Index Number:_____ SEC23/1a.23m

L-Università ta' Malta

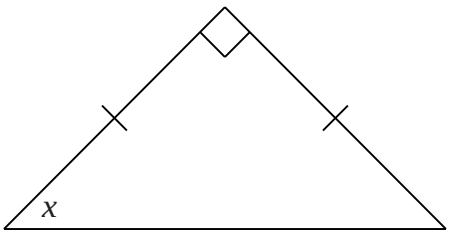
MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

SECONDARY EDUCATION CERTIFICATE LEVEL
2023 MAIN SESSION

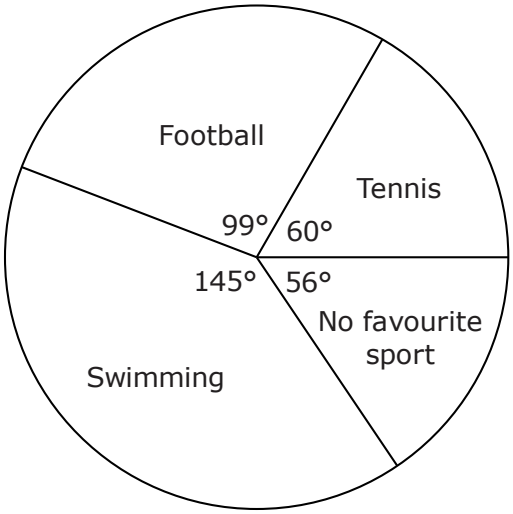
SUBJECT: **Mathematics** PAPER: I – Section A (Non-Calculator Section)
DATE: 6th May 2023 TIME: 20 minutes

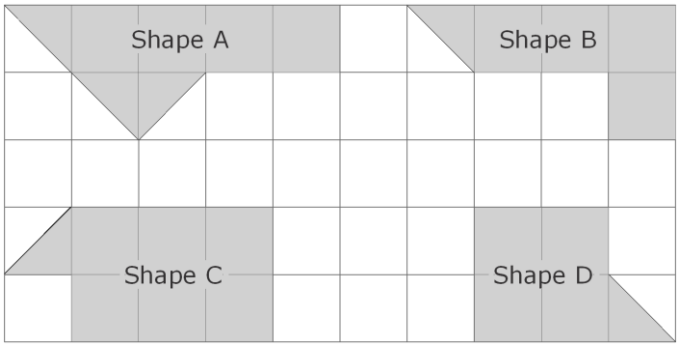
Attempt **ALL** questions.

Write your answers in the space available on the examination paper.
The use of calculators and protractors is **not** allowed.
It is not necessary to show your working.
This paper carries a total of 20 marks.

QUESTIONS AND ANSWERS **ALL QUESTIONS CARRY ONE MARK**	**SPACE FOR ROUGH WORK (IF NECESSARY)**
1 Arrange the four digits below to get the largest four digit number which is divisible by 5. 5, 2, 3, 8 **Ans** _____	
2 What is the size of the angle marked x in the figure below?  **Ans** _____	
3 A television programme starts at 10 minutes to ten. It lasts for 40 minutes. At what time does it finish? **Ans** _____	
4 Each exterior angle of a regular polygon is 40°. How many sides does this polygon have? **Ans** _____	

QUESTIONS AND ANSWERS ALL QUESTIONS CARRY ONE MARK		SPACE FOR ROUGH WORK (IF NECESSARY)
5	A tank contains 12 litres of oil. The oil is emptied into containers holding 300 ml of oil. How many containers are filled? **Ans** _____	
6	Express 200 grams as a percentage of 2 kilograms. **Ans** _____	
7	What value of x makes the following equation true? 10 million $= 10^x$ **Ans** _____	
8	Write down a prime number which is larger than 30 and smaller than 40. **Ans** _____	
9	James spends from 3:40pm to 4:35pm on his Maths homework and from 5:50pm till 6:25pm on his French homework. Find the total time he spends on his homework for these two subjects. **Ans** _____	
10	In the following expression, round each number to two significant figures, to work out an approximate answer for: $\frac{19.93 \times 14.94}{29.8}$ **Ans** _____	

QUESTIONS AND ANSWERS ALL QUESTIONS CARRY ONE MARK	**SPACE FOR ROUGH WORK (IF NECESSARY)**
11 The pie chart represents the results of a survey in which 240 teenagers were asked to name their favourite sport. How many voted for tennis?  **Ans** _____	
12 Put the following numbers in order, smallest first. $\frac{1}{4}$, 0.33 , 10% , $\frac{26}{100}$ **Ans** _____	
13 Which of the answers below is the value of $5^2 \times 5^{-2}$? (a) 25 (b) 0 (c) 1 (d) 10 **Ans** _____	
14 Simplify as much as possible: $\frac{2a + 2b}{b(a + b)}$ **Ans** _____	

QUESTIONS AND ANSWERS ALL QUESTIONS CARRY ONE MARK	SPACE FOR ROUGH WORK (IF NECESSARY)
15 $36 \times 18 = 648$ Use the calculation above to work out: 18×18 **Ans** _____	
16 Simplify $3(a + 2b + c) - 2(a - b + c)$ **Ans** _____	
17 Which of the following expressions is equal to $\frac{1}{3}$? 30%, 1^3, 3^{-1}, 1^{-3} **Ans** _____	
18 Find the total cost of 15 pens at €2.25 each and 15 diaries at €5.75 each. **Ans** _____	
19  Which **TWO** of the shapes shown in the figure above have the same area? **Ans** _____	
20 For this question use the figure shown in question 19. Which **TWO** of the shapes shown in the figure have the same perimeter? **Ans** _____	

Index Number:_____ SEC23/1b.23m

L-Università ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

SECONDARY EDUCATION CERTIFICATE LEVEL
2023 MAIN SESSION

SUBJECT:	**Mathematics**
PAPER NUMBER:	I – Section B (Calculator Section)
DATE:	6th May 2023
TIME:	1hr and 45 minutes

Answer **ALL** questions.

Write your answers in the space available on the examination paper.

Show clearly all the necessary steps, explanations and construction lines in your working.

Unless otherwise stated, diagrams are drawn to scale.

The use of non-programmable electronic calculators with statistical functions and of mathematical instruments is allowed.

Candidates are allowed to use transparencies for drawing transformations.

This paper carries a total of 80 marks.

For Office Use Only												
Sec A	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Total**

1 (a) Put the following numbers in increasing order:

0.4331, 0.55, 0.6, -2.7, -1.3

(2)

(b) Which number is greater, 4.21×10^5 or 1.32×10^6 and by how much?

(2)

(c) Work out:

(i) $\frac{4.1^3}{16}$, giving your answer to 2 decimal places.

(2)

(ii) $\sqrt{2.5 \times 10^{-7}}$, giving your answer in standard form.

(2)

(Total: 8 marks)

2 Find the cost of digging a cylindrical well 2 m in radius and 12 m deep at the rate of €120 per cubic metre.

(Total: 4 marks)

3 Sue sells 60 jam jars at a market.
The production cost for each jam jar is €1.50.

(a) She plans to sell her jam at €3.50 each jar. How many jars does she need to sell at this price to cover the production costs for all 60 jars?

(3)

(b) After selling 65% of her jam jars, Sue sold her remaining jars at €2 per jar.

(i) How much money did Sue make from the sales of the jam jars?

(3)

(ii) Calculate her profit overall as a percentage of her total cost.

(2)

(Total: 8 marks)

4 In a batch of 10 dozen eggs, 25 eggs are cracked.

(a) What is the ratio of the cracked eggs to the un-cracked eggs in its simplest form?

