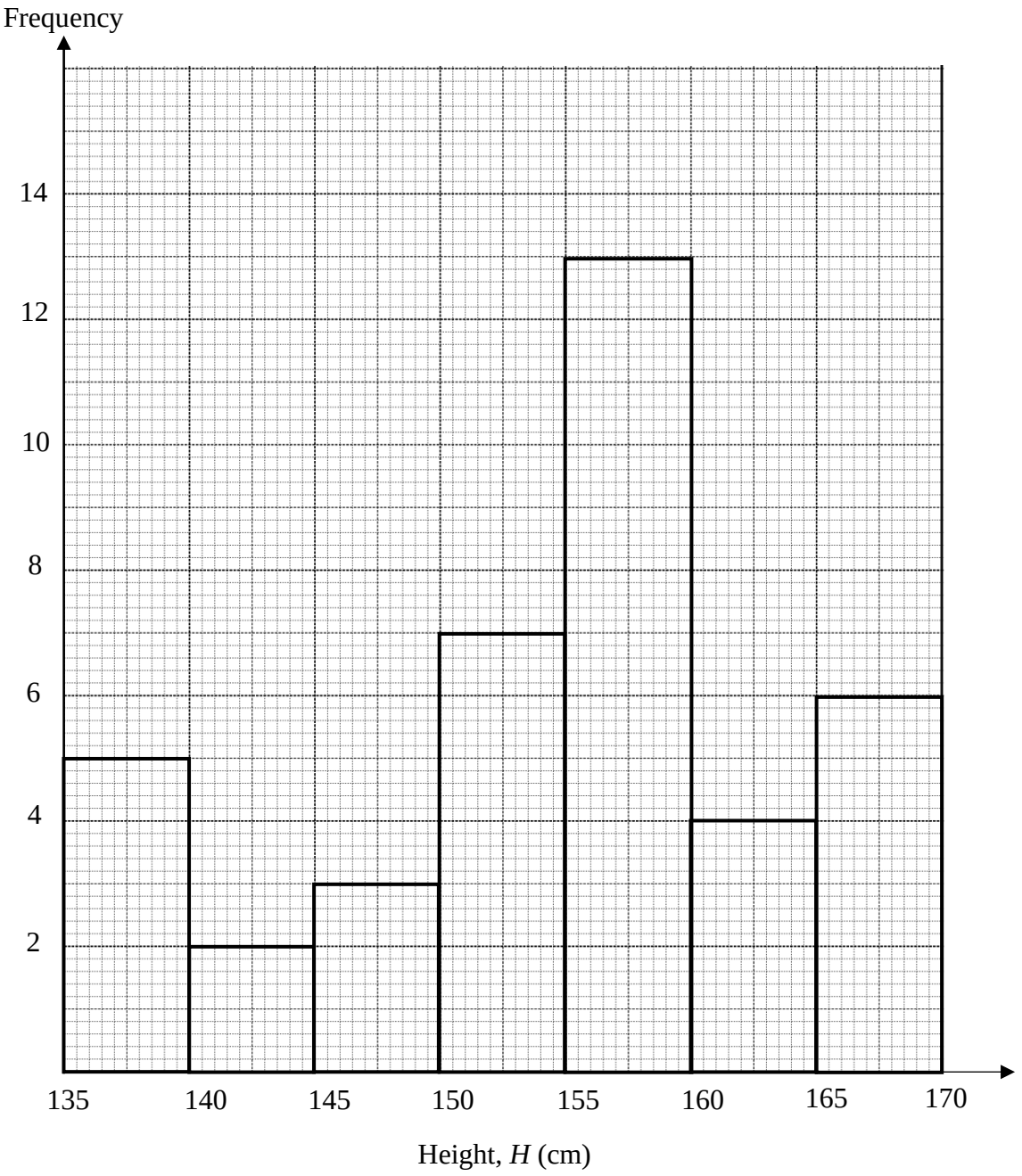
(b) Show that *YZ* is 5 cm. Hence find the exact value of $\cos b°$.

Answer …… [2]

(c) Find the length *AZ*.

Answer ……cm [1]

11 The following histogram shows the height of 40 students within a class.



(a) How many students had a height between 145 to 150 cm?

Answer …… [1]

(b) What is the modal height interval of the class?

Answer …… [1]

(c) The estimate of the mean height of the class is 150 cm.

Explain why this is only an **estimate** of the mean.

Answer ……

……. [1]

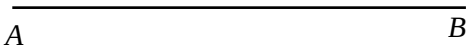
(d) Find the probability that a student chosen at random has a height of at least 160 cm.

Answer …… [2]

12 In a triangle *ABC*, *AB* = 6 cm. *AC* = 5 cm and *BC* = 7 cm.

AB is drawn below.

(a) Construct triangle *ABC*. [1]



(b) Measure angle *ABC*.

Answer angle *ABC* =……° [1]

(c) Construct the bisector of angle *ABC*. [1]

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

(e) *P* is a point of intersection between the bisector of angle *ABC* and the perpendicular bisector of *BC*. Determine if *P* lies inside or outside triangle *ABC*.

Answer *P* lies……triangle *ABC* [1]

13 The table below is for $y = x^3 - 2x + 3$.

x	-3	-2	-1	0	1	2	3
y	p	-1	4	3	2	q	24

(a) Calculate the value of p and the value of q.

Answer p = …….

q = ……. [2]

(b) Draw the graph of x for $-3 \leq x \leq 3$ on the grid (page 15).

(c) Estimate the value of y when $x = 2.5$.

