Rewarding Learning

General Certificate of Secondary Education

Centre Number

Candidate Number

Mathematics

StemUp Model Solution

Unit M8 Paper 2
(With calculator)
Higher Tier



GMC82

[GMC82]
Assessment

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 eleven** 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.

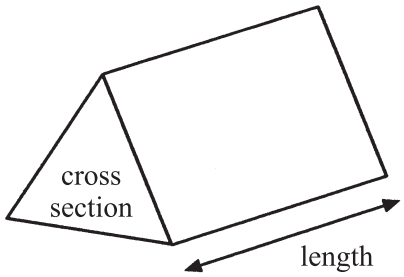
INFORMATION FOR CANDIDATES

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.

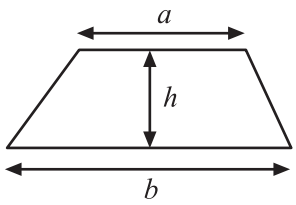
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Formula Sheet

Volume of prism = area of cross section × length

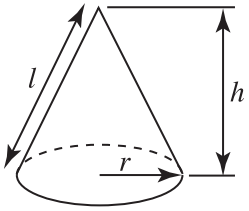


Area of trapezium = $\frac{1}{2}(a+b)h$



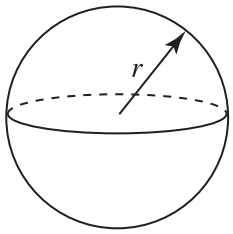
Volume of cone = $\frac{1}{3}\pi r^2 h$

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

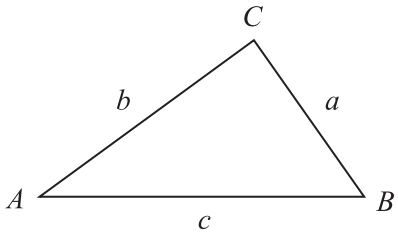


Volume of sphere = $\frac{4}{3}\pi r^3$

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

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

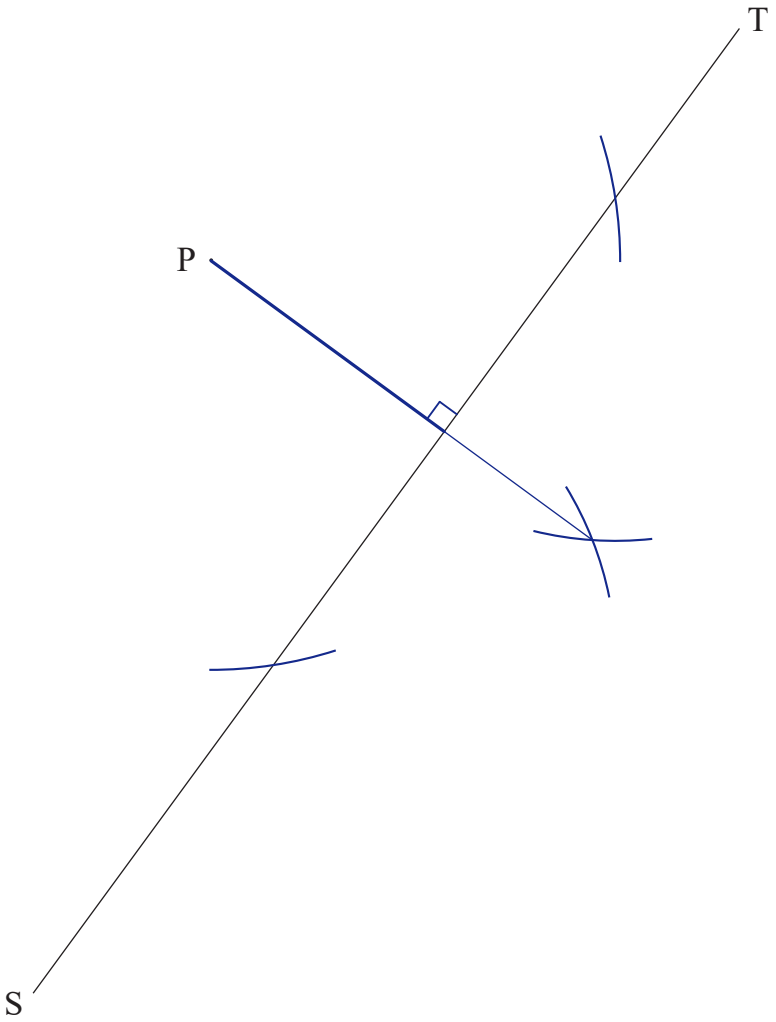
Sine Rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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

