

Register No.	Class

Name : _____



BENDEMEER SECONDARY SCHOOL

2021 END-OF-YEAR EXAMINATION

SECONDARY 2 EXPRESS

Mathematics Paper 1

DATE : 8 Oct 2021
DURATION : 1 hour 15 minutes
TOTAL : 50 marks

READ THESE INSTRUCTIONS FIRST

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 Write in dark blue or black pen on both sides of the paper.
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Answer **all** questions.

Write your answers in the spaces provided on the question paper.

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For π , use either your calculator value or 3.142, unless the question requires the answer in terms of π .

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

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50

This document consists of 10 printed pages including this cover page.

[Turn over

MATHEMATICAL FORMULAE*Compound Interest*

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

Mensuration

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

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

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

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

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

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

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

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.

- 1 (a) Calculate $\sqrt[3]{3.98 + \frac{2}{5}} - 0.2^2$ and write down the first 5 digits on your calculator display.

Answer (a) _____ [1]

- (b) Write your answer to (a) correct to
 (i) 3 decimal places,
 (ii) 3 significant figures.

Answer (b)(i) _____ [1]

(b)(ii) _____ [1]

- 2 A map is drawn to a scale of 1 cm to 500 m

- (a) Express the scale of the map in the form 1 : n , where n is an integer.

Answer (a) _____ [1]

- (b) If the actual distance between two towns is 3.5 km, find the corresponding distance on the map.

Answer (b) _____ cm [1]

- (c) The actual area of a lake is 3.5 km². Calculate the area on the map which represents the lake, giving your answer in square centimetres.

Answer (c) _____ cm² [2]

- 3 (a) Expand and simplify
 $5 - 3(2x - 1)$

Answer (a) _____ [1]

- (b) Factorise completely
 $3p^2 + 4pq - 9pr - 12qr$

Answer (b) _____ [2]

- (c) Simplify the expression
 $\frac{75x^3y^2}{4x} \div \frac{9y^3}{16x^2}$

Answer (c) _____ [2]

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- 4 5 workers take 35 days to build a boat. Assuming the men work at the same rate, calculate the number of workers needed to build a boat in 25 days.

Answer _____ workers [2]

- 5 Express as a single fraction

$$\frac{3x+2}{(3x-1)(2x+1)} - \frac{2}{3x-1}$$

Answer _____ [3]

- 6 Solve each of the following inequalities, representing the solution on a number line.
- (a) $3x + 5 < x - 3$



Answer (a) _____ [3]

- (b) (i) Solve the inequality $\frac{2x-1}{5} \leq \frac{5x-9}{2}$
- (ii) Write down the least possible integer value for x .

Answer (b)(i) _____ [3]

(b)(ii) _____ [1]

7 Solve the following equations.

(a) $3x - 2 = 7$

Answer (a) $x =$ _____ [1]

(b) $2x^2 + 7x - 4 = 0$

Answer (b) $x =$ _____ or $x =$ _____ [2]

(c) $\frac{1}{4}x^2 = 9$

Answer (c) $x =$ _____ or $x =$ _____ [2]

8 Given that $x^2 + y^2 = 170$ and $xy = 77$, find the value of $x - y$, given that $x > y$.

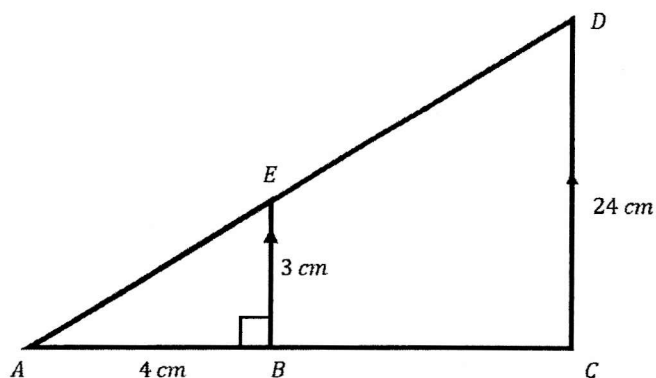
Answer $x - y =$ _____ [2]

Tuition
with
Jason

- 9 (a) The total surface area of a cone is $24\pi \text{ cm}^2$. Given that the radius of the base of the cone is 3 cm , find the volume of the cone.

Answer (a) _____ cm^3 [4]

- (b) In the diagram, $\triangle ABE$ is similar to $\triangle ACD$, $AB = 4 \text{ cm}$, $BE = 3 \text{ cm}$, $CD = 24 \text{ cm}$ and $\angle ABE = 90^\circ$
(i) Find the length of BC .



Answer (b)(i) _____ cm [2]

- (ii) Find the angle EAB .

Answer (b)(ii) _____ $^\circ$ [1]

- 10 (a) Given that $s = ut + \frac{1}{2}at^2$, express a in terms of u , s and t .

Answer (a) $a =$ _____ [2]

- (b) Hence, find the value of a when $s = 5$, $t = 8$ and $u = -15$.

Answer (b) $a =$ _____ [2]

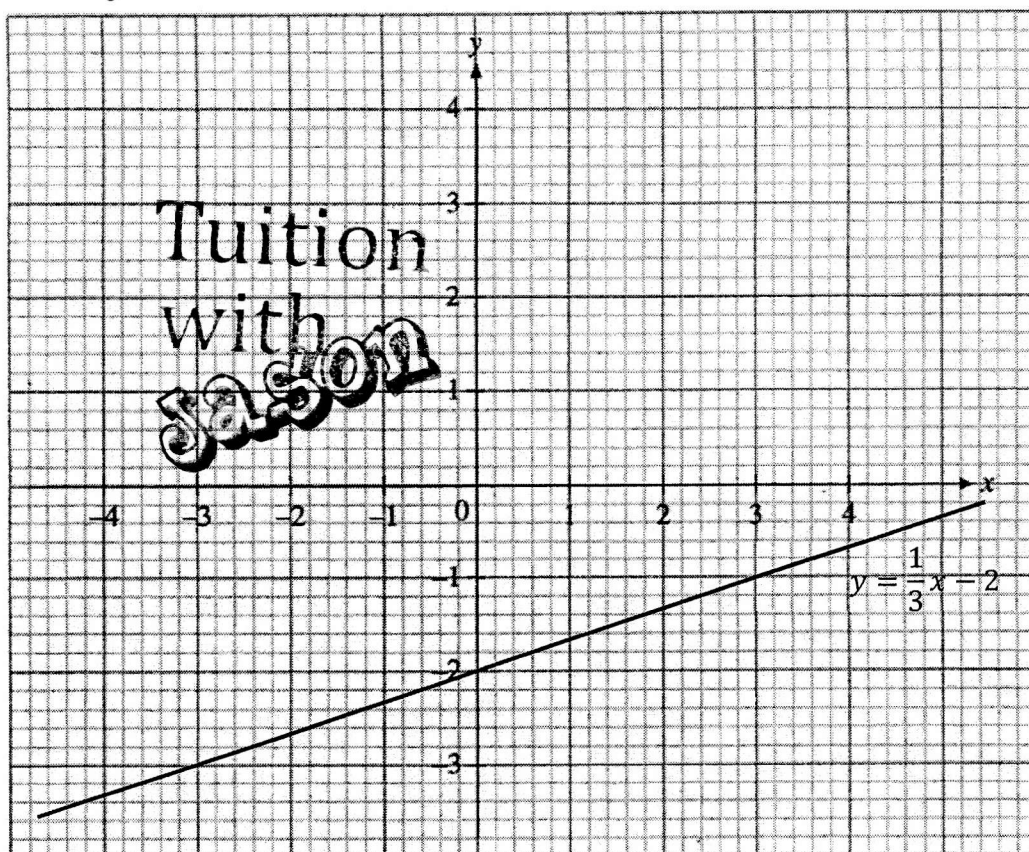
-
- 11 Solve the simultaneous equations.

$$2x + 3y = -9$$

$$3x - y = 14$$

Answer $x =$ _____
 $y =$ _____ [3]

- 12 The graph of $y = \frac{1}{3}x - 2$ is drawn on the grid below.