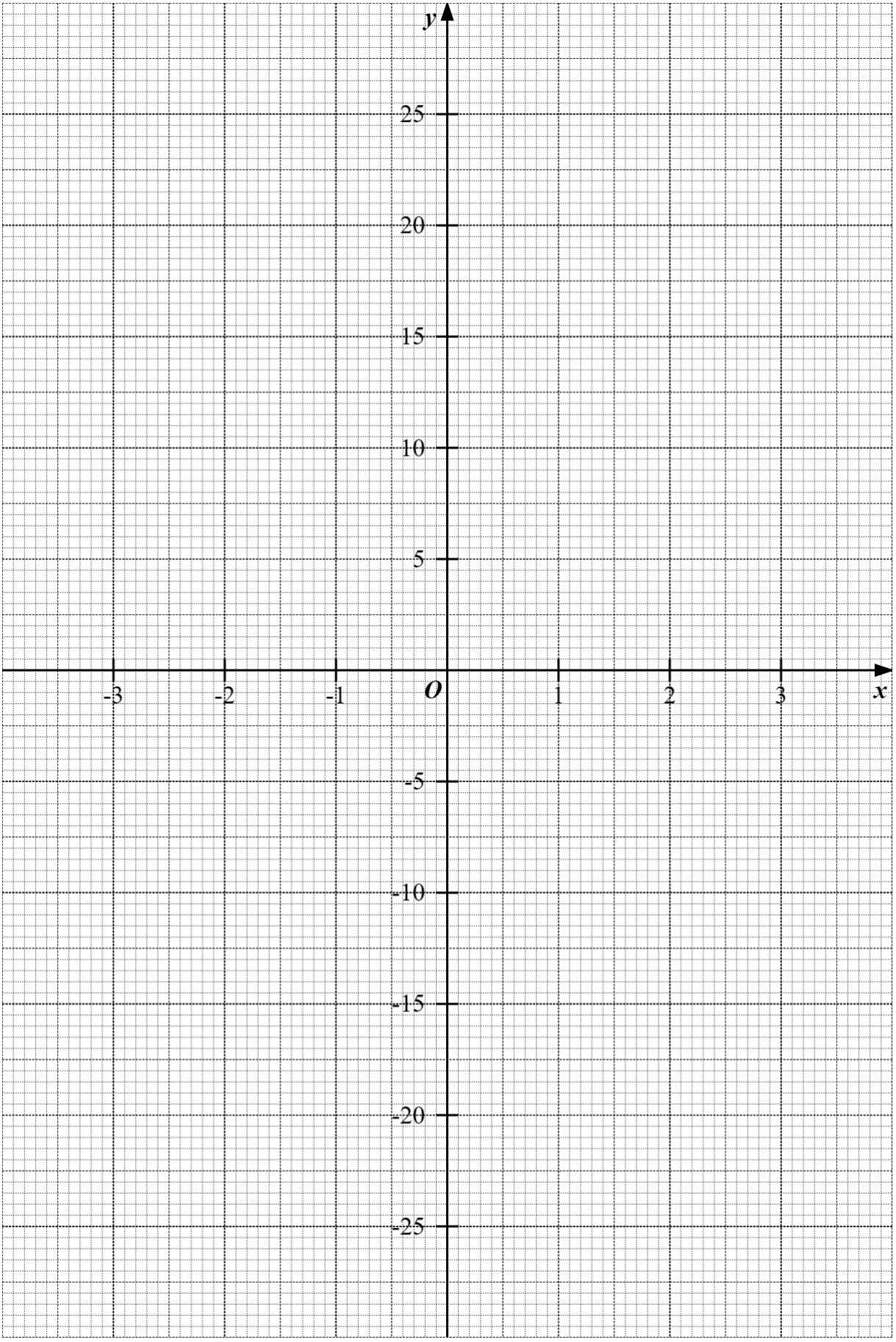
Answer y = …… [1]

(d) Use the graph to find the values of x when $y = 3$.

Answer x =…….. , …….. or …….. [1]

(e) By drawing a tangent, estimate the gradient of the graph of $y = x^3 - 2x + 3$ when $x = 1.5$.

Answer …… [2]



[3]

14 Jane wants to buy a flat in Singapore. She knows that there is Buyer's Stamp Duty (BSD) that will be added to the price of the flat.

The BSD payable is calculated in dollars and based on price of the flat.
Part of the rates are stated below:

- pay 1% on the first \$180,000 of the price of the house.
- pay 2% on the price of the house that is above \$180,000 and up to and including \$360,000.
- pay 3% o the price of the house that is above \$360, 000 and up to and including \$1,000,000.
- pay 4% of the price of the house that is above \$1,000,000 and up to and including \$1,500,000.

A formula for calculating BSD is stated in the table below:

Property value (x)	Formula for BSD payable
$x \leq 180{,}000$	$1\% \times x$
$180{,}000 < x \leq 360{,}000$	$2\% \times x$ - \$1,800
$360{,}000 < x \leq 1{,}000{,}000$	$3\% \times x$ - \$5,400
$1{,}000{,}000 < x \leq 1{,}500{,}000$	$4\% \times x$ - \$15,400

(a) Use the relevant information to calculate the BSD payable on the flat costing \$330,000.

Answer \$……. [2]

(b) In addition to BSD, Jane estimates that she will have to pay these extra costs:

- Home Valuation Fee $120
- Legal fee $462.60
- Renovation cost $80,000
- Fire/Home Insurance $8
- Furniture and electrical applicants $5,500

Jane plans to spend $750,000. What is the highest price of flat that Jane can afford? Give your answer to the nearest dollar.

Answer $……. [4]

(c) Jane considers renting a flat instead of buying one as she will need to take a bank loan of $750 000. She listed down her cost between the option of a bank loan and rental payables.

Bank Loan (per annum)	Rental (per month)
Principal amount of $18,000 Interest of 2.6% of 750,000	$3500

Would Jane pay a lesser amount per month if she chooses to borrow from a bank than renting a flat?

Answer ……..……..……..……..……..…….. [2]

Section B (8 Marks)

Answer **one** question from this section. Each question carries 8 marks.

15 The frequency table below summarizes the number of students in School *A* who visited their school's online learning portal in a month. There are a total of 100 students in School *A*.

Number of visits (x)	Frequency
$0 < x \leq 5$	9
$5 < x \leq 10$	17
$10 < x \leq 15$	38
$15 < x \leq 20$	16
$20 < x \leq 25$	20

(a) Calculate an estimate of

(i) the mean monthly number of visits to the school's online learning portal by students in School *A*.

Answer ……. [1]

(ii) the standard deviation of the monthly number of visits from students in School *A*.

Answer ……. [2]

(b) Find the fraction of the students from School *A* who visited the online learning portal at most 10 times monthly.

Answer ……. [1]

(c) Two students are randomly selected from School *A*. Find the probability that both students visited the online learning portal more than 15 times monthly and at most 25 times monthly.

