

Name	Class				Index Number			
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BROADRICK SECONDARY SCHOOL

SECONDARY 2 G3

END-OF-YEAR EXAMINATION 2023

MATHEMATICS

4052

Section 1

October 2023

Candidates answer on the Question Paper.

2 hours 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number 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.

Section 1 & Section 2

Answer **all** questions on the Question Paper.

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 .

At the end of the examination, fasten all your work for each section securely together.

The number of marks is given in brackets [] at the end of each question or part question. The total number of the marks for this paper is 90.

For Examiner's Use		
Error in	Question Number	Marks Deducted
Rounding-off		
Reasoning		
Presentation		

For Examiner's Use	
Section 1	/ 45
Section 2	/ 45
Total	90

[Turn Over

Answer **all** the questions in this section.

1 Simplify

(a) $5x - 15y - 3x + 10y,$

Answer [1]

(b) $5p - 2(p + 2).$

Answer [1]

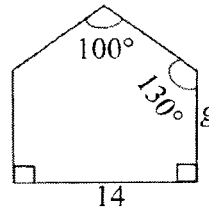
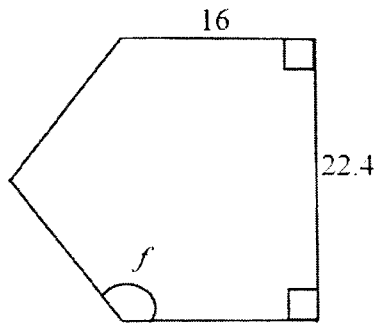
2 Solve the equation $\frac{20}{x+1} = 2x + 5.$

Answer $x =$ or [3]

- 3 Jane bought x grams of meat for 95 cents.
Find an expression for the number of grams of meat that can be bought for y dollars.

Answery [2]

- 4 Two similar pentagons are drawn below.
All lengths are given in centimetres.



- (a) Find f .

Answer $f = \dots\dots\dots^\circ$ [1]

- (b) Find g .

Answer $g = \dots\dots\dots\text{cm}$ [2]

5 A bag contains 5 blue balls, 8 green balls and 3 yellow balls.

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(a) A ball is drawn at random. Find the probability of getting a green ball.

Answer [1]

(b) x yellow balls are added to the bag. The probability of getting a yellow ball becomes $\frac{1}{2}$.
Find the value of x .

Answer $x =$ [2]

6 Five positive integers have a mean of 12, a median of 15 and a mode of 21.
Find the five numbers.

Answer [2]

7 (a) Simplify $\frac{3a^2b}{12ab^3}$.

Answer [1]

(b) Factorise $18b^2 - 32c^2$ completely.

Answer [2]

8 By factorising the expression $4y^2 + 12y + 5$, explain why it is odd for all integer values of y .

Answer

.....

.....

.....

.....

..... [3]

- 9 The stem and leaf diagram shows the height of 20 plants in a nursery.

Height of plants (cm)

Stem	Leaf
15	2 7 8 9 9 9
16	0 0 1 2 3 4 4 5 7
17	0 1 1 6 7

Key: 15 | 2 represents 152 cm

Find

- (a) the median height of the plants.

Answer cm [1]

- (b) the mean height of the plants.

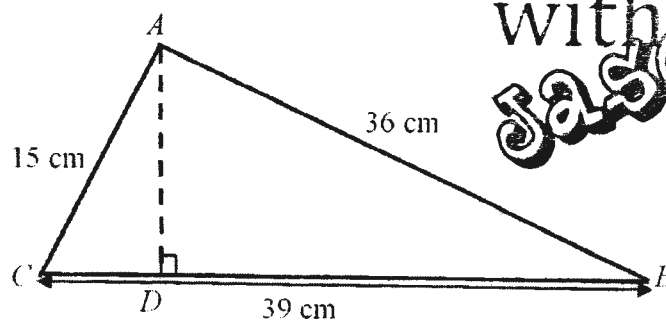
Answer cm [2]

- (c) the fraction of plants that are at most 160 cm.

Answer [1]

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- 10 A triangle ABC has sides $AB = 36$ cm, $BC = 39$ cm and $AC = 15$ cm.



- (a) Prove that triangle ABC is a right-angled triangle.

Answer

.....

.....

..... [2]

- (b) Hence, find the exact value of

(i) $\sin \hat{ABC}$,

Answer [1]

(ii) $\tan \hat{ACB}$.

Answer [1]

11 It is given that $h = \frac{k-g}{x^2-4}$.

(a) Find h when $x = -2.75$, $k = -3.5$ and $g = 10$.

Answer $h = \dots\dots\dots$ [2]

(b) Express x in terms of k , g and h .

Answer $x = \dots\dots\dots$ [3]

- 12 X is directly proportional to Y^3 .

It is given $Y = \frac{1}{3}$ when $X = 2$.

- (a) Express X in terms of Y .

Answer [2]

- (b) Find the value of X when $Y = \frac{1}{6}$.

Answer $X =$ [1]

- (c) A change in Y produces a change in X .

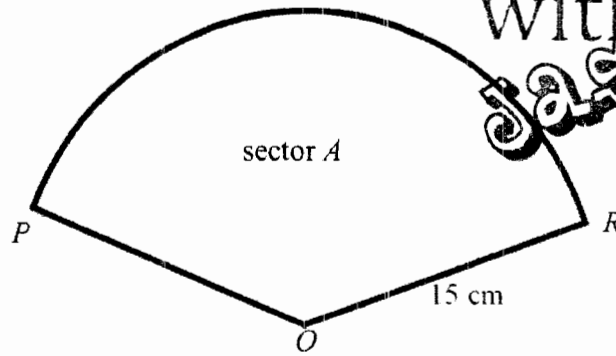
When the value of Y is multiplied by $\frac{1}{2}$ the value of X changes by a factor of m .

Find the value of m .

Answer $m =$ [2]

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- 13 The diagram shows the sector A , which is a third of a circle with radius 15 cm.



- (a) Find the area of sector A .
Leave your answer in terms of π .

Answer cm^2 [2]

- (b) A cone is formed by joining radii OP and OR of sector A together.
(i) Find the base radius of the cone

Answer cm [2]

- (ii) Find the height of the cone.

Answer cm [2]

End of Section 1

Name	Class				Index Number			
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BROADRICK SECONDARY SCHOOL
SECONDARY 2 G3
END-OF-YEAR EXAMINATION 2022

MATHEMATICS

4052

Section 2

October 2023

Candidates answer on the Question Paper.

2 hours 15 minutes

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Write your name, class and index number on all the work you hand in.

Write in dark blue or black pen.

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Section 2

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 Section 2 is 45.

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.

You are to hand in Section 1 and Section 2 separately.

For Examiner's Use (To combine with Section 1)		
Error in	Question Number	Marks Deducted
Rounding-off		
Reasoning		
Presentation		

For Examiner's Use

2

Answer **all** the questions in this section.

- 1 (a) Solve the inequality $\frac{3x}{4} + \frac{2}{3} < x$.

Answer [2]

- (b) Hence, find the smallest possible prime number.