- (a) (i) On the grid above, draw and label the graph of $y = -3$.
 (ii) Write down the coordinates of the point of intersection between the 2 lines
 $y = \frac{1}{3}x - 2$ and $y = -3$.

Answer (a)(i) Shown on grid [1]

(ii) [1]

- (b) (i) On the grid above, draw and label the graph of $y = -2x + 5$.
 (ii) **Hence**, write down the solutions of these simultaneous equations
 $y = \frac{1}{3}x - 2$
 $y = -2x + 5$.

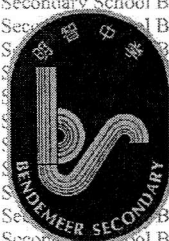
Answer (b)(i) Shown on grid. [1]

(ii) $x =$ _____
 $y =$ _____ [2]

~ End of Paper ~

Register No.	Class

Name : _____



BENDEMEER SECONDARY SCHOOL

2021 END-OF-YEAR EXAMINATION

SECONDARY 2 EXPRESS

Mathematics Paper 2

DATE : 11 Oct 2021
DURATION : 1 hour 15 minutes
TOTAL : 50 marks

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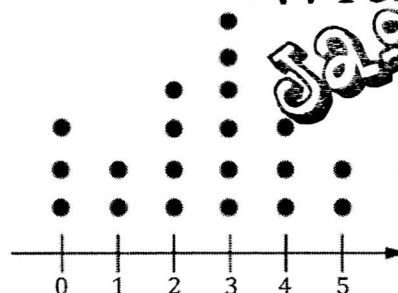
$$\text{Standard Deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2}$$

Answer **all** the questions.

- 1 (a) The number of goals scored in 20 football matches was recorded. The results are shown in the dot diagram.

Find the

- (i) mode,
(ii) median,
(iii) mean.



Answer (a)(i) _____ goals [1]

(a) (ii) _____ goals [1]

(a) (iii) _____ goals [2]

- (b) The monthly salaries, correct to nearest hundred dollars, of 27 employees, are represented in the following stem-and-leaf diagram.

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

Key: 1|0 means \$1000

- (i) Find the median monthly salary.

Answer (b)(i) \$ _____ [1]

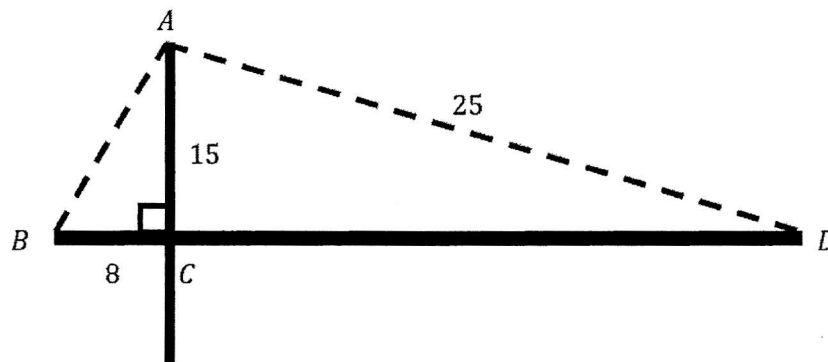
- (ii) Which average (mean or median) would be an appropriate measure of central tendency for this set of data? Give a reason to explain your answer.

Answer (b)(ii) _____ [2]

- 2 Given that p is inversely proportional to the square of q and $p = 1$ when $q = 2$, find the value of p when $q = 8$.

Answer _____ [3]

- 3 The diagram below shows the top part of a construction crane with $BC = 8\text{ m}$, $AC = 15\text{ m}$ and $AD = 25\text{ m}$. A steel cable --- is pulled taut through the ends B , A and D .



By showing your workings clearly, determine if $\angle BAD$ is 90° .

Answer

_____ [5]

4 Mrs Tan bought 50 litres of apple juice and poured the apple juice equally into x bottles.

- (a) Write down an expression, in terms of x , for the volume, in litres, of apple juice in each bottle.

Answer (a) _____ litres [1]

- (b) Mrs Tan bought the same amount of guava juice and poured the guava juice into $(x - 5)$ bottles. Write down an expression, in terms of x , for the volume, in litres, of guava juice in each bottle.

Answer (b) _____ litres [1]

- (c) It is given that the volume of guava juice in each bottle is 0.5 litres more than the volume of apple juice in each bottle.

Write down an equation in x and show that it reduces to $x^2 - 5x - 500 = 0$.

Answer (c) Shown above [3]

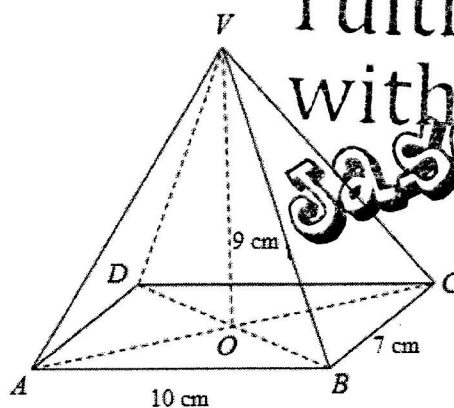
- (d) Solve the equation $x^2 - 5x - 500 = 0$.

Answer (d) $x =$ _____ or $x =$ _____ [3]

- (e) Hence, find the volume, in litres, of apple juice in one bottle.

Answer (e) _____ litres [1]

- 5 A souvenir was designed in the shape of a solid rectangular pyramid as shown below. $AB = 10\text{ cm}$, $BC = 7\text{ cm}$ and $VO = 9\text{ cm}$.



- (a) Find the volume of the souvenir.

Answer

(a) _____ cm^3 [2]

- (b) Find the total surface area of the souvenir.

Answer

(b) _____ cm^2 [4]

- 6 The length of times, t minutes, taken by a class of 40 students to complete a test is given by the following frequency table.

Time (t min)	$20 < t \leq 25$	$25 < t \leq 30$	$30 < t \leq 35$	$35 < t \leq 40$
Frequency	6	x	14	8

- (a) Find the value of x .