Answer ……. [2]

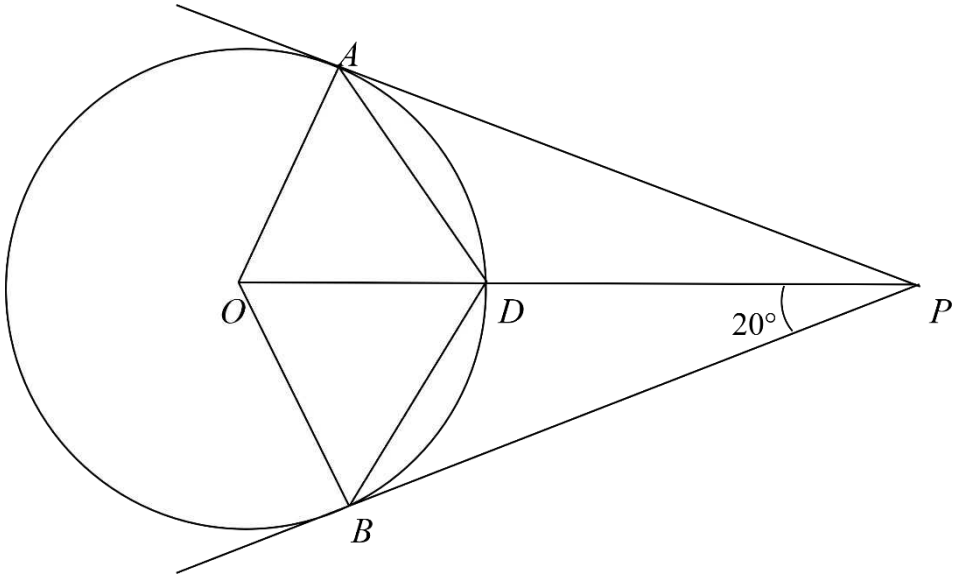
(d) 7 students are randomly selected from School A and their number of visits to the online learning portal are recorded as such:

20, 13, 6, 24, 8, 5, 17

Find the interquartile range.

Answer ……. [2]

16 (a)



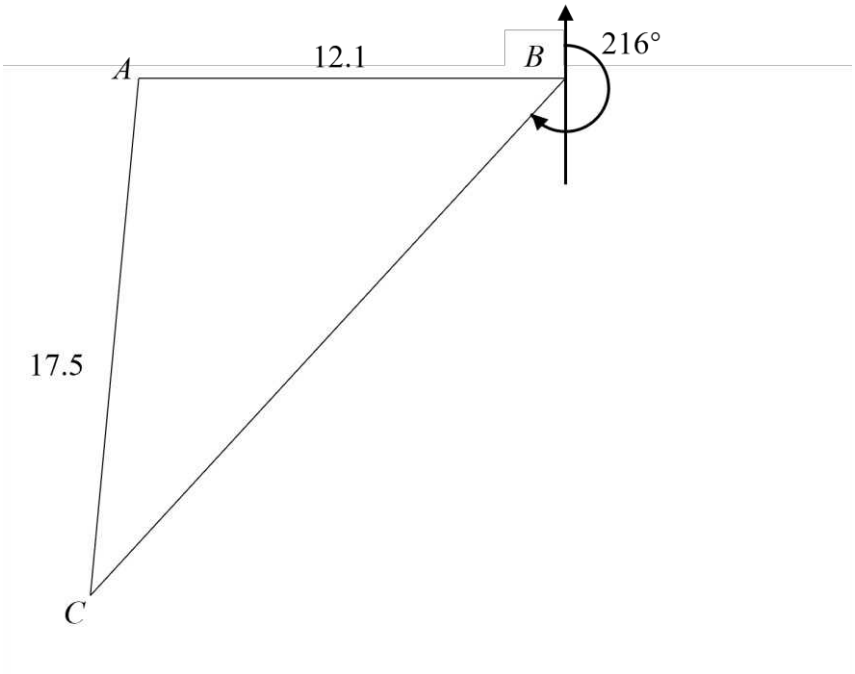
A, B, D are points on the circumference of a circle, centre *O*.
PA and *PB* are tangents to the circle.
Angle *OPB* = 20°.

Complete these statements by calculating the size of each angle. Give a reason for each statement.

Statement	Reason
Angle *OBP* = ……°	…….
	…….
Angle *BOP* = ……°	…….
	…….
Angle *OBD* = ……°	…….
	…….
Reflect Angle *AOB* =……°	…….
	……. [4]

(b) The diagram shows the location of 3 ports *A*, *B* and *C*. *A* is due west of *B*.
The bearing of *C* from *B* is 216°.
AB = 12.1 km and *AC* = 17.5 km

Find the bearing of *C* from *A*.



Answer …….° [4]

End of Paper

BENDEMEER SECONDARY SCHOOL
2024 PRELIMINARY EXAMINATION
SECONDARY FOUR NORMAL (ACADEMIC)

CANDIDATE NAME	MARKING SCHEME
CLASS	
INDEX NUMBER	

MATHEMATICS (SYLLABUS A) 4045/02

Paper 2 **5 August 2024**

2 Hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, register number on all the work you hand in.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
The use of an approved scientific calculator is expected, where appropriate.

Section A
Answer **all** the questions.

Section B
Answer **one** 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 70.

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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 ASSESSMENT USE
70

Mathematical Formulae

Compound interest

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

Section A (62 Marks)

Answer all the questions in this section.

1 **(a)** Calculate $\left(\frac{4}{5}\right)^{-\frac{1}{2}} - \sqrt{5\frac{1}{2}}$.

-1.23

Answer ..... [1]

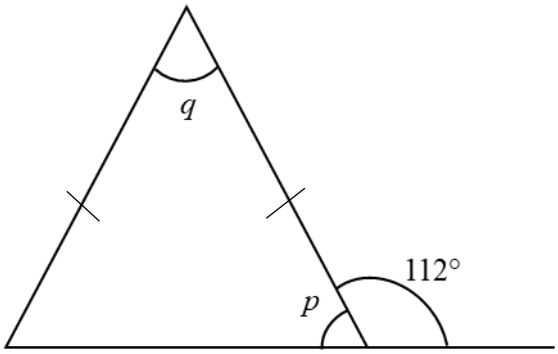
(b) By writing each number correct to 1 significant figure, estimate the value of

$$\frac{\sqrt{9.103}\times 284}{13}.$$

$\frac{\sqrt{9}\times 300}{10} = 90$

Answer ..... [1]

2 **(a)**



(i) Find p.

