Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
January 2020

Mathematics

StemUp Model Solution

Unit M7 Paper 1
(Non-Calculator)
Higher Tier



[GMC71]

GMC71

WEDNESDAY 15 JANUARY, 9.15am–10.30am

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.

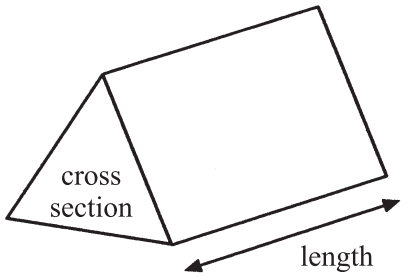
INFORMATION FOR CANDIDATES

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.

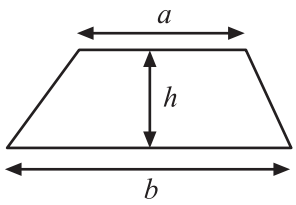
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Formula Sheet

Volume of prism = area of cross section × length

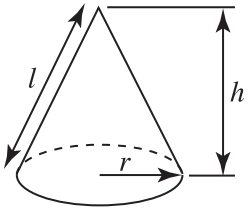


Area of trapezium = $\frac{1}{2}(a+b)h$



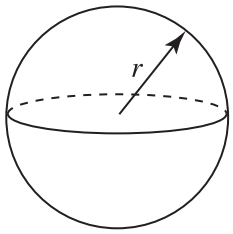
Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = πrl

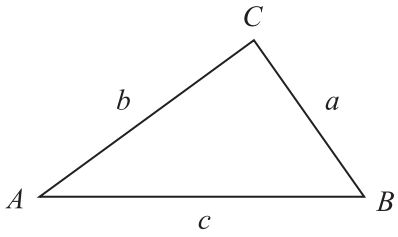


Volume of sphere = $\frac{4}{3}\pi r^3$

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 = $\frac{1}{2}ab\sin C$

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1 A sequence is formed using the rule:

"Find the next term by adding the previous two terms"

Use this rule to complete the sequence below.

x, 4, x + 4, x + 8, 2x + 12 [1]

