Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2023

Mathematics

StemUp Model Solution

Unit M7 Paper 2
(With calculator)
Higher Tier



[GMC72]

GMC72

WEDNESDAY 7 JUNE, 10.45 am–12 NOON

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

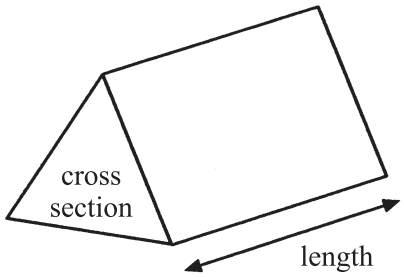
Write your Centre Number and Candidate Number in the spaces provided at the top of this page. **You are provided with Higher Tier Additional Support Materials for use with this paper.**
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page, on blank pages or tracing paper.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all sixteen** questions.
All working should be clearly shown in the spaces provided. Marks may be awarded for partially correct solutions.
You **may** use a calculator for this paper.

INFORMATION FOR CANDIDATES

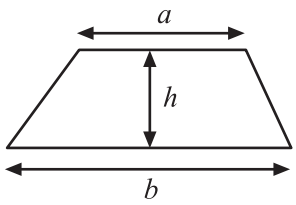
The total mark for this paper is 50.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

Formula Sheet

Volume of prism = area of cross section × length

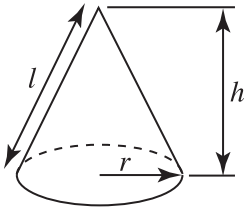


Area of trapezium = $\frac{1}{2}(a+b)h$



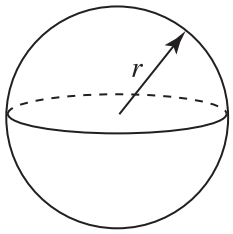
Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = $\pi r l$

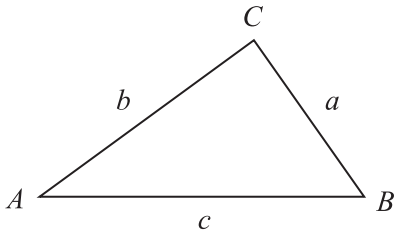


Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$



In any triangle *ABC*



Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

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

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

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1 A game cost €22.99

The exchange rate was £1 = €1.10

What was the cost in £?

22.99 ÷ 1.10 = 20.9
= £20.90

Answer £ 20.90 [2]

2 Albert wants to buy a gold chain.

Gold chains are priced by the length of the chain.

An 18-inch chain costs £264

What will Albert have to pay for a 21-inch chain?



© *Getty Images*

264 ÷ 18 = 14.666... per inch
14.666... × 21 = 308

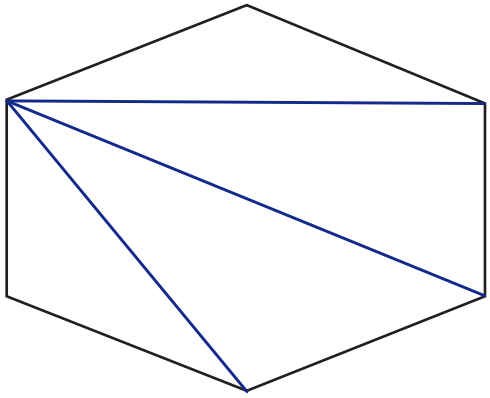
Answer £ 308 [2]

[Turn over

3 Ellie and Tanisha are working out the sum of the angles in polygons.

Ellie decides to split the hexagon below into triangles.

(a) Show how this can be done.



[1]

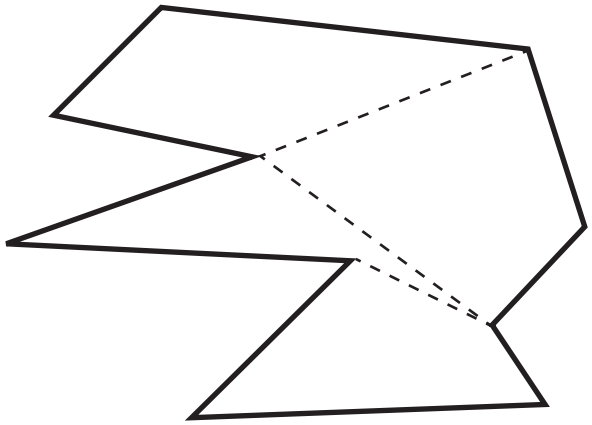
(b) What is the sum of the angles in the hexagon?