180° - 112° = 68° (Angles in a straight line)

Answer p = ...° [1]

(ii) Find q.

180° - 68° - 68° = 44° (Angle sum of triangle)

Answer q = ...° [1]

(b) Given that $\sin x° = 0.5$ and $x°$ is an obtuse angle, find $x°$.

$x = \sin^{-1} 0.5 = 30°$.
180° - 30° = 150°

Answer .....° [1]

3 Solve the simultaneous equations.

$$5x - 3y = 11$$
$$3x - y = 9$$

$5x - 3y = 11$ –(1)
$3x - y = 9$ -----(2)

(2) x 3
$9x - 3y = 27$ –(3) [M1]

(3) – (1)
$4x = 16 => x = 4$ [A1]

From (2)
$y = 3(4) - 9 = 3$ [A1]

Answer x = ……
y = …… [3]

4 Faris owns a furniture shop.

(a) The cost of a sofa was $1200.
He made a profit of 25% on the cost price when he sold it.

Find the selling price.

100% + 25% = 125% [M1]
125% × 1200 = $1500 [A1]

Answer $..... [2]

(b) He sold a cupboard at $188 with a loss of 10%.
How much was the cost of the cupboard?

90% → 188
100% → $\frac{188}{90} \times 100$ [M1]
= $208.89 [A1]

Answer $..... [2]

5 **(a)** Write these numbers in order of size, starting with the smallest.

4^3 4^0 $4^{\frac{1}{3}}$ 4^{-3}

4^{-3} , 4^0 , $4^{\frac{1}{3}}$, 4^3

Answer ……, ……., ……, …… [1]
smallest *largest*

(b) Write $\frac{a^2 \times a^1}{a^{-2}}$ as a single power of a.

$a^{2+1-(-2)} = a^5$

Answer …… [1]

(c) Simplify $7p^5 \times 2p^{-\frac{1}{2}}$.

$14p^{5-\frac{1}{2}} = 14p^{\frac{9}{2}}$ or $14p^{4.5}$ or $14p^{4\frac{1}{2}}$

Answer …… [1]

6 It is given that y is inversely proportional to the square of x.
When $x = 1$, $y = 64$.

Find the value(s) of x when $y = 25$.

$y = \frac{k}{x^2}$

$k = (64)(1) = 64$ [M1]

If state $y = \frac{k}{x}$ and solved for k [M1]

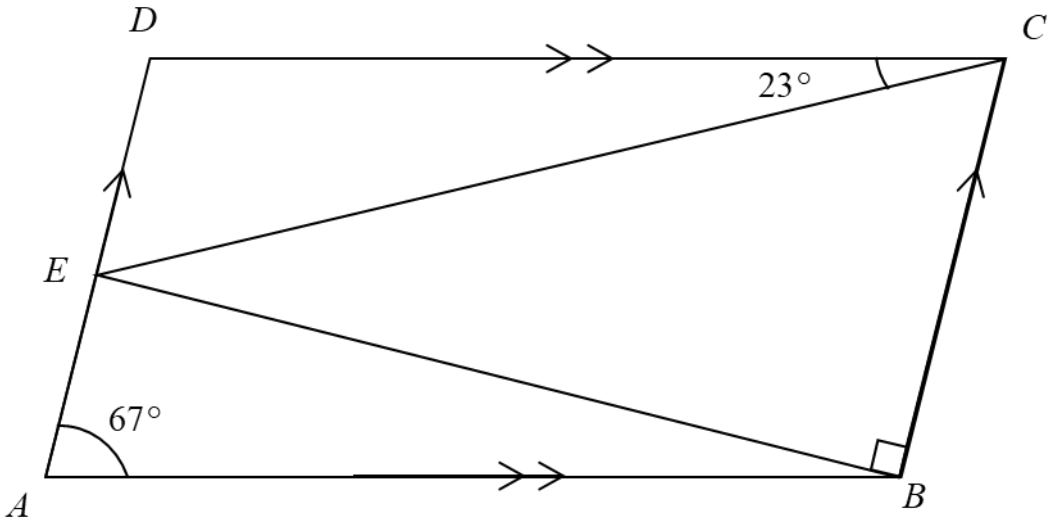
$x^2 = \frac{64}{25}$ [M1]

$x = \pm\sqrt{\frac{64}{25}} = \pm 1.6$ or $\pm\frac{8}{5}$ [A1]

Exclude $\pm$ minus 1

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

7 *ABCD* is a parallelogram in which angle *DAB* = 67° and angle *DCE* = 23°.
Given that *BE* is perpendicular to *CB*, find



(a) angle *BCE*,

67°- 23°= 44° (opp angles of parallelogram)

Answer .....° [1]

(b) angle *CEB*,

180° - 90°- 44°= 46° (angle sum of triangle)

Answer .....° [1]

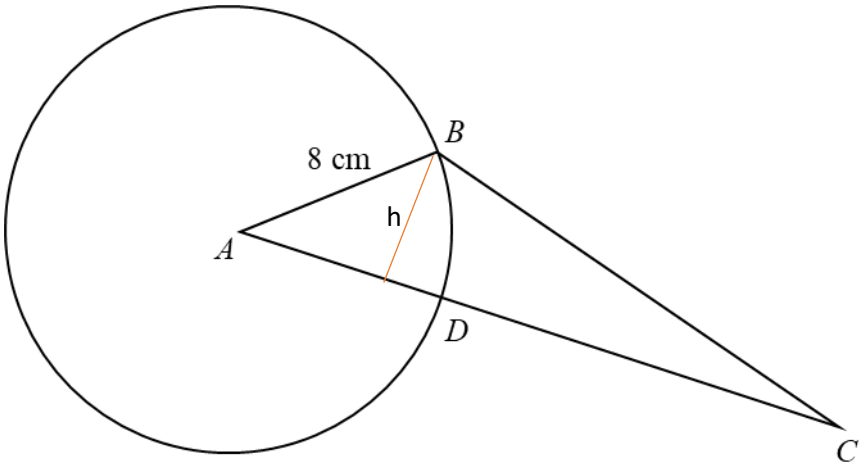
(c) angle *EDC*.