x + 4

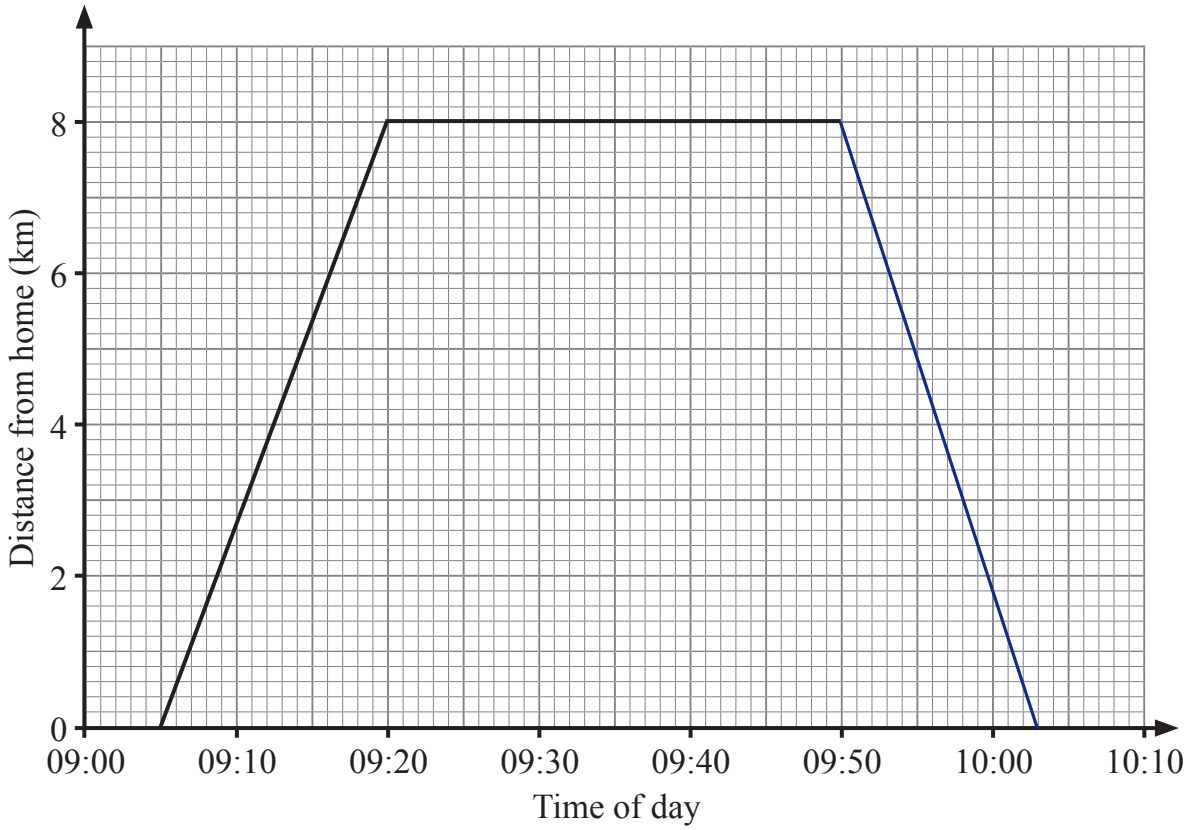
4 + (x + 4) = x + 8

(x + 4) + (x + 8) = 2x + 12

[Turn over

2 Seb cycles from his home to his piano teacher's house on Saturday morning.

He stays there for 30 minutes and then returns directly home.



(a) At what time did Seb leave his home?

Answer 09:05 [1]

(b) How long did Seb take to get to his teacher's house?

Answer 15 minutes [1]

09:20 − 09:05 = 15 minutes

Seb arrived home at 10:03

(c) Complete the distance–time graph. [1]

(d) What distance did Seb travel in total?

8 + 8 = 16

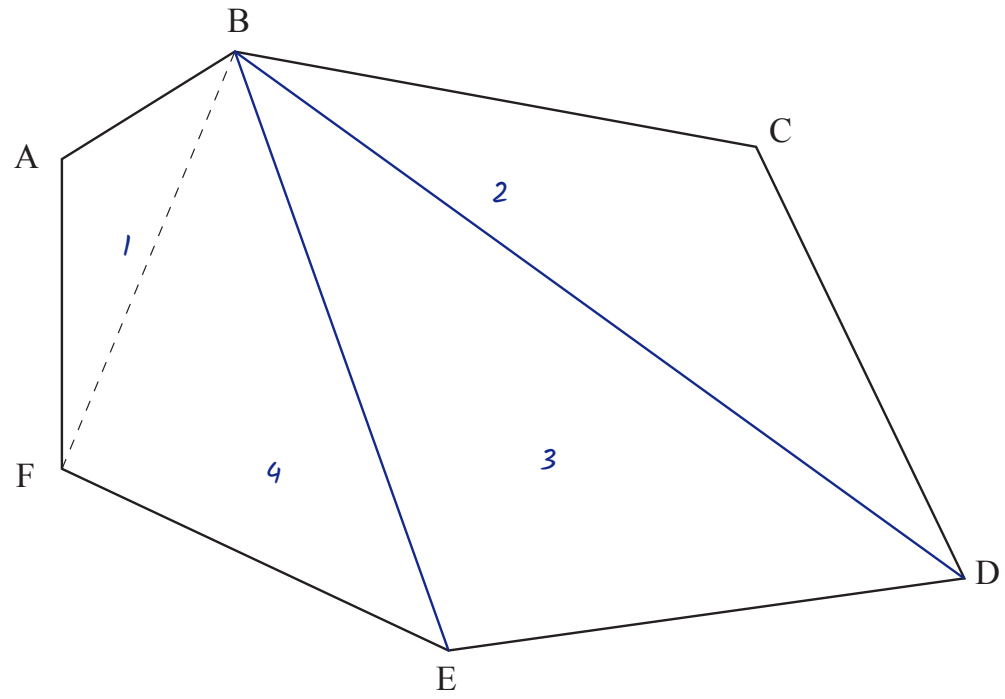
Answer 16 km [1]

(e) Did Seb travel home at a faster or slower speed?

Explain your answer clearly.

Answer faster because he took 13 minutes to get home but 15 minutes to get there, for the same 8 km (line is steeper) [1]

3 Polygon ABCDEF may be divided into triangles. One triangle is shown.



Use triangles to work out the sum of the interior angles of the polygon ABCDEF.

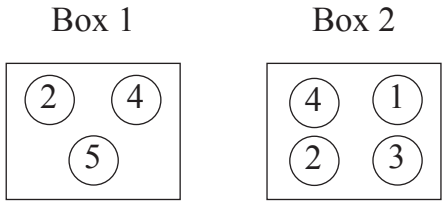
You **must show** your working.

4 triangles: 4 × 180° = 720°

Answer 720 ° [2]

[Turn over

4



There are two boxes of counters.

Each counter has a number on it as shown.

