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SPRINGFIELD SECONDARY SCHOOL
End-of-Year Examination 2023
Secondary 2 Normal Academic

STUDENT
NAME

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CLASS

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INDEX
NUMBER

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MATHEMATICS
Paper 1

4045/01
29 September 2023
1 hour 30 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your class, index 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, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.

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 brackets [] at the end of each question or part question.
The total number of marks for this paper is 50.

For Examiner's Use	
Total	/50

Do not turn over this question paper until you are told to do so.

[Turn over

Answer **all** the questions.

1 Consider the following numbers.

$$3 \qquad \sqrt{3} \qquad -4 \qquad \frac{1}{\sqrt{4}} \qquad \frac{1}{3}$$

(a) Write down the integer(s).

Answer [1]

(b) Write down the irrational number(s).

Answer [1]

2 Factorise completely

(a) $2y - 14x - 8$,

Answer [1]

(b) $x^2 - 7x - 8$.

Answer [2]

3 (a) Solve the inequality $-3x < -20$.

Answer [1]

(b) Hence, find the smallest prime number x that satisfies the inequality.

Answer $x =$ [1]

[Turn Over]

- 4 Solve the simultaneous equations.

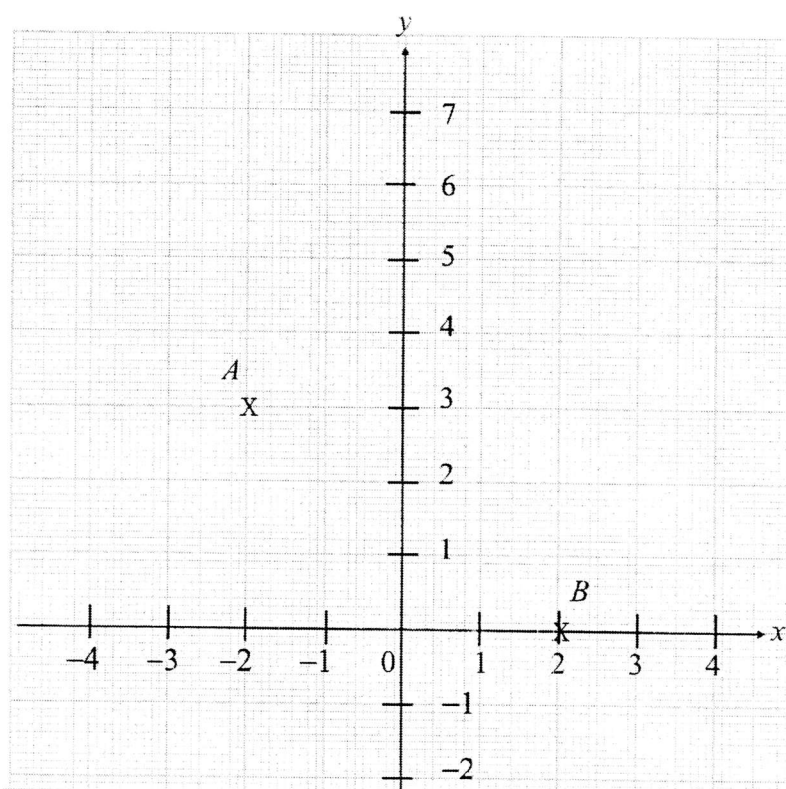
$$2x + 5y = 8$$

$$x + 3y = 6$$

Answer $x = \dots\dots\dots$

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

- 5 The grid shows two points A and B.



- (a) State the coordinates of the points A and B on the grid above.

Answer A (.....,)

B (.....,) [2]

- (b) A line is drawn from point A to point B.

Calculate the gradient of this line.

Answer [2]

- 6 The profit, \$ p , of a chicken rice stall is directly proportional to the number of plates sold, x .

(a) When $x = 8$, $p = 12$.

Find an equation connecting x and p .

Answer [2]

(b) Find the profit made from selling 25 plates of chicken rice.

Answer \$ [1]

- 7 A map of Singapore is drawn to a scale of 1: 25 000.

(a) Orchard Road is 2 km long.

Find the length of the road on the map in centimetres.

Answer cm [2]

(b) On the map, the area representing Jurong Lake Gardens is 14 cm^2 .

Calculate the actual area of Jurong Lake Gardens in square kilometres.

Answer km^2 [2]

- 8 The ages of a group of 7 students are as shown below.

9, 12, 13, 13, 14, 14, 16

- (a) Calculate the mean age of the students.

Answer years old [2]

- (b) Calculate the median age.