4 triangles: 4 × 180 = 720

Answer 720 ° [1]

Tanisha splits the decagon below into quadrilaterals as shown.

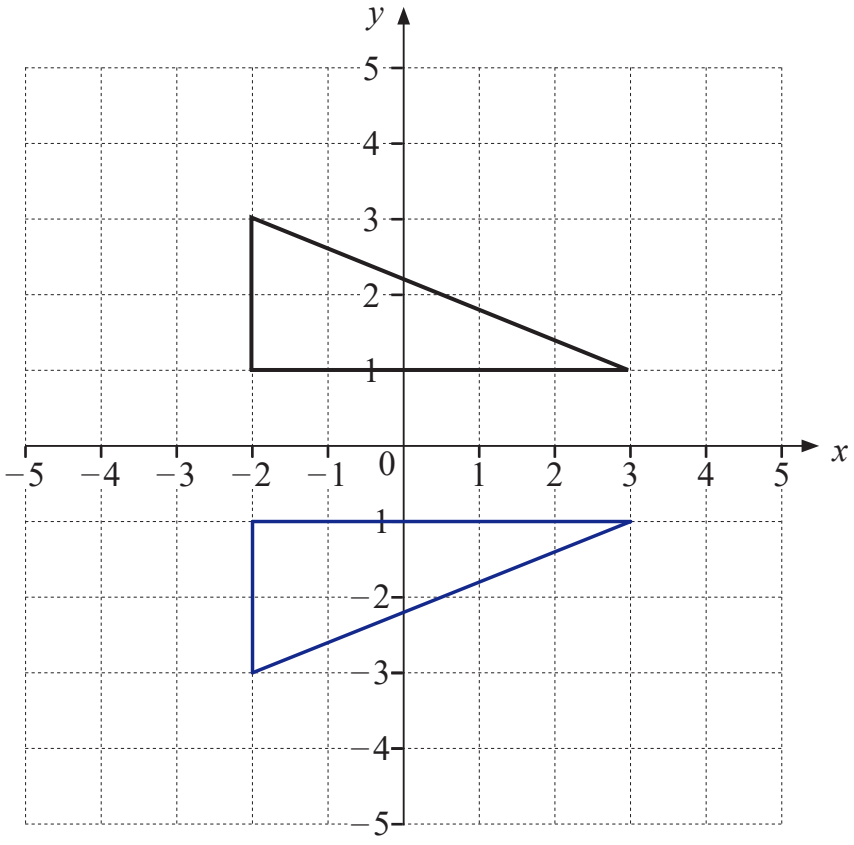
(c) What is the sum of the angles in the decagon?



4 quadrilaterals: 4 × 360 = 1440

Answer 1440 ° [1]

4 **(a)** Reflect the triangle in the x-axis.



[1]

(b) A rectangle of length 5 cm and width 8 cm is enlarged by a scale factor of 4

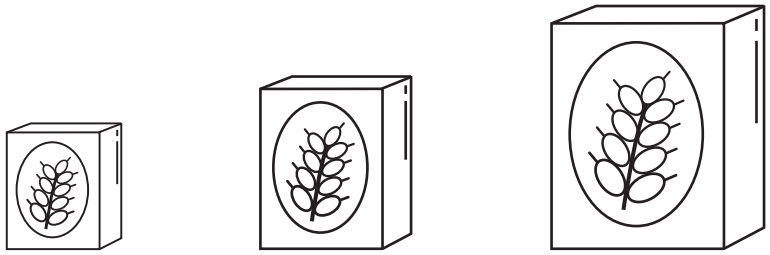
What are the dimensions of the enlarged rectangle?

length: 5 × 4 = 20 cm
width: 8 × 4 = 32 cm

Answer length 20 cm, width 32 cm [2]

[Turn over

5 A breakfast cereal is sold in three different sized boxes.



500 g 750 g 1 kg

A new size of box will be made.

It will have 20% more cereal than the 500 g box.

It will cost £1.56, which is 20p more than the 500 g box.

Will the customer who normally buys the 500 g box get a better or worse deal in buying this new size of box?
Show all working clearly.

