

Write your name here

Surname

Other names

Centre Number

Candidate Number

**Edexcel GCSE**

# Mathematics B

**Unit 2: Number, Algebra, Geometry 1  
(Non-Calculator)**

**Higher Tier**

Tuesday 1 March 2011 – Afternoon

**Time: 1 hour 15 minutes**

Paper Reference

**5MB2H/01**

**You must have:**

Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser. Tracing paper may be used.

Total Marks

## Instructions

SOLUTIONS

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- **Calculators must not be used.**



## Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk (\*)** are ones where the quality of your written communication will be assessed – *you should take particular care on these questions with your spelling, punctuation and grammar, as well as the clarity of expression.*

## Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Answer ALL questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

1 Here are the first four terms of an arithmetic sequence.

$$5 \quad 9 \quad 13 \quad 17$$

$\xrightarrow{+4} \quad \xrightarrow{+4}$

(a) What is the next term of this sequence?

21

(1)

(b) Write down an expression, in terms of  $n$ , for the  $n$ th term of the sequence.

Note: NOT " $a = 4n + 1$ ".

$$4n + 1$$

(2)

(Total for Question 1 is 3 marks)

2 Ali, Ben and Candice share £300 in the ratio 2 : 3 : 5

How much money does Candice get?

$$2 + 3 + 5 = 10 \text{ parts}$$

$$1 \text{ part} = \pounds 300 / 10 = \pounds 30$$

$$\text{Candice gets 5 parts} = \pounds 150$$

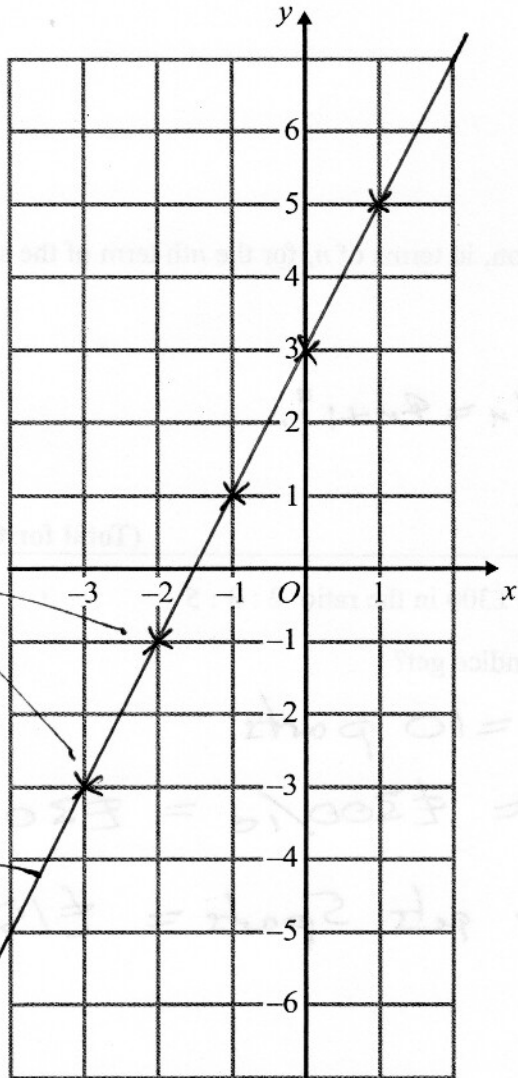
£

(Total for Question 2 is 2 marks)



3 On the grid, draw the graph of  $y = 2x + 3$  for values of  $x$  from  $x = -3$  to  $x = 1$

$x$	$y$
-3	-3
-2	-1
-1	1
0	3
1	5



At least 2 points plotted etc

line

At least 2 correct values

(Total for Question 3 is 3 marks)



- 4 Veena bought some food for a barbecue.  
She is going to make some hot dogs.  
She needs a bread roll and a sausage for each hot dog.

There are 40 bread rolls in a pack.  
There are 24 sausages in a pack.

Veena bought exactly the same number of bread rolls and sausages.

- (i) How many packs of bread rolls and packs of sausages did she buy?