12379

1 Construct the line which represents the shortest distance from point P to the line ST in the diagram below.



[2]

[Turn over

2 A solution to the equation $4x - x^3 - 2 = 0$ lies between $x = 0$ and $x = 1$

Use trial and improvement to find this solution, giving your answer correct to 1 decimal place.

Show all your working clearly.

x	$4x - x^3 - 2$	
0.5	−0.125	too small
0.6	0.184	too big
0.55	0.033625	too big

Answer $x =$ 0.5 [3]

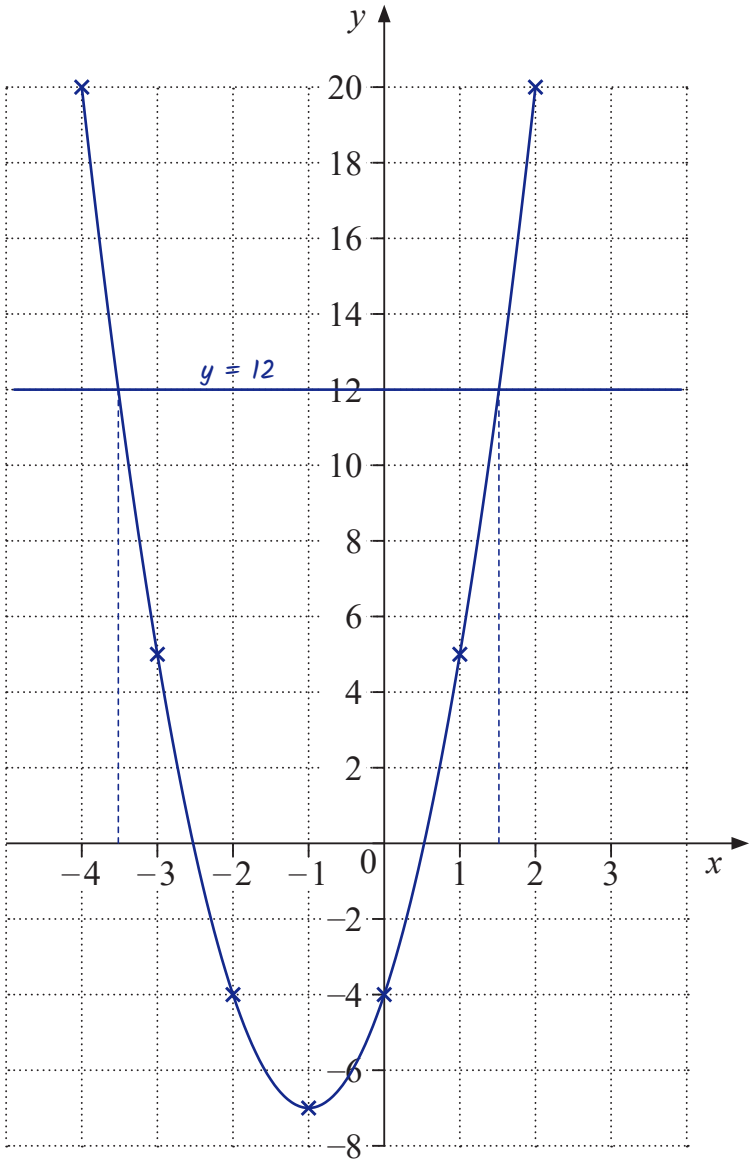
Solution lies between 0.5 and 0.55
so x = 0.5 correct to 1 decimal place

3 **(a)** Complete the table of values for $y = 3x^2 + 6x - 4$

x	−4	−3	−2	−1	0	1	2
y	20	5	−4	−7	−4	5	20

[1]

(b) Hence, draw the graph of $y = 3x^2 + 6x - 4$ on the grid below.



