

Visit
FREETESTPAPER.com
for more papers



Website: freetestpaper.com



[Facebook.com/freetestpaper](https://www.facebook.com/freetestpaper)

Class	Register Number	Name
-------	-----------------	------



BARTLEY SECONDARY SCHOOL

END-OF-YEAR EXAMINATION

MATHEMATICS

Sec 3 Express

4052/01

Paper 1

6 Oct 2023

1 hour 30 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your class, register number and name 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 / tape.

Answer **all** questions.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The use of an approved scientific calculator is expected, where appropriate.

If the degree of accuracy is not specified in the question and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For π , use either your calculator value or 3.142.

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

The total number of marks for this paper is 50.

For Examiner's Use

/ 50

This document consists of **18** printed pages and **2** blank pages.
Set By: Mrs Tan Puay Hoon

[Turn Over

Mathematical Formulae*Compound interest*

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

3

Answer **all** the questions.

- 1 Calculate $\frac{2.7 + \sqrt{2.08}}{(-1.5)^4 - 0.02^2}$, giving your answer correct to 2 significant figures.

Answer [1]

- 2 Simplify $35a^4 \div 49\sqrt{a}$.

Answer [1]

4

- 3 (a) Simplify $a - (3d + 4a)$.

Answer [1]

- (b) Factorise fully $8am - 12ak - 6dk + 4dm$.

Answer [2]

5

- (c) Express $\frac{2}{c^2-9} - \frac{5}{c+3}$ as a single fraction in its simplest form.

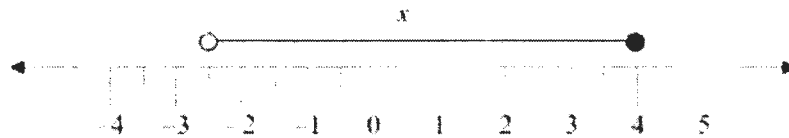
Answer [2]

6

- 4 (a) Solve the inequalities $\frac{1}{4}x - 8 \leq 3 - x < 9$.

Answer [2]

- (b) The range of values of x for the simultaneous inequalities $a < x$ and $\frac{2x+7}{3} \leq b$ are represented on the number line below.



Find the value of a and of b .

Answer $a =$

$b =$ [2]

7

5 The radius of a spherical atom of bromine is approximately 9.4×10^{-11} metres.

- (a) Express the diameter of a bromine atom in metres.
Give your answer in standard form.

Answer m [1]

- (b) The radius of a spherical atom of hydrogen is approximately 1.06×10^{-8} cm.

Find the difference, in metres, between the radius of an atom of bromine and the radius of an atom of hydrogen.
Give your answer in standard form.

Answer m [2]

8

- 6 (a) Express 396 as a product of its prime factors.

Answer [1]

- (b) The number $396k$ is a perfect square.

Find the smallest positive integer value of k .

Answer $k =$ [1]

9

- (c) Two integers, A and B , can be written as products of prime factors.

$$A = p^3 \times 3^2 \times 11^q \quad B = p^2 \times 3^5 \times 11^2$$

The highest common factor (HCF) of A and B is 396.

Write down the values of p and q .

Answer $p = \dots\dots\dots$

$q = \dots\dots\dots$ [2]

10

- 7 Mr Ng gave some nougat bars to Adrian, Bernard and Connie in the ratio $3 : w : 5$.
Connie received 32 nougat bars more than Adrian, while Bernard had 16 nougat bars less than Connie.

Calculate

- (a) the number of nougat bars Connie received,

Answer [1]

- (b) the value of w .

Answer $w =$ [2]

- 8 The table shows the number of marks Jenise scored in her Mathematics assessments WA1, WA2 and WA3. The assessments have a different percentage weighting to the overall result.

Type of assessment	$\frac{\text{Marks scored}}{\text{Total marks}}$	Percentage weighting towards overall result
WA1	$\frac{31}{50}$	15%
WA2	$\frac{63}{80}$	15%
WA3	$\frac{43}{50}$	25%
End-of-Year Examination	$\frac{?}{100}$	45%

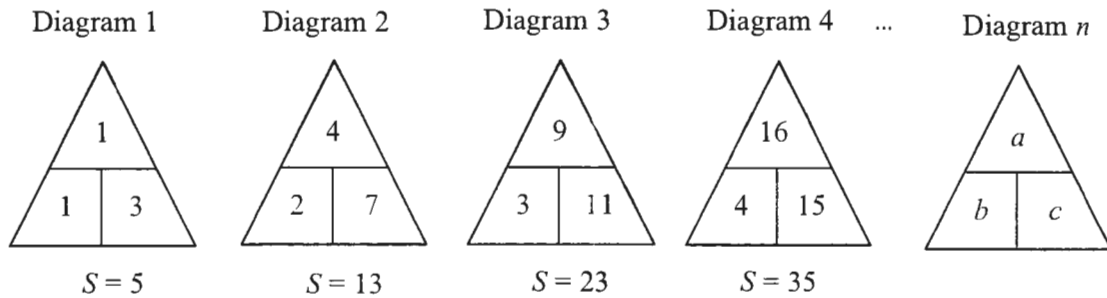
To score an A1 grade, Jenise needs to score an overall percentage of 75 or above.

