Rewarding Learning

General Certificate of Secondary Education

Centre Number

Candidate Number

Mathematics

StemUp Model Solution

Unit M7 Paper 1
(Non-Calculator)
Higher Tier



[GMC71]
Assessment

GMC71

Assessment Level of Control:
Tick the relevant box (✓)

Controlled Conditions	
Other	

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 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 seventeen** questions.
All working should be clearly shown in the spaces provided. Marks may be awarded for partially correct solutions.
You **must not** use a calculator for this paper.

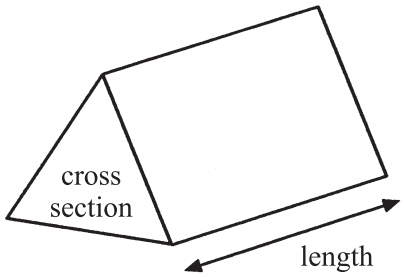
INFORMATION FOR CANDIDATES

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 ruler, compasses and a protractor.
The Formula Sheet is on page 2.

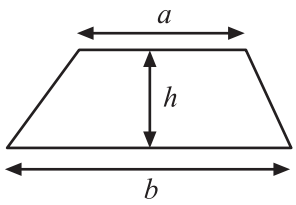
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Formula Sheet

Volume of prism = area of cross section × length

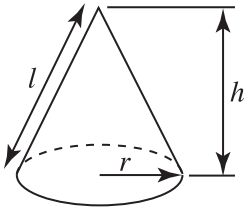


Area of trapezium = $\frac{1}{2}(a+b)h$



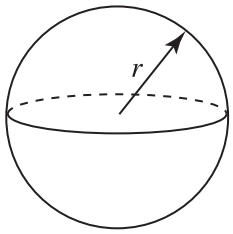
Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = πrl

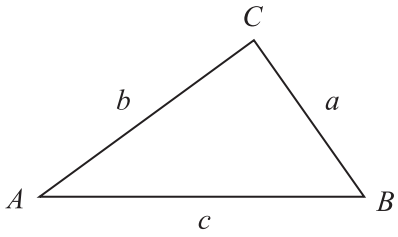


Volume of sphere = $\frac{4}{3}\pi r^3$

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

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

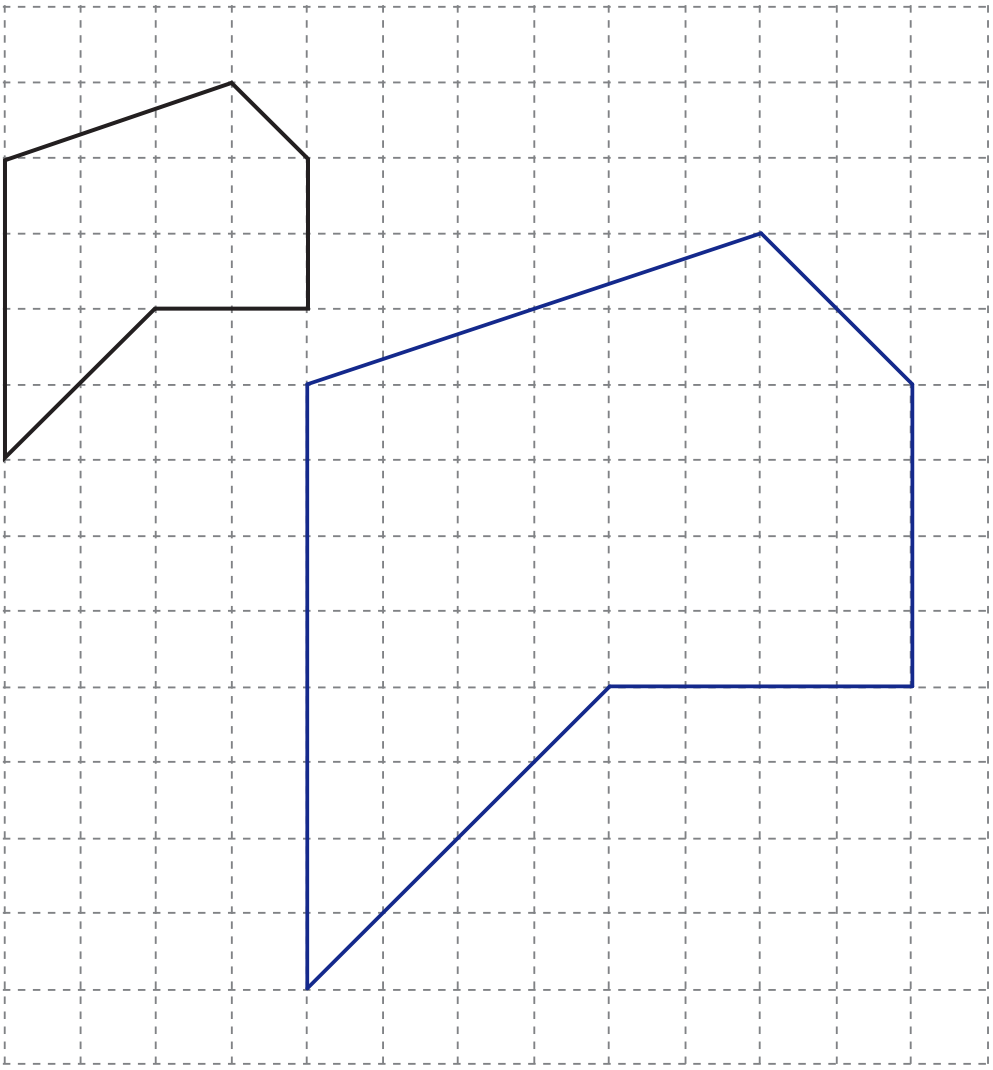
Sine Rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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

