

Centre Number						Candidate Number				
Surname										
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Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Pages	Mark
2-3	
4-5	
6-7	
8-9	
10-11	
12-13	
14	
TOTAL	



General Certificate of Secondary Education
Higher Tier
November 2012

Mathematics

43602H

Unit 2

Thursday 8 November 2012 1.30 pm to 2.45 pm

H

<p>For this paper you must have:</p> <ul style="list-style-type: none"> mathematical instruments. <p>You must not use a calculator.</p>	
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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 3 and 16. 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.



N 0 V 1 2 4 3 6 0 2 H 0 1

WMP/Nov12/43602H

43602H

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

- 1 (a) Multiply out $8(y + 3)$

$$8y + 24$$

Answer $8y + 24$ (1 mark)

- 1 (b) Factorise $4x - x^2$

$$x(4 - x)$$

Answer $x(4 - x)$ (1 mark)

- 2 On Sunday I earn £50 more than on Saturday.
Altogether I earn £600.

Work out how much I earn on Saturday.

Let x = earnings for Saturday.

Then earnings for Sunday = $x + 50$ and total

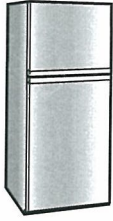
earnings is given by $x + x + 50 = 600 \Rightarrow 2x + 50 = 600$
 $\Rightarrow x = \frac{600 - 50}{2} = 275$

Answer £ 275 (3 marks)



*3 Here are three offers for a fridge freezer.

Electric Supplies



Usual price £250
30% off

New Homes



Usual price £240
 $\frac{1}{3}$ off

Fridges for Us



£50 deposit
plus
£20 a month for 6 months

Which offer is the cheapest?
You **must** show your working.

$$E.S: 250 - 30\% \text{ of } 250 = 250 - \frac{3}{10} \times 250$$

$$= 250 - 75 = \text{£}175.$$

$$N.H: 240 - \frac{1}{3} \times 240 = 240 - 80 = \text{£}160$$

$$F.F.U: 50 + 6 \times 20 = 50 + 120 = \text{£}170$$

\therefore New Homes is cheapest.

Answer New Homes (6 marks)



- 4 The number 39 can be written as the product of two prime numbers.

$$39 = 3 \times 13$$

Write **three** other numbers between 30 and 40 as the product of two prime numbers.

.....
 $31, 32 = 2 \times 2 \times 2 \times 2 \times 2, (33) = 3 \times 11,$

 $(34) = 2 \times 17, (35) = 5 \times 7, 36 = 2 \times 2 \times 3 \times 3$

 $37, (38) = 2 \times 19$

Answer 33 = 3 \times 11

..... 34 = 2 \times 17

..... 35 = 5 \times 7

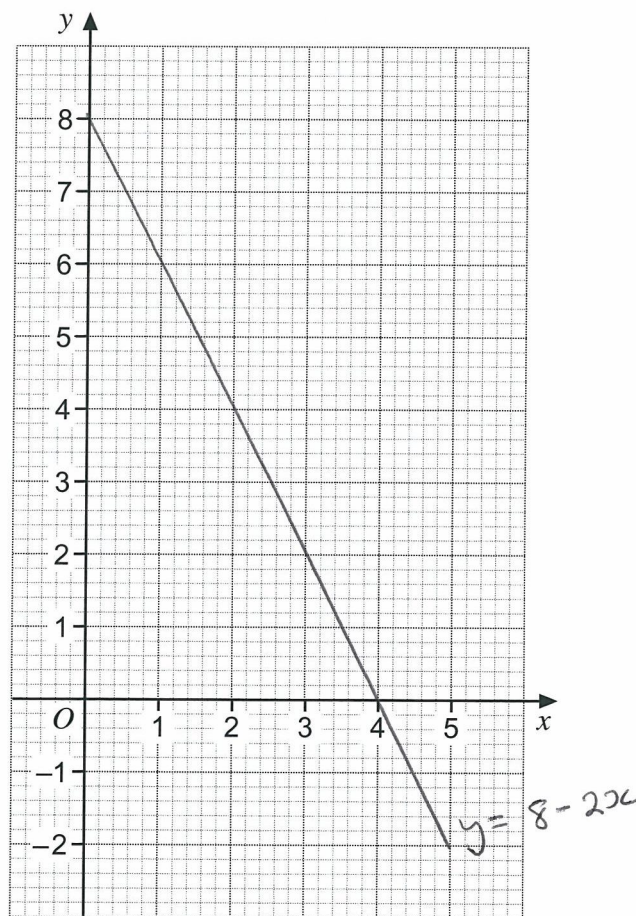
(3 marks)



- 5 On the grid below draw the graph of $y = 8 - 2x$ for values of x between 0 and 5.