(2)

(b) If the ratio is the average for all the batches, how many cracked eggs would you expect in 4 dozen eggs?

(2)

(Total: 4 marks)

5

1 cm^3 of a water weighs 1 gram
1 litre = 1000 cm^3
1 tonne = 1000 kg

A water reservoir holds 40 tonnes of water when full.
What is the capacity of the reservoir in litres? Show your working.

(Total: 4 marks)

6 In the figure below, the points P, Q, R and S lie on the circumference of a circle centre O. QS is perpendicular to the diameter PR and $\angle QPR = 42°$.

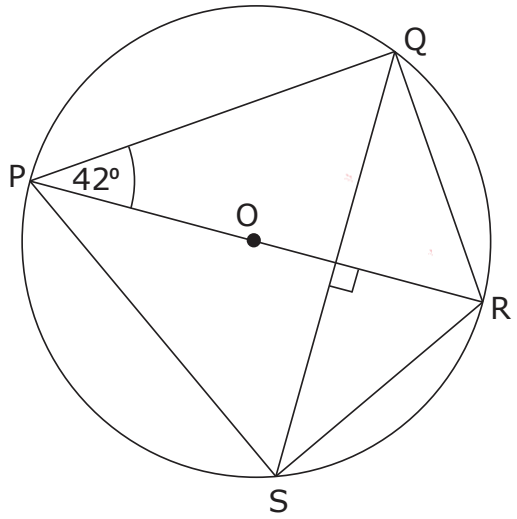


Diagram not drawn to scale

Determine the size of the following angles. Explain your reasoning.

(a) $\angle PQR$

(2)

(b) $\angle PRQ$

(2)

(c) $\angle QSR$

(2)

(d) $\angle RQS$

(2)

(e) $\angle QRS$

(2)

(Total: 10 marks)

7 The number of goals scored during the World Cup matches was as follows:

Number of goals	0	1	2	3	4	5	6	7	8	9
Number of matches	6	10	18	8	7	4	5	2	3	1

(a) How many matches were played?

(1)

(b) Find the mean number of goals scored per match.

(3)

(c) What is the range of goals scored?

(1)

(d) What is the mode of goals scored?

(1)

(e) Work out the median of the goals scored.

(2)

(Total: 8 marks)

8 The shape below is made of 2 equilateral triangles and a square.

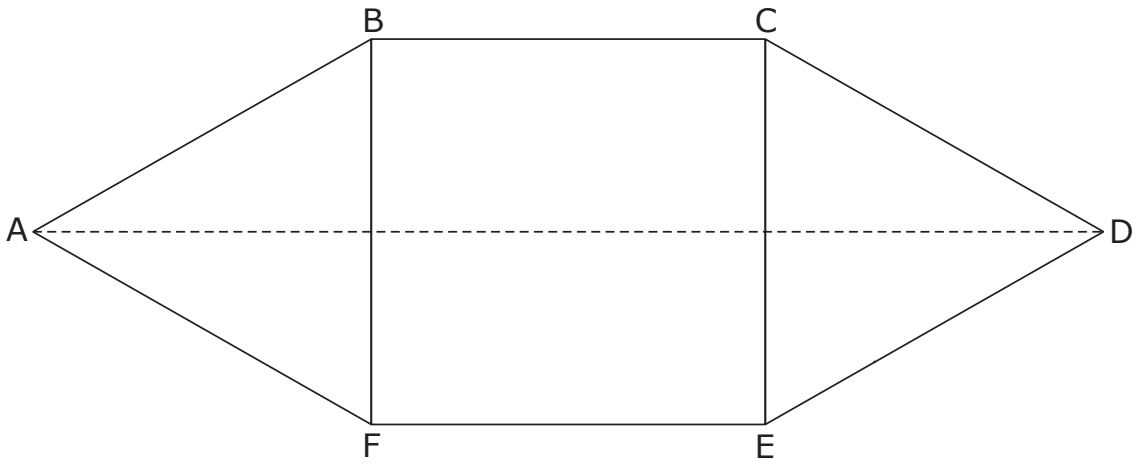


Diagram not drawn to scale

(a) Work out the size of ∠AFC.

(2)

(b) Prove that triangle AFC and triangle DCF are congruent.

(4)

(c) If AF is 5 cm, work out the length of AD.

(4)

(Total: 10 marks)

9 In the table below indicate, with a tick (✓), which of the given statements are always true, never true or sometimes true.

Give an example **only when statement is sometimes true**.

Statement	Always True	Never True	Sometimes True	Example if Sometimes True
The three angles of a triangle are equal.				
Two angles of a triangle are obtuse.				
A square is also a rectangle.				
A pentagon has all interior angles equal to 72°.				
A pentagon has all interior angles equal to 108°.				

(Total: 7 marks)

10 (a) The first five terms of a sequence are $-3, -1, 1, 3, 5, \ldots$

(i) Find the 7^{th} term of this sequence.

(1)

(ii) Find the n^{th} term of this sequence.

(2)

(iii) Find the 100^{th} term of this sequence.

(1)

(b) If $p = \frac{x}{2} - x^2$ and $q = x + x^2$, write the following expressions in terms of x. Give your answer in its simplest form.

(i) $p + q$

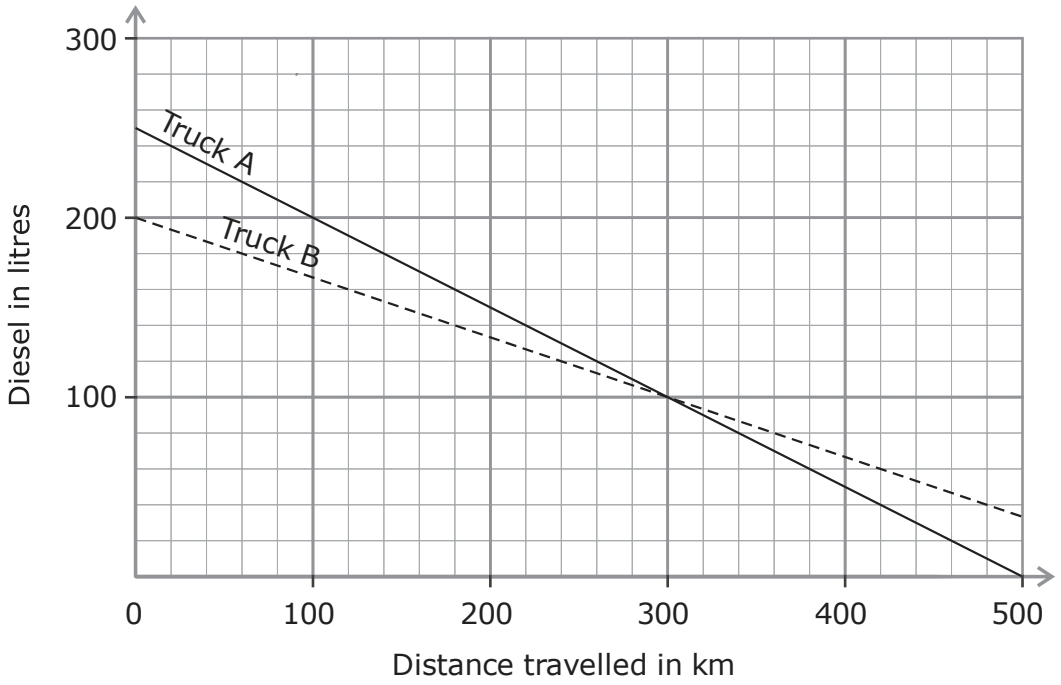
(2)

(ii) $2p - q$

(2)

(Total: 8 marks)

11 Two different delivery trucks work for the same company.
One morning the tanks of both trucks were completely filled with diesel.
The graph shows the distance travelled by each truck against the remaining diesel in each tank.