Answer [1]

- 2 Express $\frac{11y}{y-5} - \frac{4-3y}{10-2y}$ as a single fraction.

Answer [3]

3

- 3 (a) Factorise $2ax - bx + 3by - 6ay$ completely.

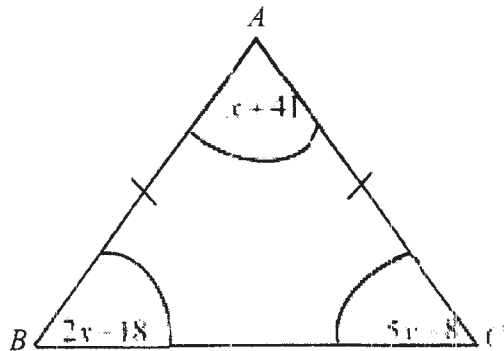
Answer [2]

- (b) Hence, simplify $\frac{(x+y)(2a-b)}{2ax - bx + 3by - 6ay}$

Answer [1]

4

- 4 Triangle ABC is an isosceles triangle, with $AB = AC$.
The angles are shown on the diagram below.



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

Answer

..... [2]

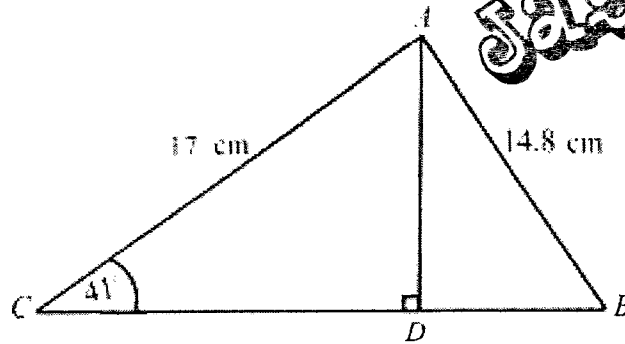
- (b) Solve the simultaneous equations.
Hence, find the size of the largest angle.

Answer ° [3]

- 5 The diagram shows a triangle ABC .

Point D lies on BC such that AD is perpendicular to BC .

$AB = 14.8$ cm, $AC = 17$ cm and angle $ACD = 41^\circ$.



- (a) Find the length of AD .

Answercm [2]

- (b) Find angle ABD .

Answer $^\circ$ [2]

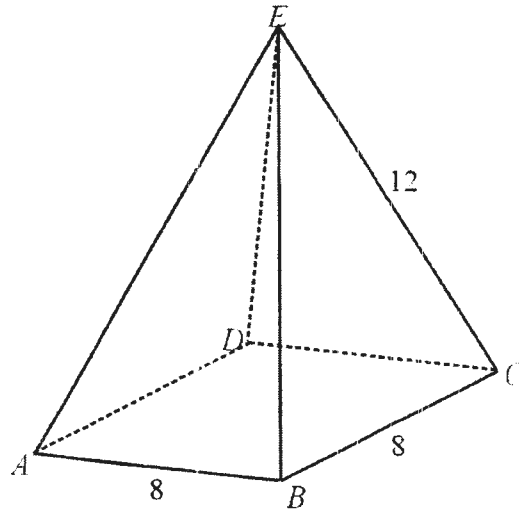
- (c) Show that the shortest distance from D to AC is 8.42 cm.

Answer

[3]

6

- 6 The diagram shows a paperweight in the shape of a pyramid $ABCDE$. $ABCD$ is a square of sides 8 cm and $AE = BE = CE = DE = 12$ cm.



- (a) Calculate the volume of the paperweight.

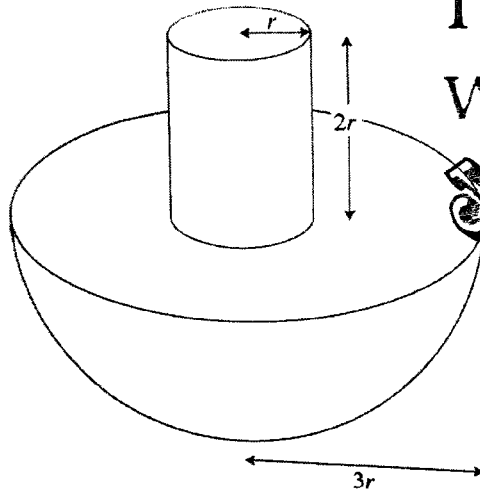
Answercm³ [4]

- (b) The paperweight will be painted red.
Find the total surface area of the paperweight to be painted.

Answercm² [2]

7

- 7 This solid is made from a cylinder and a hemisphere.
 The cylinder has radius of r and height $2r$.
 The hemisphere has a radius $3r$.
 Find an expression, in terms of π and r , for the **total surface area** of the solid.



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Answercm² [3]

- 8 The table shows some corresponding values of x and y for $y = 2x^2 - 11x + 13$.
Some corresponding values of x and y are given in the following table.

x	-2	0	2	4	6	8
y	43	13	-1	1	a	53

- (a) Calculate the value of a .

Answer $a = \dots\dots\dots$ [1]

- (b) On the grid given, draw the graph of $y = 2x^2 - 11x + 13$ for $-2 \leq x \leq 8$. [3]