For $y = mx + c$, i.e. any straight line, m is gradient and c is the y -intercept.

\therefore A line given by the equation $y = 8 - 2x$ (or $y = -2x + 8$) is a straight line with gradient -2 and y -intercept 8



(3 marks)

Turn over ►



6 (a) The n th term of a sequence is $\frac{n^2}{2}$

Which term in the sequence is the first to have a value greater than 50?

$$\frac{n^2}{2} > 50, n \text{ a +ve integer.}$$

$$\Rightarrow n^2 > 100$$

$$\Rightarrow n > 10. \therefore 11^{\text{th}} \text{ term is first to be greater than 50.}$$

Answer 11^{th} term (2 marks)

6 (b) Here is a different sequence.

$$\begin{array}{ccccccc} n \rightarrow & 1 & 2 & 3 & 4 & & \\ n^{\text{th}} \text{ term} \rightarrow & 7 & 10 & 13 & 16 & \dots & \\ & \downarrow & \downarrow & \downarrow & & & \\ & 3 & 3 & 3 & & & \end{array}$$

Work out the n th term for this sequence.

$$n^{\text{th}} \text{ term} = 3n + 4$$

Answer $3n + 4$ (2 marks)



7 One day 460 people visit a zoo.

280 are adults.

The ratio of women to men is 4 : 3

180 are children.

$\frac{3}{5}$ of them are boys.

Jane says that altogether there were more females.

Show that she is correct.

$$\text{No. of women} = \frac{4}{7} \times 280 = 160$$

$$\text{No. of girls} = \frac{2}{5} \times 180 = 72$$

$$\text{Total no. of females} = 160 + 72 = 232$$

$$\text{Total no. of males} = 460 - 232 = 228$$

\therefore Jane is correct.

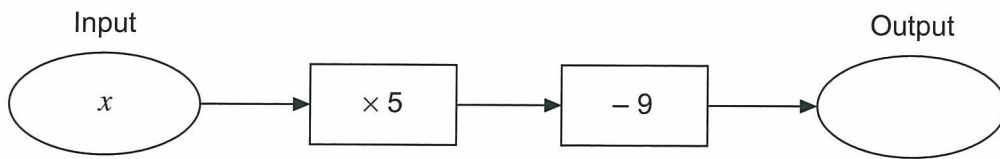
(5 marks)

Turn over for the next question



8

Here is a number machine.



The output is three times the input.

Work out the input x .

$$5x - 9 = 3x$$

$$\Rightarrow 2x = 9$$

$$\Rightarrow x = \frac{9}{2} = 4\frac{1}{2} \text{ or } 4.5$$

$$x = 4.5 \quad (4 \text{ marks})$$



9 Work out $2\frac{1}{8} - \frac{2}{3}$

$$\frac{17}{8} - \frac{2}{3} = \frac{51 - 16}{24} = \frac{35}{24} = 1\frac{11}{24}$$

Answer $1\frac{11}{24}$ (3 marks)

10 (a) Simplify fully $2a^3b \times a^2b^6$

$$2a^{(3+2)}b^{(1+6)} = 2a^5b^7$$

Answer $2a^5b^7$ (2 marks)

10 (b) Simplify fully $\frac{4c^3d^2}{8cd^2}$

$$\frac{1}{2}c^{(3-1)}d^{(2-2)} = \frac{1}{2}c^2$$

Answer $\frac{1}{2}c^2$ (2 marks)