What is the minimum mark she needs to score for the End-of-Year Examination to obtain an A1 grade for Mathematics?

Answer [3]

12

- 9 The diagrams below show part of a series of a number pattern.
 S represents the sum of the three numbers in each diagram.



- (a) Calculate the value of a when $n = 7$.

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

- (b) Calculate the value of n when $c = 47$.

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

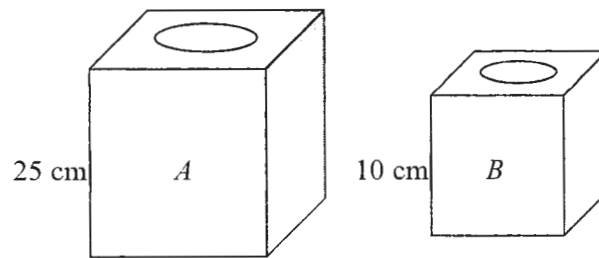
- (c) Show that the general formula for S , in terms of n , for Diagram n is $n^2 + 5n - 1$.

Answer

[2]

13

- 10 The heights of two geometrically similar containers are 25 cm and 10 cm respectively.



Container *A* is completely filled with rice.

Angel wishes to transfer **all** the rice to a few containers *B*.

How many containers *B* are needed to fill the rice in Container *A*?

Answer [3]

14

- 11 During a school carnival, students played on a giant Cartesian coordinate grid floor game, with each unit measuring one metre on both the x and y axes. Winnie and Piglet were located at positions $(3, -1)$ and $(2, 3)$ respectively.

(a) Find the distance, in metres, between Winnie and Piglet.

Answer m [2]

(b) Find the equation of the line formed by Winnie and Piglet.

Answer [2]

(c) Tigger was asked to stand at a position on the x -axis and form a straight line with Winnie and Piglet.

Find the coordinates of the position of Tigger.

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

15

- (d) Christopher stood at a position which is 5 metres from the origin, O .

Write down the coordinates of a possible position of Christopher.

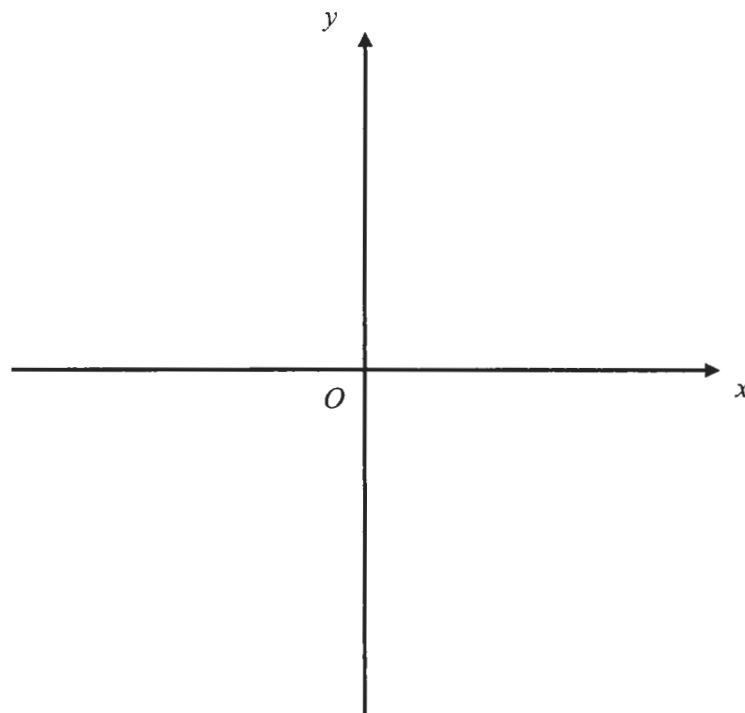
Answer (..... ,) [1]

16

- 12 (a) Express $x^2 - 6x + 4$ in the form of $(x - h)^2 + k$.