[2]

(c) Draw the line $y = 12$ on the grid.
Write down the x values of the points of intersection with this line.

Answer −3.5 , 1.5 [2]

[Turn over

4 Write the binary number 1011001 as a decimal number.

64	32	16	8	4	2	1
1	0	1	1	0	0	1

$= 64 + 16 + 8 + 1$

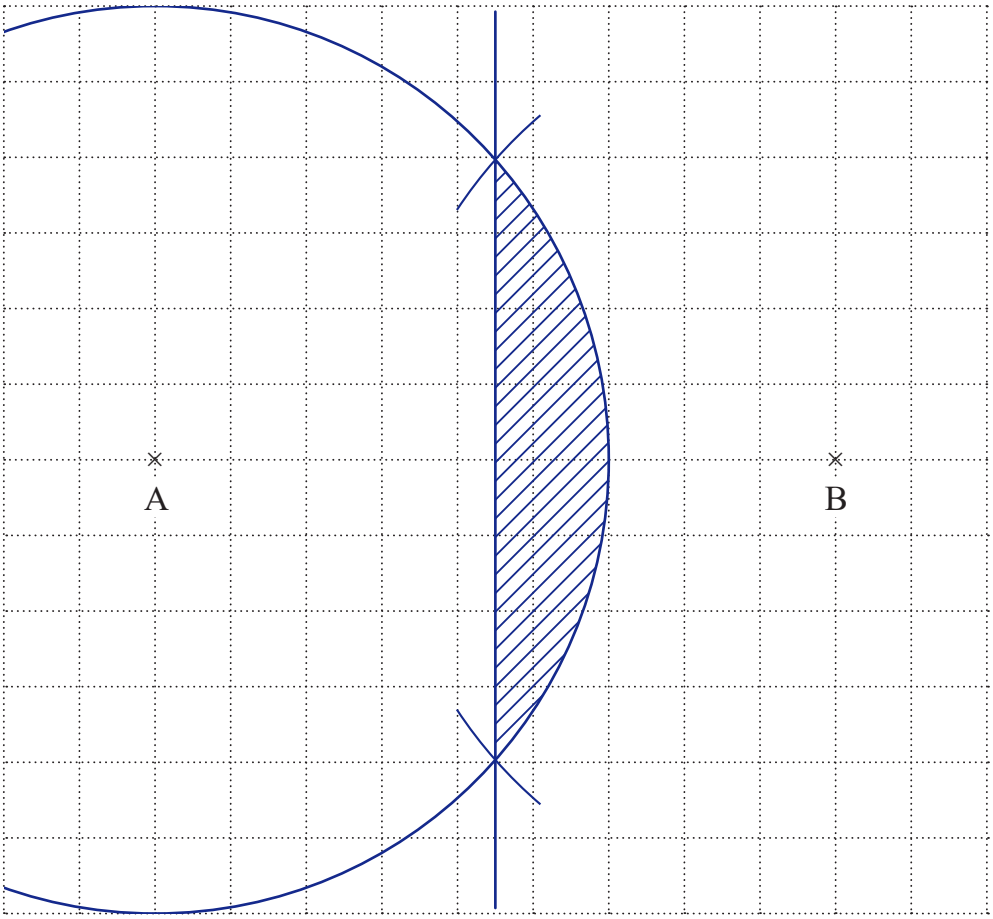
$= 89$

Answer 89 [1]

5 Two transmitters are located at points A and B, 9 metres apart.

The best reception is an area which is less than 6 metres from A and closer to B than to A.