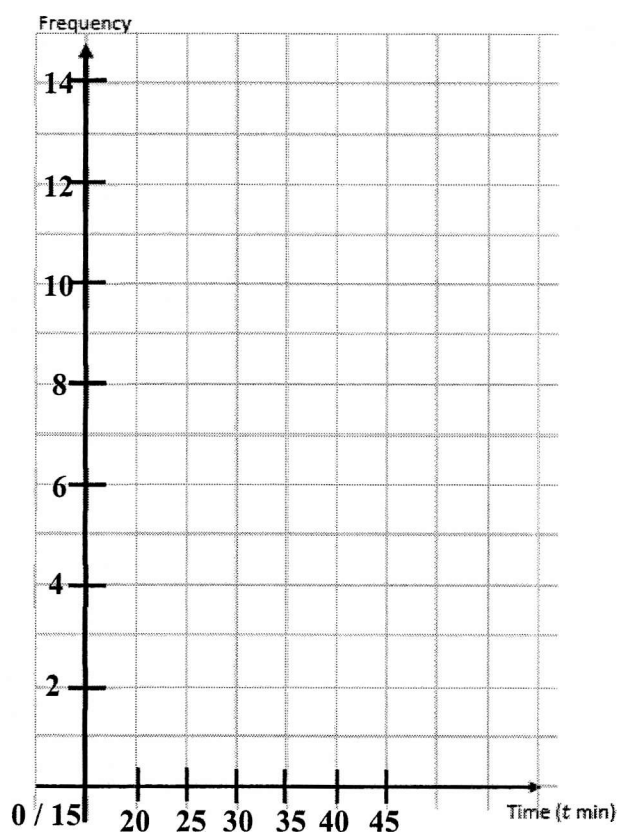
Answer (a) $x =$ _____ [1]

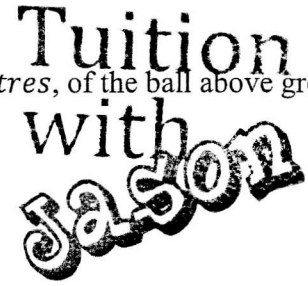
- (b) Find the mean time the students took to complete the test.

Answer (b) _____ min [2]

- (c) In the answer space below, draw a histogram that will accurately represent the same information given in the above frequency table. Include appropriate labelling where necessary.

Answer [2]





- 7 A ball is thrown upwards from a rooftop of a building. The height, h metres, of the ball above ground at time t sec, can be modelled by the equation $h = -6t^2 + 14t + 80$.

(a) State the height of the building.

Answer (a) _____ metres [1]

(b) The table shows some values of h and t .

t sec	0	1	2	3	4	5
h metres	80	88	p	68	40	q

Find the values of p and q .

Answer (b) $p =$ _____
 $q =$ _____ [2]

(c) Using a scale of 2 cm to 1 sec on the horizontal axis and 2 cm to 10 metres on the vertical axis, draw the graph of $h = -6t^2 + 14t + 80$ on the grid on page 9. [3]

(d) Use your graph to estimate

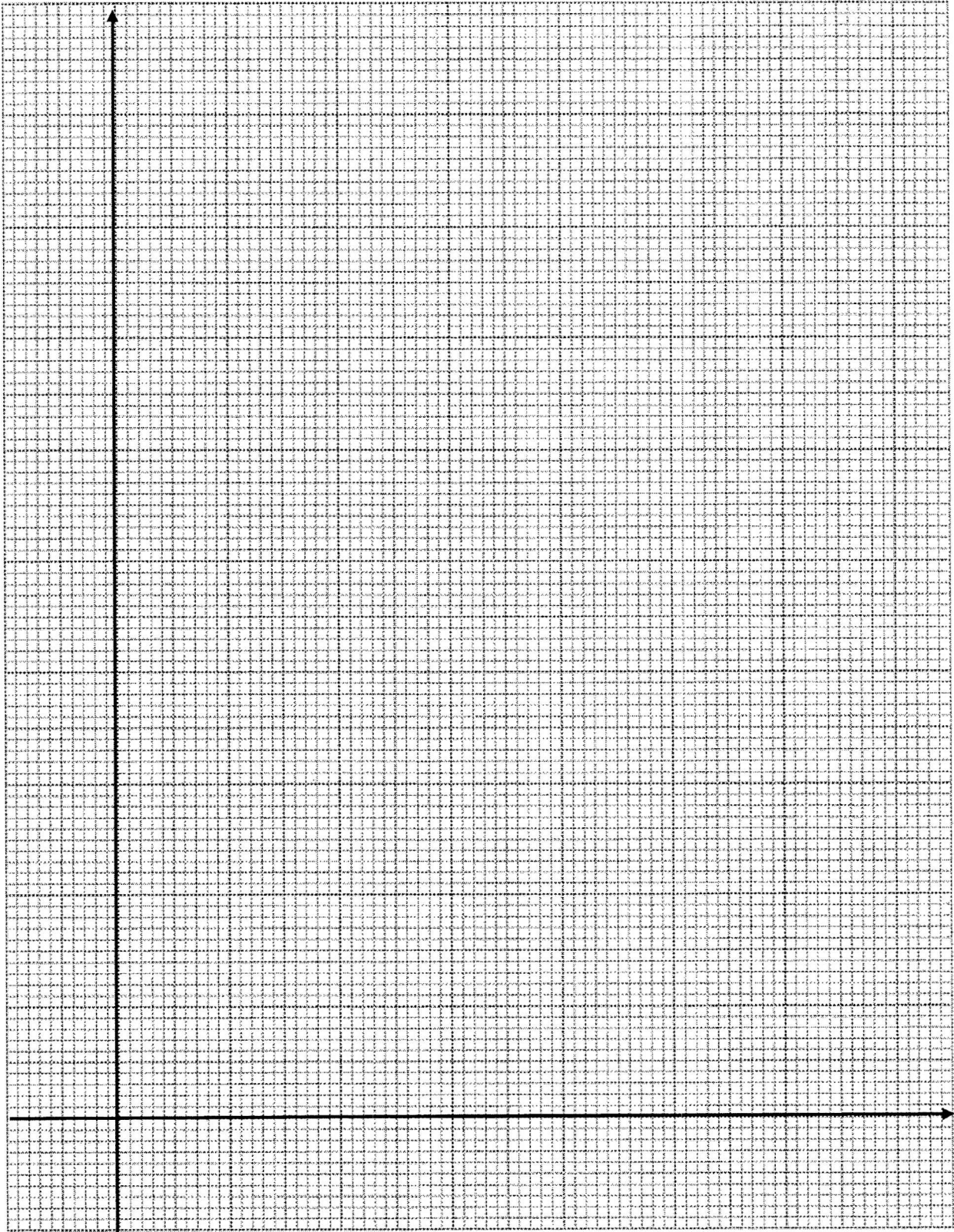
(i) the maximum height of the ball above the ground,

(d)(i) _____ metres [1]

(ii) the time when the ball is 50 metres above the ground,

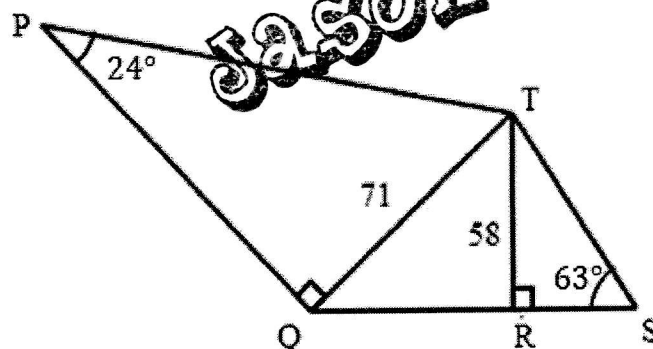
(d)(ii) _____ secs [1]

Answer for part (c)



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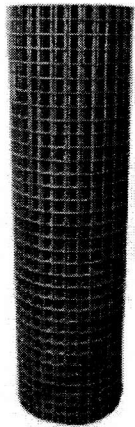
- 8 The diagram shows a field $PQRST$. $TQ = 71\text{ m}$, $TR = 58\text{ m}$, $\angle TPQ = 24^\circ$ and $\angle TSQ = 63^\circ$.