(a) How much diesel do the tanks of the two trucks hold when full?

Truck A _____ Truck B _____ (2)

(b) Give the coordinates of the point of intersection of the two lines shown in the graph.

(2)

(c) Find the gradient of the line representing the amount of diesel in Truck B.

(2)

(d) What does the gradient worked out in part (c) represent?

(1)

(e) Which truck uses up less diesel? Explain your reasoning.

(2)

(Total: 9 marks)

Blank Page

Blank Page

Index Number:_____ SEC23/2A.23m

L-Università ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

SECONDARY EDUCATION CERTIFICATE LEVEL
2023 MAIN SESSION

SUBJECT:	**Mathematics**
PAPER NUMBER:	IIA
DATE:	6th May 2023
TIME:	4:00 p.m. to 6:05 p.m.

Answer **ALL** questions.

Write your answers in the space available on the examination paper.

Show clearly all the necessary steps, explanations and construction lines in your working.

Unless otherwise stated, diagrams are drawn to scale.

The use of non-programmable electronic calculators with statistical functions and of mathematical instruments is allowed.

Candidates are allowed to use transparencies for drawing transformations.

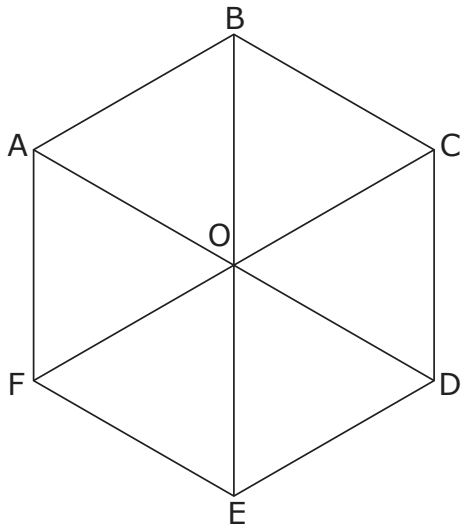
This paper carries a total of 100 marks.

Table of formulae

Area of triangle	$\frac{1}{2}ab\sin C$
Curved Surface Area of Right Circular Cone	πrl
Surface Area of a Sphere	$4\pi r^2$
Volume of a Pyramid / Right Circular Cone	$\frac{1}{3}$ base area × perpendicular height
Volume of a Sphere	$\frac{4}{3}\pi r^3$
Solutions of the equation $ax^2 + bx + c = 0$	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Sine Formula	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
Cosine Formula	$a^2 = b^2 + c^2 - 2bc\cos A$

For Office Use Only											
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Total**

1 ABCDEF is a regular **hexagon**. The diagonals AD, BE and CF meet at O.



Fill in the blank spaces:

(a) The quadrilateral ABOF is a special type of quadrilateral called a _____ .

(b) One shape which is congruent to the ABOF is _____.

(c) The number of other shapes inside ABCDEF which are congruent to ABOF is _____.

(d) A regular hexagon has _____ lines of symmetry.

(e) A regular hexagon has rotational symmetry of order _____ .

(Total: 5 marks)

2 (a) Express as a single fraction in simplest form:

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

(5)

2 (b) Show that: $(p-q)(p+2q)+q(p+3q)=(p+q)^2$

(5)

(Total: 10 marks)

3 The diagram shows a solid shape made up of a cone and a hemisphere.
The radius of the hemisphere and the cone is x cm.
The perpendicular height of the cone is $2x$.

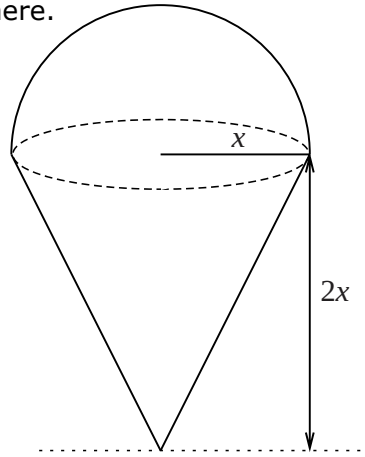


Diagram not drawn to scale

(a) Let V be the total volume of the shape.
Write down an expression for V in terms of x.

(3)

(b) Rearrange your formula in part (a) to make x the subject of the formula.

(4)

(c) Find the value of x when V = 500 cm^3. Give your answer to the nearest mm.

(2)

(Total: 9 marks)

4 An art dealer values his antiques every five years.
The value of one painting increased by 80% every five years from 2000.
The value in 2005 was €6 300.

(a) Calculate the exact value of the painting in:
(i) 2020;

(3)

(ii) 2000.

(3)

(b) The value of the painting continues to increase by 80% every five years until 2020.

The dealer believes that the value of the painting will decrease by 30% in the next 5 years due to economic problems.

What will the value of the painting be in 2025?

(2)

(Total: 8 marks)

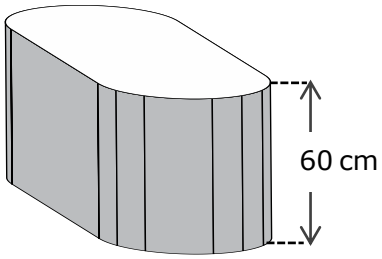
5 (a) The roof of a school hall measures 20 m by 8 m.
One night, 1 cm of rain fell on this roof. What volume of water fell on this roof?

(2)

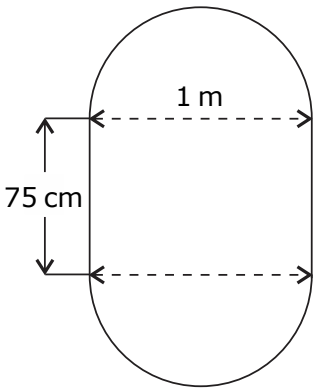
(b) This rainwater was collected in a tank of uniform cross-section of height 60 cm.

The tank was empty before it started raining.

The cross-section of the tank is a composite shape made up of a rectangle and two semicircles of diameter 1 m as shown below.



Water Tank



Cross-section

Diagram not drawn to scale

Was the tank big enough to hold all the rainwater? Explain your reasoning.

(5)

(Total: 7 marks)

6 (a) Sarah is y years old and Julia is 5 years younger than Sarah. The sum of their ages is less than 21 years.

(i) Use this information to write down an inequality in terms of y.

(2)

(ii) Work out the oldest age that Sarah can be. Give your answer as a whole number of years.