Number of rolls = number of sausages  
= a common multiple of 40 and 24.

$$\left. \begin{array}{l} 40 = 5 \times 8 \\ 24 = 3 \times 8 \end{array} \right\} \text{HCF} = 8 \quad \rightarrow \boxed{1}$$

$$\text{LCM} = \frac{40 \times 24}{8} = 40 \times 3 = 120 \quad \rightarrow \boxed{1}$$

(or rolls: 40, 80, 120, 160...  $\rightarrow \boxed{1}$   
sausages 24, 48, 72, 96, 120, 144...  $\rightarrow \boxed{1}$ )

120 rolls = 3 packs ( $3 = 120/40$ )  $\rightarrow \boxed{1}$  division.

120 sausages = 5 packs ( $5 = 120/24$ ).

or 6, 9, 10, 15 etc  
3 packs of bread rolls  
5 packs of sausages  
 $\rightarrow \boxed{1}$

- (ii) How many hot dogs can she make?

120 hot dogs  $\rightarrow \boxed{1}$

(Total for Question 4 is 5 marks)



5

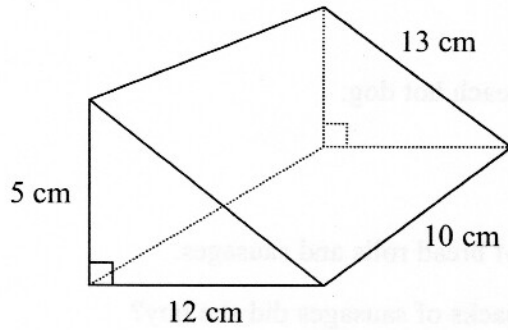
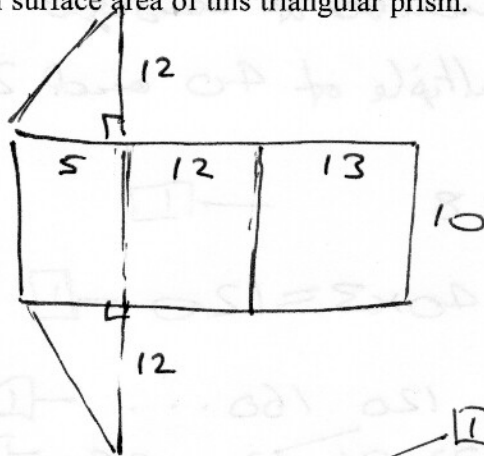


Diagram NOT accurately drawn.

Work out the total surface area of this triangular prism.



□

□

(or  $5 \times 10 + 12 \times 10 + 13 \times 10$ )

$$\frac{5 \times 12}{2} + \frac{5 \times 12}{2} + (5 + 12 + 13) \times 10$$

$$= 30 + 30 + 30 \times 10 = 360 \text{ cm}^2$$

□

□

units.

(Total for Question 5 is 4 marks)

6 The interior angle of a regular polygon is  $160^\circ$ .

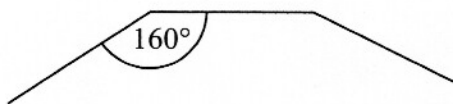


Diagram NOT accurately drawn.

(i) Write down the size of an exterior angle of the polygon.

$$180 - 160 = 20^\circ$$

□

(ii) Work out the number of sides of the polygon.

$$20^\circ = \frac{360^\circ}{n}$$

$\times n$

$\downarrow \times n$

$$20n = 360$$

$$n = \frac{360}{20} = \frac{36}{2} = 18 \text{ sides}$$

□

□

(Total for Question 6 is 3 marks)



7 A piece of card is in the shape of a trapezium.

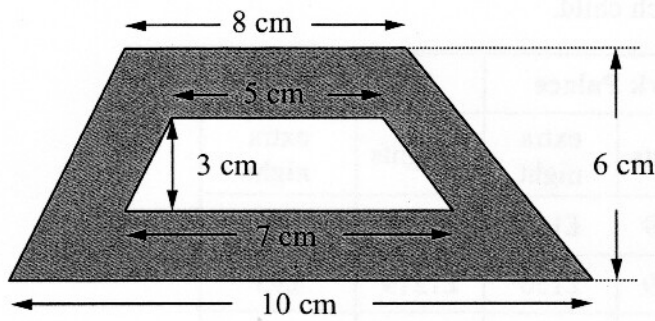



Diagram NOT accurately drawn.