- (c) Using your graph drawn, find

- (i) value of y when $x = 1$,

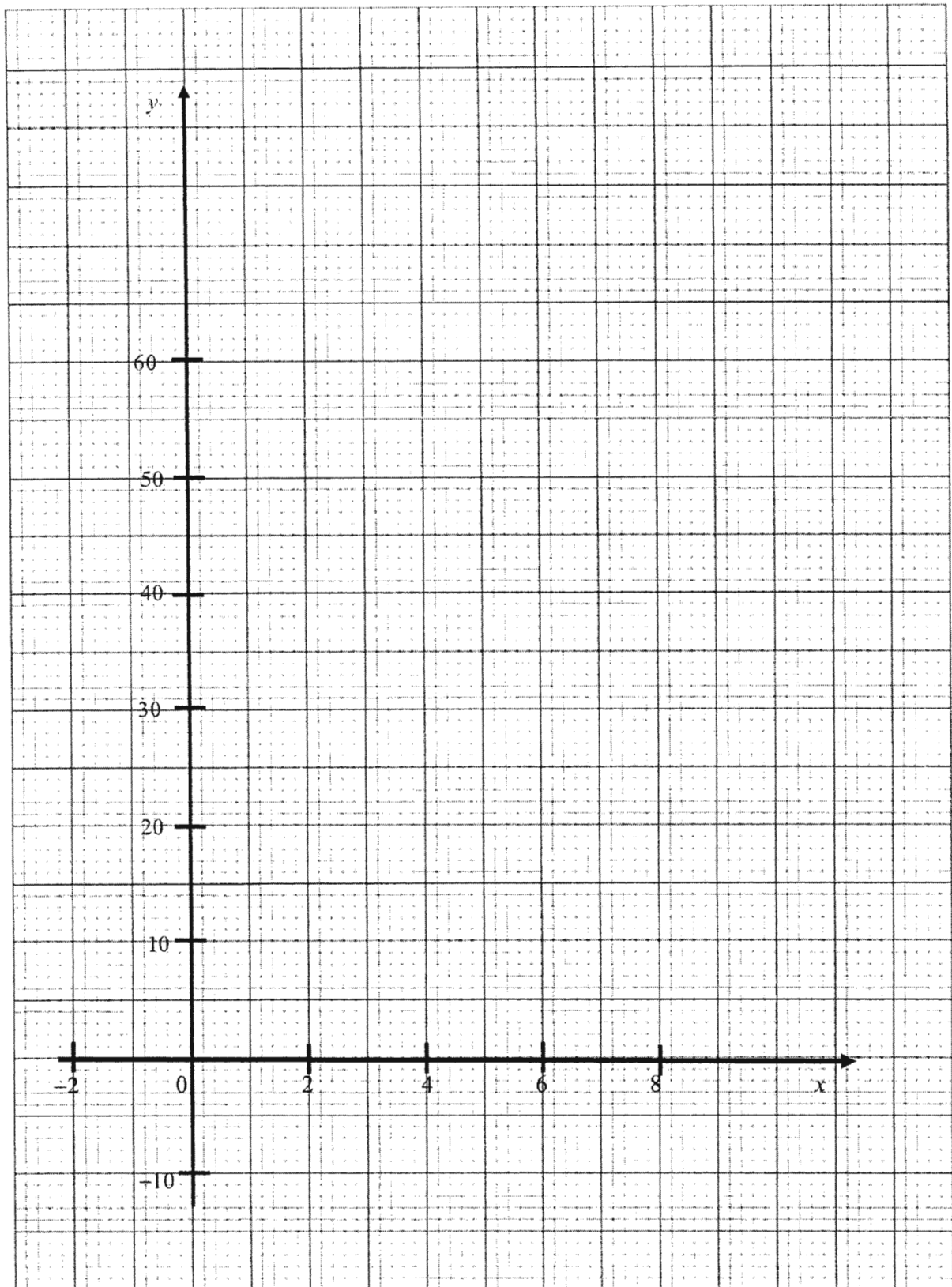
Answer $y = \dots\dots\dots$ [1]

- (ii) the coordinates of the minimum point,

Answer $(\dots\dots\dots, \dots\dots\dots)$ [1]

- (iii) the equation of the line of symmetry.

Answer $\dots\dots\dots$ [1]



9 Ms Tan wants to purchase a new laptop for her work.
She is considering to buy the laptop from Shop **A** or **B**.
She has a loyalty card for both of the shops that entitles her to a direct 15% discount off her purchases.

The price of the laptop before any discount for Shops **A** and **B** is shown in the table below.

Shop	A	B
Price of Laptop Before Any Discount	\$4850	\$4999
Shop Loyalty Card Discount	Direct 15% discount	

(a) Calculate the price of the laptop after the 15% discount for Shop **A**

Answer \$ [1]

At the same time, she decides to apply for a credit card that will give her additional discounts on the laptop.

All the information that she needs to make her decision can be found in **Table 1**.

Table 1				
Credit Card Company	Credit Card Type	Shop Loyalty Card Discount	Percentage Credit Card Rebate*	Credit Card Cashback Promotion**
X	X1	Direct 15% discount	4%	—
	X2		—	Spend a minimum of \$1000 and get \$135 cashback
Y	Y1		3% for Shop A 5% for Shop B	—

*Credit card rebate is applied on the **remaining amount after the shop loyalty card discount**.

Cashback promotion is a **cash refund after the customer makes the purchase

- (b) (i) Using the information in **Table 1**, complete **Table 2** below for Credit Card **X1**. Show your working clearly.

Table 2 (refers to Credit Card X1)			
Shop	Original Price	Price after 15% Shop Loyalty Card discount	Price after additional Credit Card Rebate*
Shop A	\$4850	answer from part (a)	\$3957.60
Shop B	\$4999	\$4249.15	

[1]

- (ii) Hence, calculate the total percentage discount given after Shop Loyalty Card discount and the additional credit card rebate.

Answer [1]

12

- (c) Ms Lin wants to apply for the credit card that gives her the greatest promotion for the laptop.

Which credit card should she apply for and which shop should she buy the laptop from?

Justify your decision and show your calculations clearly.

Answer

[5]

End of Section 2 & End of Paper

Name	Class				Index Number			
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For Examiner's Use			For Examiner's Use	
Error in	Question Number	Marks Deducted	Section 1	/ 45
Rounding-off			Section 2	/ 45
Reasoning			Total	90
Presentation				

This document consists of **11** printed pages.

Setter(s):

[Turn Over

Mathematical Formulae*Compound interest*

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

Mensuration

$$\text{Curved Surface area of a cone} = \pi r l$$

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

Answer **all** the questions in this section.

1 Simplify

(a) $5x - 15y - 3x + 10y,$

$$= 2x - 5y$$

[A1]

Answer [1]

(b) $5p - 2(p + 2).$

$$= 3p - 4$$

[A1]

Answer [1]

2 Solve the equation $\frac{20}{x+1} = 2x + 5.$

$$20 = 2x^2 + 2x + 5x + 5 \quad [\text{M1}]$$

$$(2x - 3)(x + 5) = 0 \quad [\text{M1}]$$

$$x = \frac{3}{2} \text{ or } x = -5 \quad [\text{A1}]$$

Answer $x = \dots\dots\dots$ or $\dots\dots\dots$ [3]

4

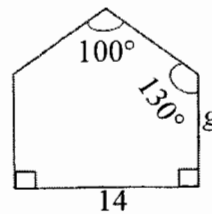
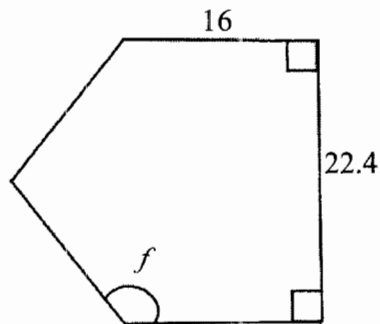
- 3 Jane bought x grams of meat for 95 cents.
Find an expression for the number of grams of meat that can be bought for y dollars.

$$\$0.95 \text{ ----- } x \text{ grams [M1]}$$

$$\$y \text{ ----- } \frac{xy}{0.95} \text{ gm [A1]}$$

Answer y [2]

- 4 Two similar pentagons are drawn below.
All lengths are given in centimetres.



- (a) Find f .

$$f = 540 - 100 - 130 - 90 - 90$$

$$f = 130$$

[A1]

Answer $f = \text{.....}^\circ$ [1]

- (b) Find g .

$$\frac{g}{16} = \frac{14}{22.4} \quad \text{[M1]}$$

$$g = 10 \quad \text{[A1]}$$

Answer $g = \text{.....cm}$ [2]

- 5 A bag contains 5 blue balls, 8 green balls and 3 yellow balls.

(a) A ball is drawn at random. Find the probability of getting a green ball.

$$\text{Probabilty of a green ball outcome} = \frac{1}{2} \quad [\text{B1}]$$

Answer [1]

(b) x yellow balls are added to the bag. The probability of getting a yellow ball becomes $\frac{1}{2}$.

Find the value of x .