(3)

(b) Solve the simultaneous equations:

$$x - 5y = 2$$
$$x^2 - xy - 20y^2 = 40$$

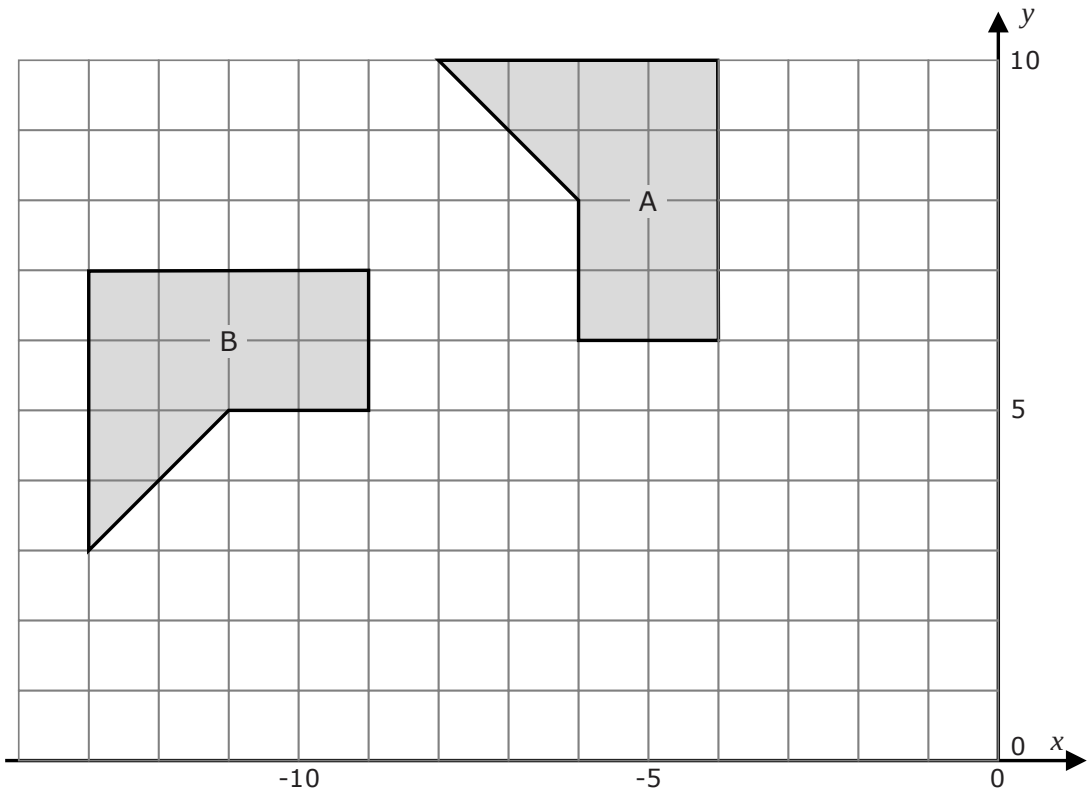
(4)

6 (c) y is inversely proportional to x. When $x = 20$, $y = 50$.
What is the value of y when $x = 10$?

(3)

(Total: 12 marks)

7



(a) Enlarge shape A by a scale factor of ½ about point 0,0. Label your image as shape C.

(2)

(b) Shape B is a rotation by 90° of shape A. Determine the centre of rotation.

(2)

(c) Which **TWO** shapes in your diagram are congruent?

(1)

(d) Name **TWO** shapes in your diagram that are similar but not congruent.

(1)

(Total: 6 marks)

8 The table below is a cumulative frequency table of the marks obtained by a number of students on an examination.

(a) Fill in the missing values in the grey cells.

Marks	Frequency	Cumulative frequency
1 – 10	3	3
11 – 20	5	
21 – 30	6	
31 – 40		23
41 – 50	10	
51 – 60	16	49
61 – 70		62
71 – 80	9	
81 – 90		76
91 – 100	4	

(3)

(b) How many students sat for the exam?

(1)

(c) Use the graph paper on the next page to represent the above data in a cumulative frequency diagram.

(5)

(d) Use your graph to estimate:

(i) the median mark;

(1)

(ii) the lower quartile;

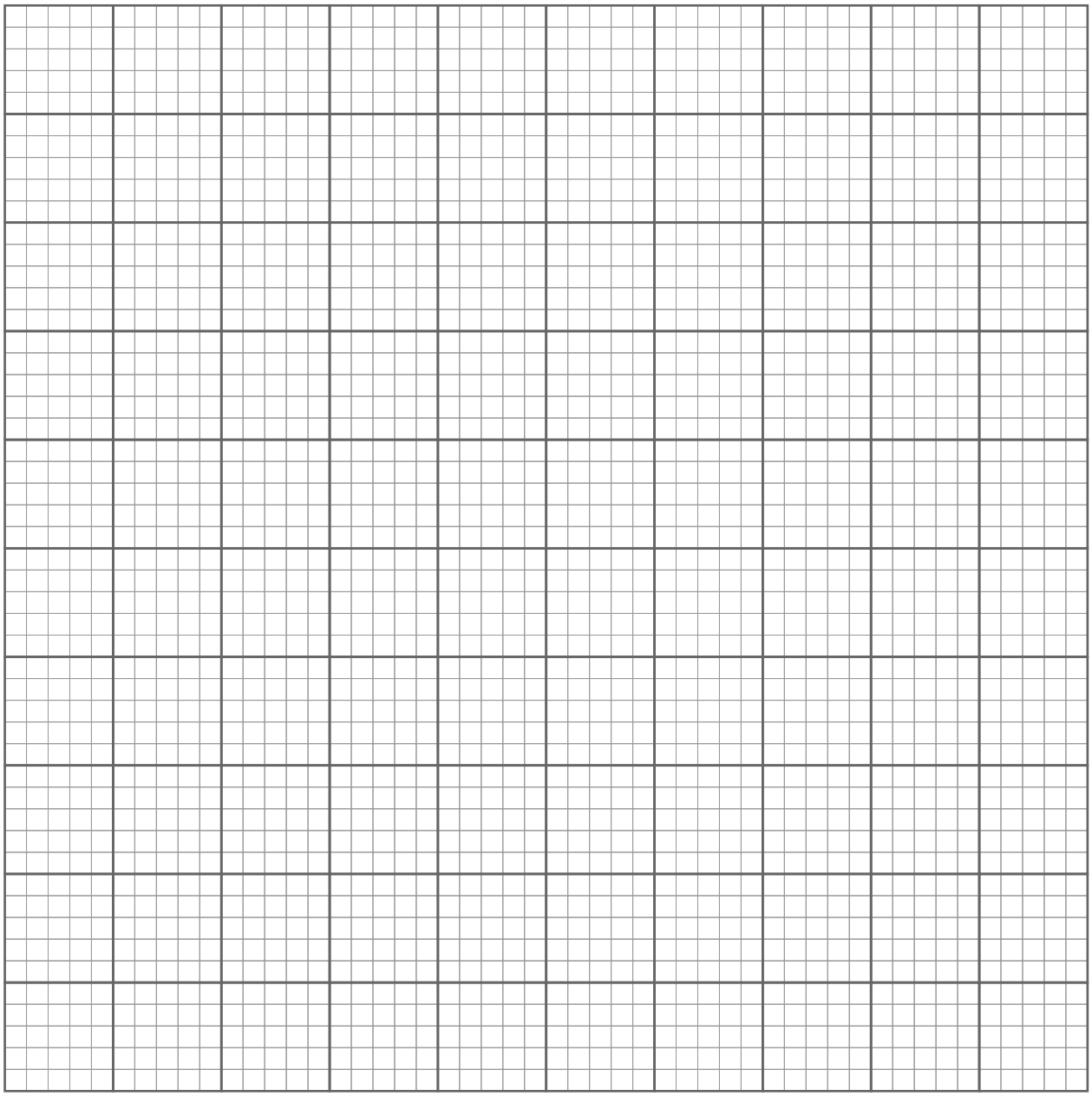
(1)

(iii) the interquartile range;

(1)

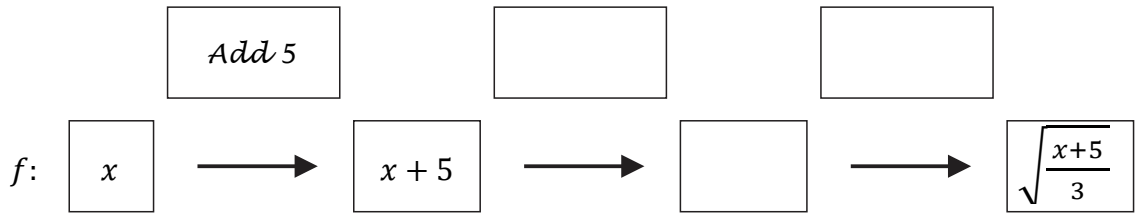
(iv) the probability that a randomly selected student obtained a mark less than 75.

