Surname

Other Names

Candidate Signature

AQA

General Certificate of Secondary Education
Higher Tier
June 2012

Mathematics

43602H

Unit 2

H

Monday 11 June 2012   1.30 pm to 2.45 pm

For this paper you must have:
• mathematical instruments.

You must **not** use a calculator.

Time allowed
• 1 hour 15 minutes

Instructions
• Use black ink or black ball-point pen. Draw diagrams in pencil.
• Fill in the boxes at the top of this page.
• Answer **all** questions.
• You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
• Do all rough work in this book.

Information
• The marks for questions are shown in brackets.
• The maximum mark for this paper is 66.
• The quality of your written communication is specifically assessed in Questions 5 and 12. These questions are indicated with an asterisk (*).
• You may ask for more answer paper and graph paper. These must be tagged securely to this answer book.

Advice
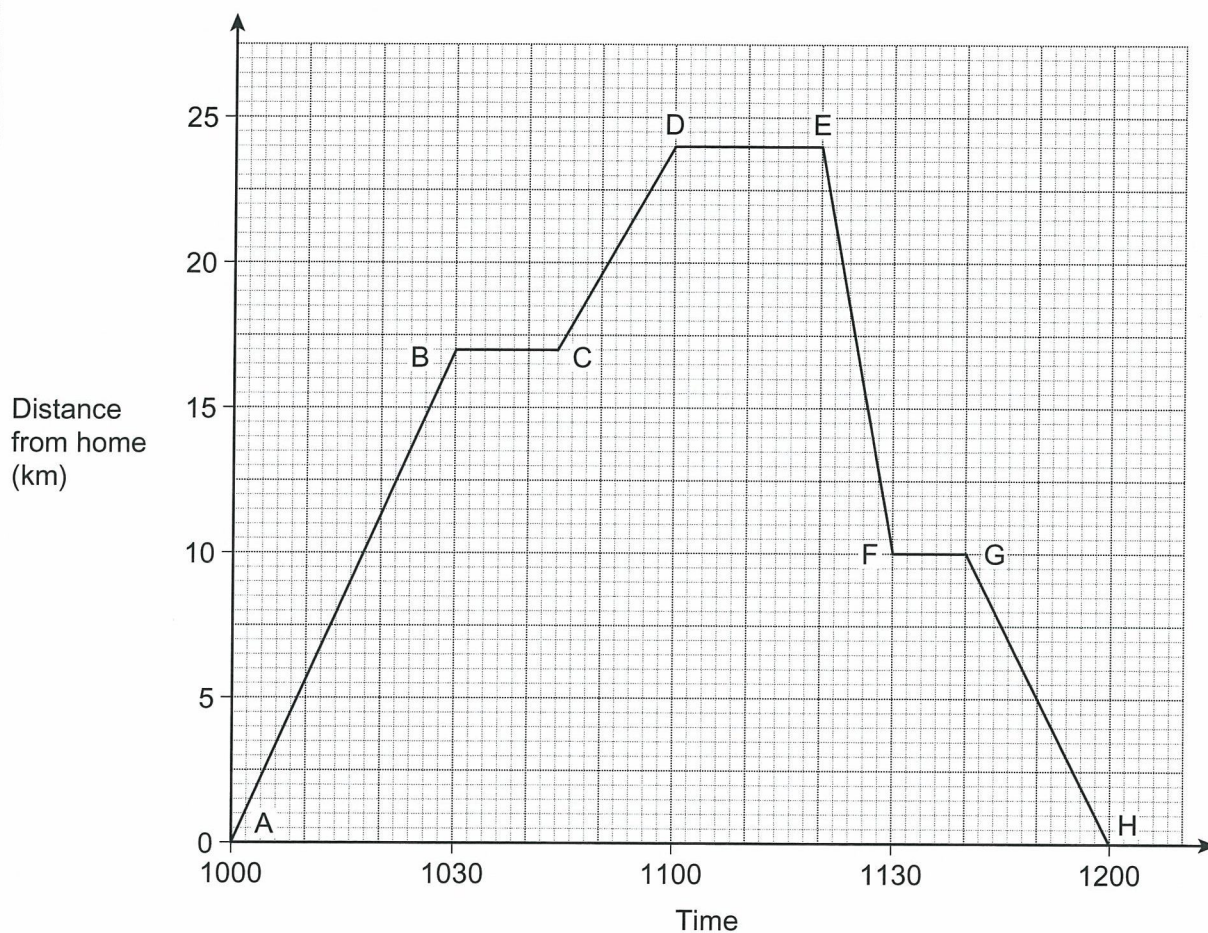• In all calculations, show clearly how you work out your answer.