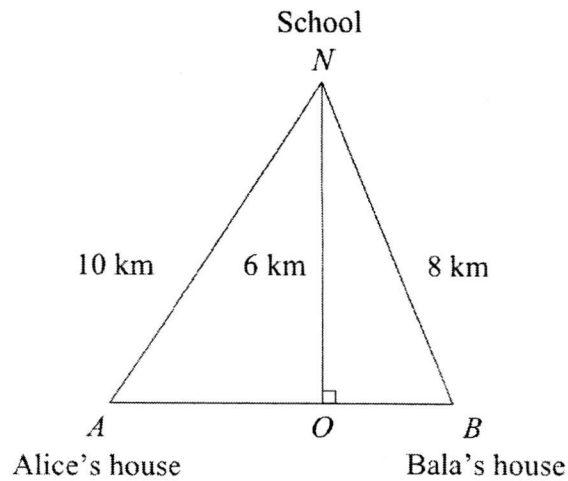
Answer years old [1]

- (c) A new student joins the group.
The new mean is 13.5.

What is the age of the new student?

Answer years old [2]

- 9 In the diagram, Alice takes the route AN while Bala takes the route BN to travel to school from their houses.



AOB is a straight line.

$AN = 10$ km, $BN = 8$ km and $ON = 6$ km.

Find the distance AOB .

Answer $AOB = \dots\dots\dots$ km [3]

10 Solve the following equations.

(a) $\frac{2}{5}x - 5 = \frac{3}{2}x$

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

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

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

11 A box contains 40 markers, of which some are red, some are blue and the rest are yellow. The probability of drawing a red marker is $\frac{3}{8}$ while the probability of drawing a blue marker is $\frac{2}{5}$.

(a) Find the number of yellow markers in the box.

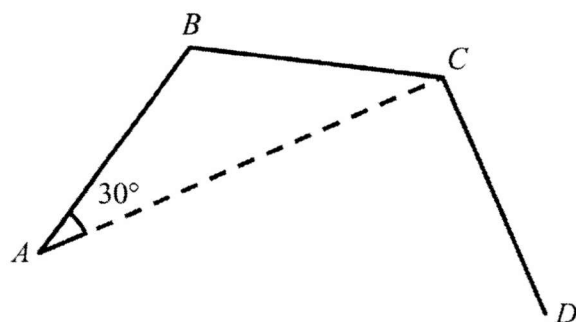
Answer $\dots\dots\dots$ [2]

(b) Find the probability of drawing a green marker from the box.

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

[Turn Over]

- 12 AB , BC and CD are three sides of a regular polygon.
Angle $BAC = 30^\circ$.



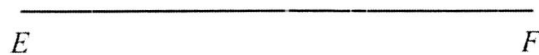
- (a) Calculate the exterior angle of the polygon.

Answer $^\circ$ [2]

- (b) Find the number of sides of the polygon.

Answer [2]

- 13 The triangle EFG has $FG = 8$ cm and angle $GEF = 116^\circ$.
The line EF has been drawn for you below.



- (a) Construct and label the triangle EFG . [2]
(b) Measure and write down the length of EG .

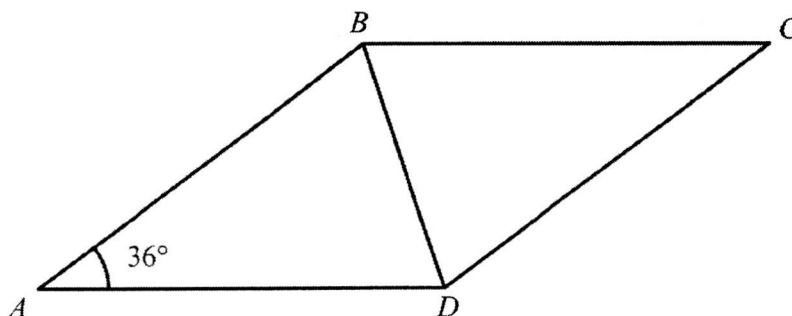
Answer cm [1]

- (c) Measure and write down angle EFG .

Answer $^\circ$ [1]

[Turn Over

- 14 The diagram shows a rhombus $ABCD$.
Angle DAB is 36° .



- (a) Stating your reasons clearly, find

- (i) angle BCD ,

Answer angle $BCD = \dots\dots\dots^\circ$ [1]

- (ii) angle DBC .

Answer angle $DBC = \dots\dots\dots^\circ$ [2]

- (b) Sherry claims that the rhombus is considered a parallelogram.

Do you agree? Explain your answer.

.....

.....

[2]

~END OF PAPER~



SPRINGFIELD SECONDARY SCHOOL
End-of-Year Examination 2023
Secondary 2 Normal Academic

STUDENT
NAME

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CLASS

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INDEX
NUMBER

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MATHEMATICS
Paper 2

4045/02
6 October 2023
1 hour 30 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your class, index 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, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.

Section A

Answer **all** questions.

Section B

Choose **one** 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 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 brackets [] at the end of each question or part question.
The total number of marks for this paper is 50.

For Examiner's Use	
Section A	/42
Section B	/8
Total	/50

Do not turn over this question paper until you are told to do so.