New box: 500 × 1.2 = 600 g

500 g box costs £1.56 − £0.20 = £1.36

Cost per 100 g:

500 g box: £1.36 ÷ 5 = 27.2p

600 g box: £1.56 ÷ 6 = 26p

26p < 27.2p, so the new 600 g box is better value

They will get a _____better_____ deal. [4]

6 Visitors to Northern Ireland were asked to name their favourite tourist attraction.

The table of probabilities is based on their responses.

Tourist attraction	Giant's Causeway	Ulster Museum	Titanic Belfast	Mussenden Temple	Derry City Walls	Other
Probability	0.3	0.1	0.14	0.13	0.13	0.2

The probability of Mussenden Temple is the same as the probability of Derry City Walls.

(a) Complete the table. [3]

0.3 + 0.1 + 0.14 + 0.2 = 0.74
1 − 0.74 = 0.26, 0.26 ÷ 2 = 0.13

(b) What is the probability a visitor named Ulster Museum or Titanic Belfast?

0.1 + 0.14 = 0.24

Answer 0.24 [1]

(c) Last week 1800 visitors were asked to name their favourite tourist attraction.

Estimate how many named Giant's Causeway.

0.3 × 1800 = 540

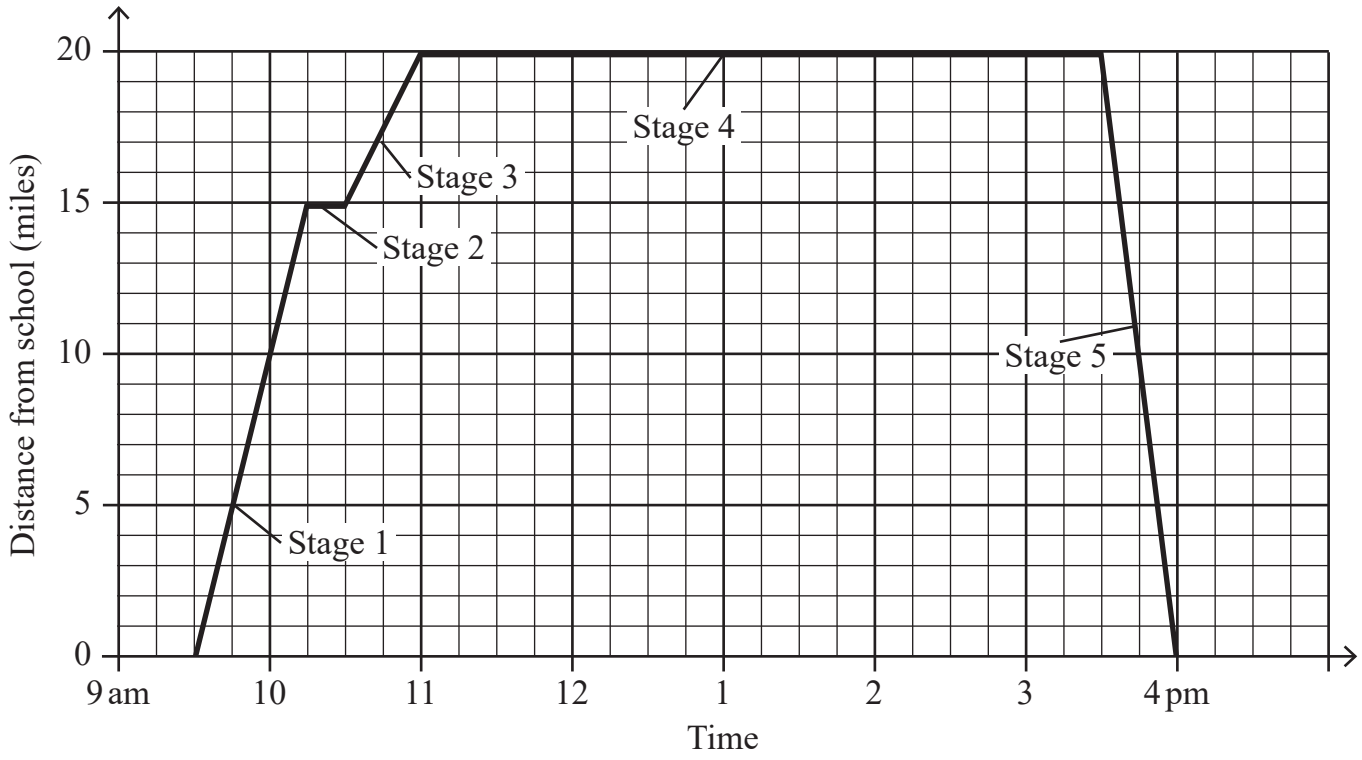
Answer 540 [2]

[Turn over

7 A group of students visit a theme park on a school trip.

The graph below shows their journey.