Shade this area on a scale drawing below, using a scale of 1 cm to 1 metre.



[3]

[Turn over

6 John earns £x per hour on Fridays and £y per hour on Saturdays.

In March he worked 20 hours on Fridays, 12 hours on Saturdays and earned £322

In April he worked 16 hours on Fridays, 10 hours on Saturdays and earned £262

Use simultaneous equations to find the values of x and y.

$20x + 12y = 322 \quad (1)$

$16x + 10y = 262 \quad (2)$

$(1) \times 5: \quad 100x + 60y = 1610$

$(2) \times 6: \quad 96x + 60y = 1572$

subtract: $4x = 38$

$x = 9.50$

sub. into (1): $20(9.50) + 12y = 322$

$190 + 12y = 322$

$12y = 132$

$y = 11$

Answer $x =$ 9.50

$y =$ 11 [5]

7 £3000 is invested at 2% compound interest per annum.

(a) Explain why the formula for the value, £V, after n years is given by

$$V = 3000(1.02)^n$$

Increasing by 2% means multiplying by 1.02 each year.
For n years multiply by 1.02 n times, i.e. by 1.02^n,
so $V = 3000 \times 1.02^n = 3000(1.02)^n$

[2]

(b) Calculate the value after 6 years.

$3000 \times 1.02^6 = 3378.4874...$

Answer £ 3378.49 [1]

(c) After how many years was the value £3247.30 to the nearest penny?

$n = 1$: $3000 \times 1.02 = 3060$
$n = 2$: $3000 \times 1.02^2 = 3121.20$
$n = 3$: $3000 \times 1.02^3 = 3183.624 = 3183.62$
$n = 4$: $3000 \times 1.02^4 = 3247.296... = 3247.30$

Answer 4 years [2]

(d) Write the formula for the value £V, after n years, if the £3000 investment decreased at a rate of 2% per annum.

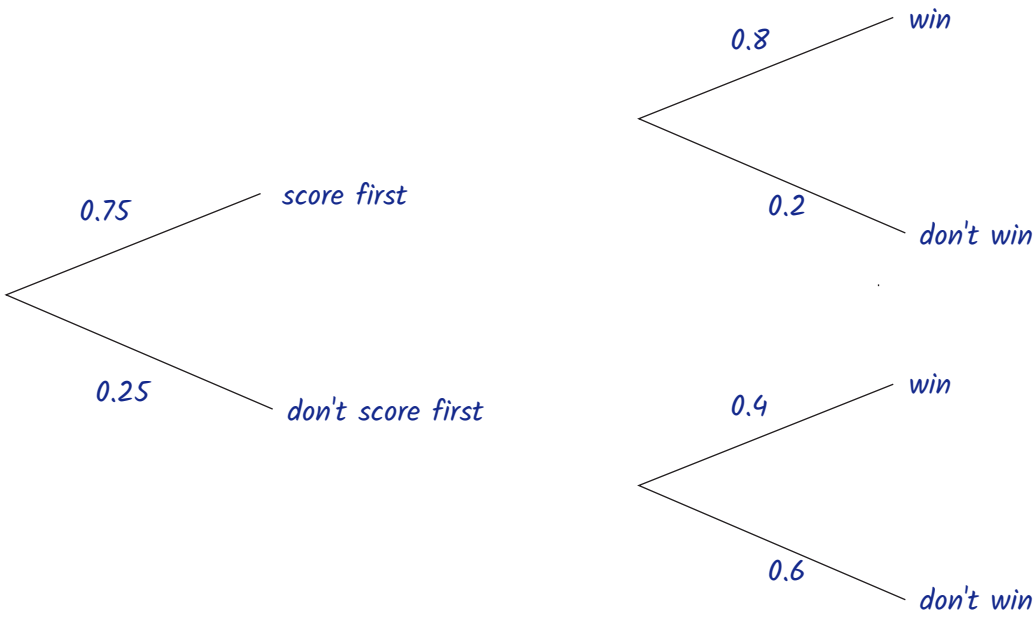
Answer $V = 3000(0.98)^n$ [1]

[Turn over

8 The probability of Fran's team scoring first in a game is 0.75

If they score first, the probability that they will win the game is 0.8
If they do not score first, the probability that they will win the game is 0.4

(a) Show this information on the tree diagram.