180° - 67° = 113° (Int. angles, parallel lines *AB* and *CD*

Answer .....° [1]

8 The diagram shows a triangle *ABC* and a circle with centre *A*.
The points *B* and *D* lie on the circumference of the circle.

The radius of the circle is 8 cm.
The length of the line *AC* is 17 cm.
The area of triangle *ABC* s 44 cm^2.



.

(a) Calculate the area of sector *ABD*.

Area of triangle $ABC = \frac{1}{2} \times 8 \times 17 \times \sin BAC$

$\frac{1}{2} \times 8 \times 17 \times \sin BAC = 44$ [M1]

$\sin BAC = \frac{44 \times 2}{8 \times 17} = \frac{11}{17}$
$\angle BAC = 40.320°$ [M1]

area of sector $ABD = \frac{40.320}{360} \times \pi \times 8^2$ [M1]
$= 22.5\ cm^2$ (to 3 s.f.) [A1]

Alternative method

$\frac{1}{2} \times h \times 17 = 44$
h =5.18 [M1]

$\sin BAC = \frac{5.18}{8}$
$\angle BAC = 40.320°$ [M1]

area of sector $ABD = \frac{40.320}{360} \times \pi \times 8^2$ [M1]
$= 22.5\ cm^2$ (to 3 s.f.) [A1]

Answer ……cm^2 [4]

(b) Calculate major arc length *ABD* if the reflex angle *BAD* is 5.6 rad.

$s = r\theta = 8\ (5.6) = 44.8$

Answer ……cm [1]

9 **(a)** Simplify $2x - 3(x - 4)$.

$2x - 3x + 12 = 12 - x.$

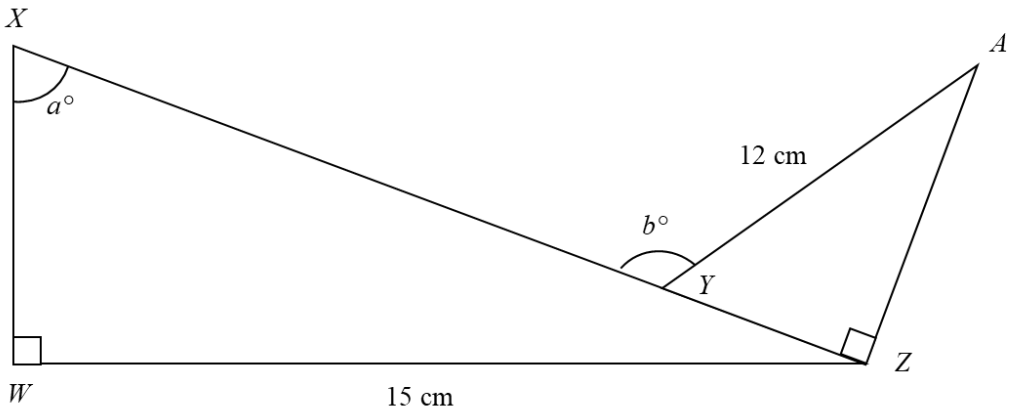
Answer …… [1]

(b) Solve $\frac{8}{x+1} = 3x - 5$, leave your answer in 2 decimal places.

$8 = (3x - 5)(x + 1)$
$8 = 3x^2 + 3x - 5x - 5$ [M1 – expansion]
$3x^2 - 2x - 13 = 0$
$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(3)(-13)}}{2(3)}$ [M1 – formula]
$x = \frac{2 \pm \sqrt{160}}{6}$
$x = 2.44$ or -1.77 [A2]

Answer x = ……or …… [4]

10 In the diagram below, XYZ is a straight line. XZ is 5 times YZ.
AY = 12 cm, WZ = 15 cm and $\sin a° = \frac{3}{5}$.



(a) Find XZ.

$\sin a° = \frac{3}{5} = \frac{15}{XZ}$

$XZ = \frac{15\times5}{3} = 25$

Answer XZ = ……cm [1]

(b) Show that YZ is 5 cm. Hence find the exact value of $\cos b°$.

$YZ = \frac{25}{5}$ = 5 (shown) [B1]

$\cos b° = -\cos AYZ = \frac{YZ}{AY} = -\frac{5}{12}$ [B1]

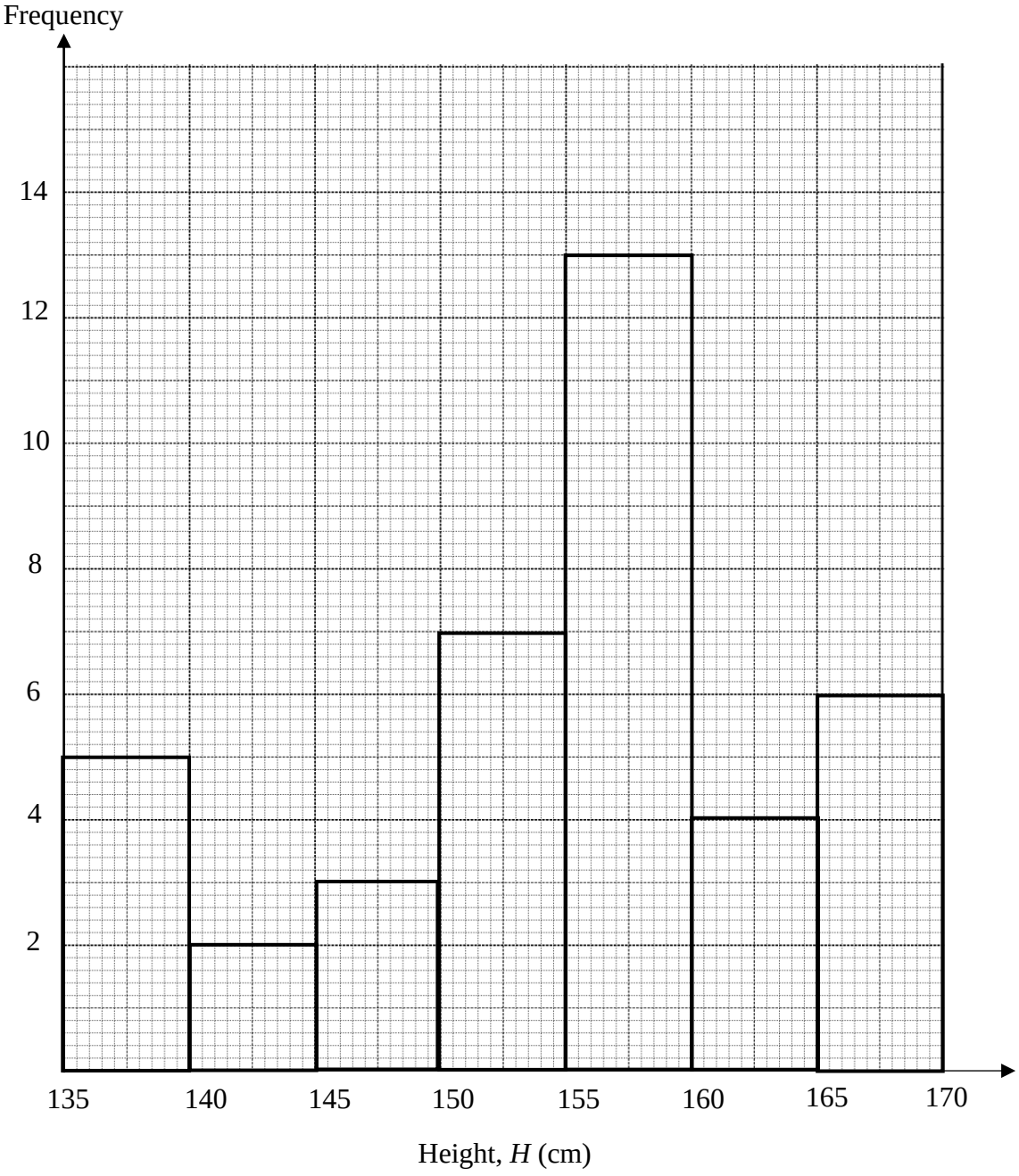
Answer …… [2]