12376

1 **(a)** On the grid, enlarge the shape with a scale factor of 2



[2]

(b) How many times bigger is the area of the enlarged shape than the smaller shape?

Area scale factor = 2^2 = 2 × 2 = 4

Answer 4 [2]

[Turn over

2 Which of the numbers below shows that the following statement is not true?

"If P is any odd number, then P + 2 is always a prime number."

Show all working before you tick the correct box.

P = 1: 1 + 2 = 3 prime

P = 3: 3 + 2 = 5 prime

P = 5: 5 + 2 = 7 prime

P = 7: 7 + 2 = 9 = 3 × 3 not prime

So P = 7 shows the statement is not true.

P = 1	☐	P = 5	☐
P = 3	☐	P = 7	☑

[2]

3 Change 20 miles/h to km/h.

5 miles = 8 km, so $20 \times \frac{8}{5} = 4 \times 8 = 32$

Answer 32 km/h [2]

4 In a Year 12 class, the following information was recorded.

	Boys	**Girls**
Wears glasses	3	5
Does not wear glasses	10	6

(a) What fraction of the pupils in the class wear glasses?

Glasses: 3 + 5 = 8 Total: 3 + 5 + 10 + 6 = 24

Answer $\frac{8}{24}$ [2]

(b) A pupil was chosen at random from the class.

What is the probability that the pupil was a boy who does not wear glasses?

Boys without glasses = 10

Answer $\frac{10}{24}$ [1]

(c) The next week a new boy joins the class.

He wears glasses.

Will this change the probability of now choosing at random a girl who wears glasses?

Explain your answer clearly.

Before: P(girl with glasses) = $\frac{5}{24}$

After: still 5 girls with glasses, 25 pupils, so $\frac{5}{25}$

Answer Yes because it was 5/24 and is now 5/25 (total changed) [2]

[Turn over

5 Sam and Julie share £35 in the ratio 6 : 1

How much is each share?

6 + 1 = 7 parts

£35 ÷ 7 = £5 per part

Sam: 6 × 5 = £30

Julie: 1 × 5 = £5

Answer Sam £ 30.00

Julie £ 5.00 [2]

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6 "Look Dad," said Erin.

"Here are all the silver coins from my piggy bank."

"How much have you got?" said Dad.

"$\frac{1}{3}$ are 5p coins, $\frac{1}{4}$ are 10p coins and the other 10 coins are 50p coins," said Erin.

What is Erin's total amount of money?

Show all working.

$\frac{1}{3} + \frac{1}{4} = \frac{4}{12} + \frac{3}{12} = \frac{7}{12}$ are 5p and 10p coins

50p coins: $1 - \frac{7}{12} = \frac{5}{12} = 10$ coins, so $\frac{1}{12} = 2$ coins

Total $= 12 \times 2 = 24$ coins

$\frac{1}{3}$ of 24 = 8 five-pence coins, $\frac{1}{4}$ of 24 = 6 ten-pence coins

Money $= 8 \times 5 + 6 \times 10 + 10 \times 50$

$= 40 + 60 + 500 = 600p = £6.00$

Answer £6.00 [5]

[Turn over

7 ABCDE is a pentagon.

Lines AF and CG are straight lines.