New Probabilty of a yellow ball outcome,

$$\frac{x+3}{x+16} = \frac{1}{2}$$

$$x = 10$$

[M1]

[A1]

Answer $x =$ [2]

- 6 Five positive integers have a mean of 12, a median of 15 and a mode of 21.

Find the five numbers.

$$\frac{x+y+15+21+21}{5} = 12 \quad [\text{M1}]$$

$$x+y=3$$

The five no. are : 1,2,15,21,21 [A1]

Answer [2]

6

7 (a) Simplify $\frac{3a^2b}{12ab^3}$.

$$\frac{a}{4b^2} \quad [B1]$$

Answer [1]

(b) Factorise $18b^2 - 32c^2$ completely.

$$\begin{aligned} 2(9b^2 - 16c^2) & \quad [M1] \\ 2(3b + 4c)(3b - 4c) & \quad [A1] \end{aligned}$$

Answer [2]

8 By factorising the expression $4y^2 + 12y + 5$, explain why it is odd for all integer values of y .

$$\begin{aligned} &= (2y+5)(2y+1) && \text{Factorised} && [B1] \\ \text{For } y = 2 \text{ (positive integer), } &(2 \times 2 + 5)(2 \times 2 + 1) = 77 \text{ (odd)} && && [B1] \\ \text{For } y = -2 \text{ (-ve integer), } &(2 \times (-2) + 5)(2 \times (-2) + 1) = -3 \text{ (odd)} && \} && \end{aligned}$$

Odd no. $\times$ Odd no. will always give an odd value [B1]

Answer

.....

.....

.....

..... [3]

- 9 The stem and leaf diagram shows the height of 20 plants in a nursery.

Height of plants (cm)									
Stem	Leaf								
15	2	7	8	9	9	9			
16	0	0	1	2	3	4	4	5	7
17	0	1	1	6	7				

Key: 15 | 2 represents 152 cm

Find

- (a) the median height of the plants,

$$\frac{162+163}{2} = 162.5 \text{ cm} \quad [\text{A1}]$$

Tuition with Jason

Answer cm [1]

- (b) the mean height of the plants.

$$\frac{152+157+158+3 \times 159+2 \times 160+161+162+163+2 \times 164+165+167+170+2 \times 171+176++177}{20}$$

[M1]

Average height is 163.75 cm. [A1]

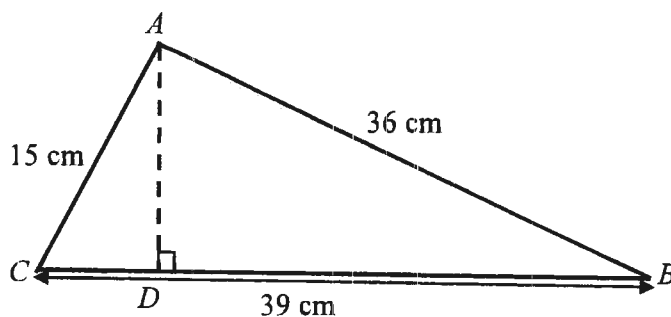
Answer cm [2]

- (c) the fraction of plants that are at most 160 cm.

$$\frac{8}{20} = \frac{2}{5} \quad [\text{A1}]$$

Answer [1]

- 10 A triangle ABC has sides $AB = 36$ cm, $BC = 39$ cm and $AC = 15$ cm.



- (a) Prove that triangle ABC is a right-angled triangle.

$$BC^2 = 39^2 = 1521$$

$$AB^2 + AC^2 = 15^2 + 36^2 = 1521 \quad [\text{M1}]$$

$$\text{Since } BC^2 = AB^2 + AC^2$$

By Converse of Pythagoras Theorem, Triangle ABC is a Right Angle Δ [A1]

Answer

.....

.....

..... [2]

- (b) Hence, find the exact value of

(i) $\sin \hat{ABC}$,

$$\sin \hat{ABC} = \frac{15}{39}$$

$$= \frac{5}{13} \quad [\text{B1}]$$

Answer [1]

(ii) $\tan \hat{ACB}$.

$$\tan \hat{ACB} = \left(\frac{36}{15} \right)$$

$$= 2\frac{2}{5} \quad [\text{B1}]$$

Answer [1]

11 It is given that $h = \frac{k-g}{x^2-4}$.

(a) Find h when $x = -2.75$, $k = -3.5$ and $g = 10$.

$$h = \frac{-3.5-10}{(-2.75)^2-4} \quad [\text{M1}]$$

$$h = -3\frac{15}{19} \quad [\text{A1}]$$

Answer $h = \dots\dots\dots$ [2]

(b) Express x in terms of k , g and h .

$$h(x^2-4) = k-g$$

$$x^2-4 = \frac{k-g}{h} \quad [\text{M1}]$$

$$x^2 = \frac{k-g+4h}{h} \quad [\text{M1}]$$

$$x = \pm \sqrt{\frac{k-g+4h}{h}} \quad [\text{A1}]$$

Answer $x = \dots\dots\dots$ [3]

- 12 X is directly proportional to Y^3 .

It is given $Y = \frac{1}{3}$ when $X = 2$.

- (a) Express X in terms of Y .

$$X = kY^3$$

$$2 = k \left(\frac{1}{3} \right)^3$$

$$k = 54$$

[M1]

$$X = 54Y^3$$

[A1]

Answer [2]

- (b) Find the value of X when $Y = \frac{1}{6}$.

$$X = 54 \left(\frac{1}{6} \right)^3$$

$$X = \frac{1}{4}$$

[B1]

Answer $X =$ [1]

- (c) A change in Y produces a change in X .

When the value of Y is multiplied by $\frac{1}{2}$ the value of X changes by a factor of m .

Find the value of m .

$$X = kY^3$$

$$k \left(\frac{1}{2} Y \right)^3 = k \frac{1}{8} Y^3 \quad [\text{M1}]$$

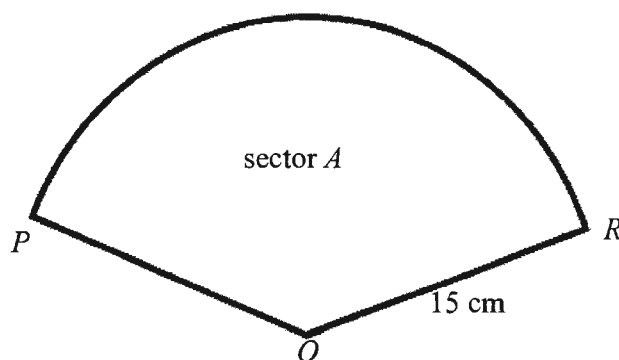
$$\left(\frac{1}{2} \right)^3 = \frac{1}{8}$$

$$m = \frac{1}{8}$$

[A1]

Answer $m =$ [2]

- 13 The diagram shows the sector A , which is a third of a circle with radius 15 cm.