[Turn Over

Section A (42 marks)

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

1 (a) Simplify $\frac{4mn^2}{9} \div \frac{14m^2}{3}$.

Answer [2]

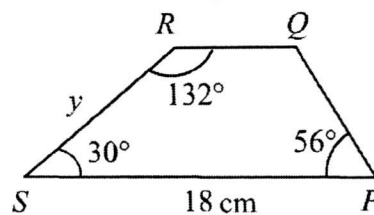
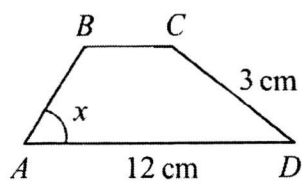
(b) Expand and simplify $2(x+3)-3(x+4)$.

Answer [2]

2 Simplify $\frac{3q^2-12q}{q^2-16}$.

Answer [3]

- 3 In the diagram, quadrilateral $ABCD$ is similar to quadrilateral $PQRS$.



Find

- (a) x ,

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

- (b) y .

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

- 4 The length, h cm, of a rectangle is inversely proportional to its breadth, b cm.
The length of the rectangle is 9 cm when its breadth is 7 cm.

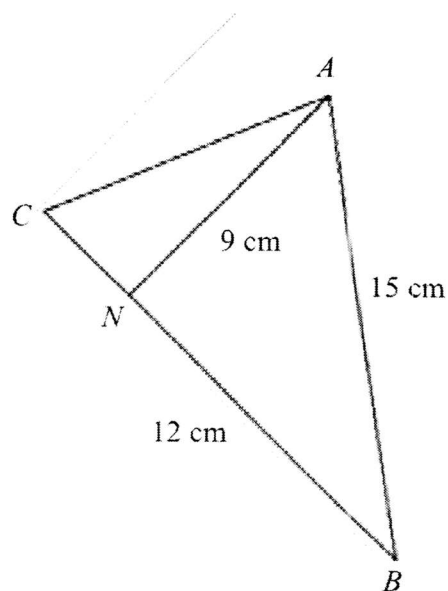
- (a) Find an equation connecting h and b in the form of $hb = k$, where k is a constant.

Answer $\dots\dots\dots$ [2]

- (b) Explain what the constant k represents.

$\dots\dots\dots$ [1]

- 5 ABC is a triangle and N is a point on BC .
 $AB = 15$ cm, $BN = 12$ cm and $AN = 9$ cm.



- (a) Show that ABN is a right-angled triangle.

Answer

[2]

- (b) The area of triangle ABC is 71.5 cm^2 .

Find BC .

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

6 A pen costs \$ x and a notebook costs \$4 more than the pen.

(a) Timothy bought 5 pens.

Write down an expression, in terms of x , for the amount that Timothy paid.

Answer [1]

(b) Umairah bought 3 notebooks.

Write down an expression, in terms of x , for the amount that Umairah paid.

Answer [1]

(c) Umairah spent \$9 more than Timothy.

Write down an equation in x to represent this information and solve it to find the amount that Umairah paid.

Answer \$ [3]

- 7 The test scores for a class of 40 students are shown in the table below.

Marks	Frequency
$0 \leq x < 10$	5
$10 \leq x < 20$	6
$20 \leq x < 30$	12
$30 \leq x < 40$	13
$40 \leq x < 50$	p

- (a) (i) Using the information given, show that $p = 4$.