Work out the value of $x + y + z$

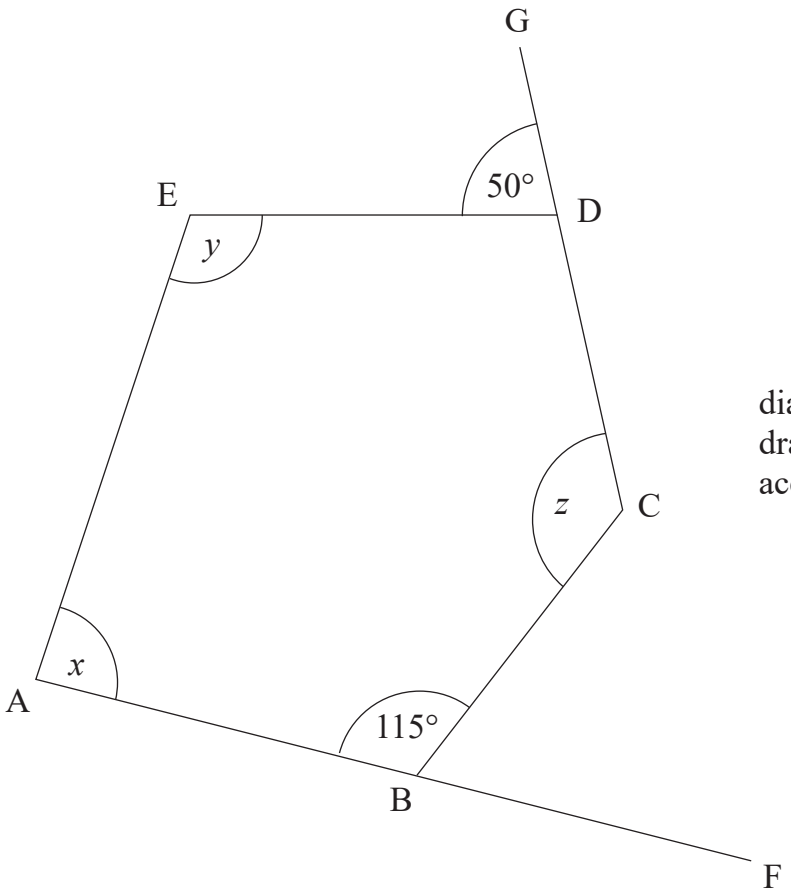


diagram not drawn accurately

Angle EDC = 180° – 50° = 130° (angles on a straight line)

Known angles: 115° + 130° = 245°

Angles in a pentagon = 3 × 180° = 540°

x + y + z = 540° – 245° = 295°

Answer 295 ° [5]

8 Simplify each of the following.

(a) $4p^3 \times 3p^4$

$4 \times 3 = 12$, $p^{3+4} = p^7$

Answer $12p^7$ [1]

(b) $(q^2)^3 \div q^8$

$q^6 \div q^8 = q^{6-8}$

Answer q^{-2} [1]

9 Find the *n*th term of the sequence

7, 4, 1, −2, ...

Difference = −3, so −3n

n = 1: $-3 \times 1 = -3$, $7 - (-3) = 10$

nth term = $-3n + 10$

Answer *n*th term = $-3n + 10$ [2]

[Turn over

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10 Tony tests a six-sided dice which he thinks is biased towards the even numbers.

He carries out an experiment by rolling the dice.

He records the results as E (even) or O (odd).

E O E O E E O E E O E O

(a) What is the relative frequency of an even number?

Evens: 7 out of 12 rolls

Answer $\frac{7}{12}$ [1]

(b) How could Tony improve the experiment?

Answer Roll the dice many more times (increase the number of trials) [1]

11 Make y the subject of

$$3y - 12 = 4x$$

$3y - 12 = 4x$

$3y = 4x + 12$

Answer $y = \frac{4x + 12}{3}$ [2]

12 A rectangle has a length of $3x$ cm and a width of $(x + 5)$ cm.

The length is greater than the width.

(a) Write this information as an inequality in x.

Answer $3x > x + 5$ [1]

(b) **(i)** Solve the inequality.

$3x > x + 5$

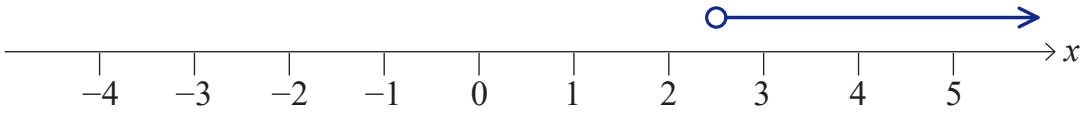
$3x - x > 5$

$2x > 5$

$x > 2.5$

Answer $x > 2.5$ [1]

(ii) Show your answer on the number line below.