(2)

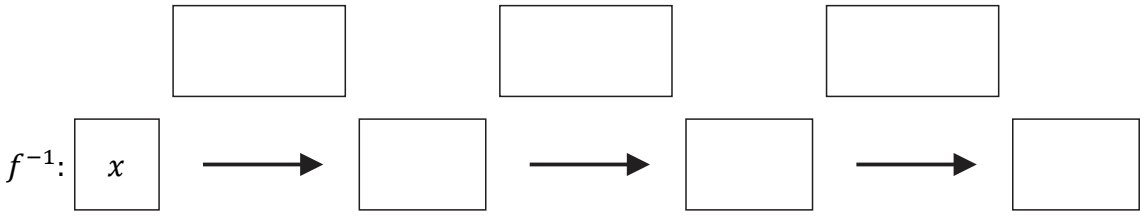


(Total: 14 marks)

9 (a) Complete the function machine for $f(x) = \sqrt{\frac{x+5}{3}}$ and for $f^{-1}(x)$, the inverse function of f.



(2)



(3)

(b) Determine the value of $f^{-1}(4)$.

(1)

(c) Solve the equation:

$$\frac{x+5}{3} = x^2 - 4$$

giving your answers correct to 2 decimal places.

(4)

(Total: 10 marks)

10 (a) The graph of $y = \frac{5}{x}$ is shown below. Plot the line $y = 2x - 3$ on the same axes.

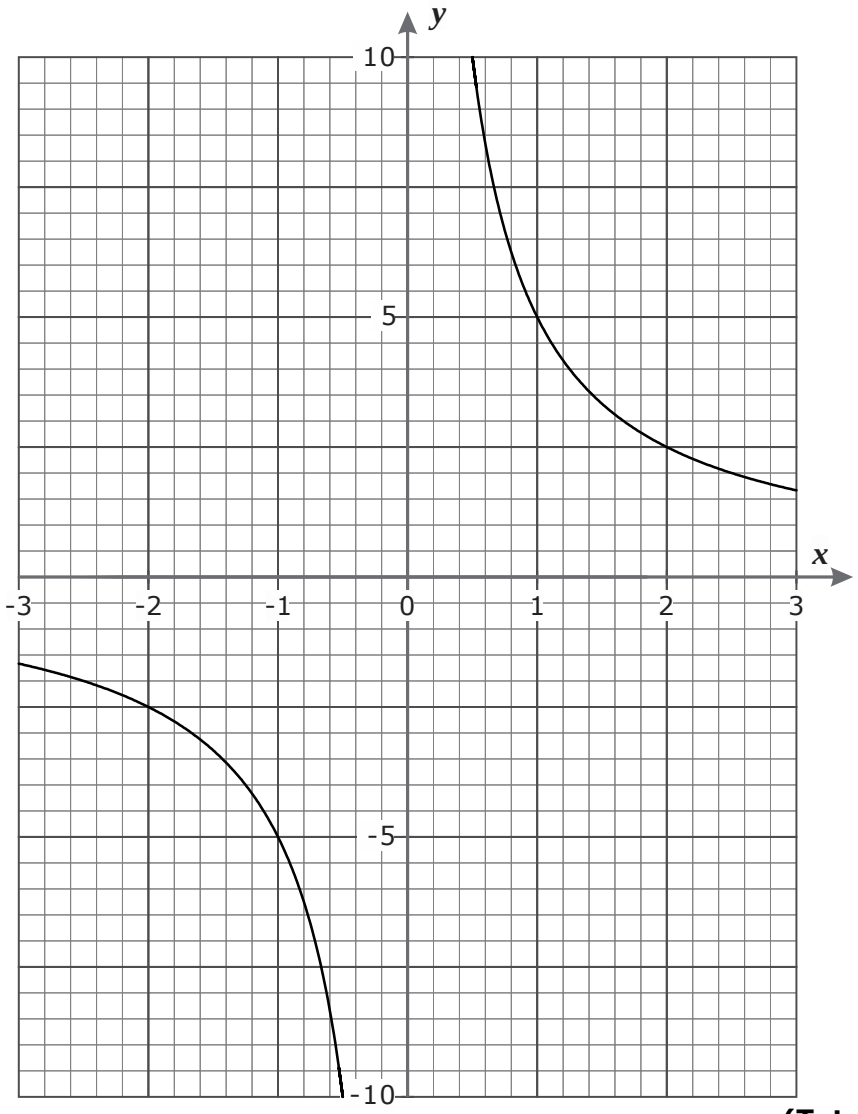
(2)

(b) Show that the equation $2x^2 - 3x - 5 = 0$ is satisfied at the points of intersection of the two graphs. Hence, use your graph to solve this equation.

(3)

(c) Solve the equation $2x^2 - 3x - 5 = 0$ by factorising the trinomial.

(2)



(Total: 7 marks)

11 Three buildings located at Rabat, Qormi and Zabbar are denoted by R, Q and Z respectively.

The sketch shows the path of a helicopter flight. The helicopter leaves R and travels to Q which is 8.3 km away.

At Q it changes direction and flies a distance of 9 km to Z.

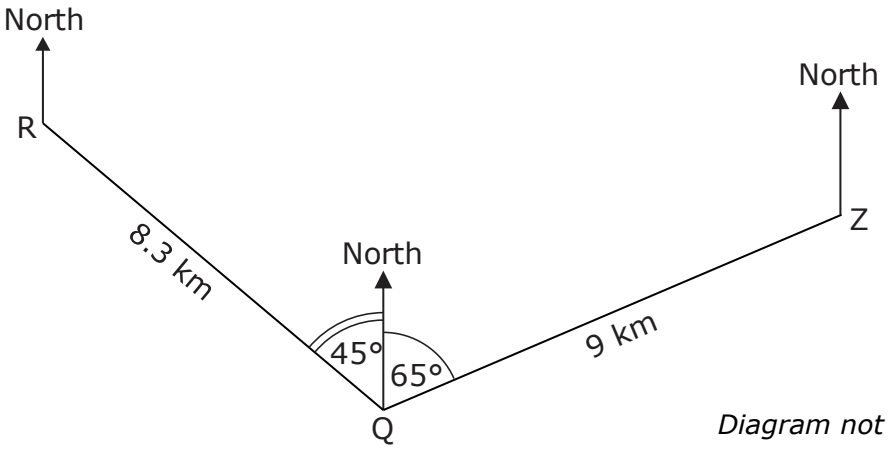


Diagram not drawn to scale

(a) Using the angles given in the figure, determine:

(i) the bearing of Q from R;

(ii) the bearing of R from Q.

(2)

(b) Using the cosine formula, work out the distance RZ.

(4)

(c) Work out the size of $\angle RZQ$.

(4)

(d) Determine the bearing of R from Z.

(2)

(Total: 12 marks)

Index Number:_____ SEC23/2B.23m

L-Università ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

SECONDARY EDUCATION CERTIFICATE LEVEL
2023 MAIN SESSION

SUBJECT:	**Mathematics**
PAPER NUMBER:	IIB
DATE:	6th May 2023
TIME:	4:00 p.m. to 6:05 p.m.