They leave school at 9.30 am and arrive back at 4 pm.



(a) Which was the fastest stage on the journey **to** the theme park?

Answer Stage 1 [1]

(b) How long did the students stay in the theme park?

11 am to 3.30 pm

Answer 4 hours 30 minutes [1]

(c) Calculate the average speed of the journey back to school.

20 miles in 30 minutes (0.5 hour)

20 ÷ 0.5 = 40

Answer 40 mph [2]

8 **(a)** Simplify $y^8 \div y^2$

$y^{8-2} = y^6$

Answer y^6 [1]

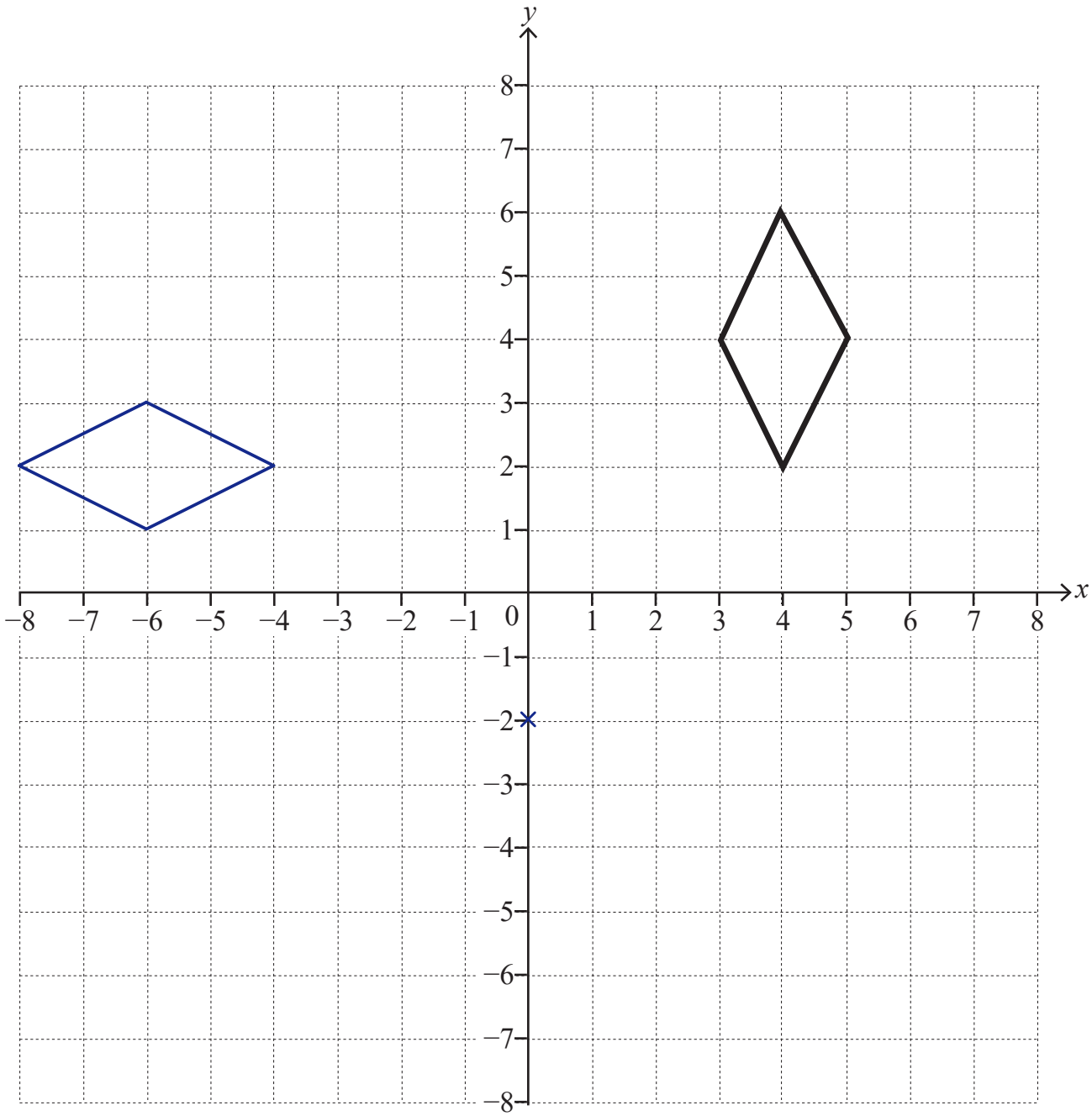
(b) Solve the inequality $7x > 3x - 12$

$7x - 3x > -12$
$4x > -12$
$x > -12 \div 4$

Answer $x > -3$ [2]

[Turn over

9 Rotate the shape 90° anticlockwise about (0, −2)



[2]

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10 **(a)** Write the decimal number 19 as a binary number.