A hole is cut in the card.  
The hole is in the shape of a trapezium.

Work out the area of the shaded region.

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

Large trapezium, area =  $\frac{(8+10)}{2} \times 6 = \frac{18}{2} \times 6 = 9 \times 6 = 54 \text{ cm}^2$  □

Small trapezium, area =  $\frac{(5+7)}{2} \times 3 = \frac{12 \times 3}{2} = 18 \text{ cm}^2$  □

Shaded area =  $54 - 18 = 36 \text{ cm}^2$

↑  
subtract □ □


..... cm<sup>2</sup>

(Total for Question 7 is 3 marks)



8 The table shows the costs, per person, of a holiday at two different hotels. It shows the cost for 5 nights and the cost for each extra night. It also shows the discount for each child.

Date holiday starts	Park Palace		Dubai Grand	
	5 nights	extra night	5 nights	extra night
01 Jan – 31 Mar	£1169	£150	£849	£86
01 Apr – 09 Apr	£1229	£150	£1219	£95
10 Apr – 15 Jul	£810	£80	£853	£53
16 Jul – 20 Aug	£810	£80	£854	£53
21 Aug – 10 Dec	£810	£80	£869	£94
Discount for each child	$\frac{1}{5}$ off		15% off	


starting 1st August  


There are two adults and two children in the Smith family. The family want a holiday for 7 nights, starting on 1st August.

One hotel will be cheaper for them than the other hotel.


Work out the cost of the cheaper holiday. You must show all your working.

Park Palace

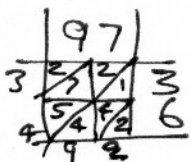
Children  $\frac{1}{5}$  off, child cost =  $0.8 \times$  adult. 

2 adults + 2 children,  $2 + 2 \times 0.8 = 3.6 \times$  price for 1 adult.


Cost for 1 adult for 7 nights =  $810 + 2 \times 80 = £970$

Total cost  $£970 \times 3.6$  

$= 1000 \times 3.6 - 30 \times 3.6 = 3600 - 108 = 3492$

(or  $970 \times 3.6 = 97 \times 36$ , ).

Dubai Grand

Children 15% off, price  $0.85 \times$  adult price 

2 adults + 2 children,  $2 + 2 \times 0.85 = 3.7 \times$  adult price.



1 adult for 7 nights, £854 + 2 x 53  
 = 854 + 106 = £960

960 x 3.7 = 96 x 37 = 3552

	9	6	
3	2	7	8
5	6	4	2
	5	2	

a correct total.

Park Palace is the cheaper hotel, it costs them £3492.

£ .....

(Total for Question 8 is 6 marks)





9 A plane takes 30 seconds to fly a distance of 8 kilometres.

Work out the average speed of the plane, in miles per hour.

$$8 \text{ km} = 5 \text{ miles.} \quad \square$$

$$\text{Speed} = \frac{5 \text{ miles}}{\frac{1}{2} \text{ minute}} = \frac{10 \text{ miles}}{1 \text{ minute}} = 10 \text{ miles/minute} \quad \square$$

$$= 600 \text{ miles per hour.}$$

(or equivalent) . \(\square\)

..... miles per hour

(Total for Question 9 is 3 marks)

10  $AB$  is a line segment.

$A$  is the point  $(2, 5, 6)$ .

The midpoint of the line  $AB$  has coordinates  $(-1, -4, 2)$ .