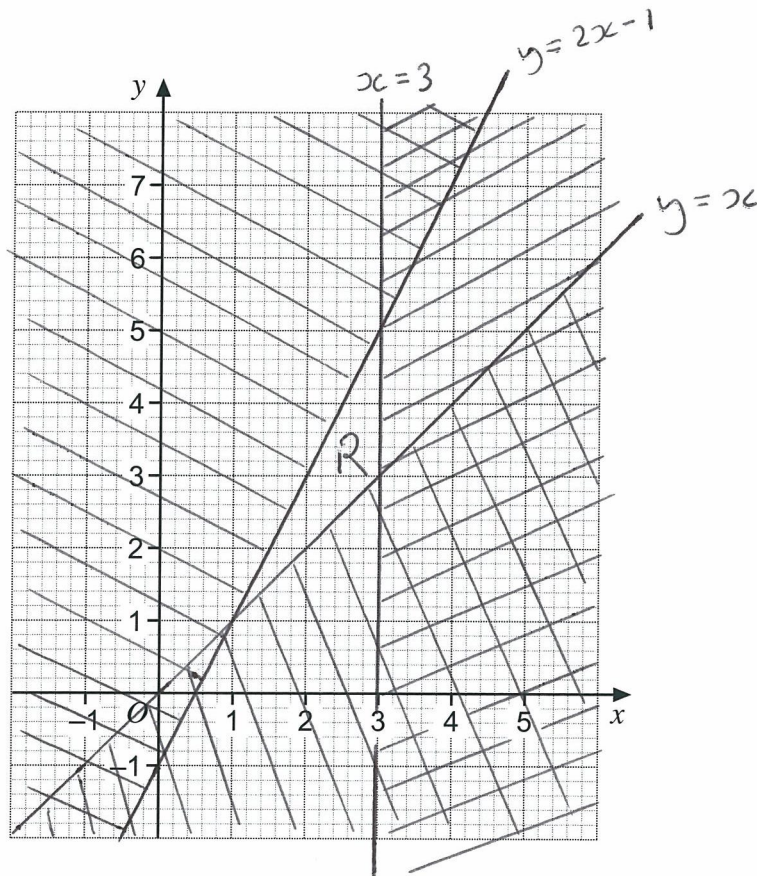


11 Put a label, R, in the region on the grid satisfied by all three of these inequalities.

$$x \leq 3$$

$$y \geq x$$

$$y \leq 2x - 1$$



(4 marks)



- 12 (a) A human cell nucleus has a diameter of 0.000 001 metres.

Write this number in standard form.

Answer 1×10^{-6} (1 mark)

- 12 (b) There are up to 5×10^{13} cells in a human body.

Write 5×10^{13} as an ordinary number.

Answer 50,000,000,000,000 (1 mark)

- 12 (c) A patient has a disease.
She has 4^3 body cells affected on day 1.

The number of affected cells doubles every day.
The disease becomes serious when 2^{10} body cells are affected.

On which day does the disease become serious?
You **must** show your working.

$$4^3 = (2^2)^3 = 2^{(2 \times 3)} = 2^6$$

$$2^6 \times 2^n = 2^{10} \quad \text{where } n = \text{day no.} - 1 \text{ and}$$

$$\Rightarrow 2^{(6+n)} = 2^{10} \quad \text{thus day no.} = n + 1.$$

$$\Rightarrow 6 + n = 10 \text{ and so } n = 10 - 6 = 4. \quad \therefore \text{day no.} = 4 + 1 = 5$$

Day 5 (3 marks)

Turn over for the next question



13 (a) Expand and simplify $(2x + 1)(x - 2)$

$$2x^2 - 4x + x - 2$$

$$= 2x^2 - 3x - 2$$

Answer $2x^2 - 3x - 2$ (3 marks)

13 (b) Factorise fully $3x^2 - 48y^2$

$$3(x^2 - 16y^2)$$

$$= 3(x^2 - (4y)^2)$$

$$= 3(x + 4y)(x - 4y)$$

N.B: $a^2 - b^2 \equiv (a + b)(a - b)$
as per difference of two
Squares rule.

Answer $3(x + 4y)(x - 4y)$ (3 marks)



- 14 Make x the subject of $\frac{w-x}{y} = 2x - 3$

$$(2x-3)y = w-x$$

$$2xy - 3y = w - x$$

$$2xy + x = w + 3y$$

$$x(2y+1) = w+3y$$

$$x = \frac{w+3y}{2y+1}$$

Answer $x = \frac{w+3y}{2y+1}$ (4 marks)

- 15 (a) $\sqrt{75} = a\sqrt{3}$

Work out the value of a .

$$75 = 3 \times 5 \times 5 \quad \sqrt{75} = \sqrt{25 \times 3} = \sqrt{25} \cdot \sqrt{3}$$

$$= 5\sqrt{3} \quad \therefore a = 5$$

Answer $a = 5$ (2 marks)

- 15 (b) Evaluate $27^{-\frac{2}{3}}$

$$27^{-\frac{2}{3}} = \frac{1}{27^{\frac{2}{3}}} = \frac{1}{(\sqrt[3]{27})^2}$$

$$= \frac{1}{3^2} = \frac{1}{9}$$

Answer $\frac{1}{9}$ (3 marks)



*16(a) Show that $x^2 - 8x + 20$

can be written in the form $(x - a)^2 + a$

where a is an integer.

$$\begin{aligned} & x^2 - 8x + \left(\frac{1}{2}(-8)\right)^2 + 20 - \left(\frac{1}{2}(-8)\right)^2 \\ &= x^2 - 8x + 16 + 20 - 16 \\ &= x^2 - 8x + 16 + 4 \\ &= (x - 4)^2 + 4 \end{aligned}$$

(3 marks)

16 (b) Hence explain how you know that $x^2 - 8x + 20$ is always positive.

The square of any 'real' number is always positive.
Since $(x - 4)^2 \geq 0$, $(x - 4)^2 + 4 > 0$ and so
 $x^2 - 8x + 20$ is always positive.

(2 marks)

END OF QUESTIONS



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