- (a) Calculate the perimeter of the field $PQRST$.

Answer (a) _____ m [5]

- (b) The town council would like to fix a wire fence around the entire field. The best deal sought by the management is shown below :



Outdoor Garden Iron Wire Green Safety Fence Roll

☆☆☆☆☆ No Ratings

Brand: OEM | More Lawn & Garden from OEM

Free Shipping

\$14.23 / Roll

~~\$25.64~~ -44%

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Features :

Garden Fence : This fence screen are made of iron wire with PE plated, more durable and not easy to break.

Mesh Structure : Uniform mesh, smooth mesh surface, concise structure, beautiful and practical, strong stability.

Wide Use : Perfect climbing plant support no matter short or tall plant, also can be used as fences, dividers.

Plant frame : Adjustable frame to wrap the led string light to décor your festival party wall or fence, or hanging other small things, creating atmosphere.

Garden Decoration : Tidy up the yard, beautiful and orderly, make the plants convenient to take care of and clean.

Specification :

Material : Iron Wire + PE Plated

Color : Green

Size : 0.5 m x 3 m (width x length)

How much will the town council have to pay for the fence? Show your working clearly.

Answer (b) \$ _____ [2]

~ End of Paper ~

Mark Scheme

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Answer **all** the questions.

- 1 (a) Calculate $\sqrt[3]{3.98 + \frac{2}{5}} - 0.2^2$ and write down the first 5 digits on your calculator display.

1.5961 B1

Many students wrote down 1.6311 as their answer.

Answer (a) _____ [1]

- (b) Write your answer to (a) correct to
 (i) 3 decimal places,
 (ii) 3 significant figures.

(i) 1.596 B1

(ii) 1.60 B1

Answer (b)(i) _____ [1]

(b)(ii) _____ [1]

- 2 A map is drawn to a scale of 1 cm to 500 m

- (a) Express the scale of the map in the form 1 : n , where n is an integer.

1 cm : 50 000 cm

$\therefore$ scale = 1 : 50 000 A1

50 000 not accepted / $\frac{1}{50000}$ accepted

Answer (a) _____ [1]

- (b) If the actual distance between two towns is 3.5 km, find the corresponding distance on the map.

1 cm : 0.5 km

7 cm : 3.5 km A1

Answer (b) _____ cm [1]

- (c) The actual area of a lake is 3.5 km². Calculate the area on the map which represents the lake, giving your answer in square centimetres.

1 cm : 0.5 km

1 cm² : 0.25 km² M1

14 cm² : 3.5 km² A1

Answer (c) _____ cm² [2]

- 3 (a) Expand and simplify
 $5 - 3(2x - 1)$

$$= 5 - 6x + 3$$

$$= 8 - 6x$$

A1

$$2(4 - 3x) \text{ not accepted}$$

Answer (a) _____ [1]

- (b) Factorise completely

$$3p^2 + 4pq - 9pr - 12qr$$

$$= p(3p + 4q) - 3r(3p + 4q)$$

$$= (p - 3r)(3p + 4q)$$

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M1

A1

Answer (b) _____ [2]

- (c) Simplify the expression

$$\frac{75x^3y^2}{4x} \div \frac{9y^3}{16x^2}$$

$$= \frac{75x^3y^2}{4x} \times \frac{16x^2}{9y^3}$$

M1

$$= \frac{100x^4}{3y}$$

A1

Answer (c) _____ [2]

- 4 5 workers take 35 days to build a boat. Assuming the men work at the same rate, calculate the number of workers needed to build a boat in 25 days.

35 days	--	5 workers	
$35 \times 5 = 175$ days	--	1 worker	M1
25 days	--	$\frac{175}{25} = 7$ workers	A1

Answer _____ days [2]

- 5 Express as a single fraction

$$\frac{3x+2}{(3x-1)(2x+1)} - \frac{2}{3x-1}$$

$\frac{3x+2}{(3x-1)(2x+1)} - \frac{2(2x+1)}{(3x-1)(2x+1)}$	M1
$= \frac{3x+2-4x-2}{(3x-1)(2x+1)}$	M1
$= -\frac{x}{(3x-1)(2x+1)}$	A1

Answer _____ [3]

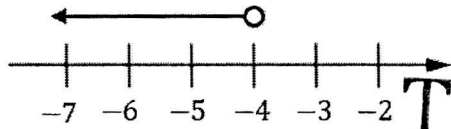
6 Solve each of the following inequalities, representing the solution on a number line.

(a) $3x + 5 < x - 3$

$3x - x < -3 - 5$ M1

$2x < -8$

$x < -4$ A1



No marks awarded if labelling of numbers is above number line.
No ECF awarded

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Answer

(a) _____ [3]

- (b) (i) Solve the inequality $\frac{2x-1}{5} \leq \frac{5x-9}{2}$
(ii) Write down the least possible integer value for x .

(i) $\frac{4x-2}{10} \leq \frac{25x-45}{10}$ M1

$4x - 2 \leq 25x - 45$

$-2 + 45 \leq 25x - 4x$ M1

$43 \leq 21x$

$x \geq 2\frac{1}{21}$ A1

(ii) $x = 3$ B1

Students still have the bad habit of writing $2\frac{1}{21}$ instead of $x \geq 2\frac{1}{21}$ on the answer line provided, not understanding that the answer is an inequality. No marks awarded.

Answer (b)(i) _____ [3]

(b)(ii) _____ [1]

7 Solve each of the following equations.

(a) $3x - 2 = 7$

$$3x = 9$$

$$x = 3$$

A1

Answer (a) $x =$ _____ [1]

(b) $2x^2 + 7x - 4 = 0$

$$(2x - 1)(x + 4) = 0$$

M1

$$2x - 1 = 0$$

or

$$x + 4 = 0$$

$$x = \frac{1}{2}$$

or

$$x = -4$$

A1

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with
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Answer (b) $x =$ _____ or $x =$ _____ [2]

(c) $\frac{1}{4}x^2 = 9$

$$x^2 = 36$$

M1

$$x = \pm\sqrt{36}$$

$$x = \pm 6$$

A1

Answer (c) $x =$ _____ or $x =$ _____ [2]

8 Given that $x^2 + y^2 = 170$ and $xy = 77$, find the value of $x - y$, given that $x > y$.

$$(x - y)^2 = x^2 - 2xy + y^2$$

$$(x - y)^2 = 170 - 2(77) = 16$$

M1

$$x - y = \sqrt{16} \quad (x > y)$$

$$x - y = 4$$

A1

Common and serious mistakes :

$$(x + y)^2 = x^2 + y^2, \text{ writing } (x + y)^2 = 170$$

$$\sqrt{x^2 - y^2} = x - y, \text{ writing } \sqrt{x^2 - y^2} = \sqrt{16} = x - y = 4$$

No marks awarded even though numerical answers are the same.