- (a) Find the area of sector A .
Leave your answer in terms of π .

$$\text{Area of sector } A = \frac{1}{3} \times \pi \times 15^2 \quad [\text{M1}]$$

$$\text{Area of sector } A = 75\pi \quad [\text{A1}]$$

Answer cm^2 [2]

- (b) A cone is formed by joining radii OP and OR of sector A together.
(i) Find the base radius of the cone

Area of cone = Area of sector A (where r = base radius and $l = 15$ cm)

$$\pi r(15) = 75\pi \quad [\text{M1}]$$

$$r = 5 \quad [\text{A1}]$$

Answer cm [2]

- (ii) Find the height of the cone.

Using Pythagoras Theorem to find height of cone,

$$h^2 = 15^2 - 5^2 \quad [\text{M1}]$$

$$h = \sqrt{15^2 - 5^2} = 14.142 = 14.1 \text{ cm} \quad [\text{A1}]$$

Answer cm [2]

End of Section 1

Question	Working/ Steps
1a	$= 2x - 5y$
1b	$= 3p - 4$
2	$x = \frac{3}{2}$ or $x = -5$
3	$\$y \text{ ----- } \frac{xy}{0.95} \text{ gm}$
4a	$f = 130$
4b	$g = 10$
5a	Probabilty of a green ball outcome $= \frac{1}{2}$
5b	$x = 10$
6	The five no. are : 1,2,15,21,21
7a	$\frac{a}{4b^2}$
7b	$2(3b + 4c)(3b - 4c)$
8	Odd no. $\times$ Odd no. will always give an odd value
9a	$\frac{162+163}{2} = 162.5 \text{ cm}$
9b	Average height is 163.75 cm.
9c	$\frac{8}{20} = \frac{2}{5}$
10a	Since $BC^2 = AB^2 + AC^2$ By Converse of Pythagoras Theorem, Triangle ABC is a Right Angle Δ [A1]
10bi	$= \frac{5}{13}$
10bii	$= 2\frac{2}{5}$
11a	$h = -3\frac{15}{19}$
11b	$x = \pm \sqrt{\frac{k-g+4h}{h}}$
12a	$X = 54Y^3$

12b	$X = \frac{1}{4}$
12c	$m = \frac{1}{8}$
13a	Area of sector $A = 75\pi$
13bi	$r = 5$
13bii	$h = \sqrt{15^2 - 5^2} = 14.142 = 14.1 \text{ cm}$

Tuition
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Jason

Name	Class				Index Number			
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BROADRICK SECONDARY SCHOOL

SECONDARY 2 G3

END-OF-YEAR EXAMINATION 2022

MATHEMATICS

4052

Section 2

October 2023

Candidates answer on the Question Paper.

2 hours 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number 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.

Section 2

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 Section 2 is 45.

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.

You are to hand in Section 1 and Section 2 separately.

For Examiner's Use (To combine with Section 1)		
Error in	Question Number	Marks Deducted
Rounding-off		
Reasoning		
Presentation		

For Examiner's Use

This document consists of 12 printed pages.

Setter(s):

[Turn Over

2

Answer **all** the questions in this section.

- 1 (a) Solve the inequality $\frac{3x}{4} + \frac{2}{3} < x$.

$$\frac{2}{3} < \frac{4x-3x}{4} \quad [\text{M1}]$$

$$x > 2\frac{2}{3} \quad [\text{A1}]$$

Answer [2]

- (b) Hence, find the smallest possible prime number.

$$\text{Smallest prime} = 3 \quad [\text{A1}]$$

Answer [1]

- 2 Express $\frac{11y}{y-5} - \frac{4-3y}{10-2y}$ as a single fraction.

$$= \frac{2(11y)}{(y-5)} - \frac{(4-3y)}{-2(y-5)} \quad [\text{M1}]$$

$$= \frac{22y}{2(y-5)} + \frac{(4-3y)}{2(y-5)}$$

$$= \frac{22y+4-3y}{2(y-5)} \quad [\text{M1}]$$

$$= \frac{19y+2}{2(y-5)} \quad [\text{A1}]$$

Answer [3]

3

- 3 (a) Factorise $2ax - bx + 3by - 6ay$ completely.

$$x(2a - b) + 3y(b - 2a)$$

$$x(2a - b) - 3y(2a - b) \quad [\text{M1}]$$

$$(x - 3y)(2a - b) \quad [\text{A1}]$$

Answer [2]

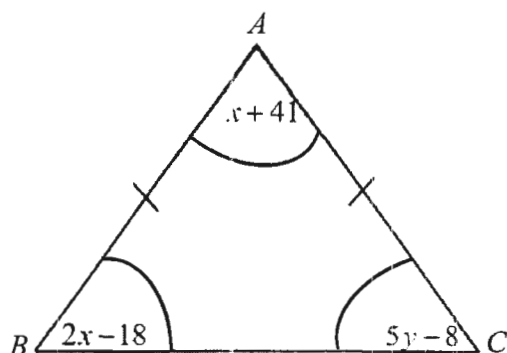
- (b) Hence, simplify $\frac{(x + y)(2a - b)}{2ax - bx + 3by - 6ay}$

$$\frac{(x + y)(2a - b)}{(x - 3y)(2a - b)}$$

$$\frac{(x + y)}{(x - 3y)} \quad [\text{A1}]$$

Answer [1]

- 4 Triangle ABC is an isosceles triangle, with $AB = AC$. The angles are shown on the diagram below.



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

$$\text{Eqn (1) : } 2x - 18 = 5y - 8$$

$$\text{Eqn (1) : } 2x - 5y = 10$$

$$\text{Eqn (2) : } 2x - 18 + x + 41 + 5y - 8 = 180$$

$$\text{Eqn (2) : } 3x + 5y = 165$$

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Answer

..... [2]

- (b) Solve the simultaneous equations.
Hence, find the size of the largest angle.

$$\text{Eqn (1) + Eqn (2) : } 5x = 175, \quad x = 35$$

$$y = \frac{2(35) - 10}{5} = 12$$

$$x = 35, y = 12$$

[M1]

$$\angle A = x + 41 = 35 + 41 = 76^\circ$$

$$\angle B = 2(35) - 18 = 52^\circ$$

$$\angle C = 5(12) - 8 = 52^\circ$$

[M1] for 1 base angle and angle BAC

$$\text{Largest angle} = 76^\circ$$

[A1]

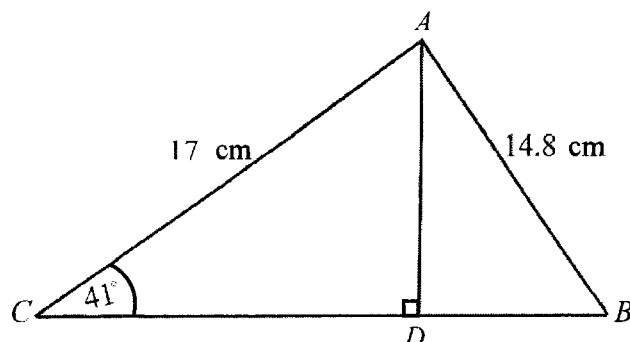
Answer ° [3]

5

- 5 The diagram shows a triangle ABC .

Point D lies on BC such that AD is perpendicular to BC .

$AB = 14.8$ cm, $AC = 17$ cm and angle $ACD = 41^\circ$.