16 8 4 2 1
1 0 0 1 1

Answer 10011 [1]

(b) Rearrange $h - 3m = y$ to make m the subject.

$h - 3m = y$
$h - y = 3m$
$m = (h - y) \div 3$

Answer $m = \frac{h - y}{3}$ [2]

11 A regular polygon has exterior angles of size 15°

(a) How many sides has the polygon?

$360 \div 15 = 24$

Answer 24 [2]

(b) Bailey thinks all regular pentagons are congruent.

Is he correct?

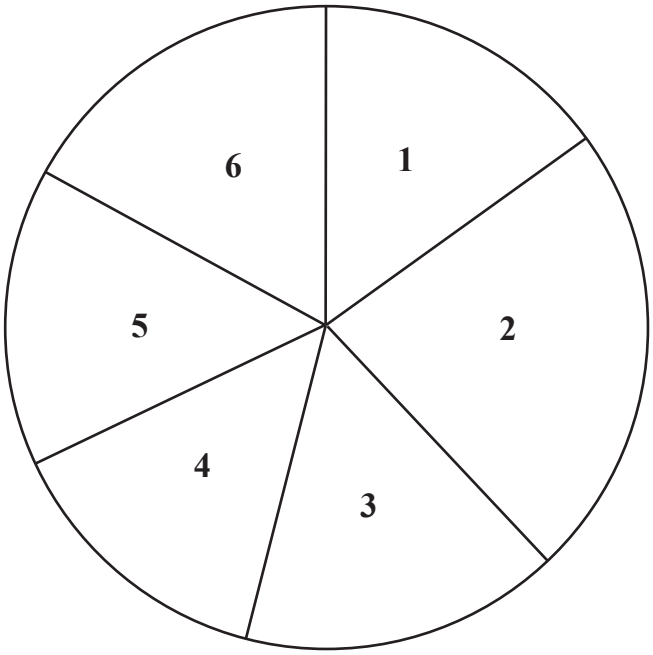
Circle your answer.

yes (no) more information needed [1]

[Turn over

12 Georgia rolls a dice a number of times and records the outcome each time.

She displays her results in this pie chart.



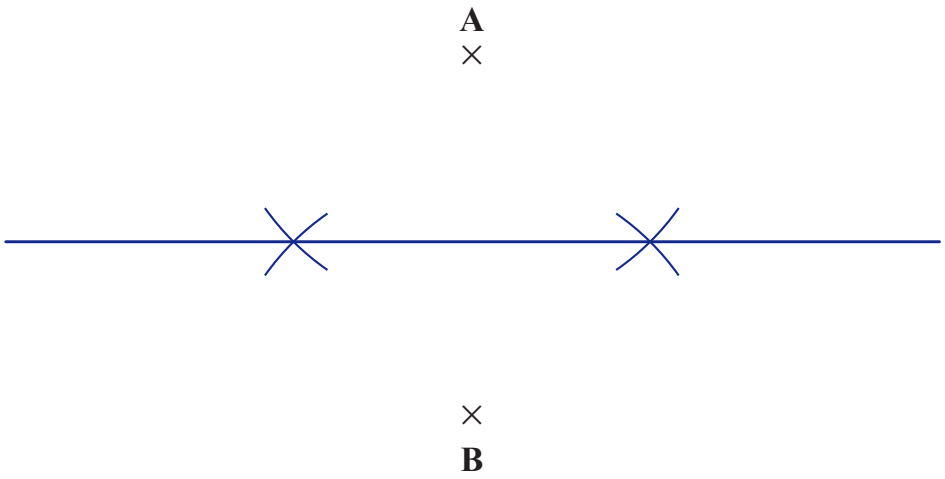
Alice thinks Georgia's dice is biased.