Answer [2]

- (b) (i) Sketch the graph of $y = x^2 - 6x + 4$, clearly indicating its turning point and y -intercept. [2]

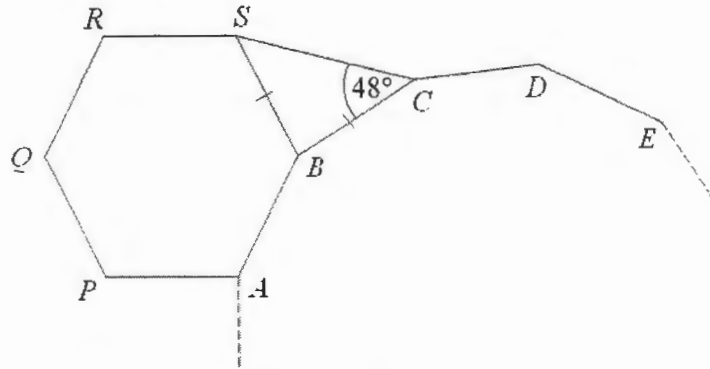


- (ii) Hence write down the equation of the line of symmetry.

Answer [1]

17

13



$APQRSB$ is a regular hexagon and SBC is an isosceles triangle.

Angle $BCS = 48^\circ$.

$ABCDE...$ is part of a regular polygon.

(a) Find angle APQ .

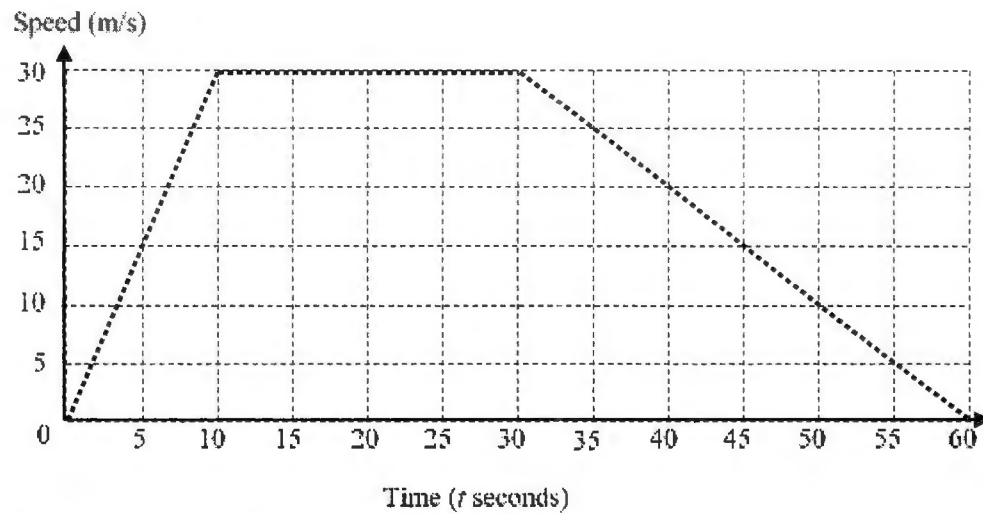
Answer $^\circ$ [1]

(b) Show that the regular polygon $ABCDE...$ has 15 sides.

[3]

18

- 14 The diagram below shows a speed-time graph of a cyclist's journey.



- (a) Find the speed of the cyclist at $t = 8$ seconds.

Answer m/s [1]

- (b) Find the deceleration for the last 30 seconds of his journey.

Answer m/s^2 [1]

19

- (c) Area under the speed-time graph represents the distance travelled.

Find the average speed of the cyclist's whole journey.

Answer m/s [2]