- (a) Find the length of AD .

$$\sin 41^\circ = \frac{AD}{17} \quad [\text{M1}]$$

$$AD = \sin 41^\circ \times 17 = 11.153 = 11.2 \text{ cm} \quad [\text{A1}]$$

Answer cm [2]

- (b) Find angle ABD .

$$\angle ABD = \sin^{-1}\left(\frac{11.153}{14.8}\right) \quad [\text{M1}]$$

$$\angle ABD = 48.901^\circ = 48.9^\circ \quad [\text{A1}]$$

Answer $^\circ$ [2]

- (c) Show that the shortest distance from D to AC is 8.42 cm.

Answer

By Pythagoras Th ($\triangle ACD$)

$$CD = \sqrt{17^2 - 11.153^2} = \sqrt{164.61} \quad [\text{M1}]$$

$$\frac{1}{2} \times \sqrt{164.61} \times 11.153 = \frac{1}{2} \times h \times 17 \quad [\text{M1}]$$

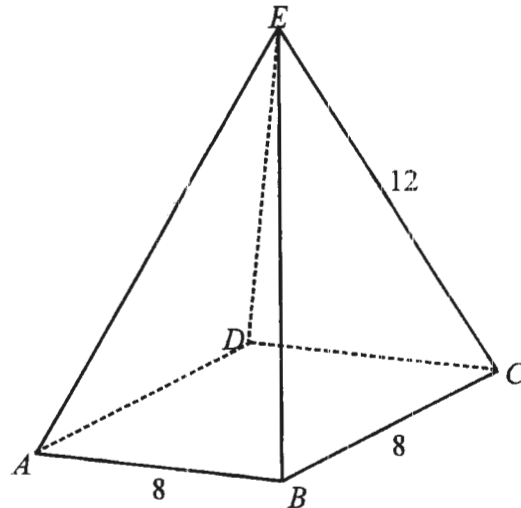
$$\frac{\sqrt{164.61} \times 11.153}{17}$$

$$8.4172 = 8.42 \text{ cm} \quad (\text{to 3 sf}) \quad [\text{A1}]$$

[3]

6

- 6 The diagram shows a paperweight in the shape of a pyramid $ABCDE$. $ABCD$ is a square of sides 8 cm and $AE = BE = CE = DE = 12$ cm.



- (a) Calculate the volume of the paperweight.

Let M be midpoint of AB and O be centre of $ABCD$.

$$AM = MO = \frac{8}{2} = 4 \text{ cm}$$

Using Pythagoras' Theorem,

$$EM^2 = AE^2 - AM^2 = 12^2 - 4^2 = 128 \quad [\text{M1}]$$

Using Pythagoras' Theorem,

$$EO^2 = EM^2 - MO^2 = 128 - 4^2 = 112 \quad [\text{M1}]$$

$$EO = \sqrt{112} \text{ cm}$$

$$\text{Volume of candle, } = \frac{1}{3} \times (8)(8) \times \sqrt{112} \quad [\text{M1}]$$

$$= 225.771 = 226 \text{ cm}^3 \quad [\text{A1}]$$

Answercm³ [4]

- (b) The paperweight will be painted red.

Find the total surface area of the paperweight to be painted.

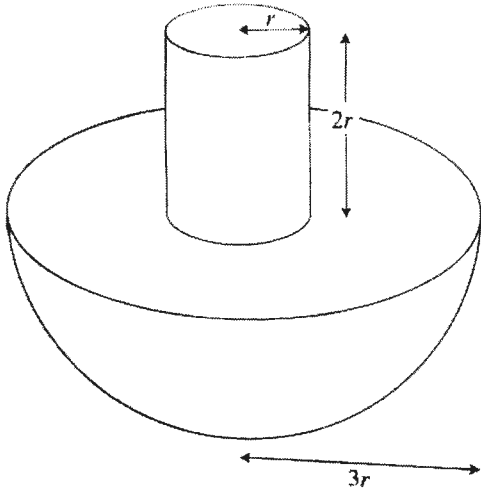
Total Surface Area of Pyramid $ABCDE$ is,

$$= \frac{1}{2} \times 8 \times \sqrt{128} \times 4 + (8 \times 8) \quad [\text{M1}]$$

$$= \frac{1}{2} \times 8 \times \sqrt{128} \times 4 + (8 \times 8) = 245.01 = 245 \text{ cm}^2 \quad [\text{A1}]$$

Answercm² [2]

- 7 This solid is made from a cylinder and a hemisphere.
 The cylinder has radius of r and height $2r$.
 The hemisphere has a radius $3r$.
 Find an expression, in terms of π and r , for the **total surface area** of the solid.



Total surface area,

$$= 2\pi(3r)^2 \text{ [B1]} + \pi(3r)^2 + 2\pi r(2r) \text{ [B1]}$$

$$= 18\pi r^2 + 9\pi r^2 + 4\pi r^2$$

$$= 31\pi r^2 \text{ [A1]}$$

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Answercm² [3]

8

- 8 The table shows some corresponding values of x and y for $y = 2x^2 - 11x + 13$.

Some corresponding values of x and y are given in the following table.

x	-2	0	2	4	6	8
y	43	13	-1	1	a	53

- (a) Calculate the value of a .

Answer $a = \dots\dots\dots$ [1]

- (b) On the grid given, draw the graph of $y = 2x^2 - 11x + 13$ for $-2 \leq x \leq 8$. [3]