Answer **ALL** questions.

Write your answers in the space available on the examination paper.

Show clearly all the necessary steps, explanations and construction lines in your working.

Unless otherwise stated, diagrams are drawn to scale.

The use of non-programmable electronic calculators with statistical functions and of mathematical instruments is allowed.

Candidates are allowed to use transparencies for drawing transformations.

This paper carries a total of 100 marks.

For Office Use Only

Question No	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Mark										
Question No	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Mark										

Total Mark

1 The first five terms of a sequence are:

$$0, -0.5, -1, -1.5, -2, \ldots$$

(a) What is the next term of this sequence?

(1)

(b) What is the 10^{th} term of this sequence?

(2)

(Total: 3 marks)

2 A carton of orange juice holds $2\frac{1}{2}$ litres of juice. A glass holds $\frac{1}{8}$ of a litre.

How many glasses can be filled from one carton of orange juice?

(Total: 3 marks)

3 The pictogram below shows the number of patients admitted to a hospital emergency department over a three-day weekend.

Day	Number of Patients Admitted to the Emergency Department
Friday	
Saturday	
Sunday	

(a) On Sunday 26 patients were admitted to the emergency department.

Find the value of 

(2)

(b) How many patients were admitted to the emergency department over these three days?

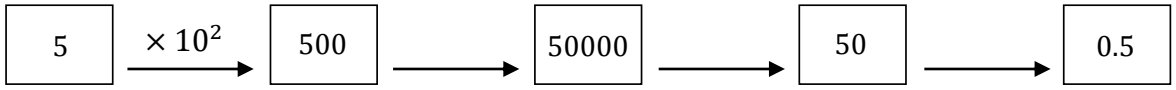
(3)

(c) The following week there was an increase of 15% in the number of patients admitted from Friday to Sunday. Find the number of patients admitted in the following three-day weekend.

(2)

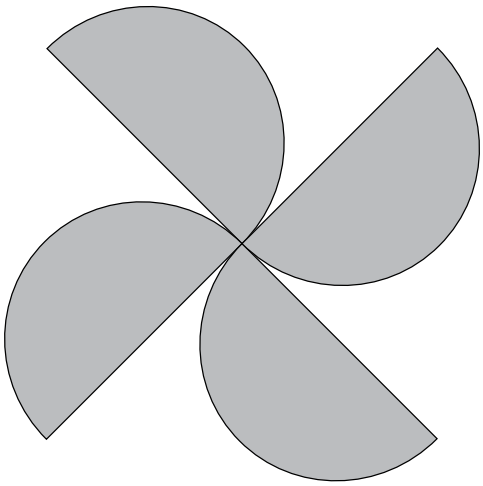
(Total: 7 marks)

4 Each stage of this calculation chain involves a multiplication or division by a power of 10.
Complete the calculation chain **by writing above the arrows.**
The first stage is already completed.



(Total: 3 marks)

5 The shape below is made up of 4 identical semicircles with diameter 7 cm.



(a) What is the order of rotational symmetry of the shape? _____ (1)

(b) Does the shape have lines of reflective symmetry? _____ (1)

(c) Work out the area of the shape in cm^2 correct to 1 decimal place.

(4)

(Total: 6 marks)

6 Use ruler and compasses only for your constructions in this question.

(a) On the line below:

(i) At P, construct ∠QPS of size 60° so that PS is 11 cm long; (2)

(ii) At Q, construct ∠AQR of size 60° so that QR is 11 cm long. (2)

(b) Join the necessary points to close the quadrilateral PQRS.

What is this type of quadrilateral called? _____ (1)

(c) Construct the perpendicular bisector of PQ. Label the points where this bisector meets the lines PQ and PS as X and Y respectively.

Measure XY _____ (4)

(Total: 9 marks)

7 The diagram represents a room in the shape of a rectangle ABCD.

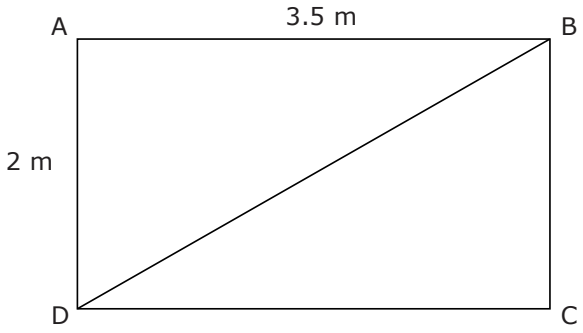


Diagram not drawn to scale

(a) Work out the length of the diagonal BD.

(2)

(b) Work out the size of ∠BDC.

(2)

(Total: 4 marks)

8 An airplane leaves Nairobi airport at 23:30 and arrives at London Heathrow airport the next day at 05:15. The time in Nairobi is 3 hours ahead of the time in London.

(a) How long did the flight take?

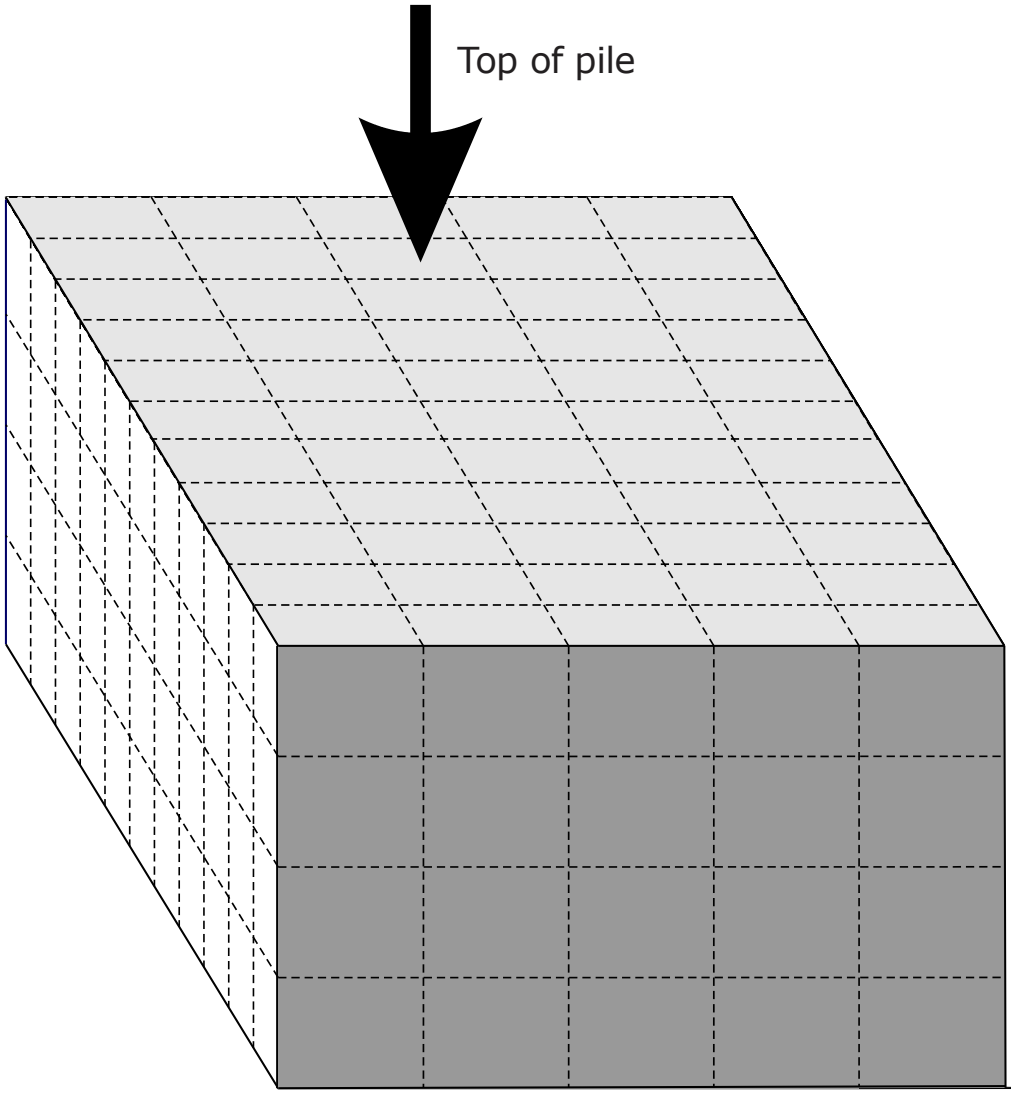
(3)

(b) The distance between Nairobi and London is 6819 km.
Find the average speed of the plane for the journey from Nairobi to London in km/h.