End of Paper

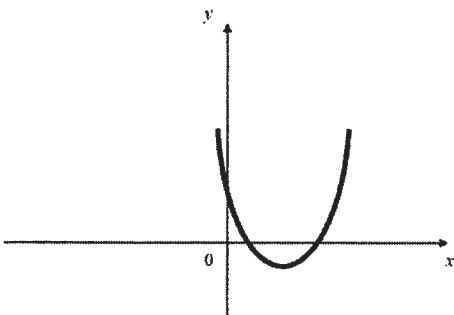
20

BLANK PAGE

SOLUTIONS FOR SEC 3 EXPRESS 2023 P1 V2

1		$\frac{2.7 + \sqrt{2.08}}{(-1.5)^4 - 0.02^2} = 0.82 \text{ [2 SF] [B1]}$	
2		$\begin{aligned} & 35a^4 \div 49\sqrt{a} \\ &= \frac{5}{7}a^{\frac{7}{2}} \text{ [B1]} \end{aligned}$	
3	a	$\begin{aligned} a - (3d + 4a) &= a - 3d - 4a \\ &= -3a - 3d \text{ [B1]} \end{aligned}$	
	b	$\begin{aligned} & 8am - 12ak - 6dk + 4dm \\ &= 8am - 12ak + 4dm - 6dk \\ &= 4a(2m - 3k) + 2d(2m - 3k) \text{ [M1]} \\ &= 2(2a + d)(2m - k) \text{ [A1]} \end{aligned}$	Presence of either one factorization correctly: Extracting common factor [M1] Erroneous working but able to get the final answer [M0A0]
	c	$\begin{aligned} & \frac{2}{c^2 - 9} - \frac{5}{c + 3} \\ &= \frac{2}{(c + 3)(c - 3)} - \frac{5}{c + 3} \\ &= \frac{2}{(c + 3)(c - 3)} - \frac{5(c - 3)}{(c + 3)(c - 3)} \text{ [M1]} \\ &= \frac{2 - 5c + 15}{(c + 3)(c - 3)} \\ &= \frac{17 - 5c}{(c + 3)(c - 3)} \text{ [A1]} \end{aligned}$	making common denominator (c² - 9)(c + 3) with all correct working on numerator [M1]
4	a	$\begin{aligned} & \frac{1}{4}x - 8 \leq 3 - x < 9 \\ & \frac{1}{4}x - 8 \leq 3 - x \quad \text{or} \quad 3 - x < 9 \\ & \frac{5}{4}x \leq 11 \quad \text{or} \quad x > -6 \\ & x \leq 8\frac{4}{5} \quad \text{or} \quad x > -6 \text{ [either 1 is correct [M1]]} \\ & \text{Final : } -6 < x \leq 8\frac{4}{5} \text{ [A1]} \end{aligned}$	

4	b	$\frac{2x+7}{3} \leq b$ $x \leq \frac{3b-7}{2}$ $\frac{3b-7}{2} = 4$ $b = 5 \quad [\text{B1}]$ $a = -2.5 \quad [\text{B1}]$	
5	a	$9.4 \times 10^{-11} \times 2 = 1.88 \times 10^{-10} \quad [\text{B1}]$	
	b	$1.06 \times 10^{-8} \div 100 = 1.06 \times 10^{-10} \quad [\text{M1}]$ Difference = $1.2 \times 10^{-11} \quad [\text{A1}]$	
6	a	$396 = 2^2 \times 3^2 \times 11 \quad [\text{B1}]$	Accept product but not in index form
	b	11 [B1]	
	c	$p = 2, q = 1 \quad [\text{B1}, \text{B1}]$	
7	a	2 units rep 32 bars 1 unit rep 16 bars Connie has $16 \times 5 = 80 \quad [\text{B1}]$	
	b	1 unit = 16 bars therefore $(5 - w) = 1 \quad [\text{M1}]$ $w = 4 \quad [\text{A1}]$	Award M1 for presence of 64
8		$\frac{31}{50} \times 15 + \frac{63}{80} \times 15 + \frac{43}{50} \times 25 = 42.6125 \quad [\text{M1}]$ to score at least 75%, the remainder is 32.3875 [M1] $\frac{32.3875}{45} \times 100 = 71.9722$ Hence, she should score 72 marks [A1]	Attempt to find remainder [M1]
9	a	49 [B1]	
	b	12 [B1]	
	c	$n + n^2 + (4n - 1) \quad [\text{M1}]$ $= n^2 + 5n - 1 \quad [\text{A1}]$	Presence of n^2 or $(4n - 1) \quad [\text{M1}]$
10		Container A : Container B 25 : 10 5 : 2 125 : 8 [volume ratio] [M1] Number of containers B needed = $\frac{125}{8} \quad [\text{M1}] = 15.625$ 16 containers [A1]	Accept volume ratio 15625 : 1000 [M1]
11	a	Length = $\sqrt{(2-3)^2 + (3-(-1))^2} \quad [\text{M1}]$ = 4.1231 [A1] ≈ 4.12	