Answer **all** questions in the spaces provided.

1 Amy leaves home in her car at 1000 and returns at 1200.
The graph shows her journey.

1 (a) How far does she travel in her car altogether?

$24 \times 2 = 48 \ km$

Answer .... 48 .... km   *(1 mark)*

1 (b) For how long does the car stop altogether?

$14 + 20 + 10 = 44 \ mins$

Answer .... 44 .... minutes   *(2 marks)*

1 (c) On which part of her journey is she travelling at the fastest speed?
Give a reason for your answer.

The ~~absolute~~ gradient of a distance-time graph (i.e. change in distance ÷ change in time) gives you the speed, so E-to-F was the part of Amy's journey where she was travelling at the fastest speed.

(2 marks)

2 Here are some of the ingredients for a pie.

Minced lamb	450 g
Potatoes	900 g
Carrots	75 g
Stock	300 ml

Oliver has only 300 g of minced lamb.

How much of the other ingredients should he use?

$\frac{300}{450} = \frac{2}{3}$,   Potatoes: $900 \times \frac{2}{3} = 600g$

Carrots: $75 \times \frac{2}{3} = 50g$

Stock: $300 \times \frac{2}{3} = 200ml$

Potatoes .... 600 .... g

Carrots .... 50 .... g

Stock .... 200 .... ml

(3 marks)

8

Turn over ▶

3   Use approximations to estimate the value of $\dfrac{402.5}{2.19 \times 38.7}$

$\simeq \dfrac{400}{2 \times 40} = \dfrac{400}{80}$

$= \dfrac{40}{8} = 5$

Answer .... 5 .... *(3 marks)*

4 (a)   Expand $w(w + 6)$

$w(w) + 6w$

Answer ...... $w^2 + 6w$ ...... *(2 marks)*

4 (b)   Factorise fully $8y + 20$

Answer ...... $4(2y + 5)$ ...... *(2 marks)*

*5 Post and packing on a parcel is £8.00 for delivery in the UK.
This increases by 40% if the parcel is sent to the USA.

Work out the cost to send the parcel to the USA.

$8 + 40\%$ of $8 = 8 + 0.4(8) = 8 + 3.2$

$= £11.20$.   ALTERNATIVELY, just do $8 \times 1.4 = £11.20$

Answer £ .... 11.20 ....   (3 marks)

6 The value of $(x-4)(y+3)$ is -10

Work out a possible pair of values for x and y.

$\overset{5}{(\overbrace{x-4})}\overset{-2}{(\overbrace{y+3})} = -10$

If $x - 4 = 5$, then $x = 5 + 4 = 9$

and if $y + 3 = -2$, then $y = -2 - 3 = -5$

$x = $ .... 9 .... $y = $ .... -5 ....   (2 marks)

Turn over for the next question

12

Turn over ▶

7 (a)   Write 126 as a product of prime factors.

$126 = 2 \times 63$

$= 2 \times 3 \times 21$

$= 2 \times 3 \times 3 \times 7$

Answer $2 \times 3^2 \times 7$ *(2 marks)*

7 (b)   Work out the Highest Common Factor (HCF) of 72 and 126

$72 = 2 \times 2 \times 2 \times 3 \times 3$

$126 = 2 \times 3 \times 3 \times 7$

HCF $\{72, 126\} = 2 \times 3 \times 3 = 18$

Answer 18 *(2 marks)*

8   Solve $3(x - 2) = 5x + 8$

$3x - 6 = 5x + 8$

$\Rightarrow 2x + 8 = -6$

$\Rightarrow x = \dfrac{-6 - 8}{2} = \dfrac{-14}{2} = -7$

Answer $x = -7$ *(3 marks)*

9 n is an integer.

List the values of n such that $-1 \leqslant n + 3 < 5$

$-1 - 3 \leqslant n < 5 - 3$

$\Rightarrow -4 \leqslant n < 2$

Answer $-4, -3, -2, -1, 0, 1$ *(2 marks)*

10   Alice has £4.
Billie has twice as much as Alice.

Billie has two-thirds of the amount Chris has.
The amount Chris has is four-fifths of his age in years.