(3)

(Total: 6 marks)

9

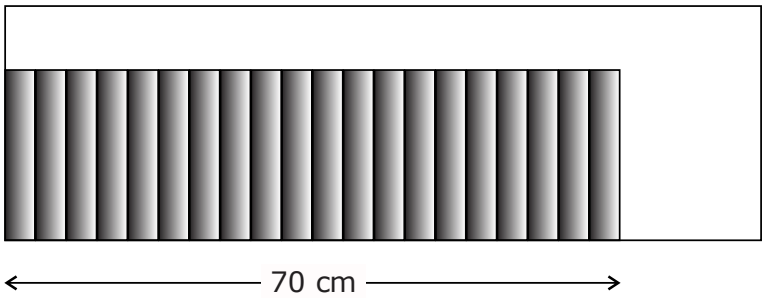


A number of identical boxes are stacked in a pile as shown in the diagram above. There are no gaps inside the pile.

How many boxes are there in the pile?

(Total: 4 marks)

10



Nathan has 20 identical books on a shelf. The books take up 70 cm of shelf length. Nathan removes 7 books. What shelf length do the remaining books take up?

(Total: 4 marks)

11 Grandma shares a sum of money between Ann, Ben and Chris in the ratio 3:5:7 respectively. Ann gets €120.

What was the total sum of money grandma shared between her three grandchildren?

(Total: 3 marks)

12 Simplify:

(a) $\frac{3a^2+2ab}{2ab}$

(2)

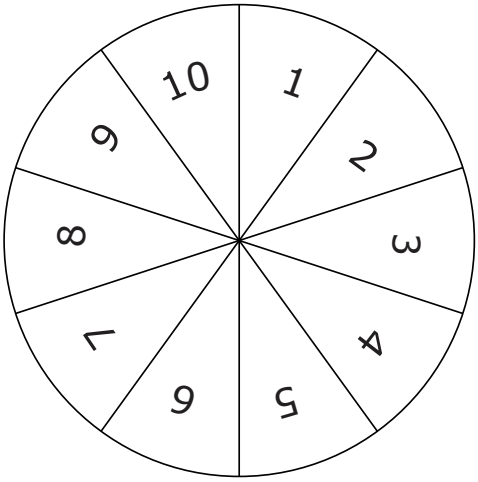
(b) $\sqrt{x(x-p)+px}$

(3)

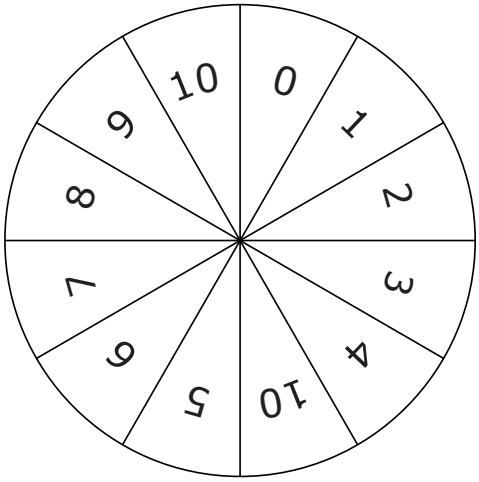
(Total: 5 marks)

13 The two spinners shown below were used at a village fair.

Spinner A



Spinner B



If each of the spinners is spun once:

(a) What is the probability that spinner A lands on 0?

(1)

(b) What is the probability that spinner B lands on 0?

(1)

(c) What is the probability that spinner A lands on 10?

(1)

(d) What is the probability that spinner B lands on 10?

(1)

(e) Which spinner is more likely to land on 10, spinner A or spinner B?
Explain your reasoning.

(2)

(Total: 6 marks)

14

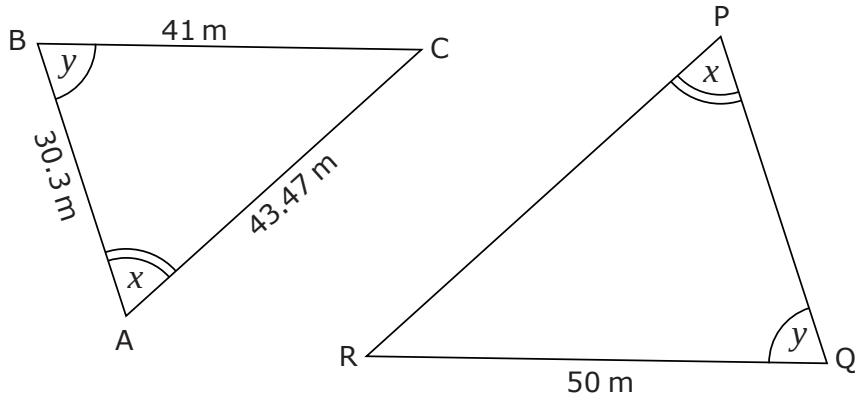


Diagram not drawn to scale

In the figure above, triangle ABC is similar to triangle PQR.
Using the measures given in the figure, work out the length of PR.

(Total: 4 marks)

15 Make x subject of the formulae:

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

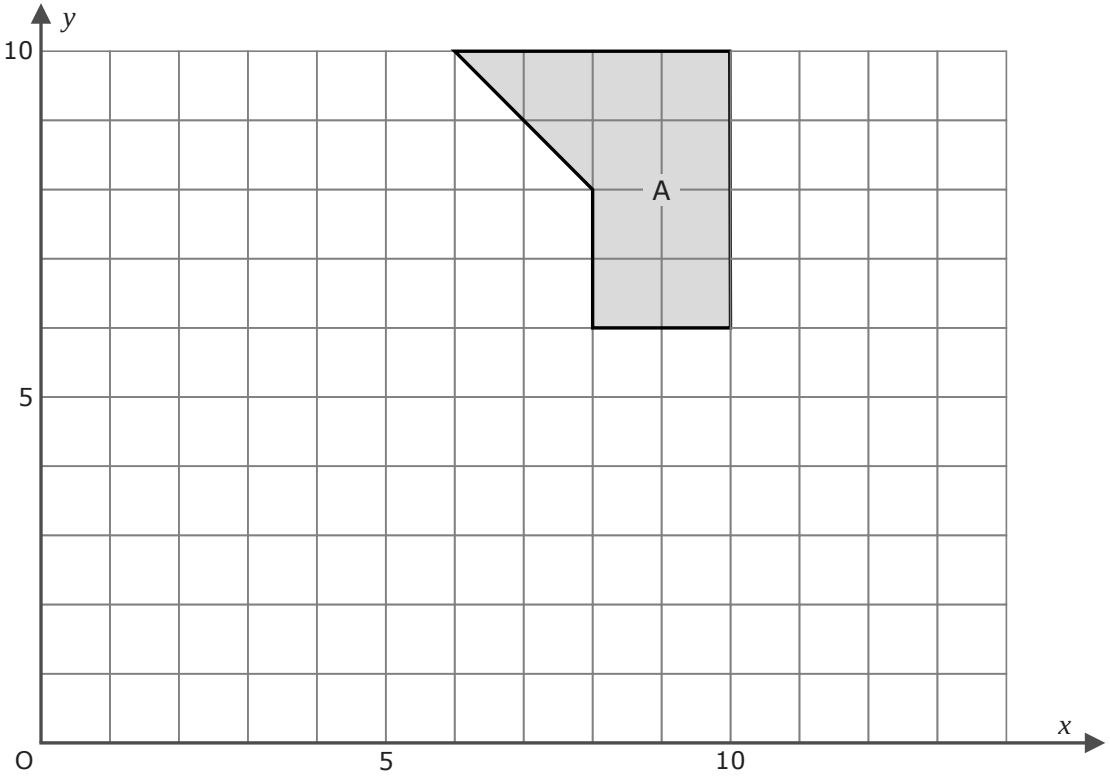
(2)