	b	$\text{gradient} = \frac{3 - (-1)}{2 - 3} = -4 \quad [\text{M1}]$ Equation $y - 3 = -4(x - 2)$ $y = -4x + 11 \quad [\text{A1}]$	
	c	$y = -4x + 11$ cuts the x axis: $y = 0$ $0 = -4x + 11$ $x = \frac{11}{4}$ coordinates = $(\frac{11}{4}, 0)$ [or equivalent] [B1]	
	d	$(0, 5)(0, -5)(5, 0)(5, -0)(\pm 3, 4)(\mp 3, 4)(3, \pm 4)(3, \mp 4)(-3, -4),$ $(\pm 4, 3), (\mp 4, 3), (4, \pm 3), (4, \mp 3), (-4, -3)$ [B1]	
12	a	$x^2 - 6x + 4$ $= (x - 3)^2 - 5 \quad [\text{B1}] \quad -5 \quad [\text{B1}]$	
	b	 [B1] for correct shape regardless of coordinates [B1] labelling the y intercept and turning point accurately	Turning point = $(3, -5)$ Y intercept = 4
	c	$x = 3 \quad [\text{B1}]$	
13	a	$\angle APQ = \frac{(6-2) \times 180}{6} = 120 \quad [\text{B1}]$	
	b	$\angle SBC = 180 - 48 - 48 = 84$ $\angle ABC = 360 - 120 - 84 = 156 \quad [\text{M1}]$ $\frac{(n-2) \times 180}{n} = 156 \quad [\text{M1}]$ or $n(180 - 156) = 360 \quad [\text{M1}]$ $180n - 360 = 156n$ $24n = 360$ $n = 15 \quad (\text{shown}) \quad [\text{A1}]$	Do not accept if candidates use 15 to show
14	a	$\frac{30}{10} = \frac{v}{8}$ $v = 24 \text{ m/s} \quad [\text{B1}]$	Or any appropriate method

	b	$deceleration = \frac{30-0}{30} = 1 \text{ m/s}^2 \quad [\text{B1}]$	
	c	$Distance = \frac{1}{2}(60+20)(30) = 1200 \quad [\text{M1}]$ $Ave \text{ Speed} = \frac{1200}{60} = 20 \text{ m/s} \quad [\text{A1}]$	

Class	Register Number	Name
-------	-----------------	------



BARTLEY SECONDARY SCHOOL

END OF YEAR EXAMINATION

MATHEMATICS

Sec 3 Express

4052/02

Paper 2

11 October 2023

1 hour 30 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your class, register number and name 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 / tape.

Answer **all** questions.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The use of an approved scientific calculator is expected, where appropriate.

If the degree of accuracy is not specified in the question and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

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

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

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

The total number of marks for this paper is 50.

For Examiner's Use

/ 50

Set by: Tan KJ

This document consists of **15** printed pages and **1** blank page.

[Turn over]

Mathematical Formulae*Compound interest*

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

Mensuration

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

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

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

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

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

Trigonometry

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

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

3

Answer **all** the questions.

1 (a) Solve $\frac{2}{3x-1} = \frac{3}{x}$.

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

4

(b) Solve these simultaneous equations.

$$4y + x = 1$$

$$6x - 8y = -18$$

You must show your working.

Answer $x = \dots\dots\dots$

$y = \dots\dots\dots$ [3]

5

(c) $q = \frac{r}{p^3 - 2}$

(i) Find q when $p = -4$ and $r = -10$.

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

(ii) Rearrange the formula to make p the subject.

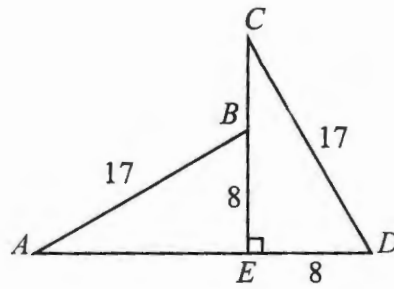
Answer $p = \dots\dots\dots$ [2]

(iii) Find the value of p for which q is undefined.

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

6

2



In the diagram, AD is a straight line, $AB = CD = 17$ cm, and $BE = DE = 8$ cm.

- (a) Show that triangle ABE is congruent to triangle CDE .

Answer

.....

.....

.....

.....

.....

[2]

- (b) Leaving your answers in fractions, find

- (i) $\cos \angle ABC$,

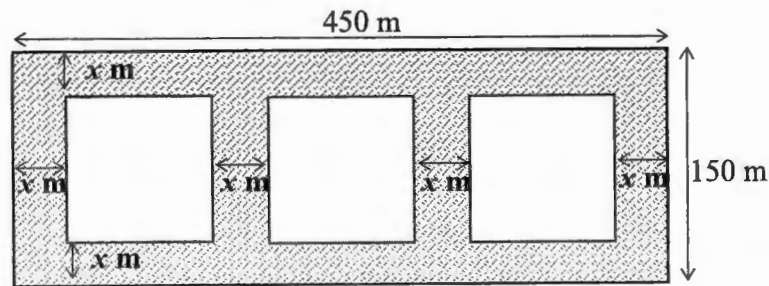
Answer [1]

- (ii) $\sin \angle ABC$.