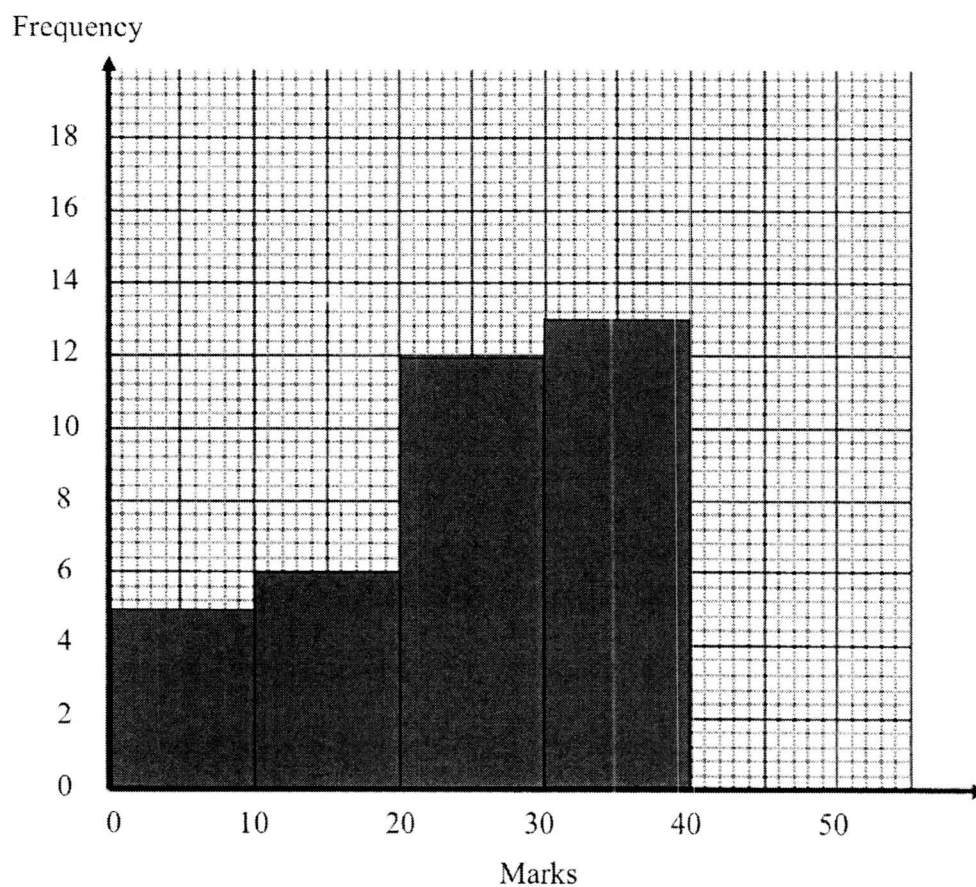
Answer

[1]

- (ii) A histogram is drawn to represent the information.

Complete the histogram.

[1]



[Turn Over

- (b) Calculate an **estimate** of the mean test score for the class.

Answer marks [3]

8 A polygon has 13 sides.

- (a) Find the sum of interior angles of the 13-sided polygon.

Answer° [2]

- (b) One of the interior angles is 72° .
The remaining angles are x° each.

Find the value of x .

Answer $x =$ [2]

- 9 A food supplier sells baked beans in cylindrical cans of dimensions as shown in Fig. 1.

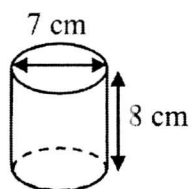


Fig. 1

The supplier receives an order to ship 216 cans of baked beans.

To ship the order, he needs to pack them in rectangular boxes.

The table below shows two box sizes that he is considering to purchase.

Box size	Dimensions (cm)	Maximum number of cans per box	Cost per box (\$)
Large	$21 \times 21 \times 17$	18	1.20
Medium	$14 \times 21 \times 9$	x	0.50

- (a) The baked bean cans are packed vertically as shown in Fig. 1.

By considering the dimensions of the medium box, show that $x = 6$.

Answer

[1]

- (b) An extra \$5 is charged for purchases of less than 15 boxes.
The supplier wants the cheapest option.

Which box size should he purchase? Show your working clearly.

Answer

[5]

[Turn Over]

- 10 The table of below shows the graph $y = 3x - 2$ for $-3 \leq x \leq 3$.

x	-3	-2	-1	2	3
y	-11	a	-5	4	7

- (a) Calculate the value of a .