Answer $x - y =$ _____ [2]

- 9 (a) The total surface area of a cone is $24\pi \text{ cm}^2$. Given that the radius of the base of the cone is 3 cm , find the volume of the cone.

$$\pi(3^2) + \pi(3)(l) = 24\pi \quad \text{M1}$$

$$9\pi + 3\pi l = 24\pi$$

$$3\pi l = 15\pi$$

$$l = \frac{15\pi}{3\pi} = 5 \quad \text{M1}$$

Using Pythagoras theorem,

$$5^2 = 3^2 + h^2$$

$$h = \sqrt{25 - 9} = 4 \quad \text{M1}$$

$$\begin{aligned} \text{Volume} &= \frac{1}{3}\pi(3^2)(4) \\ &= 12\pi = 37.7 \text{ cm}^3 \quad \text{A1} \end{aligned}$$

Many students did not consider the base area into the total surface area. No ECF marks.

Answer (a) _____ cm^3 [4]

- (b) In the diagram, $\triangle ABE$ is similar to $\triangle ACD$, $AB = 4 \text{ cm}$, $BE = 3 \text{ cm}$, $CD = 24 \text{ cm}$ and $\angle ABE = 90^\circ$

- (i) Find the length of BC .

$$\frac{AC}{4} = \frac{24}{3} \quad \text{M1}$$

$$AC = \frac{24}{3} \times 4 = 32$$

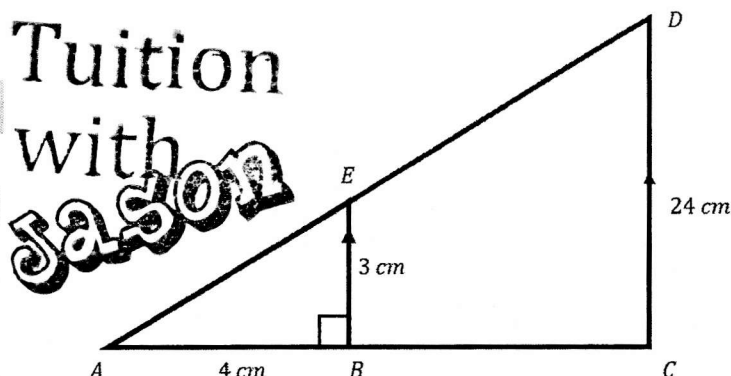
$$BC = 32 - 4 = 28 \quad \text{A1}$$

Some students used the ratio

$$\frac{BC}{AB} = \frac{DC}{BE}$$

No marks awarded.

Some students used trigonometry, method too tedious and time consuming.



Answer (b)(i) _____ cm [2]

- (ii) Find the angle EAB .

$$\tan \angle EAB = \frac{3}{4}$$

$$\angle EAB = \tan^{-1} \frac{3}{4} = 36.9^\circ \quad \text{A1}$$

Answer (b)(ii) _____ $^\circ$ [1]

- 10 (a) Given that $s = ut + \frac{1}{2}at^2$, express a in terms of u , s and t .

$$\begin{aligned} s - ut &= \frac{1}{2}at^2 \\ 2(s - ut) &= at^2 && \text{M1} \\ a &= \frac{2(s-ut)}{t^2} \quad \text{or} \quad \frac{2s-2ut}{t^2} && \text{A1} \end{aligned}$$

Students are still leaving fraction / decimal in a fraction, resulting in loss of marks.

$$\text{i.e. } a = \frac{s-ut}{\frac{1}{2}t^2} \text{ or } a = \frac{s-ut}{0.5t^2}$$

Tuition
with
Jason

Answer (a) $a =$ _____ [2]

- (b) Hence, find the value of a when $s = 5$, $t = 8$ and $u = -15$.

$$\begin{aligned} a &= \frac{2(5 - (-15)(8))}{8^2} && \text{M1} \\ a &= \frac{250}{64} = 3.90625 \text{ or } 3\frac{29}{32} && \text{A1} \end{aligned}$$

ECF marks awarded, based on part (a).

Answer (b) $a =$ _____ [2]

- 11 Solve the simultaneous equations.

$$\begin{aligned} 2x + 3y &= -9 \\ 3x - y &= 14 \end{aligned}$$

$$\begin{aligned} 2x + 3y &= -9 && (1) \\ 3x - y &= 14 && (2) \end{aligned}$$

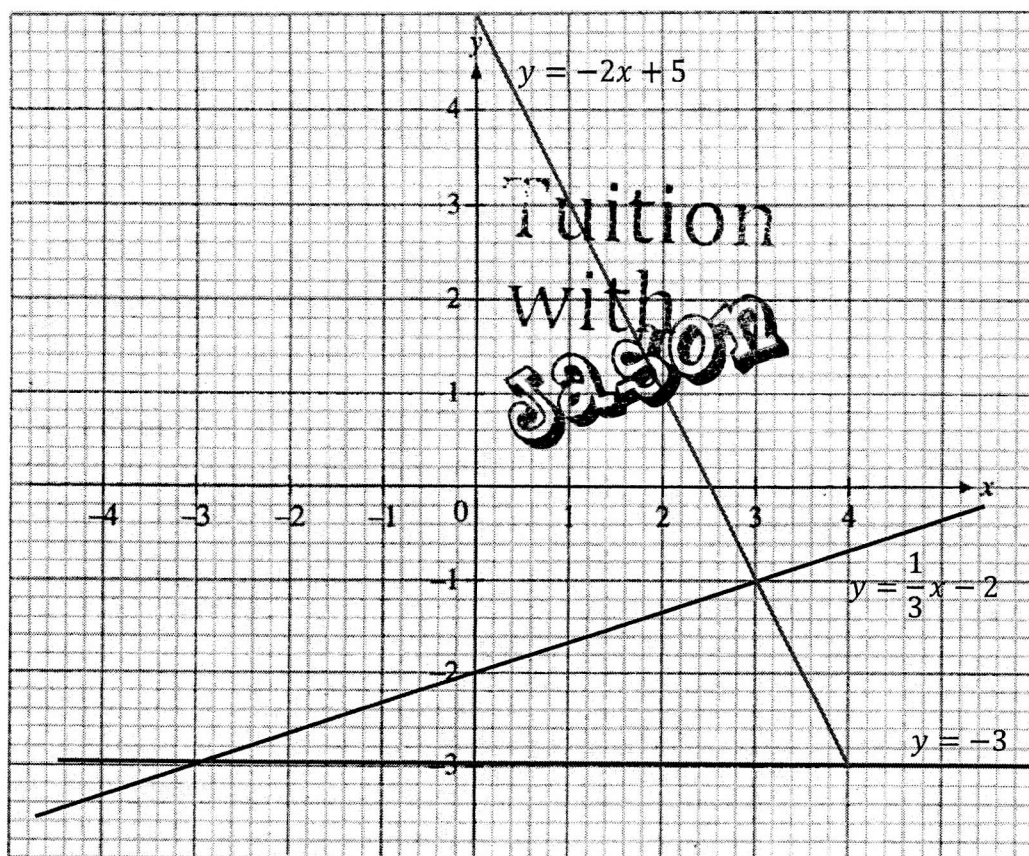
$$\begin{aligned} (2) \times 3 : \\ 9x - 3y &= 42 && (3) \quad \text{M1} \\ (1) + (3) : \\ 11x &= 33 \\ x &= 3 && \text{A1} \end{aligned}$$

$$\begin{aligned} \text{Sub } x = 3 \text{ into (2):} \\ 3(3) - y &= 14 \\ -y &= 14 - 9 = 5 \\ y &= -5 && \text{A1} \end{aligned}$$

$$\begin{aligned} \text{From (2):} \\ y &= 3x - 14 && (3) \quad \text{M1} \\ \text{Sub (3) into (1)} \\ 2x + 3(3x - 14) &= -9 \\ 11x - 42 &= -9 \\ 11x &= 33 \\ x &= 3 && \text{A1} \\ \text{Sub } x = 3 \text{ into (3):} \\ y &= 3(3) - 14 \\ y &= -5 && \text{A1} \end{aligned}$$

Answer $x =$ _____
 $y =$ _____ [3]

- 12 The graph of $y = \frac{1}{3}x - 2$ is drawn on the grid below.