Answer [2]

7

- 3 The layout of a residential estate can be represented in the diagram below. The unshaded areas are residential blocks, while shaded area is a continuous corridor x metres in width.



- (a) Show that the total area occupied by the residential blocks is given by the expression

$$8x^2 - 1500x + 67500.$$

Answer

[2]

- (b) The total area of the residential blocks is $48\,000\text{ m}^2$.

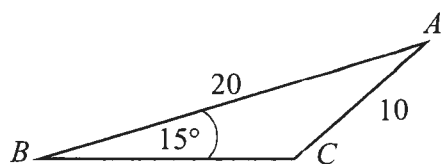
Using the expression in part (a), find x , the width of the green corridor, giving your answer correct to 1 decimal place.

Answer

Answer $x = \dots\dots\dots\text{ m}$ [3]

8

4



In triangle ABC , angle ABC is 15° , AB is 20 cm, and AC is 10 cm.

(a) Find angle ACB .

Answer Angle $ACB = \dots\dots\dots^\circ$ [2]

(b) Find angle BAC .

Answer Angle $BAC = \dots\dots\dots^\circ$ [1]

(c) Find the area of triangle ABC .

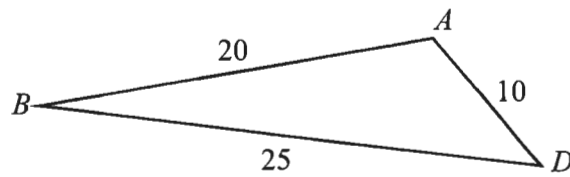
Answer $\dots\dots\dots \text{cm}^2$ [2]

9

- (d) Find the shortest distance from C to AB .

Answer cm [2]

(e)



The point C is now moved to point D , such that BD is 25 cm.

Show that angle BAD is approximately 108.2° .

Answer

[2]

- 5 (a) Complete the table of values for $y = -x^3 + 3x - 3$.

[2]

x	-3	-2	-1	0	1	2	3
y		-1	-5	-3		-5	-21

- (b) On the grid opposite, draw the graph of $y = -x^3 + 3x - 3$ for $-3 \leq x \leq 3$.

[3]

- (c) By drawing a tangent, find the gradient of the curve at $x = -1.5$.

Answer [2]

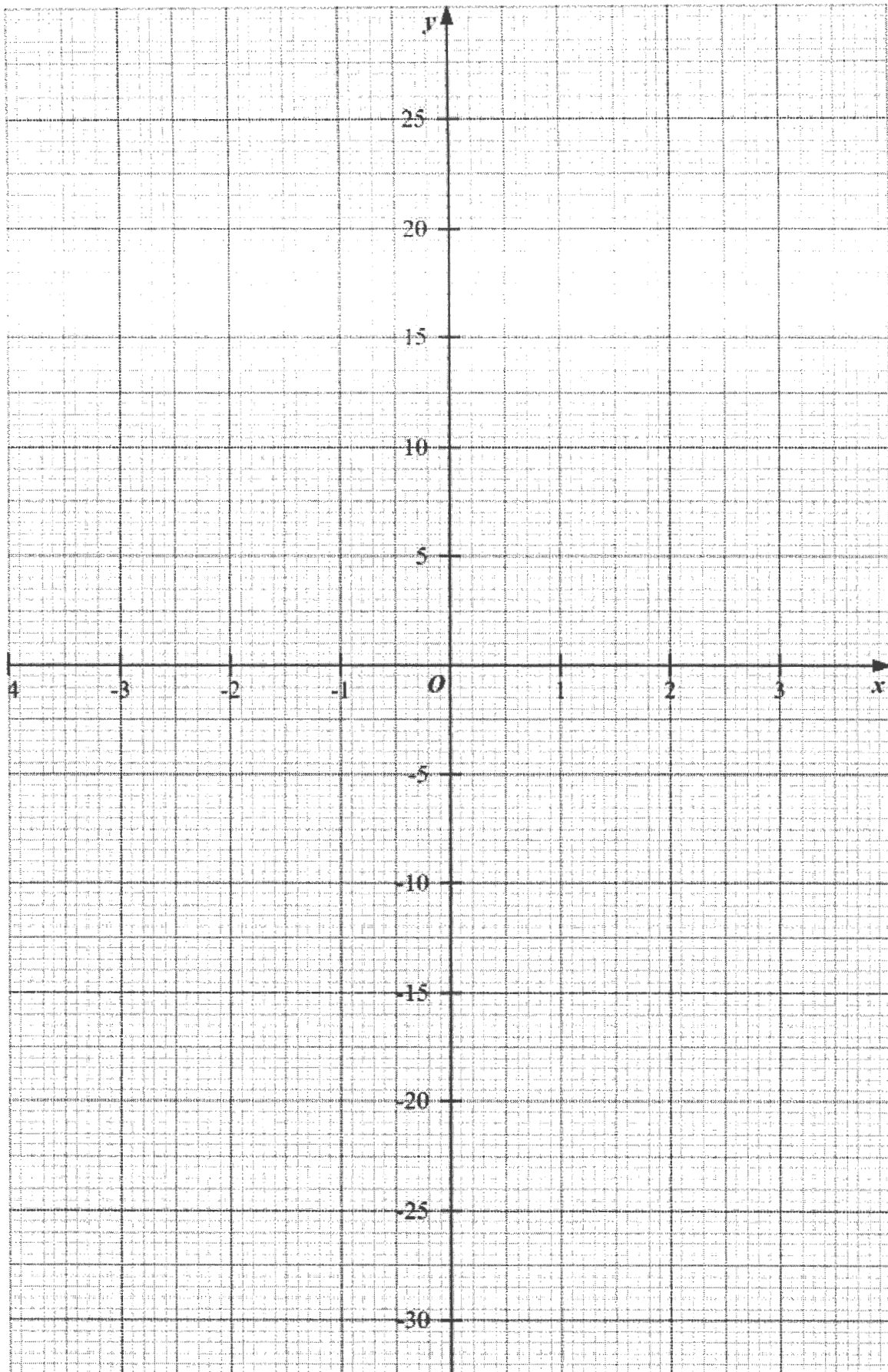
- (d) By drawing suitable lines on your graph, find the value(s) of