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

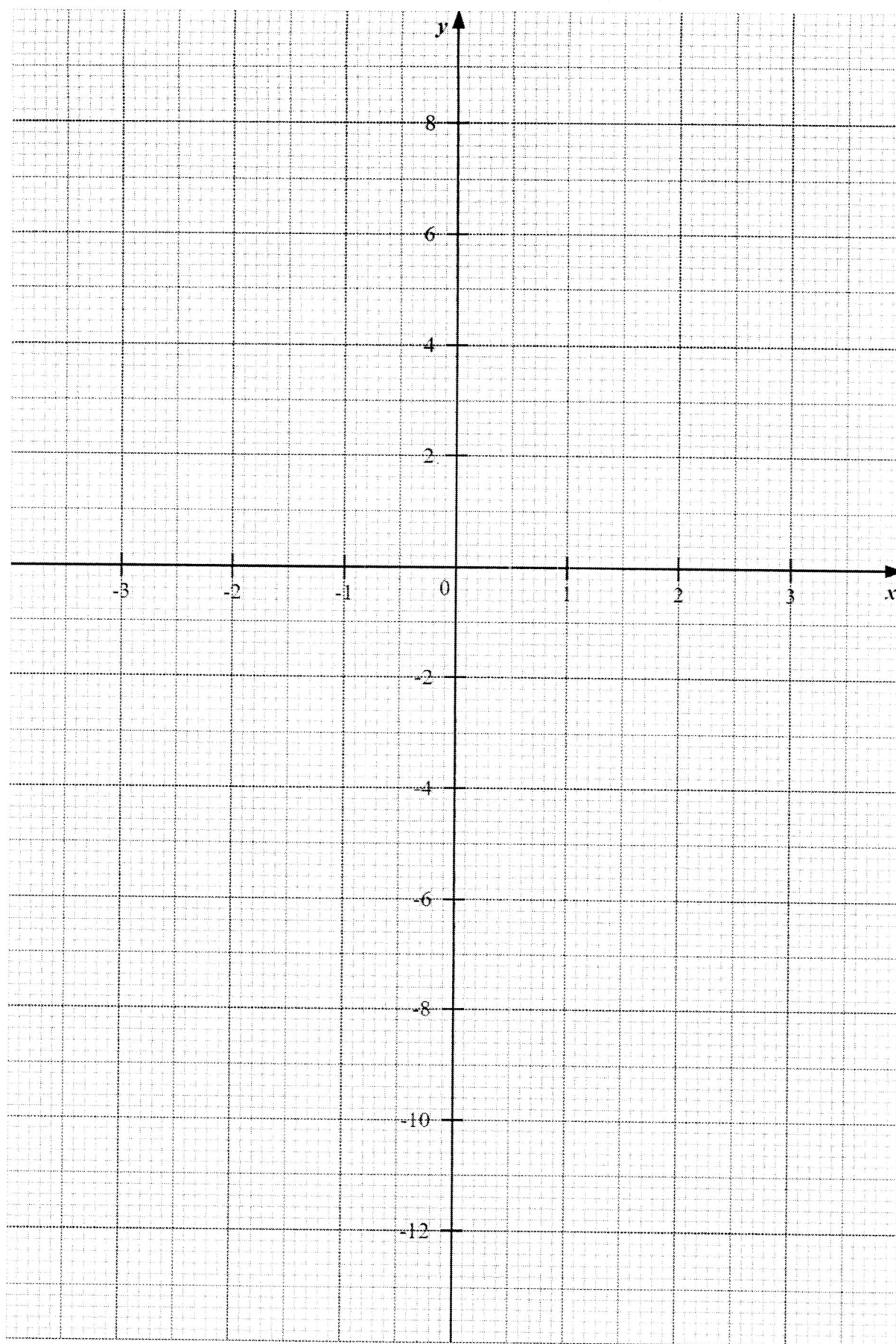
- (b) Using the grid on **page 11**, plot the graph $y = 3x - 2$ for $-3 \leq x \leq 3$. [2]

- (c) The point $C(p, 2.5)$ lies on the graph.

Mark and label point C on your graph. [1]

- (d) Write down the coordinates of the y-intercept.

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



Section B (8 marks)

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

- 11** The stem and leaf diagram shows the test scores for a class of students.

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

Key: 2 | 1 means 21 marks

- (a)** Find

- (i)** the total number of students who took the test,

Answer students [1]

- (ii)** the modal score,

Answer marks [1]

- (iii)** the median score.

Answer marks [1]

- (b)** The passing mark of the test is 40 marks.
A student is selected at random.

Find the probability of selecting a student who passed the test.
Give your answer as a fraction in the simplest form.

Answer [1]

- (c) Students who scored less than 45 marks are required to attend remedial.

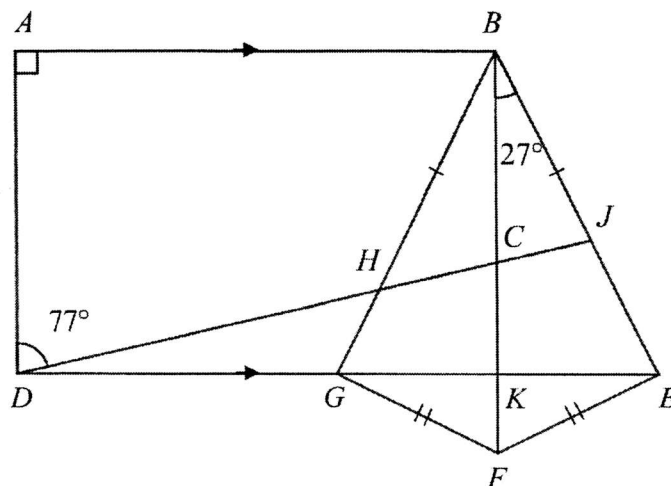
Find the percentage of students who need to attend remedial.

Answer % [2]

- (d) x students took the test on another day.
Their scores were included and the median score became 43.

Find the minimum value of x .

Answer $x =$ [2]



The diagram shows two quadrilaterals $ABGD$ and $BEFG$.
 Angle $ADH = 77^\circ$, angle $CBE = 27^\circ$ and angle DAB is a right angle.
 AB is parallel to DG .
 $BG = BE$ and $FG = FE$.
 $DHCJ$ and $DGKE$ are straight lines.

- (a) Write down the names of quadrilaterals $ABGD$ and $BEFG$.

Answer $ABGD$:

$BEFG$: [2]

- (b) Find angle BGE .

Answer Angle $BGE = \dots\dots\dots^\circ$ [3]

(c) Find angle ABJ .

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

(d) Find angle CJB .