Bob disagrees.

What information is needed to decide who is correct?

Answer *the number of trials (times the dice was rolled)* [1]

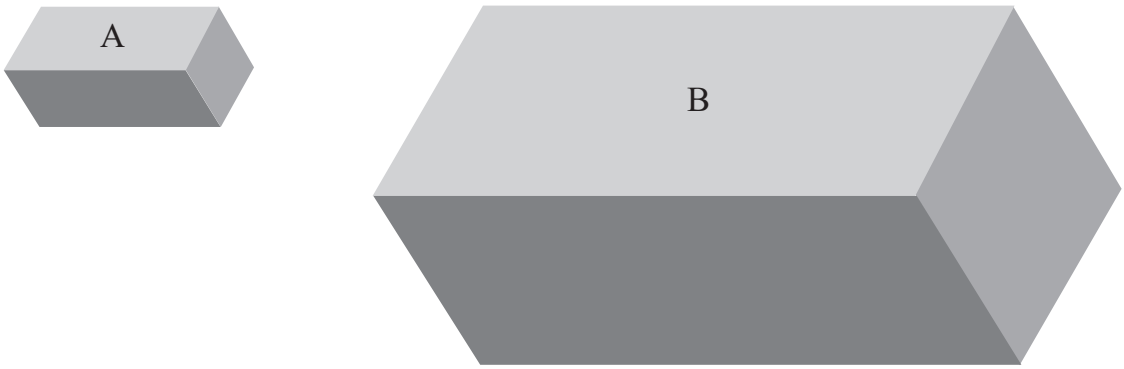
13 Draw the locus of all points which are the same distance from **A** and **B**.



[2]

[Turn over

14 Cuboid B is an enlargement, scale factor 3, of cuboid A.



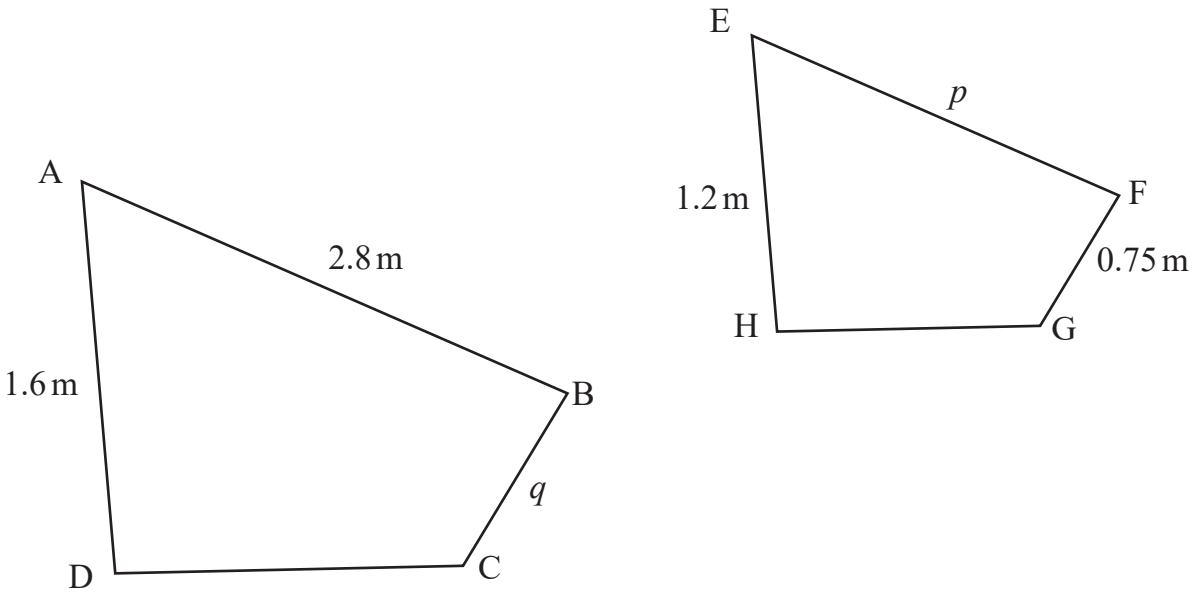
The volume of B is $x\,\text{cm}^3$

(a) What is the volume of A?