How old is Chris?

$A = 4$

$B = 2 \times 4 = 8$

$B = \frac{2}{3}$ of C

$\Rightarrow \frac{2C}{3} = 8$

$\Rightarrow C = \frac{8 \times 3}{2} = \frac{24}{2} = 12$

Chris' age is given by $12 \div \frac{4}{5} = 12 \times \frac{5}{4} = 15$

Answer 15 years   *(4 marks)*

Turn over ▶

11 (a) Write 2.46×10^{-3} as an ordinary number.

....

....

Answer ......0.00246...................................... *(1 mark)*

11 (b) Work out the value of $(1.8 \times 10^5) \div (9 \times 10^2)$

Give your answer in standard form.

$$\frac{1.8 \times 10^5}{9 \times 10^2} = \frac{1.8}{9} \times \frac{10^5}{10^2}$$

$$= 0.2 \times 10^{(5-2)} = 0.2 \times 10^3 = 2 \times 10^2$$

Answer ......2×10^2...................................... *(2 marks)*

*12 Grace wants to hire a taxi from home to the railway station.
She normally uses Ace Taxis or Best Cars.

	Fixed charge	Rate per kilometre
Ace Taxis	£2.20	£1.60
Best Cars	£4.00	£1.40

Here is an advert for a new taxi firm, Cozycabs.

Cozycabs

No fixed charge
£1.70 per kilometre

The cost of this journey is the same using Ace Taxis and Best Cars.
Let the distance from home to the railway station be x kilometres.

Use this information to set up and solve an equation in x.

Decide whether it is cheaper for Grace to hire a taxi from Cozycabs for the journey.

$$1.6x + 2.2 = 1.4x + 4$$
$$\Rightarrow 0.2x = 1.8$$
$$\Rightarrow x = \frac{1.8}{0.2} = \frac{18}{2} = 9 \text{ km.}$$

Cost of 9 km Journey for 'Ace' & 'Best' is given by:
$$1.6(9) + 2.2 = 14.4 + 2.2 = £16.60$$

Cost for Cozycabs is given by $1.7 \times 9 = £15.30$

∴ Cozycabs is cheaper for a 9 km Journey.

(6 marks)

9

Turn over ▶

13   Solve the simultaneous equations $5x - 4y = 24$ · · ·   ①
                                                  $x + 2y = \ 9$ · · ·   ②

You **must** show your working.
Do **not** use trial and improvement.

① × 2: $2x + 4y = 18$ · · · ③

① + ③: $7x = 42 \implies x = \dfrac{42}{7} = 6$

In ②, $y = \dfrac{9-x}{2} = \dfrac{9-6}{2} = \dfrac{3}{2} = 1.5$

$x = \underline{\hspace{2cm} 6 \hspace{1cm}}$, $y = \underline{\hspace{1cm} 1.5 \hspace{1cm}}$ *(3 marks)*

14   Here is a table using powers of 3.

Power of 3	3^0	3^1	3^2	3^3	3^4	3^5	3^6	3^7	...
Value	1	3	9	27	81	243	729	2187	...
Remainder when the value is divided by 11	1	3	9	5	4	1	3	9	...

The repeating pattern of remainders continues.

What is the remainder when 3^{2012} is divided by 11?
Show working to justify your answer.

The remainder when 3^x is divided by 11 is the same as the remainder when $3^{(\text{remainder when } x \text{ is divided by } 5)}$ is divided by 11.

So the remainder when 3^{2012} is divided by 11 is the same as the remainder when $3^{(\text{remainder when } 2012 \text{ is divided by } 5)}$ is divided by 11.

$\dfrac{2012}{5} = 402\frac{2}{5}$, i.e. remainder is 2.