(c) Find the length AZ.

$AZ = \sqrt{12^2 - 5^2} = 10.9$

Answer ……cm [1]

11 The following histogram shows the height of 40 students within a class.



(a) How many students had a height between 145 to 140 cm?

3

Answer …… [1]

(b) What is the modal height interval of the class?

$155 < H < 160$

Answer …… [1]

(c) The estimate of the mean height of the class is 150 cm.

Explain why this is only an **estimate** of the mean.

Since the histogram does not show the heights of the individual children, this is only an estimate of the mean.

Answer ……
…… [1]

(d) Find the probability that a student chosen at random has a height of at least 160 cm.

No. of students whose height of at least 160 cm = 4 + 6 = 10 [M1]

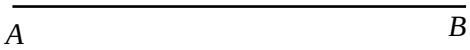
Probability = $\frac{10}{40} = \frac{1}{4}$

Answer …… [2]

12 In a triangle ABC, AB = 6 cm. AC = 5 cm and BC = 7 cm.

AB is drawn below.

(a) Construct triangle ABC. [1]



(b) Measure angle ABC.

Answer angle ABC = 44/45° [1]

(c) Construct the bisector of angle ABC. [1]

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

(e) P is a point of intersection between the bisector of angle ABC and the perpendicular bisector of BC. Determine if P lies inside or outside triangle ABC.

Answer P lies _inside___triangle ABC [1]

13 The table below is for $y = x^3 - 2x + 3$.

x	-3	-2	-1	0	1	2	3
y	p	-1	4	3	2	q	24

(a) Calculate the value of p and the value of q.

$p = (-3)^3 - 2(-3) + 3 = -18$

$q = (2)^3 - 2(2) + 3 = 7$

Answer p = ...

q = ... [2]

(b) Draw the graph of x for $-3 \leq x \leq 3$ on the grid (page 15).

(c) Estimate the value of y when $x = 2.5$.

From graph, y = 13.5/14

Answer y = ... [1]

(d) Use the graph to find the values of x when $y = 3$.

x = -1.4, 0, 1.4

Answer x =..... , ... or ..... [1]

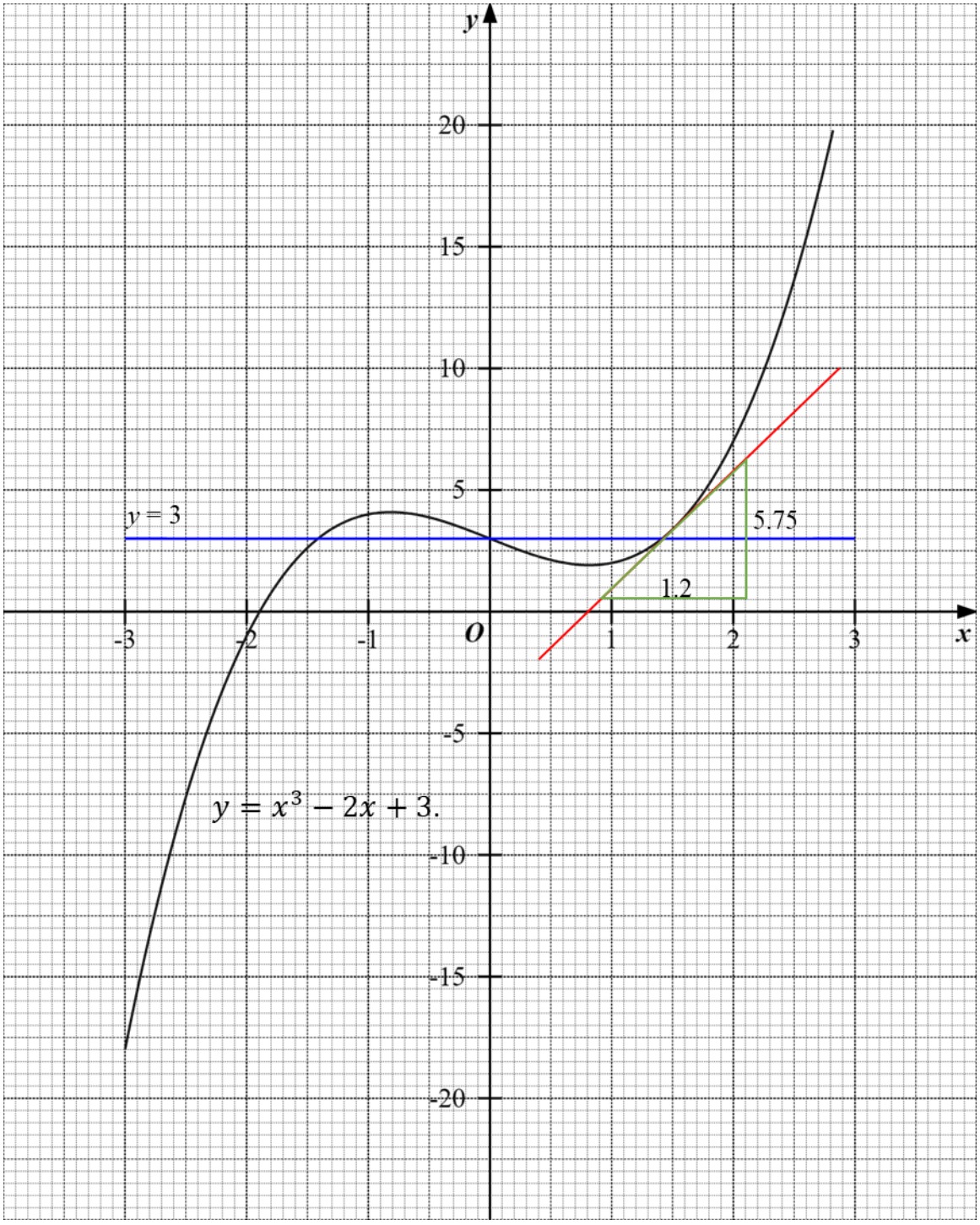
(e) By drawing a tangent, estimate the gradient of the graph of $y = x^3 - 2x + 3$ when $x = 1.5$.