- (a) (i) On the grid above, draw and label the graph of $y = -3$.
(ii) Write down the coordinates of the point of intersection between the 2 lines $y = \frac{1}{3}x - 2$ and $y = -3$.

Answer (a)(i) Shown on grid [1]

$(-3, -3)$ A1

No marks awarded if not written in coordinates

(ii) [1]

- (b) (i) On the grid above, draw and label the graph of $y = -2x + 5$.
(ii) **Hence**, write down the solutions of these simultaneous equations

$$y = \frac{1}{3}x - 2$$

$$y = -2x + 5.$$

$x = 3, y = -1$ A1

1 mark deducted if solved algebraically. ECF 2 marks awarded based on graph.

Answer (b)(i) Shown on grid. [1]

(ii) $x =$ _____
 $y =$ _____ [2]

~ End of Paper ~

Mark Scheme

Register No.

Class

Name : _____



BENDEMEER SECONDARY SCHOOL
2021 END-OF-YEAR EXAMINATION
SECONDARY 2 EXPRESS
Mathematics Paper 2

DATE : 11 Oct 2021
DURATION : 1 hour 15 minutes
TOTAL : 50 marks

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
 Write in dark blue or black pen on both sides of the paper.
 You may use a 2B pencil for any diagrams or graphs.
 Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

Answer **all** questions.
 Write your answers in the spaces provided on the question paper.
 All the diagrams in this paper are **not** drawn to scale.
 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 .

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

FOR EXAMINER'S USE
50

This document consists of 11 printed pages including this cover page.

[Turn over

MATHEMATICAL FORMULAE

Compound Interest

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

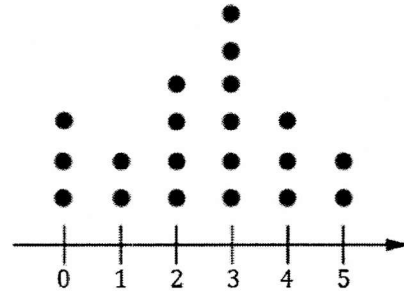
$$\text{Standard Deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2}$$

Answer **all** the questions.

- 1 (a) The number of goals scored in 20 football matches was recorded. The results are shown in the dot diagram.

Find the

- (i) mode,
(ii) median,
(iii) mean.



(i) mode = 3 B1

(ii) median = $\frac{3+3}{2} = 3$ B1

(iii) mean = $\frac{0+2+8+18+12+10}{20}$ M1
 $= \frac{50}{20} = 2.5$ A1

1 mark deducted if working not shown

Answer

(a)(i) _____ goals [1]

(a) (ii) _____ goals [1]

(a) (iii) _____ goals [2]

- (b) The monthly salaries, correct to nearest hundred dollars, of 27 employees, are represented in the following stem-and-leaf diagram.

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

Tuition with Jason

Key: 1|0 means \$1000

- (i) Find the median monthly salary.

\$2400 B1

Answer

(b)(i) \$ _____ [1]

- (ii) Which average (mean or median) would be an appropriate measure of central tendency for this set of data? Give a reason to explain your answer.

Answer (b)(ii) Median, there is an outlier which will affect the mean A1, A1

[2]

- 2 Given that p is inversely proportional to the square of q and $p = 1$ when $q = 2$, find the value of p when $q = 8$.

$$p = \frac{k}{q^2} \quad \text{M1}$$

$$1 = \frac{k}{2^2}$$

$$k = 4 \quad \text{M1}$$

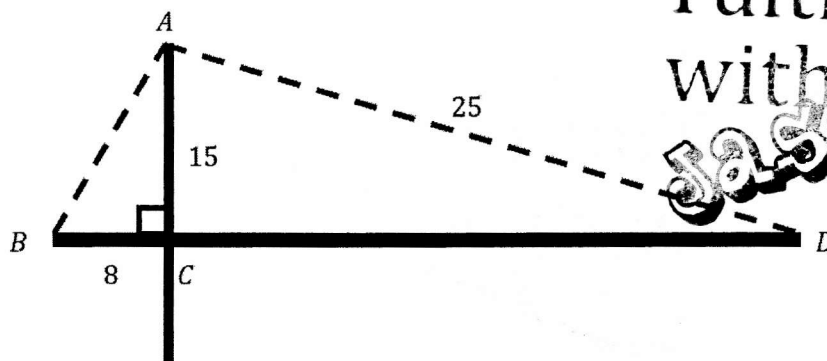
$$p = \frac{4}{8^2} = \frac{1}{16} \text{ or } 0.0625 \quad \text{A1}$$

A handful of students used $\sqrt{q}$ instead of q^2 .

Some were careless in their last step and wrote $p = \frac{4}{8} = \frac{1}{2}$

Answer _____ [3]

- 3 The diagram below shows the top part of a construction crane with $BC = 8 \text{ m}$, $AC = 15 \text{ m}$ and $AD = 25 \text{ m}$. A steel cable --- is pulled taut through the ends B , A and D .



By showing your workings clearly, determine if $\angle BAD$ is 90° .

Answer

Using pythagoras theorem,

$$AB = \sqrt{15^2 + 8^2} = 17 \text{ cm} \quad \text{M1}$$

$$CD = \sqrt{25^2 - 15^2} = 20 \text{ cm} \quad \text{M1}$$

$$AB^2 + AD^2 = 17^2 + 25^2 = 914 \quad \text{M1}$$

$$BD^2 = 28^2 = 784 \quad \text{M1}$$

$$\text{Since } AB^2 + AD^2 \neq BD^2, \angle BAD \neq 90^\circ \quad \text{A1}$$

OR

$$\tan \angle BAC = \frac{8}{15} \quad \text{M1}$$

$$\angle BAC = 28.07^\circ \quad \text{M1}$$

$$\cos \angle CAD = \frac{15}{25} \quad \text{M1}$$

$$\angle CAD = 53.13^\circ \quad \text{M1}$$

$$\angle BAD = 28.07^\circ + 53.13^\circ = 81.2^\circ \neq 90^\circ \quad \text{A1} \quad [5]$$

Students must learn to write on the answer lines provided, and not in the space beside the diagram. They need to write proper statement to indicate what they are finding, which side or angle.

Students should also know that 'By Converse of Pythagoras Theorem' is to prove the right angle. If not, there's no need to quote 'By Converse....'

- 4 Mrs Tan bought 50 litres of apple juice and poured the apple juice equally into x bottles.
- (a) Write down an expression, in terms of x , for the volume, in litres, of apple juice in each bottle.

$$\frac{50}{x} \text{ litres} \quad \text{B1}$$

Answer (a) _____ litres [1]

- (b) Mrs Tan bought the same amount of guava juice and poured the guava juice into $(x - 5)$ bottles. Write down an expression, in terms of x , for the volume, in litres, of guava juice in each bottle.

$$\frac{50}{x-5} \text{ litres} \quad \text{B1}$$

Answer (b) _____ litres [1]

- (c) It is given that the volume of guava juice in each bottle is 0.5 litres more than the volume of apple juice in each bottle.