[3]

(b) Fran's team will play 50 games this season.

Use your tree diagram to predict how many games they will win.

Show your working clearly.

$P(\text{win}) = 0.75 \times 0.8 + 0.25 \times 0.4$

$= 0.6 + 0.1 = 0.7$

Expected wins $= 0.7 \times 50 = 35$ games

[3]

9 The lengths of the sides of a triangle are 6 cm, 7 cm and 8 cm.

Calculate the three angles in the triangle.

Let A be the angle opposite the 8 cm side.

$$\cos A = \frac{6^2 + 7^2 - 8^2}{2 \times 6 \times 7} = \frac{21}{84} = 0.25$$

$A = \cos^{-1}(0.25) = 75.5224...° = 75.52°$

Let B be the angle opposite the 7 cm side.

$$\frac{\sin B}{7} = \frac{\sin 75.52}{8}$$

$\sin B = 7 \times \sin 75.52 \div 8 = 0.84721...$

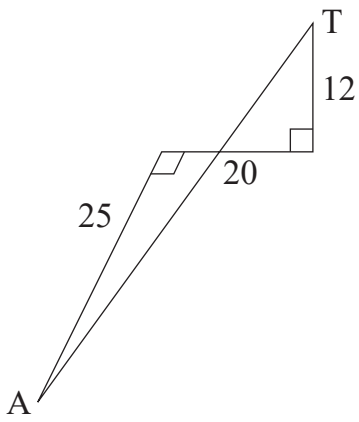
$B = \sin^{-1}(0.84721...) = 57.910...° = 57.91°$

Third angle $C = 180 - 75.52 - 57.91 = 46.57°$

Answer 75.52 °, 57.91 °, 46.57 ° [6]

[Turn over

10



From a point A, a pylon is 25 m north and 20 m east.
The pylon is 12 m high.

(a) Calculate the distance AT, where T is the top of the pylon.

$AT^2 = 25^2 + 20^2 + 12^2$

$= 625 + 400 + 144 = 1169$

$AT = \sqrt{1169} = 34.1906...$

Answer 34.19 m [3]

(b) Calculate the angle of elevation of T from A.

Horizontal distance $= \sqrt{(25^2 + 20^2)} = \sqrt{1025} = 32.0156...$

$\tan\theta = \frac{12}{\sqrt{1025}} = 0.37481...$

$\theta = \tan^{-1}(0.37481...) = 20.548...°$

Answer 20.55 ° [3]

11 A bag contains 40 marbles. x of these are white.

One marble is taken at random and then, without replacement, a second marble is taken at random.

The probability that neither of these is white is $\frac{5}{12}$

(a) Show that $x^2 - 79x + 910 = 0$

P(neither white) $= \frac{40 - x}{40} \times \frac{39 - x}{39} = \frac{5}{12}$

$(40 - x)(39 - x) = 40 \times 39 \times \frac{5}{12}$

$1560 - 40x - 39x + x^2 = 650$

$x^2 - 79x + 1560 - 650 = 0$

$x^2 - 79x + 910 = 0$ as required

[4]

(b) Hence, calculate the probability that both marbles taken are white.

$(x - 14)(x - 65) = 0$

$x = 14$ or $x = 65$ (not possible, only 40 marbles)

so there are 14 white marbles

P(both white) $= \frac{14}{40} \times \frac{13}{39} = \frac{182}{1560} = \frac{7}{60}$

Answer $\frac{7}{60}$ [3]

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For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
Total Marks	

Examiner Number

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