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

~END OF PAPER~

Marking Scheme 2023 2NA Paper 1 EOY Exam

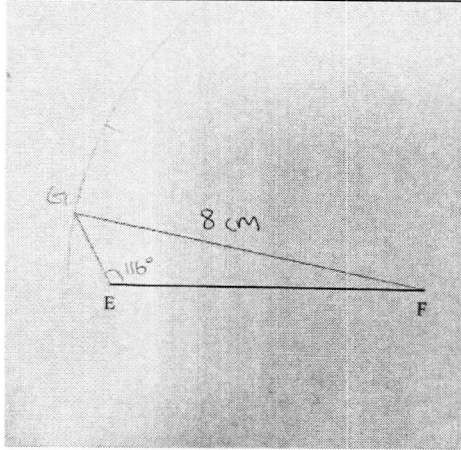
No.	Answer	Marks	Remarks	AOs
1a	3, -4	B1		AO1
1b	$\sqrt{3}$	B1		AO1
2a	$2y - 14x - 8 = 2(y - 7x - 4)$	B1		AO1
2b	$x^2 - 7x - 8 = (x - 8)(x + 1)$	M1 A1	Award 1 mark for correct use of multiplication frame. Award full 2 marks if full working is not shown.	AO1
3a	$-3x < -20$ $x > \frac{20}{3}$	B1	o.e.	AO1
3b	7	B1		AO2

4	$2x + 5y = 8 \quad (1)$ $x + 3y = 6 \quad (2)$ $2 \times (2):$ $2x + 6y = 12 \quad (3)$ $(3) - (1):$ $(2x + 6y) - (2x + 5y) = 12 - 8$ $2x + 6y - 2x - 5y = 4$ $y = 4$ Sub $y = 4$ into (2): $x + 3(4) = 6$ $x = -6$ $x = -6, y = 4$ <i>OR</i> $2x + 5y = 8 \quad (1)$ $x + 3y = 6 \quad (2)$ From (2): $x = 6 - 3y \quad (3)$ Sub (3) into (1): $2(6 - 3y) + 5y = 8$ $12 - 6y + 5y = 8$ $y = 4$ Sub $y = 4$ into (3): $x = 6 - 3(4)$ $x = -6$ $x = -6, y = 4$			
		M1	Award M1 for correct subtraction of one eqn from another.	
		M1		
		A1	Award M1 for substituting y or x into eqn.	AO1
		[M1]	Award M1 for correct substitution of one eqn into another.	
		[M1]		
		[A1]	Award M1 for substituting y or x into eqn.	
5a	$A(-2, 3)$ $B(2, 0)$	B1 B1		AO1

5b	$\text{Gradient} = \frac{3-0}{-2-2}$ $= -\frac{3}{4}$	M1 A1	Award M1 for correct substitution Accept rise over run method. Award full 2 marks if working not shown.	AO1
6a	$p = kx$, where is k a constant. When $x = 8$, $p = 12$ $12 = 8k$ $k = 1.5$ $p = 1.5x$	M1 A1	Award if student finds k correctly.	AO1
6b	$p = 1.5 \times 25$ $p = 37.5$	B1		AO2
7a	1 cm : 0.25 km 2 km : 8 cm Length on map is 8 cm. OR 1 : 25000 Length on map = $2 \text{ km} \div 25000$ $= 0.00008 \text{ km}$ $= 8 \text{ cm}$	M1 A1 [M1] [A1]		AO2

7b	$1 \text{ cm}^2 : 0.0625 \text{ km}^2$ $14 \text{ cm}^2 : 0.875 \text{ km}^2$ Actual area on map is 0.875 km^2 . OR Area scale: $1 : 625000000$ Actual area $= 14 \times 625000000$ $= 8750000000 \text{ cm}^2$ $= 0.875 \text{ km}^2$	M1 A1 [M1] [A1]		AO2
8a	Mean $= \frac{9+12+13+13+14+14+16}{7}$ $= 13$	M1 A1		AO1
8b	13	B1		AO1
8c	Let the age of new student be x . $13.5 = \frac{9+12+13+13+14+14+16+x}{8}$ $108 = 91 + x$ $x = 17$	M1 A1		AO2
9	$OA = \sqrt{10^2 - 6^2}$ $= 8$ $OB = \sqrt{8^2 - 6^2}$ $= \sqrt{28}$ $AOB = \sqrt{28} + 8$ $= 13.3 \text{ (3 s.f.)}$	M1 M1 A1	Award M1 for correct application of Pythagoras' theorem.	AO2
10a	$\frac{2}{5}x - 5 = \frac{3}{2}x$ $\frac{11}{10}x = -5$ $x = -\frac{50}{11}$	M1 A1	o.e.	AO1