Write down an equation in x and show that it reduces to $x^2 - 5x - 500 = 0$.

$$\begin{aligned} \frac{50}{x-5} - \frac{50}{x} &= \frac{1}{2} && \text{M1} \\ \frac{50x - 50x + 250}{x^2 - 5x} &= \frac{1}{2} && \text{M1} \\ x^2 - 5x &= 500 \\ x^2 - 5x - 500 &= 0 \text{ (shown)} && \text{A1} \end{aligned}$$

Tuition
with
Jason

Answer (c) Shown above [3]

- (d) Solve the equation $x^2 - 5x - 500 = 0$.

$$\begin{aligned} (x+20)(x-25) &= 0 && \text{M1} \\ x+20 &= 0 \quad \text{or} \quad x-25 = 0 \\ x &= -20 \quad \quad \quad x = 25 && \text{A2} \end{aligned}$$

1 mark deducted if working not shown

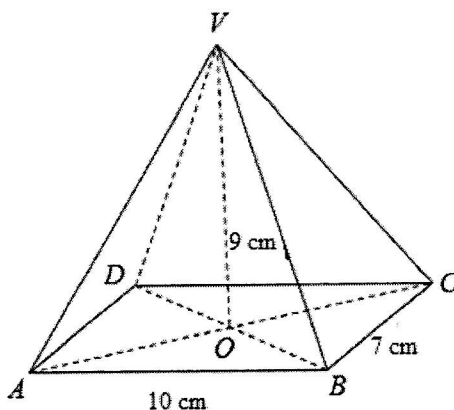
Answer (d) $x =$ _____ or $x =$ _____ [3]

- (e) Hence, find the volume, in litres, of apple juice in one bottle.

$$\frac{50}{25} = 2 \text{ litres} \quad \text{A1}$$

Answer (e) _____ litres [1]

- 5 A souvenir was designed in the shape of a solid rectangular pyramid as shown below. $AB = 10\text{ cm}$, $BC = 7\text{ cm}$ and $VO = 9\text{ cm}$.



- (a) Find the volume of the souvenir.

$$\begin{aligned}\text{Volume} &= \frac{1}{3} \times (10 \times 7) \times 9 && \text{M1} \\ &= 210\text{ cm}^3 && \text{A1}\end{aligned}$$

Some students cannot recall the formula for volume of pyramid.

Answer (a) _____ cm^3 [2]

- (b) Find the total surface area of the souvenir.

Let M and N be the midpoints of AB and BC respectively.

Using Pythagoras Theorem,

$$VM^2 = 3.5^2 + 9^2 = 93.25$$

$$VM = \sqrt{93.25}$$

$$VN^2 = 9^2 + 5^2 = 106$$

$$VN = \sqrt{106}$$

M1

Total surface area

$$= 2 \times \frac{1}{2} \times 10 \times \sqrt{93.25} + 2 \times \frac{1}{2} \times 7 \times \sqrt{106} + 10 \times 7 \quad \text{M1}$$

$$= 238.635$$

$$= 239\text{ cm}^2 \text{ (3 s.f.)} \quad \text{A1}$$

Answer (b) _____ cm^2 [4]

- 6 The length of times, t minutes, taken by a class of 40 students to complete a test is given by the following frequency table.

Time (t min)	$20 < t \leq 25$	$25 < t \leq 30$	$30 < t \leq 35$	$35 < t \leq 40$
Frequency	6	x	14	8

- (a) Find the value of x .

$$x = 40 - 6 - 14 - 8 = 12 \quad \text{A1}$$

Answer

(a) $x =$ _____ [1]

- (b) Find the mean time the students took to complete the test.

$$\begin{aligned} \text{Mean} &= \frac{22.5 \times 6 + 27.5 \times 12 + 32.5 \times 14 + 37.5 \times 8}{40} \\ &= \frac{1220}{40} \quad \text{M1} \\ &= 30.5 \text{ min} \quad \text{A1} \end{aligned}$$

Deduct 1 mark for no working shown

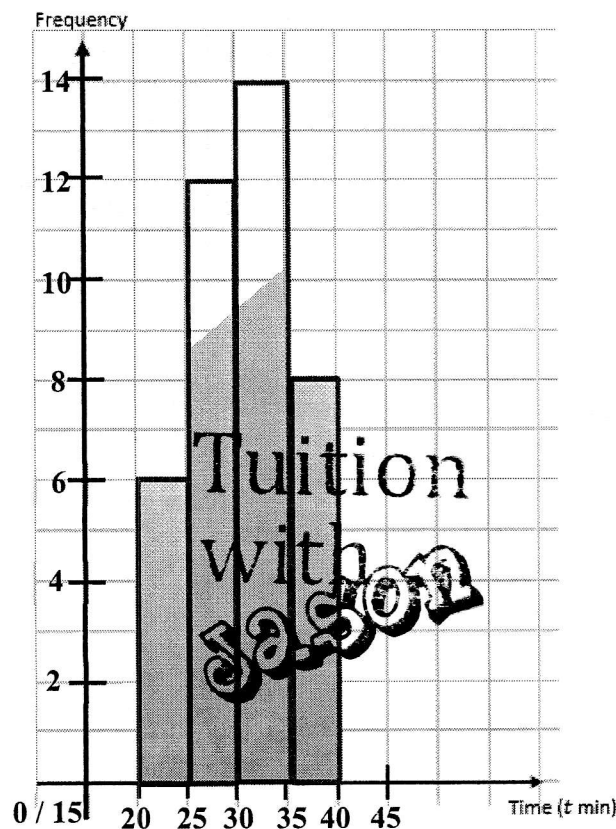
Answer

(b) _____ min [2]

- (c) In the answer space below, draw a histogram that will accurately represent the same information given in the above frequency table. Include appropriate labelling where necessary.

Answer

[2]



7 A ball is thrown upwards from a rooftop of a building. The height, h metres, of the ball above ground at time t sec, can be modelled by the equation $h = -6t^2 + 14t + 80$.

(a) State the height of the building.

Height = 80 metres B1

Answer (a) _____ metres [1]

(b) The table shows some values of h and t .

t sec	0	1	2	3	4	5
h metres	80	88	p	68	40	q

Find the values of p and q .