Find the coordinates of point  $B$ .

$$(2, 5, 6) \text{ to } (-1, -4, 2) \text{ move } (-3, -9, -4) \quad \square$$

$$\text{Continue, } (-1-3, -4-9, 2-4) = (-4, -13, -2)$$

OR let  $B$  be  $(x, y, z)$

$$\left( \frac{2+x}{2}, \frac{5+y}{2}, \frac{6+z}{2} \right) = (-1, -4, 2) \quad \square$$

$$2+x = -2, \quad x = -4$$

$$5+y = -3, \quad y = -8$$

$$6+z = 4, \quad z = -2$$

$$(-4, -13, -2)$$

(Total for Question 10 is 2 marks)



11 (a) Expand

$3(x + 2)$



$3x + 6$

(2)

(b) Factorise completely

$12x^3y - 18xy^2$

$= 6(2x^3y - 3xy^2)$

$= 6xy(2x^2 - 3y)$



(2)

(c) Expand and simplify

$(2x - 3)(x + 4)$

$= 2x^2 + 8x - 3x - 12$

$= 2x^2 + 5x - 12$

— [1] if 3 of the 4 terms ok.

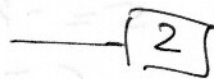


(2)

(d) Simplify

$5x^4y^3 \times 2x^3y^2$

$= 10x^7y^5$



(1 if ~~one~~ one mistake in the 10,  $x^7$  or  $y^5$ ).

(2)

(Total for Question 11 is 8 marks)



12 Write down the value of

(i)  $7^0$

1

(ii)  $5^{-1}$

$\frac{1}{5}$

(iii)  $9^{\frac{1}{2}}$

3

(Total for Question 12 is 3 marks)

13 (a) Write down the equation of a straight line that is parallel to  $y = 5x + 6$

Can have  $y = 5x + \text{any number}$   
(except 6!)

$y = 5x$   
(1)

(b) Find an equation of the line that is perpendicular to the line  $y = 5x + 6$  and passes through the point  $(-2, 5)$ .

Gradient of  $y = 5x + 6$ ,  $m_1 = 5$

Perpendicular gradient  $m_2 = \frac{-1}{m_1} = -\frac{1}{5}$  (1)

Then either  $y = mx + c = -\frac{1}{5}x + c$

At  $(-2, 5)$ ,  $5 = -\frac{1}{5} \times -2 + c = \frac{2}{5} + c$  (1)

$c = 5 - \frac{2}{5} = 4\frac{3}{5}$

OR formula

$y - y_1 = m(x - x_1)$ ,  $y - 5 = -\frac{1}{5}(x - (-2)) = -\frac{1}{5}x - \frac{2}{5}$   
 $y = -\frac{1}{5}x + 5 - \frac{2}{5}$

$y = -\frac{1}{5}x + 4\frac{3}{5}$

(3) (1)

(Total for Question 13 is 4 marks)



14 Simplify fully

$$\frac{x^2 - 2x - 15}{x^2 - 4x - 21}$$

1

$$= \frac{(x-5)(x+3)}{(x-7)(x+3)}$$

1

(divide by  $(x+3)$  top & bottom)