- (c) Using your graph drawn, find

- (i) value of y when $x = 1$,

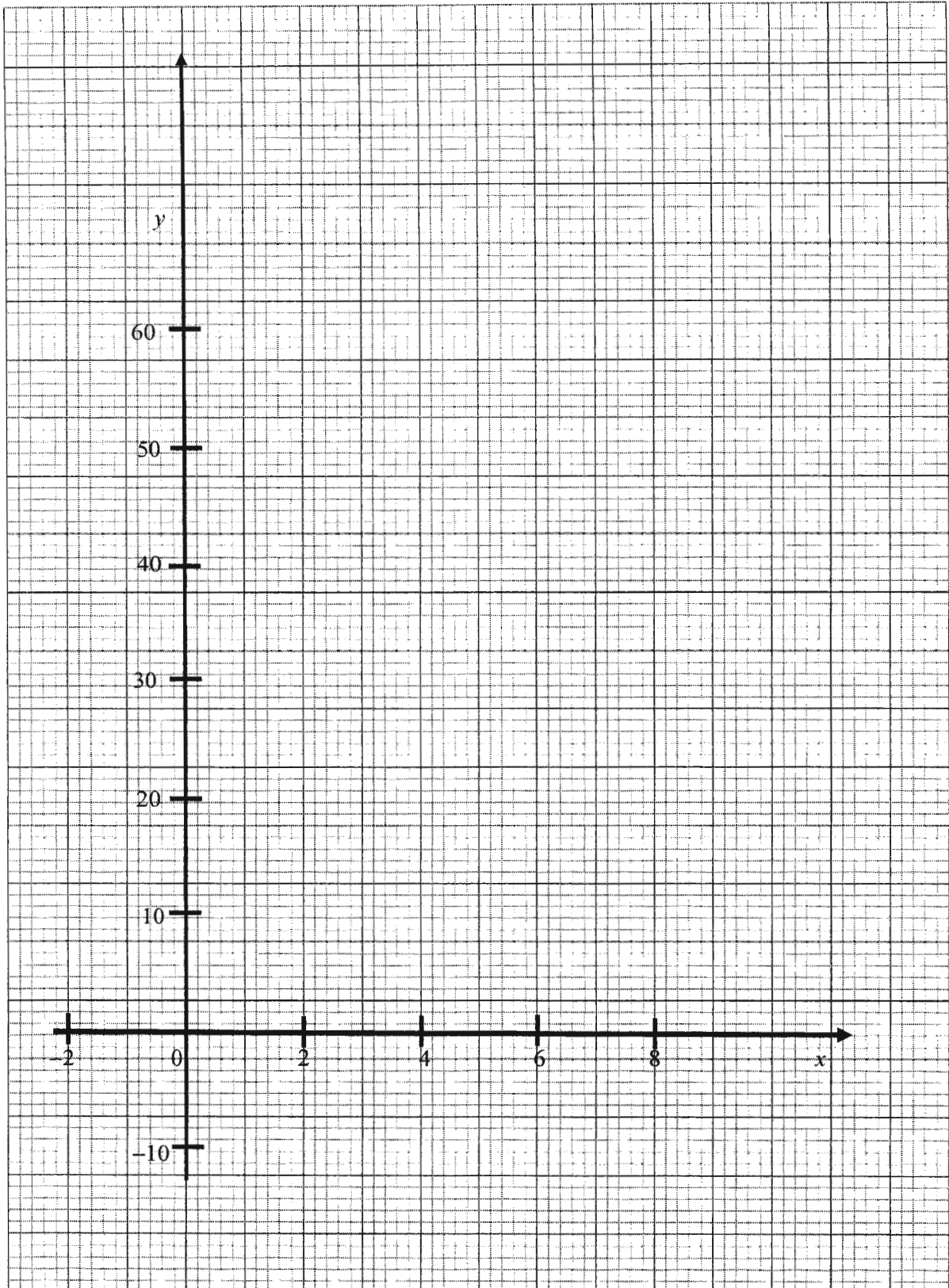
Answer $y = \dots\dots\dots$ [1]

- (ii) the coordinates of the minimum point,

Answer $(\dots\dots\dots, \dots\dots\dots)$ [1]

- (iii) the equation of the line of symmetry.

Answer $\dots\dots\dots$ [1]



- 9 Ms Tan wants to purchase a new laptop for her work.
 She is considering to buy the laptop from Shop **A** or **B**.
 She has a loyalty card for both of the shops that entitles her to a direct 15% discount off her purchases.

The price of the laptop before any discount for Shops **A** and **B** is shown in the table below.

Shop	A	B
Price of Laptop Before Any Discount	\$4850	\$4999
Shop Loyalty Card Discount	Direct 15% discount	

- (a) Calculate the price of the laptop after the 15% discount for Shop **A**

Answer \$ [1]

At the same time, she decides to apply for a credit card that will give her additional discounts on the laptop.

All the information that she needs to make her decision can be found in **Table 1**.

Table 1				
Credit Card Company	Credit Card Type	Shop Loyalty Card Discount	Percentage Credit Card Rebate*	Credit Card Cashback Promotion**
X	X1	Direct 15% discount	4%	—
	X2		—	Spend a minimum of \$1000 and get \$135 cashback
Y	Y1		3% for Shop A 5% for Shop B	—

*Credit card rebate is applied on the **remaining amount after the shop loyalty card discount**.

Cashback promotion is a **cash refund after the customer makes the purchase

- (b) (i) Using the information in **Table 1**, complete **Table 2** below for Credit Card **X1**. Show your working clearly.

Table 2 (refers to Credit Card X1)			
Shop	Original Price	Price after 15% Shop Loyalty Card discount	Price after additional Credit Card Rebate*
Shop A	\$4850	answer from part (a)	\$3957.60
Shop B	\$4999	\$4249.15	

[1]

- (ii) Hence, calculate the total percentage discount given after Shop Loyalty Card discount and the additional credit card rebate.

Answer [1]

- (c) Ms Lin wants to apply for the credit card that gives her the greatest promotion for the laptop.

Which credit card should she apply for and which shop should she buy the laptop from?

Justify your decision and show your calculations clearly.

Answer

[5]