- (i) x when $x^3 = 3x - 3$,

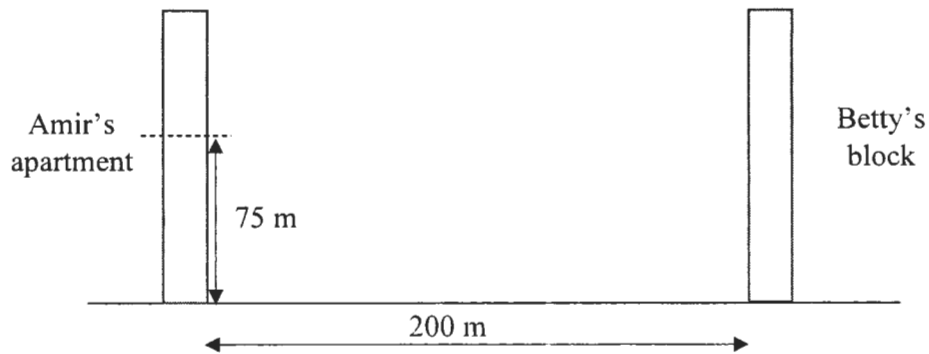
Answer $x =$ [1]

- (ii) k for which $-x^3 + 3x - 3 = k$ has exactly two solutions.

Answer $k =$ or [2]



6



Amir's apartment is 75 m above ground. Betty's apartment is in a neighbouring block that is 200 m away from Amir's block.

[Assumption: the thickness of the wall is negligible.]

- (a) Calculate the angle of depression from Amir's apartment to the base of Betty's block.

Answer ° [2]

- (b) The angle of elevation from Amir to Betty's apartment is 10° .

Calculate the height of Betty's apartment above the ground.

Answer m [3]

- 7 In a famous experiment, a biologist kept mice in a large tank. The mice had enough food and water, and were kept safe from diseases and predators.

The mice were allowed to breed, and researchers noted the number of mice. The table below shows the number of mice for the first 240 days of the experiment.

Number of days, d	0	60	120	180	240
Mouse population, P	S	200	400	800	1600

- (a) Predict the mouse population

- (i) S , at the start of the experiment,

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

- (ii) after 300 days.

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

- (b) In your own words, describe the growth of the mouse population.

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

- (c) The population growth can be represented by the formula

$$P = S(2)^{\frac{d}{k}}$$

where P is the mouse population,
 S is the mouse population at the start of the experiment,
 d is the number of days of the experiment.

Use the table of values to find the value of k .

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

- (d) When the mouse population hit 3600, the tank became overcrowded. The mouse population began to fall by 10% of the remaining population every day.

It took 28 days for the mouse population to fall from 3600 to below 200.

Jerry proposed that the declining population, $P_{declining}$, could be estimated using the formula

$$P_{declining} = 3600 \left(\frac{10}{100} \right)^n$$

where n is the number of days since the population started to decline.