$p = 84$ $q = 0$ B2

Tuition
with
Jason

(b) $p =$ _____
 $q =$ _____ [2]

(c) Using a scale of 2 cm to 1 sec on the horizontal axis and 2 cm to 10 metres on the vertical axis, draw the graph of $h = -6t^2 + 14t + 80$ on the grid on page 7. [3]

(d) Use your graph to estimate

(i) the maximum height of the ball above the ground,

88 m A1

(d)(i) _____ metres [1]

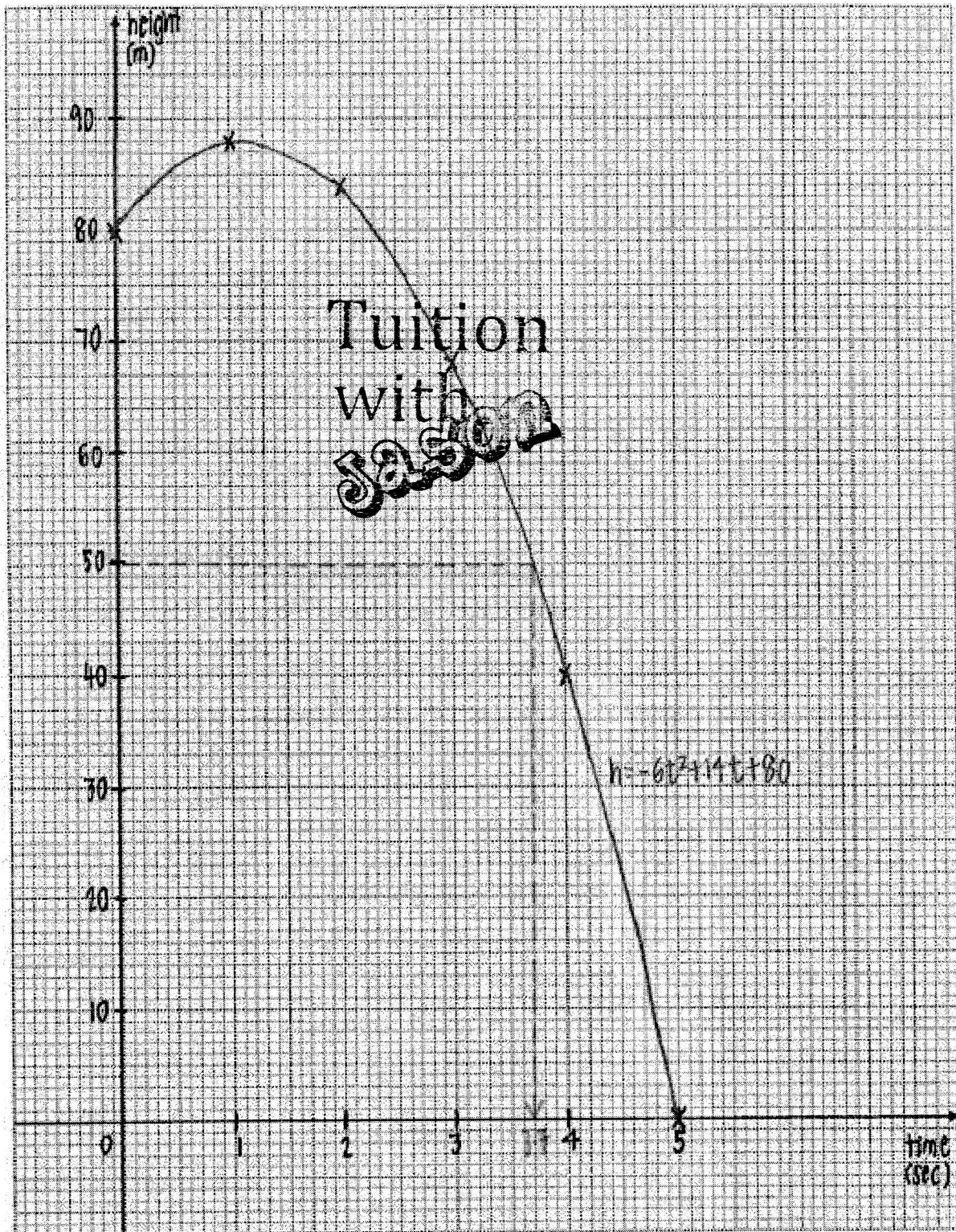
(ii) the time when the ball is 50 metres above the ground,

3.7 sec A1

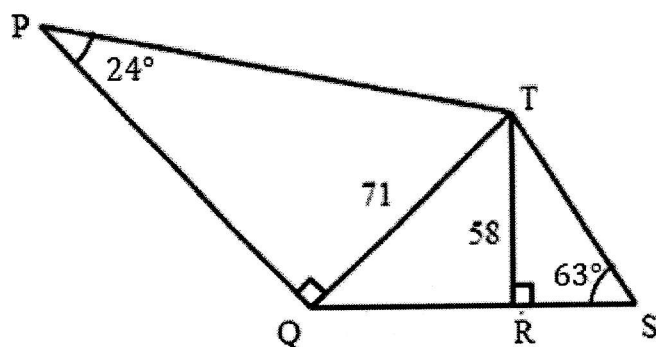
Answer must tally with graph

(d)(ii) _____ secs [1]

Answer for part (c)



- 8 The diagram shows a field $PQRST$. $TQ = 71$ m, $TR = 58$ m, $\angle TPQ = 24^\circ$ and $\angle TSQ = 63^\circ$.



- (a) Calculate the perimeter of the field $PQRST$.

$$\tan 24^\circ = \frac{71}{PQ}$$

$$PQ = \frac{71}{\tan 24^\circ}$$

$$PQ = 159.46 \text{ m}$$

$$QR = \sqrt{71^2 - 58^2}$$

$$QR = \sqrt{1677} = 40.9511 \text{ m} \quad \text{M1}$$

$$\tan 63^\circ = \frac{58}{RS}$$

$$RS = \frac{58}{\tan 63^\circ} = 29.5524 \text{ m} \quad \text{M1}$$

$$\sin 63^\circ = \frac{58}{TS}$$

$$TS = \frac{58}{\sin 63^\circ} = 65.0949 \text{ m} \quad \text{M1}$$

$$\sin 24^\circ = \frac{71}{PT}$$

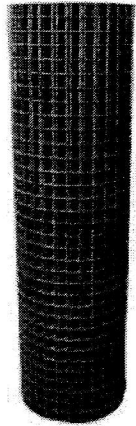
$$PT = \frac{71}{\sin 24^\circ} = 174.5601 \text{ m} \quad \text{M1}$$

$$\begin{aligned} \text{Perimeter} &= 159.46 + 40.9511 + 29.5524 + 65.0949 + 174.5601 \\ &= 469.61 = 470 \text{ m} \end{aligned}$$

Tuition
With
Jason

Answer (a) _____ m [5]

- (b) The town council would like to fix a wire fence around the entire field. The best deal sought by the management is shown below :



Outdoor Garden Iron Wire Green Safety Fence Roll

☆☆☆☆☆ No Ratings



Brand: OEM | More Lawn & Garden from OEM

Free Shipping

\$14.23 / Roll

~~\$25.61~~ -44%

Features :

Garden Fence : This fence screen are made of iron wire with PE plated, more durable and not easy to break.

Mesh Structure : Uniform mesh, smooth mesh surface, concise structure, beautiful and practical, strong stability.

Wide Use : Perfect climbing plant support no matter short or tall plant, also can be used as fences, dividers.

Plant frame : Adjustable frame to wrap the led string light to décor your festival party wall or fence, or hanging other small things, creating atmosphere.

Garden Decoration : Tidy up the yard, beautiful and orderly, make the plants convenient to take care of and clean.

Specification :

Material : Iron Wire + PE Plated

Color : Green

Size : 0.5 m x 3 m (width x length)

How much will the town council have to pay for the fence? Show your working clearly.

$$\text{Number of rolls} = \frac{469.61}{3} = 156.5$$

$$\approx 157$$

M1

$$\text{Total amount} = 157 \times \$14.23$$

$$= \$2234.11$$

Tuition
With
Jason

Students must show the steps to round up the number of rolls in order to be awarded marks.

ECF awarded.

Answer

(b)

\$ _____ [2]

~ End of Paper ~