End of Section 2 & End of Paper

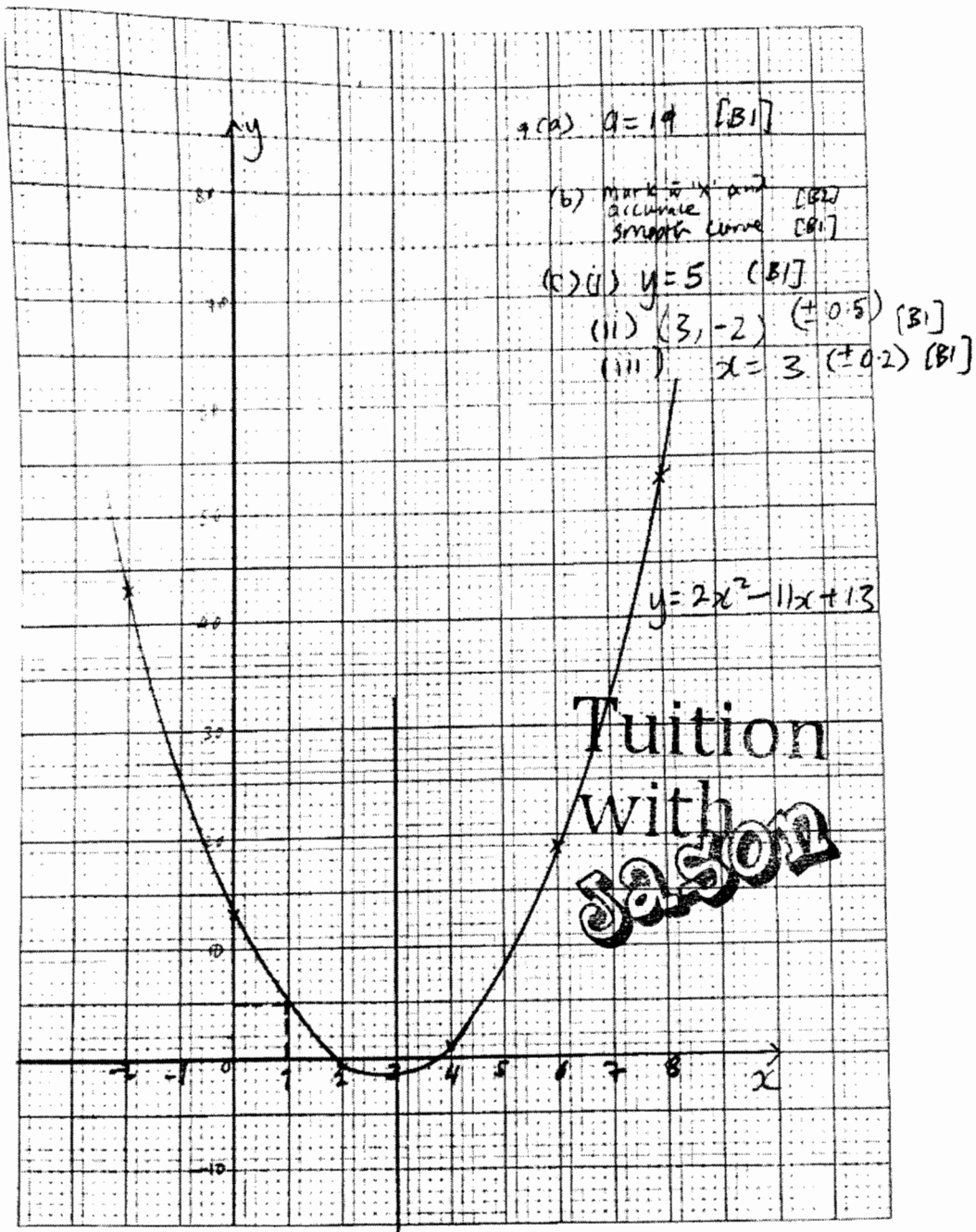
Qn	Working/ Steps
1a	$\frac{2}{3} < \frac{4x-3x}{4} \quad [M1]$ $x > 2\frac{2}{3} \quad [A1]$
1b	Smallest prime = 3 [A1]
2	$= \frac{2(11y)}{(y-5)} - \frac{(4-3y)}{-2(y-5)} \quad [M1]$ $= \frac{22y}{2(y-5)} + \frac{(4-3y)}{2(y-5)}$ $= \frac{22y+4-3y}{2(y-5)} \quad [M1]$ $= \frac{19y+2}{2(y-5)} \quad [A1]$
3a	$x(2a-b) + 3y(b-2a)$ $x(2a-b) - 3y(2a-b) \quad [M1]$ $(x-3y)(2a-b) \quad [A1]$
3b	$\frac{(x+y)(2a-b)}{(x-3y)(2a-b)}$ $\frac{(x+y)}{(x-3y)} \quad [A1]$
4a	Eqn (1) : $2x-18=5y-8$ Eqn (1) : $2x-5y=10 \quad [A1]$ Eqn (2) : $2x-18+x+41+5y-8=180$ Eqn (2) : $3x+5y=165 \quad [A1]$
4bi	Eqn (1) + Eqn (2): $5x=175, x=35$ $y = \frac{2(35)-10}{5} = 12$ $x=35, y=12$ $\angle A = x+41 = 35+41 = 76^\circ$ $\angle B = 2(35)-18 = 52^\circ$ $\angle C = 5(12)-8 = 52^\circ$ Largest angle = $76^\circ \quad [A1]$ [M1] for 1 base angle and angle BAC
5a	$\sin 41^\circ = \frac{AD}{17} \quad [M1]$ $AD = \sin 41^\circ \times 17 = 11.153 = 11.2 \text{ cm} \quad [A1]$

5b	$\angle ABD = \sin^{-1}\left(\frac{11.153}{14.8}\right) \quad [M1]$ $\angle ABD = 48.901^\circ = 48.9^\circ \quad [A1]$
5c	By Pythagoras Th ($\triangle ACD$) [M1] $CD = \sqrt{17^2 - 11.153^2} = \sqrt{164.61}$ $\frac{1}{2} \times \sqrt{164.61} \times 11.153 = \frac{1}{2} \times h \times 17 \quad [M1]$ $\frac{\sqrt{164.61} \times 11.153}{17}$ $8.4172 = 8.42 \text{ cm} \quad (\text{to 3 sf}) \quad [A1]$
6a	Let M be midpoint of AB and O be centre of $ABCD$. $AM = MO = \frac{8}{2} = 4 \text{ cm}$ Using Pythagoras' Theorem, $EM^2 = AE^2 - AM^2 = 12^2 - 4^2 = 128 \quad [M1]$ Using Pythagoras' Theorem, $EO^2 = EM^2 - MO^2 = 128 - 4^2 = 112 \quad [M1]$ $EO = \sqrt{112} \text{ cm}$ Volume of candle, $= \frac{1}{3} \times (8)(8) \times \sqrt{112} \quad [M1]$ $= 225.771 = 226 \text{ cm}^3 \quad [A1]$
6b	$= \frac{1}{2} \times 8 \times \sqrt{128} \times 4 + (8 \times 8) \quad [M1]$ $= \frac{1}{2} \times 8 \times \sqrt{128} \times 4 + (8 \times 8) = 245.01 = 245 \text{ cm}^2 \quad [A1]$
7	Total surface area, $= 2\pi(3r)^2 \quad [B1] + \pi(3r)^2 + 2\pi r(2r) \quad [B1]$ $= 18\pi r^2 + 9\pi r^2 + 4\pi r^2$ $= 31\pi r^2 \quad [A1]$

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9

9a After loyalty card discount

Price in Shop A

$$= 4850 \times 0.85$$

$$= 4122.50$$

[B1]

9b	Shop	Original Price	Price after 15% Discount	Price after additional 4% Credit Card Rebate*
	Shop A	\$4850	\$4122.50	\$3957.6
	Shop B	\$4999	\$4249.15	\$4079.18 [B1]

For credit card X1, total percentage discount

$$= \frac{3957.60 - 4850}{4850} \times 100\% = 18.4\% \quad \text{Or} \quad = \frac{4079.18 - 4999}{4999} \times 100\% = 18.4\%, [A1]$$

Or = 15% + 3.4% = 18.4%

9c	Since credit card X1 gives a higher discount in Shop A, while credit card Y1 gives a higher discount in Shop B, we only need to consider these two situations first.		*Alternatively, if students did the calculations for both credit cards X1 and Y1 in both shops and are correct, award M2. (see Alternative Solution 1)
	<u>price of laptop in Shop A + using X1</u> after 15% discount = 4122.50 after 4% discount = 4122.50 x 0.96 3957.60	M1	
	<u>price of laptop in Shop B + using Y1</u> after 15% discount = 4999 x 0.85 = 4249.15	M1	
	after 5% discount = 4249.15 x 0.95 = 4036.69	M1	or M2 if student calculated based on total percentage discount
	Since Shop A + using X1 gives the lowest price for the laptop, compare the savings between this and Shop A + using X2.		
	Savings for Shop A + using X1 = 4122.50 – 3957.60 = 164.90		
	This savings is more than the \$135 cashback.	M1	
	Ms Lin should apply for credit card X1 and buy the laptop from shop A because it gives the greatest promotion.	A1	
	Alternative Solution 1		
	percentage discounts for credit card X1, for both = 15%, then 4% OR total 18.4% Y1, for shop A = 15%, then 3% OR total 17.55% Y1, for shop B = 15%, then 5% OR total 19.25%		
	Laptop price in Shop A credit card X1 = 3957.60 credit card X2 = 3987.50 credit card Y1 = 3998.83	M1	

	Laptop price in Shop B credit card X1 = 4079.18 credit card X2 = 4114.15 credit card Y1 = 4036.69	M1	
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