(b) $y = 3x^2$

(2)

(Total: 4 marks)

16



(a) Translate Shape A by $\begin{pmatrix} 2 \\ -5 \end{pmatrix}$. Label the image B.

(2)

(b) Enlarge Shape A by a scale factor of $\frac{1}{2}$ about (0, 0). Label the image C.

(2)

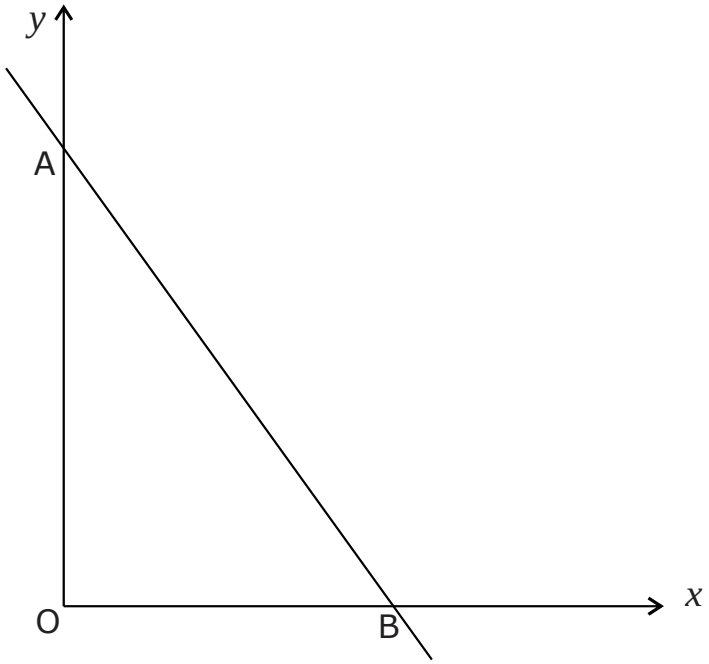
(Total: 4 marks)

17 The diameter of the Earth is 1.2742×10^4 km.

Assuming that the Earth is a perfect sphere, find the circumference of the Equator in kilometres. Give your answer in standard form to 2 significant figures.

(Total: 4 marks)

18 The line $y = 6 - 3x$ cuts the y-axis at A and the x-axis at B.



(a) Find the coordinates of A.

(2)

(b) Find the coordinates of B.

(2)

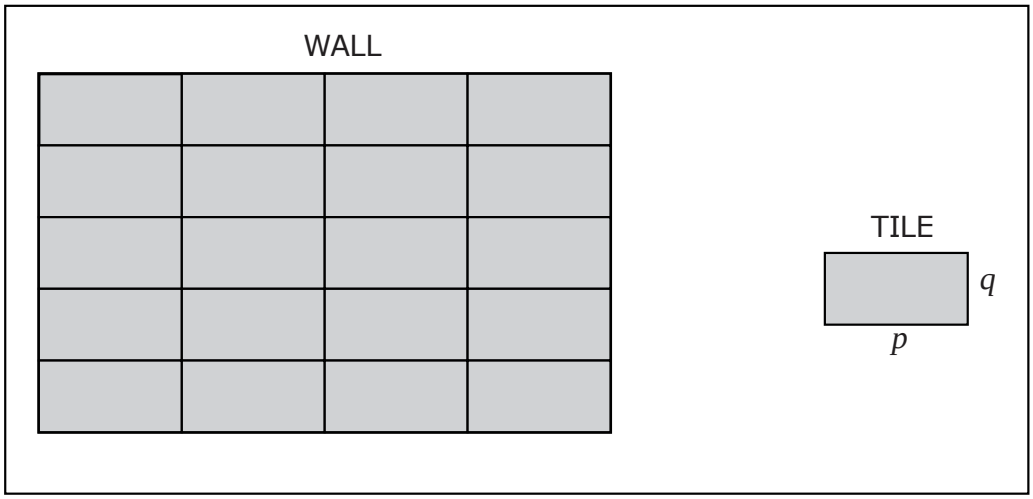
(c) Give the coordinates of any other point on this line.

(2)

(Total: 6 marks)

19 A wall is covered completely with rectangular tiles. The arrangement of tiles is shown in the figure below.

Tiling Arrangement



Each tile is p metres long and q metres wide.

(a) The perimeter of the tile is 3.6 m. Write an equation in terms of p and q.

(2)

(b) The tiled wall has perimeter 15.6 m.
Four tiles exactly cover the length while five tiles exactly cover the height of the wall.
Use this information to write another equation in terms of p and q.

(2)

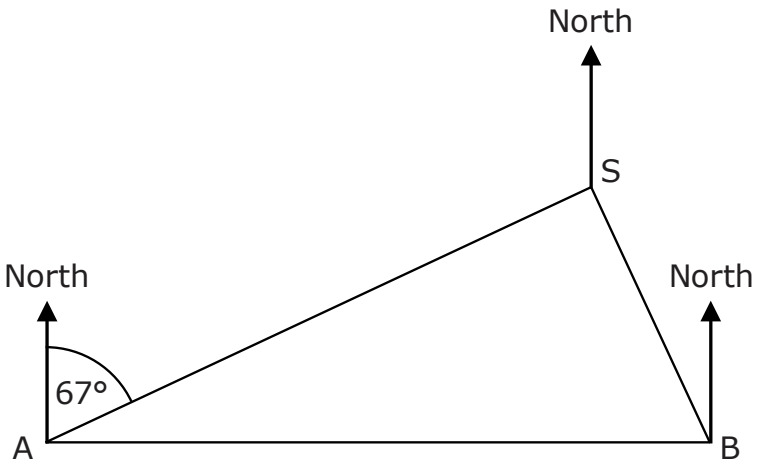
(c) Solve simultaneously the two equations from parts (a) and (b) to find the values of p and q.

(4)

(Total: 8 marks)

20 A and B are two lighthouses and S is a ship at sea.
The bearing of S from A is 067° and the bearing of S from B is 337°.
A is to the west of B.

Diagram not drawn to scale



(a) Calculate the size of ∠SAB.

(1)

(b) Calculate the size of ∠SBA.

(3)

(c) Calculate the bearing of B from S.

(3)

(Total: 7 marks)

Blank Page

Blank Page