Mike takes one counter at random from Box 1 and then one counter at random from Box 2

(a) Complete the table to show all possible outcomes of counters taken.

		Box 2			
		1	2	3	4
Box 1	2	(2, 1)	(2, 2)	(2, 3)	(2, 4)
	4	(4, 1)	(4, 2)	(4, 3)	(4, 4)
	5	(5, 1)	(5, 2)	(5, 3)	(5, 4)

[2]

Same number: (2, 2) and (4, 4)

2 out of 12 outcomes

(b) What is the probability that Mike takes a counter with the same number on it from each box?

Answer $\frac{2}{12} = \frac{1}{6}$ [1]

(c) The numbers on the counters taken are **multiplied**.

What is the probability of this multiplication giving an **even** number?

Odd products only from (5, 1) and (5, 3)

Even = 12 − 2 = 10 outcomes

Answer $\frac{10}{12} = \frac{5}{6}$ [1]

(d) On another day, Laura takes one counter from each box and **multiplies** the numbers together.

She replaces the counters and does the same thing again for a total of 30 times.

How many times would you expect her to get an **odd** number answer?

$P(\text{odd}) = \frac{2}{12} = \frac{1}{6}$

$\frac{1}{6} \times 30 = 30 \div 6 = 5$

Answer 5 [3]

[Turn over

5 Estimate the value of $\dfrac{593}{4.1 \times 9.7}$

Show all your working.

$593 \approx 600$ $\quad 4.1 \approx 4$ $\quad 9.7 \approx 10$

$\dfrac{600}{4 \times 10} = \dfrac{600}{40} = 15$

Answer 15 [2]

6 The prize money in a golf tournament is divided between the three golfers who finish first, second and third in the ratio 7 : 4 : 3

What **fraction** of the prize money does each of the first three golfers receive?

Write each fraction in its simplest form.

$7 + 4 + 3 = 14$ parts

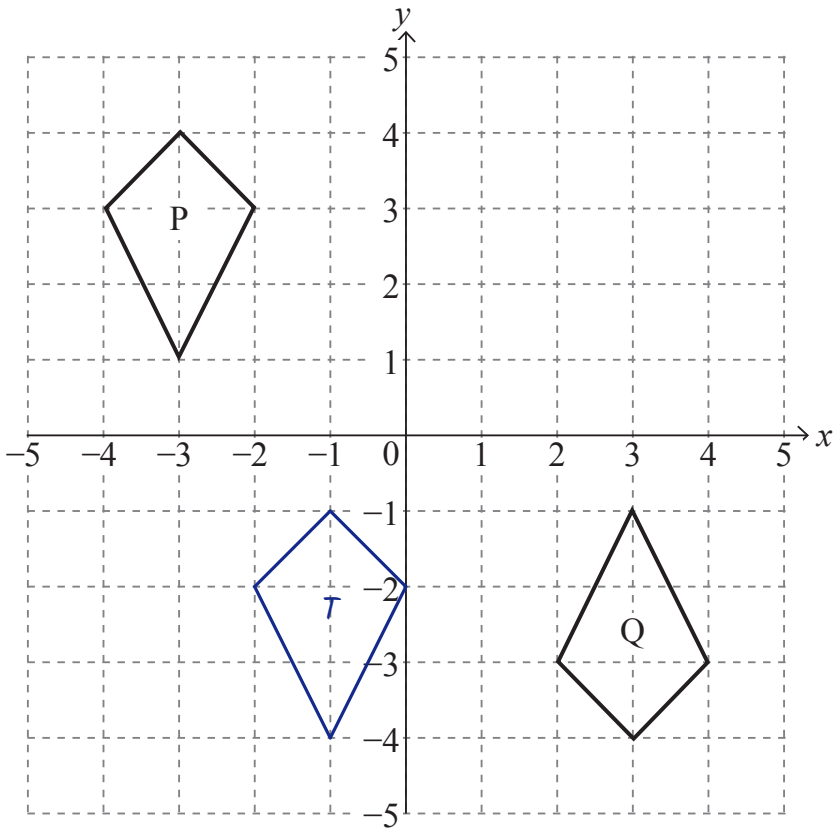
1st: $\dfrac{7}{14} = \dfrac{1}{2}$

2nd: $\dfrac{4}{14} = \dfrac{2}{7}$

3rd: $\dfrac{3}{14}$

Answer 1st $\dfrac{1}{2}$ 2nd $\dfrac{2}{7}$ 3rd $\dfrac{3}{14}$ [3]

7



(a) Describe fully the single transformation which would move shape P to shape Q.