gradient = $\frac{6.25 - 0.5}{2.1 - 0.9} = 4.79$ [M1]

Actual = 4.75

Accept ± 0.5 $(4.25, 5.25)$ [A1]

Answer ..... [2]


y
20
15
10
5
-5
-10
-15
-20
x
-3
-2
-1
O
1
2
3
y = 3
5.75
1.2
y = x³ − 2x + 3.

14 Jane wants to buy a flat in Singapore. She knows that there is Buyer's Stamp Duty (BSD) that will be added to the price of the flat.

The BSD payable is calculated in dollars and based on price of the flat.
Part of the rates are stated below:

- pay 1% on the first $180,000 of the price of the house.
- pay 2% on the price of the house that is above $180,000 and up to and including $360,000.
- pay 3% o the price of the house that is above $360, 000 and up to and including $1,000,000.
- pay 4% of the price of the house that is above $1,000,000 and up to and including $1,500,000.

A formula for calculating BSD is stated in the table below:

Property value (x)	Formula for BSD payable
$x \leq 180{,}000$	$1\% \times x$
$180{,}000 < x \leq 360{,}000$	$2\% \times x$ - $1,800
$360{,}000 < x \leq 1{,}000{,}000$	$3\% \times x$ - $5,400
$1{,}000{,}000 < x \leq 1{,}500{,}000$	$4\% \times x$ - $15,400

(a) Use the relevant information to calculate the BSD payable on the flat costing $330,000.

Method 1
2% × 330000 - $1,800 = $4800

Method 2
1% of $180,000 = $1,800
330,000 – 180,000 = 150,000
2% of next $150000 = $3,000

$1800 + $3000 = $4800

Answer $…… [2]

(b) In addition to BSD, Jane estimates that she will have to pay these extra costs:

- Home Valuation Fee $120
- Legal fee $462.60
- Renovation cost $80,000
- Fire/Home Insurance $8
- Furniture and electrical applicants $5,500

Jane plans to spend $750,000. What is the highest price of flat that Jane can afford? Give your answer to the nearest dollar.

Extra cost = $120 + $462.60 + $80,000 + $8 + $5500 = $86,090.60 [M1]

$750,000 - $86,090.60 = $663,909.40 [M1]

$663,909.40 -(0.03$x$-5400) = x [M1]

$663,909.40 +5400 = 1.03$x$

x = $649,815 [A1]

Answer $…… [4]

(c) Jane considers renting a flat instead of buying one as she will need to take a bank loan of $750 000. She listed down her cost between the option of a bank loan and rental payables.

Bank Loan (per annum)	Rental (per month)
Principal amount of $18,000 Interest of 2.6% of 750,000	$3500

Would Jane pay a lesser amount per month if she chooses to borrow from a bank than renting a flat?

Bank Loan
Method 1 – by month
Principal amount per month = $\$18000 \div 12 = \$1500$
2.6% of 750,000 = $19,500 per annum = $1625 per month
Loan payable per month = $1500 + $1625 = $3125 [M1]

Method 2 – by month
or SI = $\frac{750000(2.6)(1)}{100}$ = $19500
Bank Loan = (19500 + 18000)÷ 12 =$3125

3500 – 3125 = 375

Yes, Jane will pay $375 lesser if she chooses to take up a bank loan instead of renting a flat. [A1]

Method 3 – by year
Bank Loan
2.6% of 750,000 = $19,500
$19500+$18000 = $37500

Rental
$3500 x 12 = $42000

Answer …….. [2]

Section B (8 Marks)

Answer one question from this section. Each question carries 8 marks.

15 The frequency table below summarizes the number of students in School *A* who visited their school's online learning portal in a month. There are a total of 100 students in School *A*.

Number of visits (x)	Frequency
$0 < x \leq 5$	9
$5 < x \leq 10$	17
$10 < x \leq 15$	38
$15 < x \leq 20$	16
$20 < x \leq 25$	20

(a) Calculate an estimate of

(i) the mean monthly number of visits to the school's online learning portal by students in School *A*.

Number of visits (x)	Frequency	mid-value of x	fx	fx^2
$0 < x \ll 5$	9	2.5	22.5	56.25
$5 < x \ll 10$	17	7.5	127.5	956.25
$10 < x \ll 15$	38	12.5	475	5937.5
$15 < x \ll 20$	16	17.5	280	4900
$20 < x \ll 25$	20	22.5	450	10125
			$\sum fx = 1355$	$\sum fx^2 = 21975$

Mean $= \frac{\sum fx}{\sum f} = \frac{9\times2.5+17\times7.5+38\times12.5+16\times17.5+20\times22.5.}{100} = 13\frac{11}{20}$ or 13.55 or $\frac{271}{20}$

Answer ..... [1]

(ii) the standard deviation of the monthly number of visits from students in School *A*.