$$= \frac{x-5}{x-7} \quad \text{--- 1}$$

Factors of -15 are

- 1 x 15
- 3 x 5
- 5 x 3 adds to -2.
- 15 x 1

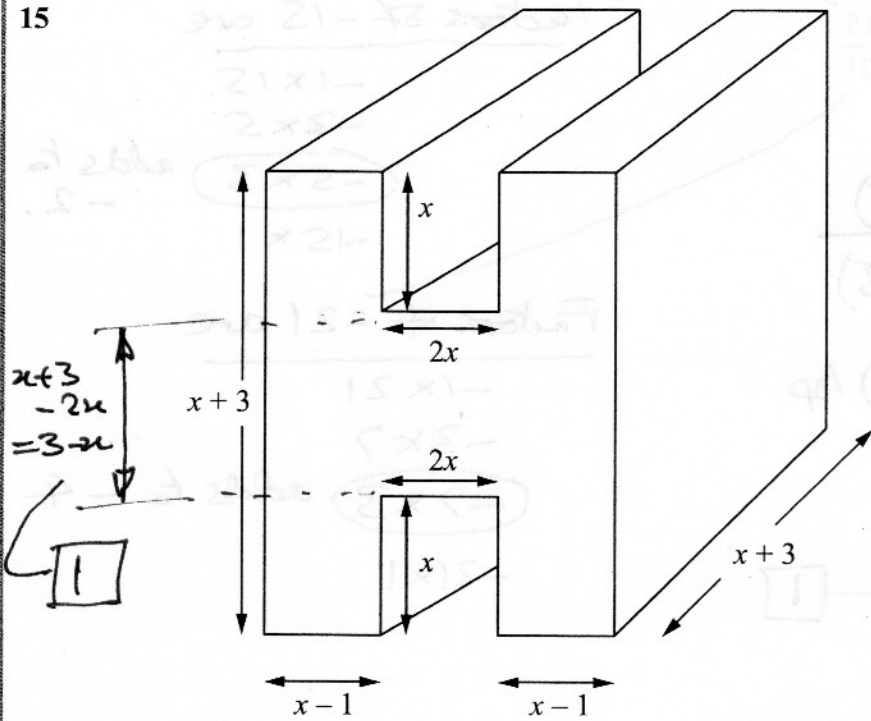
Factors of -21 are

- 1 x 21
- 3 x 7
- 7 x 3 adds to -4
- 21 x 1

(Total for Question 14 is 3 marks)

15

Diagram NOT accurately drawn.



The diagram shows a prism.  
 All measurements are in cm.  
 All corners are right angles.  
 The volume of the prism is  $V \text{ cm}^3$ .

Find a formula for  $V$ .

Cross-section area



Area =  $2(x^2 + 2x - 3) + (6x - 2x^2)$

Adding  $\rightarrow$

$$= 2x^2 + 4x - 6 + 6x - 2x^2$$

$$= 10x - 6$$

Volume = (cross section area)  $\times$  length

$$= (10x - 6)(x + 3)$$

$$= 10x^2 + 30x - 6x - 18$$

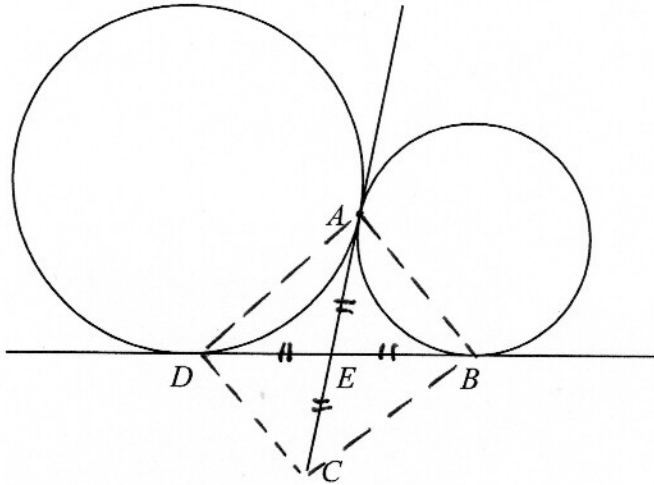
$V = 10x^2 + 24x - 18$

(Total for Question 15 is 4 marks)



\*16

Diagram NOT accurately drawn.



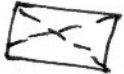
$A$  and  $D$  are two points on the circumference of a circle.  
 $A$  and  $B$  are two points on the circumference of a smaller circle.  
 $DB$  and  $AC$  are tangents to both circles.  
 $E$  is the intersection of  $DB$  and  $AC$ .  
 $E$  is the midpoint of  $AC$ .

Prove that  $ABCD$  is a rectangle.

Length  $DE = AE$  (tangents to big circle are equal length to their point of intersection). — [1]

Length  $AE = BE$  (ditto for small circle).

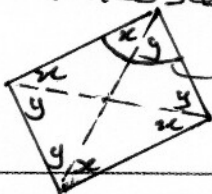
Length  $AE = CE$  since  $E$  is the mid-point.

Since the diagonals  $AC$  and  $DB$  bisect each other, it is either a rectangle  or parallelogram [1]



Since the diagonals are equal in length, it cannot be a parallelogram  $\therefore$  it is a rectangle — [1]

OR 4 isosceles triangles, angles in each corner are  $(x+y)$  so all 4 corners same angle, must be  $90^\circ = 360/4$ .



(Total for Question 16 is 4 marks)

TOTAL FOR PAPER IS 60 MARKS