Answer *Rotation of 180° about the origin (0, 0)* [3]

(b) Translate shape P by 2 units to the right and 5 units down.

Label the image T. [1]

(c) Describe fully the single transformation which would move shape T back to shape P.

Answer *Translation 2 units to the left and 5 units up* [2]

[Turn over

8 Simplify the following.

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

Answer $12y^7$ [1]

(b) $(m^4)^5$

Answer m^{20} [1]

9 **(a)** Solve the inequality $6y + 5 \geq 2$

$6y + 5 \geq 2$

$6y \geq 2 - 5$

$6y \geq -3$

$y \geq \frac{-3}{6}$ $\quad y \geq -\frac{1}{2}$

Answer $y \geq -\frac{1}{2}$ [2]

(b) Write down the smallest **integer** value of y which satisfies the inequality

$6y + 5 \geq 2$

$y \geq -0.5$, so $y = 0$

Answer $y =$ 0 [1]

10 **(a)** Write 25 as a binary number.

25 = 16 + 8 + 1

16 8 4 2 1

1 1 0 0 1

Answer 11001 [1]

(b) Write the binary number 1101001 in decimal form.

64 32 16 8 4 2 1

1 1 0 1 0 0 1

64 + 32 + 8 + 1 = 105

Answer 105 [1]

11 Make m the subject of the formula $H = mr + s$

$H = mr + s$

$H - s = mr$

$m = \frac{H - s}{r}$

Answer $m =$ $\frac{H - s}{r}$ [2]

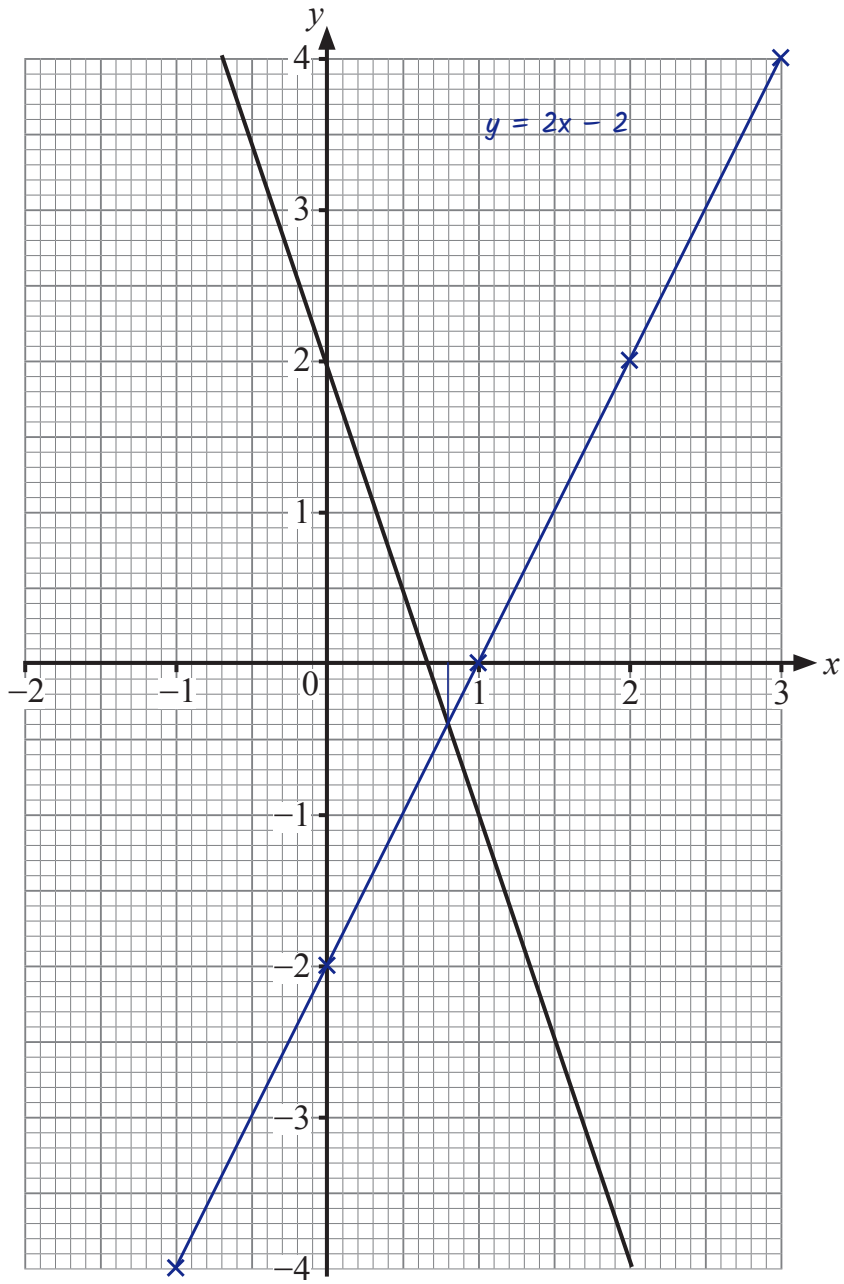
12 Two fair dice are rolled.