S.D = $\sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$

.= $\sqrt{\frac{21975}{100} - 13.55^2}$ [M1]

= 6.01 [A1]

Answer …… [2]

(b) Find the fraction of the students from School *A* who visited the online learning portal at most 10 times monthly.

$\frac{17+9}{100} = \frac{26}{100} = \frac{13}{50}$ [B1]

Answer …… [1]

(c) Two students are randomly selected from School *A*. Find the probability that both students visited the online learning portal more than 15 times monthly and at most 25 times monthly.

$\frac{36}{100} \times \frac{35}{99} = \frac{7}{55}$ [B1]

Answer …… [2]

(d) 7 students are randomly selected from School A and their number of visits to the online learning portal are recorded as such:

20, 13, 6, 24, 8, 5, 17

Find the interquartile range.

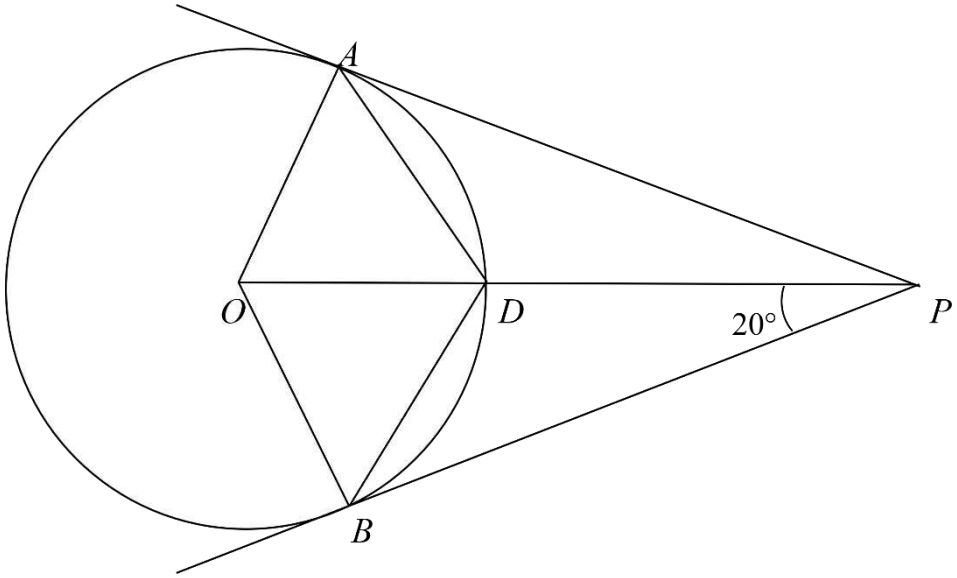
5, (6), 8, (13), 17, (20), 24

Q1 = 6, Q3 = 20 [M1]

IQR = 20 – 6 = 14 [A1]

Answer …… [2]

16 (a)



A, *B*, *D* are points on the circumference of a circle, centre *O*.
PA and *PB* are tangents to the circle.
Angle *OPB* = 20°.

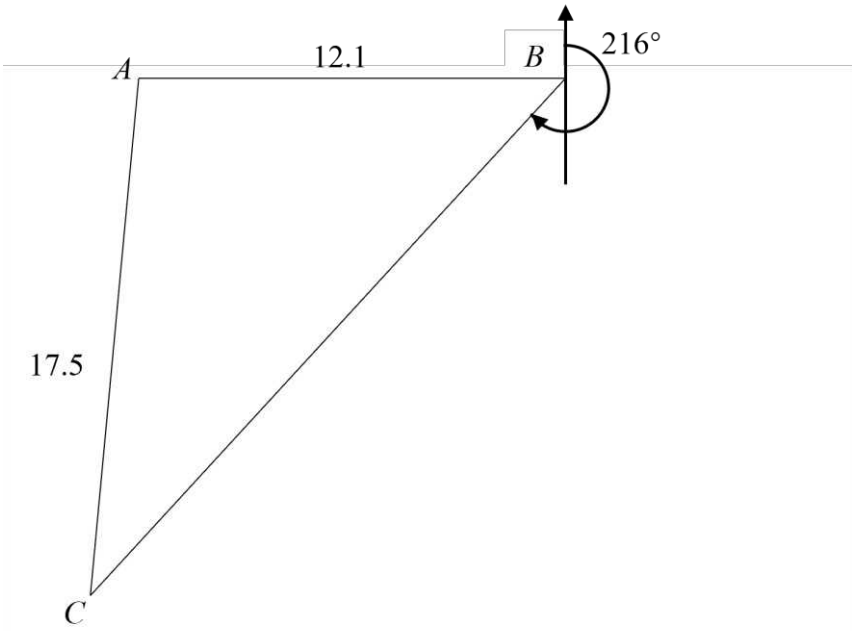
Complete these statements by calculating the size of each angle. Give a reason for each statement.

Statement	Reason
Angle *OBP* = 90°	Tangent ⊥radius [B1]
Angle *BOP* = 180° – 90° – 20° = 70°	∠ Sum of Δ [B1]
Angle *OBD* = $\frac{180° - 70°}{2}$ = 55°	base ∠ of isos. Δ [B1]
Reflect Angle AOB = 55° x 2 x 2 = 220°	∠ at center = 2 ∠ at circumference [B1]
Or 360° – 70°- 70° = 220°	Tangent from ext. pt. and ∠s at a pt.

[4]

(b) The diagram shows the location of 3 ports *A*, *B* and *C*. *A* is due west of *B*.
The bearing of *C* from *B* is 216°.
AB = 12.1 km and *AC* = 17.5 km

Find the bearing of *C* from *A*.



$\angle ABC = 270° - 216° = 54°$

Using sine rule

$$\frac{\sin 54°}{17.5} = \frac{\sin ACB}{12.1}$$ [M1]

$$\sin ACB = \frac{\sin 54° \times 12.1}{17.5}$$

$\angle ACB = \sin^{-1} 0.55938 = 34.013°$ [M1]

$\angle CAB = 180° - 54° - 34.013 = 91.987°$ [M1]

Bearing of *C* from *A* = 90° + 91.987° = 182° [A1]

Answer ……° [4]

End of Paper