And $3^2 \div 11$ leaves remainder 9

Answer ....**9**.................. *(3 marks)*

Turn over ▶

15 Make y the subject of $\quad x = \dfrac{2 + 3y}{y - 5}$

$$x(y - 5) = 2 + 3y$$
$$xy - 5x = 2 + 3y$$
$$xy - 3y = 2 + 5x$$
$$y(x - 3) = 2 + 5x$$
$$\Rightarrow y = \dfrac{2 + 5x}{x - 3}$$

Answer $\quad y = \dfrac{2 + 5x}{x - 3}$ **(4 marks)**

16 (a) Write $\sqrt{175}$ in the form $a\sqrt{b}$ where a and b are integers greater than 1.

$$175 = 5 \times 5 \times 7$$
$$\sqrt{175} = \sqrt{25 \times 7} = \sqrt{25} \times \sqrt{7} = 5\sqrt{7}$$

Answer $\quad 5\sqrt{7}$ **(2 marks)**

16 (b) Simplify fully $\quad \dfrac{24}{\sqrt{3}} \quad$ by rationalising the denominator.
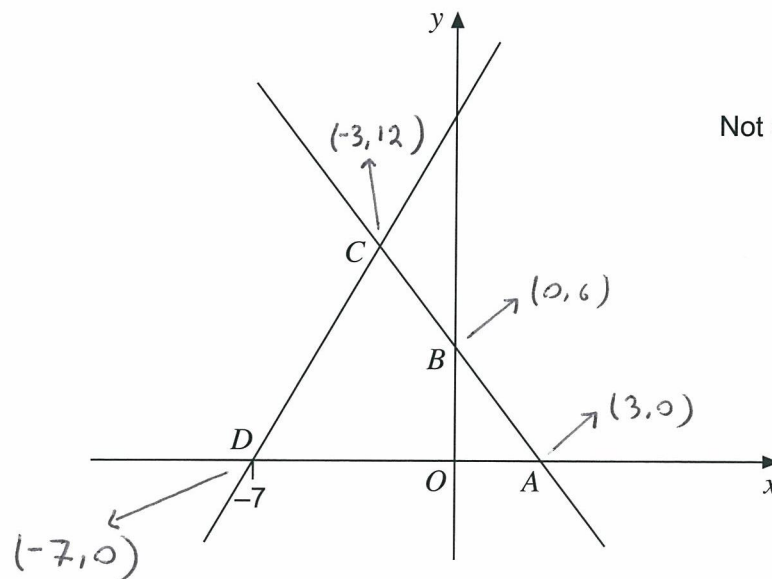
$$\dfrac{24\sqrt{3}}{\sqrt{3} \cdot \sqrt{3}} = \dfrac{24\sqrt{3}}{3} = 8\sqrt{3}$$

Answer $\quad 8\sqrt{3}$ **(2 marks)**

17 In the diagram, points A, B and C lie on the line $2x + y = 6$
B is the midpoint of AC.
D is the point $(-7, 0)$.

Not drawn accurately

Work out the equation of the line through C and D.

$2x + y = 6 \implies y = -2x + 6 \implies$ y-intercept is 6
and x-intercept is given by solution to equation
$-2x + 6 = 0$, i.e. $x = \frac{0-6}{-2} = \frac{-6}{-2} = 3$.
So coordinates for points A and B are $(3, 0)$ and
$(0, 6)$ respectively. As B is the midpoint of AC,
coordinates for C are $(-3, 12)$. CD is a straight
line of the form $y = mx + c$ with $m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$
$= \frac{12 - 0}{-3 - (-7)} = \frac{12}{4} = 3$. So $y = 3x + c$ passing through
$(-7, 0)$. $\implies 0 = 3(-7) + c \implies c = 0 + 21 = 21$.
$\therefore$ Equation of line through C and D is $y = 3x + 21$

Answer .... $y = 3x + 21$ .... (5 marks)

13

Turn over ▶

18   Here is an identity $(3x + c)(x + c) \equiv 3x^2 - dx + 16$

c and d are integers.

Work out all possible pairs of values of c and d.
You **must** show your working.

$(3x+c)(x+c) \equiv 3x^2 + 3cx + cx + c^2$

$= 3x^2 + 4cx + c^2$

$\Rightarrow c^2 = 16$ and $4c = -d$

For $c^2 = 16$, $c = \pm\sqrt{16} = \pm 4$.

When $c = 4$, $d = \dfrac{4(4)}{-1} = -16$

and when $c = -4$, $d = \dfrac{4(-4)}{-1} = \dfrac{-16}{-1} = 16$

Answer $(c, d) = (4, -16)$ or $(-4, 16)$ *(5 marks)*

END OF QUESTIONS

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