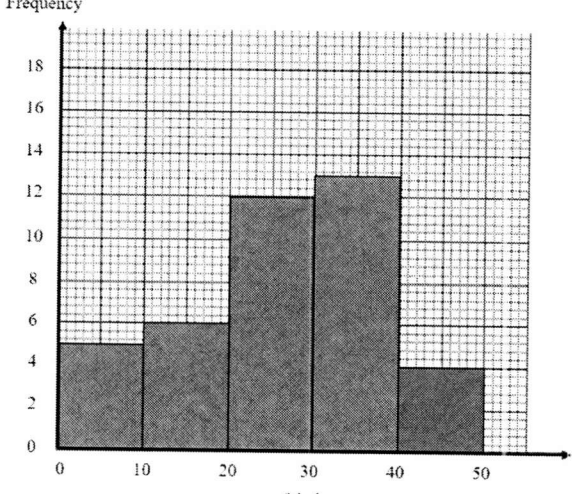
10b	$\frac{3(y-2)}{2} = \frac{y+4}{5}$ $\frac{3y-6}{2} = \frac{y+4}{5}$ $\frac{15y-30}{10} = \frac{2y+8}{10}$ $15y-30 = 2y+8$ $13y = 38$ $y = \frac{38}{13}$ <i>OR</i> $\frac{3(y-2)}{2} = \frac{y+4}{5}$ $\frac{15(y-2)}{2} = y+4$ $15(y-2) = 2(y+4)$ $15y-30 = 2y+8$ $y = \frac{38}{13}$	M1 M1 A1	o.e.	AO1
		[M1] [M1] [A1]	o.e.	
11a	No. of yellow markers $= 40 - \frac{3}{8}(40) - \frac{2}{5}(40)$ $= 40 - 15 - 16$ $= 9$	M1 A1		AO2
11b	0	B1		AO1

12a	$\hat{ABC} = 180^\circ - 30^\circ - 30^\circ$ $= 120^\circ$ Ext. angle = $180^\circ - 120^\circ$ $= 60^\circ$ <i>OR</i> Ext. angle = $30^\circ + 30^\circ$ (ext. angle of triangle) $= 60^\circ$	M1 A1 [M1] [A1]		AO2
12b	no. of sides = $\frac{360}{60}$ $= 6$	M1 A1	Award M1 only if student applies correct formula with incorrect 12a	AO1
13a	 Refer to diagram shown. B1 – correct length of GF with arc B1 – correct angle GEF		Deduct 1m if student does not draw correct shape with labels.	AO1
13b	1.7 ± 0.1 cm	B1		AO1
13c	$11^\circ \pm 1^\circ$	B1		AO1
14ai	$\hat{BCD} = 36^\circ$ (opp $\angle$ of rhombus)	A1	Overall minus 1m if wrong	AO2

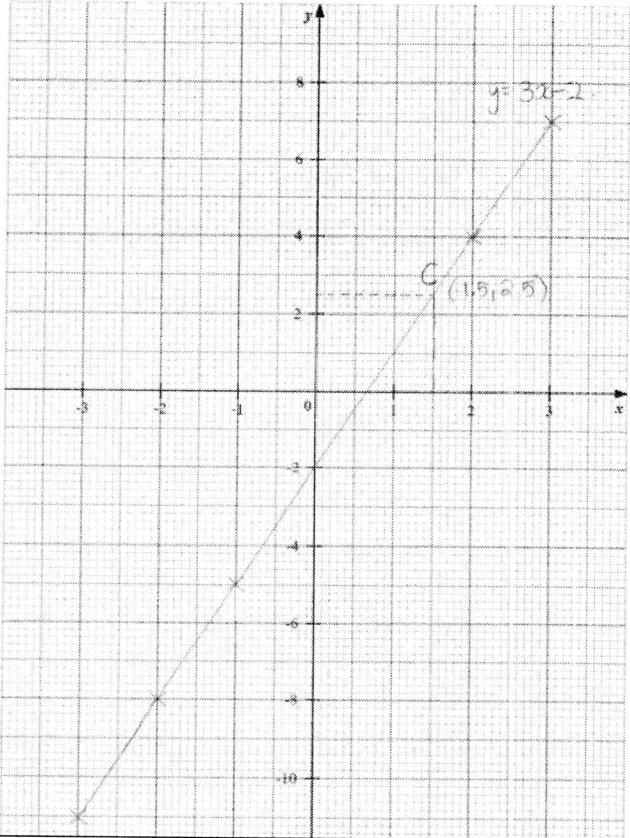
			reasoning given.	
14aii	$\hat{D}\hat{B}C = (180^\circ - 36^\circ) \div 2 \quad (\text{base } \angle \text{ of isos. triangle})$ $= 72^\circ$ <i>OR</i> $\hat{A}\hat{B}C = 180^\circ - 36^\circ \quad (\text{int. } \angle \text{ AD // BC})$ $= 144^\circ$ $\hat{D}\hat{B}C = 144^\circ \div 2 \quad (\text{rhombus diagonals bisect int. angles})$ $= 72^\circ$	M1 A1 [M1] [A1]		AO2
14b	Yes. Opposite sides of a rhombus are parallel. OR Both opposite angles are equal.	A1 M1	Award only if reasoning is correct.	AO3