Volume scale factor = 3^3 = 27
Volume of A = x ÷ 27

Answer $\frac{x}{27}$ cm^3 [2]

(b) Two similar shapes are shown.



Diagrams are not drawn to scale.

(i) Find the value of p.

Scale factor = 1.2 ÷ 1.6 = 0.75
p = 2.8 × 0.75 = 2.1

Answer 2.1 m [2]

(ii) Find the value of q.

q = 0.75 ÷ 0.75 = 1

Answer 1 m [1]

[Turn over

15 When a body is moving through the air, the air resistance R newtons (N) is proportional to the square of the velocity v m/s.

At a velocity of 100 m/s, the air resistance is 50 N.

(a) Find R in terms of v.

$R = kv^2$
$50 = k \times 100^2$
$k = 50 \div 10000 = 0.005$

Answer $R = 0.005v^2$ [2]

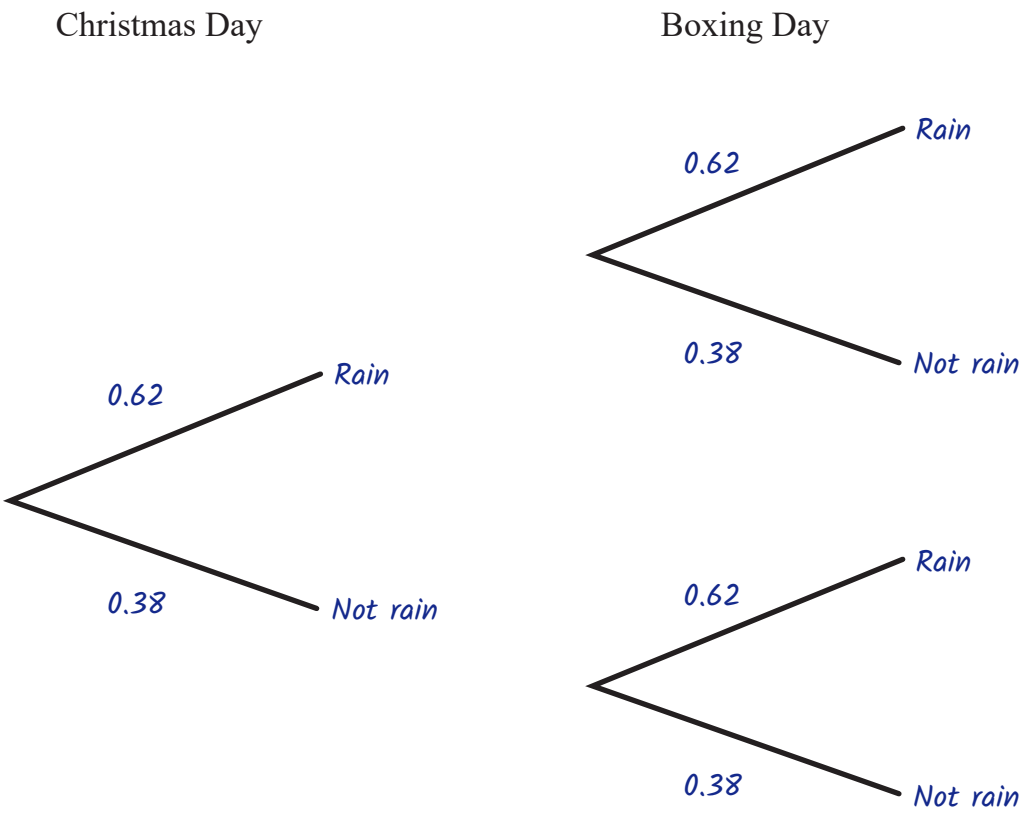
(b) Find R when $v = 120$ m/s.

$R = 0.005 \times 120^2$
$= 0.005 \times 14400 = 72$

Answer 72 N [1]

16 The probability that it rains in Ireland on any given day in December is 0.62

(a) Complete the tree diagram to show this information for Christmas Day and Boxing Day.



[2]

(b) What is the probability that it rains on exactly one of these days?