[1]

[Turn over

13

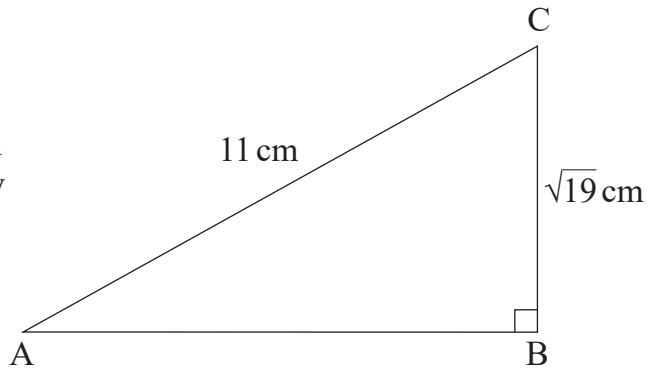


diagram
not drawn
accurately

ABC is a right-angled triangle.

Work out the length of AB, giving your answer as a surd.

$AB^2 + (\sqrt{19})^2 = 11^2$

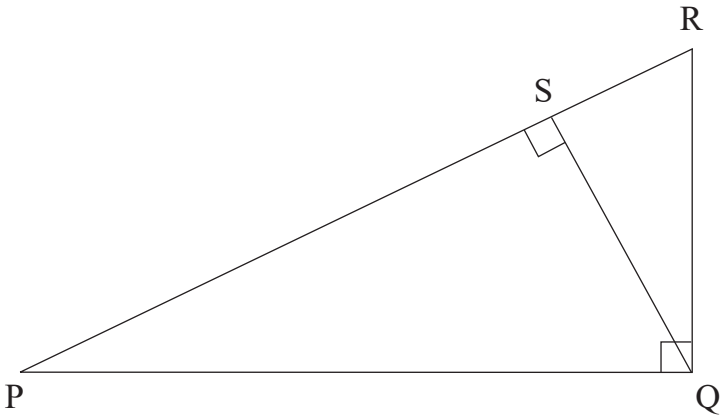
$AB^2 = 11^2 - (\sqrt{19})^2$

$AB^2 = 121 - 19 = 102$

$AB = \sqrt{102}$

Answer $\sqrt{102}$ cm [3]

14



PQR is a right-angled triangle and QS is the perpendicular line from Q to PR.

Prove that the triangles PQR and QSR are similar.

Compare triangles PQR and QSR:

Angle PQR = angle QSR = 90° (both right angles)

Angle QRS = angle PRQ (angle R is common to both triangles)

So the third angles are also equal

(angle sum of a triangle is 180°): angle QPR = angle SQR

The triangles are equiangular, hence PQR and QSR are similar.

[3]

[Turn over

15

Special Menu

Two Courses (starter and main **or** main and dessert) £15.95

Starters
Soup of the Day
Caesar Salad
Baked Brie
Bruschetta

Mains
Fish of the Day
Chicken Kiev
Pork Medallions
Ribeye Steak (£3 supplement)
Spaghetti Bolognese

Desserts
Cheesecake
Apple Pie
Ice Cream

A restaurant has the above Special Menu available.

How many different ways are there of choosing two courses (starter and main **or** main and dessert)?

Starter + main: $4 \times 5 = 20$

Main + dessert: $5 \times 3 = 15$

Total $= 20 + 15 = 35$

Answer 35 [3]

16 Re-arrange the formula to make r the subject.

$$V = \frac{4}{3}\pi r^3$$

$3V = 4\pi r^3$

$r^3 = \frac{3V}{4\pi}$

Answer $r = \sqrt[3]{\frac{3V}{4\pi}}$ [2]

17 The height of a balloon, h, varies directly as the square root of its surface area, A.

When the balloon's surface area is 81 its height is 12

What is its height when its surface area is 144?

$h = k\sqrt{A}$

$12 = k\sqrt{81} = 9k$

$k = \frac{12}{9} = \frac{4}{3}$

$h = \frac{4}{3} \times \sqrt{144} = \frac{4}{3} \times 12 = 16$

Answer 16 [3]

THIS IS THE END OF THE QUESTION PAPER

DO NOT WRITE ON THIS PAGE

For Examiner's use only	
Question Number	**Marks**
1	
2	
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5	
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12	
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17	
Total Marks	

Examiner Number

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