Marking Scheme 2023 2NA Paper 2 EOY Exam

No.	Answer	Marks	Remarks	AOs
1a	$\frac{4mn^2}{9} \div \frac{14m^2}{3}$ $= \frac{4mn^2}{9} \times \frac{3}{14m^2}$ $= \frac{2n^2}{21m}$	M1 A1		AO1
1b	$2(x+3) - 3(x+4)$ $= 2x+6-3x-12$ $= -x-6$	M1 A1	o.e.	AO1
2	$\frac{3q^2-12q}{q^2-16}$ $= \frac{3q(q-4)}{q^2-16}$ $= \frac{3q(q-4)}{(q-4)(q+4)}$ $= \frac{3q}{q+4}$	M1 M1 A1		AO1
3a	$x = 56$	B1		AO1
3b	$\frac{AD}{PS} = \frac{CD}{RS}$ $\frac{12}{18} = \frac{3}{y}$ $y = 4.5$	M1 A1		AO2
4a	Sub $h = 9$, $b = 7$: $9 \times 7 = 63$ $k = 63$ $hb = 63$	M1 A1		AO1
4b	k is the area of the rectangle.	B1		AO3

5a	$9^2 + 12^2$ $= 225$ $= 15^2$ Since $AN^2 + BN^2 = AB^2$, triangle ABN is a right angled triangle.	M1 A1	Also accept "converse of Pythagoras' theorem"	AO3
5b	$71.5 = 0.5(9)(BC)$ $BC = 15.9$ (3 s.f.)	M1 A1		AO1
6a	$5x$	B1		AO2
6b	$3(x + 4)$	B1	o.e.	AO2
6c	$5x + 9 = 3x + 12$ $x = 1.5$ Hence, Umairah paid: $3(1.5) + 12$ $= \$16.50$	M1 M1 A1	Award 1m for correct eqn	AO2
7ai	$p = 40 - 5 - 6 - 12 - 13$ $= 4$	B1	Award 1m if working is shown	AO2
7aii	Frequency  Marks	B1		AO2
7b	Estimate = $\frac{5(5) + 6(15) + 12(25) + 13(35) + 4(45)}{40}$ $= 26.25$ marks	M1, M1 A1	Award M1 for mid values used Award M1 for correct formula used	AO2

8a	Sum of interior angles = $(13 - 2) \times 180^\circ$ = 1980°	M1 A1		AO1
8b	$1980 - 72 = 1908$ $x = \frac{1908}{12}$ = 159	M1 A1		AO2
9a	Maximum no. of cans = $2 \times 3 \times 1$ = 6	B1	Award if student shows both steps.	AO2
9b	No. of large boxes needed = $216 \div 18$ = 12 Total cost for 12 large boxes = $12(\$1.20) + \5 = \$19.40 No. of medium boxes needed = $216 \div 6$ = 36 Total cost for 36 medium boxes = $36(\$0.50)$ = \$18 He should use the medium boxes as they are cheaper.	M1 M1 M1 A1		AO3
10a	$a = -8$	B1		AO1
10b	Refer to graph attached. Plotting at least 2 points correctly. Straight line that passes through all plotted points.	B1 B1		AO1
10c	Refer to graph attached. Point C labelled correctly at (1.5, 2.5).	B1		AO1
10d	(0, -2)	B1		AO1

			Graph for Q10.	
Section B (2 choose 1)				
11ai	21 students	B1		AO1
11aii	57 marks	B1		AO1
11aiii	44 marks	B1		AO1
11bi	$\text{Probability} = \frac{14}{21}$ $= \frac{2}{3}$	B1		AO1
11bii	$\text{Percentage} = \frac{11}{21} \times 100$ $= 52.4\% (3 s.f.)$	M1 A1		AO2
11d	4	B2		AO2
12a	ABGD: Trapezium BEFG: Kite	B2		AO1

12b	$H\hat{B}C = C\hat{B}J$ (diagonals bisect kite) $= 27^\circ$ $B\hat{G}E = 180^\circ - 27^\circ - 90^\circ$ ($\angle$ sum of triangle) $= 63^\circ$	M1 M1 A1	Award if student subtracts 90°	AO2
12c	$A\hat{B}J = 90^\circ + 27^\circ$ $= 117^\circ$	B1		AO1
12d	$C\hat{J}B = 360^\circ - 77^\circ - 90^\circ - 117^\circ$ ($\angle$ sum of quad.) $= 76^\circ$ OR $H\hat{D}G = 90^\circ - 77^\circ$ $= 13^\circ$ $C\hat{J}B = 13^\circ + 63^\circ$ (ext. $\angle$ of triangle) $= 76^\circ$	M1 A1 [M1] [A1]		AO2