P(rain, not rain) + P(not rain, rain)
= 0.62 × 0.38 + 0.38 × 0.62
= 0.2356 + 0.2356 = 0.4712

Answer 0.4712 [2]

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Question Number	**Marks**
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Examiner Number

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Summer 2023

GCSE Mathematics

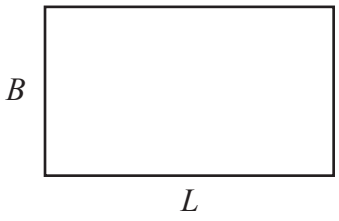
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(For use in Summer 2023)

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$$\text{Average Speed} = \frac{\text{Distance}}{\text{Time}}$$

Perimeter, Area and Volume

The perimeter of a polygon is the distance around the outside of the polygon.



The area of a rectangle is found by multiplying the length of the rectangle by the breadth.

$A = L \times B$ where L is length and B is breadth.

The volume of a cuboid is found by multiplying the length by the breadth by the height of the cuboid.

$V = L \times B \times H$ where V is volume, L is length, B is breadth and H is height.

The area of a circle is $A = \pi r^2$ where r is the radius of the circle.

The circumference (perimeter) of a circle is $C = 2\pi r$ where r is the radius of the circle. An alternative formula is $C = \pi d$ where d is the diameter of the circle.

Mid point of a line

If (x_1, y_1) and (x_2, y_2) are the end points of a line, then the coordinates of the midpoint M of the line are

$$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

Gradient of a line

If (x_1, y_1) and (x_2, y_2) are two points on a line, then the gradient m of the line is

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Lines

Parallel lines have the same gradient.

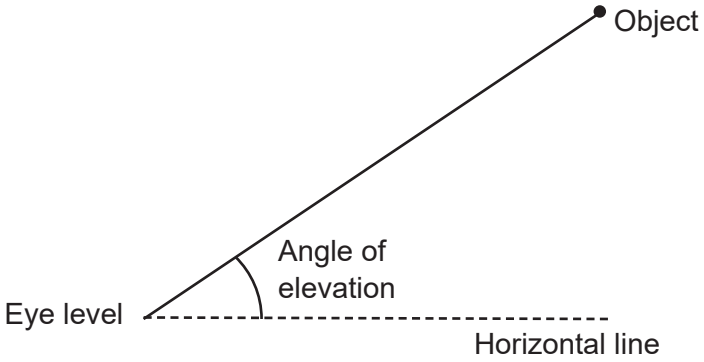
If a straight line has gradient m, then a line which is perpendicular to this line has a gradient $-\frac{1}{m}$

Geometry and Angles

There are 180° on a straight line.
There are 180° inside a triangle.
An isosceles triangle is a triangle with 2 equal sides and 2 equal angles.
The sum of all the angles inside a polygon is given by $180(n - 2)$ where n is the number of sides in the polygon.

Angle of elevation

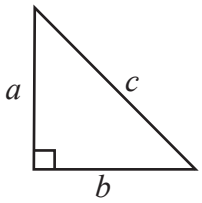
If a person stands and looks up at an object, the **angle of elevation** is the angle between the horizontal line of sight and the object.



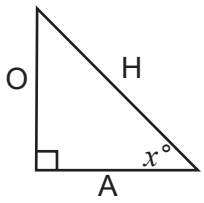
Pythagoras' Theorem

If a, b and c are the sides of a right angled triangle shown below, then

$$a^2 + b^2 = c^2$$



Trigonometric ratios in right angled triangles



$\sin x° = \frac{O}{H}$ $\cos x° = \frac{A}{H}$ $\tan x° = \frac{O}{A}$

Tangent/Radius property

The tangent to a circle is perpendicular to the radius at the point of contact with the circle.

Alternate Segment Theorem

In a circle, the angle between a chord and a tangent through one of the end points of the chord is equal to the angle in the alternate segment.

Mean

The mean of a set of data is the sum of all the data values divided by the number of data values.

Estimate for the mean of a grouped frequency distribution

Estimated mean = sum of (mid interval values multiplied by their frequency) divided by the sum of all the frequencies.

Pie Chart

In a pie chart, the total angle that corresponds to the entire data set is 360°

Probability

The sum of the probabilities of all outcomes equals 1

Frequency density in histograms

$\text{Frequency density} = \frac{\text{Frequency}}{\text{Class width}}$