- (i) Show that Jerry's formula is wrong.

Answer

.....
..... [1]

- (ii) Explain what Jerry should change to make his formula correct.

Answer

.....
..... [1]

15

- (e) In another experiment, 100 mice were kept in similar conditions, but only 1 pair of mice were allowed to breed.

The breeding pair of mice produced a litter of 6 mice every month. All new baby mice were also not allowed to breed. No mice died during the experiment.

Calculate the minimum number of months taken for the total number of mice to reach 180.

Answer months [1]

END OF PAPER

BLANK PAGE

Bartley Secondary School 2023 3E EOY P2 Answer scheme

1	(a)	$2x = 9x - 3$ $x = \frac{3}{7}$	M1 A1	or common denominator
	(b)	Working $x = -2, y = \frac{3}{4}$	M1 A2	
	(c)(i)	$\frac{5}{33}$	B1	
	(c)(ii)	$p^3 - 2 = \frac{r}{q}$ or equivalent $p = \sqrt[3]{\frac{r}{q} + 2}$	M1 A1	
	(c)(iii)	Accept $\sqrt[3]{2}$ or 1.26	B1	
2	(a)	AD is a straight line and $\angle CED = 90^\circ, \therefore \angle AEB = 90^\circ$ [R] $AB = CD = 17$ (given, H) $BE = DE = 8$ (given, S) $\therefore \triangle ABE \equiv \triangle CDE$ (RHS Congruency Test) If students use Pythagoras' Theorem to find remaining side, or trigo to find included angle, accept SSS, SAS, AAS or ASA accordingly, ensuring that the appropriate Congruency test is applied.	B1 B1	B1 for any 2 correct Correct test
	(b)(i)	$-\frac{8}{17}$	B1	
	(b)(ii)	$\frac{\sqrt{17^2 - 8^2}}{17}$ $= \frac{15}{17}$	M1 A1	for pythagoras
3	(a)	$(450 - 4x)(150 - 2x)$ $= 67500 - 1500x + 8x^2$	B2	1 for each bracket. Only B1 if both brackets given but in the wrong operation, e.g. subtraction or division instead of multiplication

	(b)	$67500 - 1500x + 8x^2 = 48000$ $2x^2 - 375x + 4875 = 0$ $x = \frac{375 \pm \sqrt{(-375)^2 - 4(2)(4875)}}{2(2)}$ $= 14.1 \text{ or } 173.4 \text{ (rej)}$	M1 M1 A1	Set up eqn Substitute correctly based on their eqn
4	(a)	$\frac{\sin ACB}{20} = \frac{\sin 15}{10}$ $ACB = 31.2^\circ \text{ (rej) or } 148.8^\circ$	M1 A1	
	(b)	16.2°	B1	Allow FT from 4a
	(c)	$\frac{1}{2}(20)(10)\sin 16.18$ $= 27.9(3sf)$	M1 A1	Substitution. Allow FT from 4b
	(d)	$\frac{1}{2}(20)h = 27.86$ $h = 2.79(3sf)$	M1 A1	Allow FT from 4c
	(e)	$\angle BAD = \cos^{-1} \left(\frac{20^2 + 10^2 - 25^2}{2(20)(10)} \right)$ $= 108.2^\circ \text{ (shown)}$	B1 B1	Correct formula, Correct substitution
5	(a)	15 and -1	B2	B1 each
	(b)	Correct plot Smooth line (see annex)	B2 B1	-1 for each wrongly plotted point
	(c)	Gradient = -3.75 [accept -4.5 to -2.5]	M1 A1	Set up with correct points
	(d)(i)	-2.1 [Accept -2.3 to -2.05, cannot accept -2]	B1	
	(d)(ii)	-1 or -5	B2	Max of 1 only if no lines drawn.
6	(a)	$\theta = \tan^{-1} \left(\frac{75}{200} \right)$ $= 20.6^\circ$	M1 A1	Or $\tan \theta = 75/200$. 1 point only for 69.4°

	(b)	$h = 200 \tan 10^\circ$ $H = 75 + h$ $= 110m(3sf)$	M1 M1 A1	Formula Addition
7	(a)(i)	100	B1	
	(a)(ii)	3200	B1	
	(a)	The population <u>doubles every 60 days</u>	B1	
	(c)	60	B1	
	(d)(i)	Correct substitution, working and conclusion should show <u>$P \ll 200$</u>	B1	
	(d)(ii)	Change 10/100 to <u>90/100 or 0.9</u> , or $\left(1 - \frac{10}{100}\right)^n$	B1	
	(e)	14 months (must round up to 14)	B1	