Make a list of all the ways it is possible to get a total score of 7 on the two dice.

Answer (1, 6), (2, 5), (3, 4), (4, 3), (5, 2), (6, 1) [2]

[Turn over

13



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By drawing a suitable line on the grid opposite solve the simultaneous equations

$y = 2x - 2$

$y = -3x + 2$

$y = 2x - 2$: x -1 0 1 2 3

y -4 -2 0 2 4

Answer $x =$ 0.8 $y =$ −0.4 [4]

The lines cross at (0.8, −0.4)

[Turn over

14 Find the value of $(-2)^{-2}$

$(-2)^{-2} = \frac{1}{(-2)^2} = \frac{1}{4}$

Answer $\frac{1}{4}$ [2]

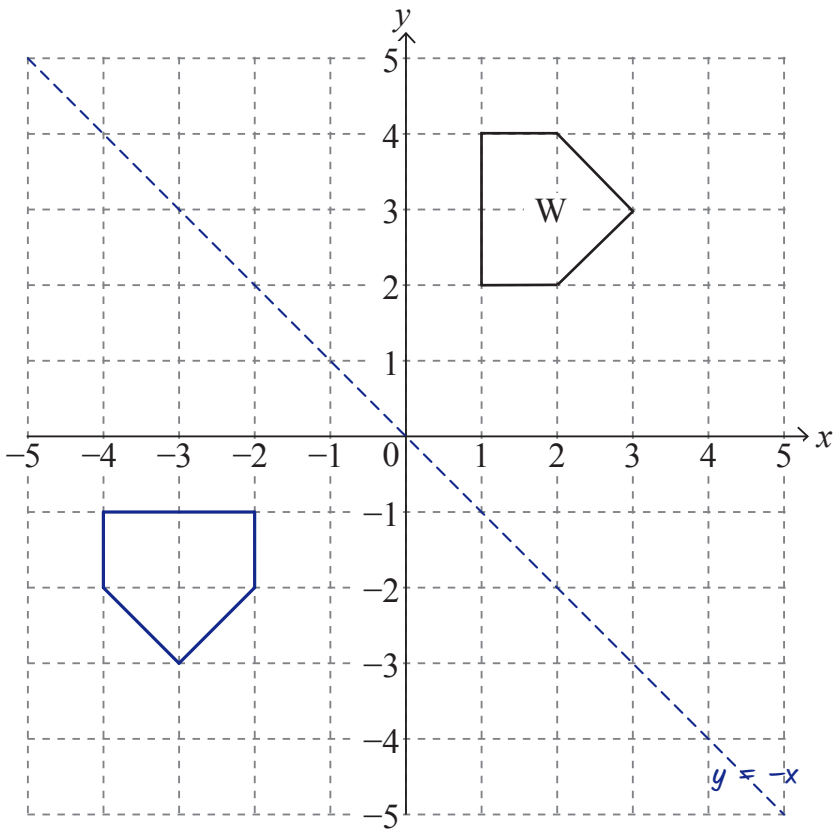
15 Make x the subject of the formula $y = \frac{b}{\sqrt{x}}$

$\sqrt{x} = \frac{b}{y}$

$x = \frac{b^2}{y^2}$

Answer $x = \frac{b^2}{y^2}$ [2]

16



On the grid, draw the reflection of the shape W in the line $y = -x$ [2]

[Turn over

17 There are three main routes from Belleek to Enniskillen by car.

There are five main routes from Enniskillen to Fintona by car.

(a) How many different ways can James travel from Belleek to Enniskillen to Fintona by car using only main routes?

$3 \times 5 = 15$

Answer 15 [1]

(b) On a particular day, two of the main routes from Enniskillen to Fintona were closed.

By what percentage has the number of different ways for James to travel from Belleek to Enniskillen to Fintona by car using only main routes been reduced?

Routes now: $3 \times 3 = 9$

Reduction $= 15 - 9 = 6$

$\frac{6}{15} = \frac{2}{5} = \frac{40}{100} = 40\%$

Answer 40 % [2]

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