

Write your name here

Surname

Other names

## Edexcel GCSE

# Mathematics B

Unit 3: Number, Algebra, Geometry 2 (calculator)

Higher Tier

**Practice paper**

Time: 1 hour 45 minutes

5MB3/3H

**You must have:**

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

Total marks

### Instructions

- Use black ink or ballpoint pen.
- Answer all the questions.
- Calculators may be used.
- If your calculator does not have a  $\pi$  button, take the value of  $\pi$  to be 3.142 unless the question instructs otherwise.

### Information

- The total mark for this paper is 80.
- The marks for each question are shown in brackets.
- Questions labelled with an asterisk (\*) are those where the quality of your written communication will be assessed.

### 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.

**Answer ALL questions.**  
**Write your answers in the spaces provided.**  
**You must write down all stages in your working.**  
**Calculator permitted.**

1. a Solve  $5x - 3 = x + 7$

$$4x - 3 = 7$$

$$4x = 7 + 3 = 10$$

$$x = 10/4$$

$$x = 2.5 \quad (2)$$

b Solve  $5(y + 2) < 22$

$$y + 2 < \frac{22}{5}$$

$$\therefore y + 2 < 4.4$$

$$y < 2.4$$

$$y < 2.4 \quad (2)$$

(Total for Question 1 = 4 marks)

\*2. John is going on a business trip to the USA.

He thinks that he will need 750 dollars for his trip.

The exchange rate is £1 = \$1.56

He has to pay a 2% commission on the exchange.

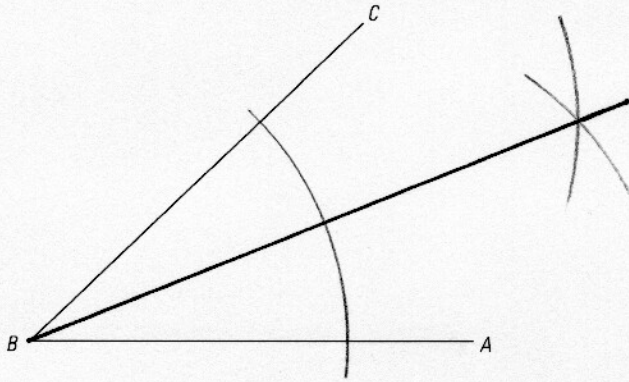
He has £500 to exchange.

Will it be enough? You must explain your answer.

To make \$750 he will need to exchange  
 $\$750 \div \$1.56/\pounds = \pounds 480.77$   
 including the 2% commission, this works  
 $480.77 \times 1.02 = \pounds 490.38$ . Yes, he has enough! (4)

(Total for Question 2 = 4 marks)

3.



Construct the bisector of the angle  $ABC$ . You must show all your construction lines. (2)

(Total for Question 3 = 2 marks)

4. Simplify  $3(x + 2y) - (x - y)$

$$= 3x + 6y - x + y$$

$$= 2x + 7y$$

.....  $2x + 7y$  ..... (2)

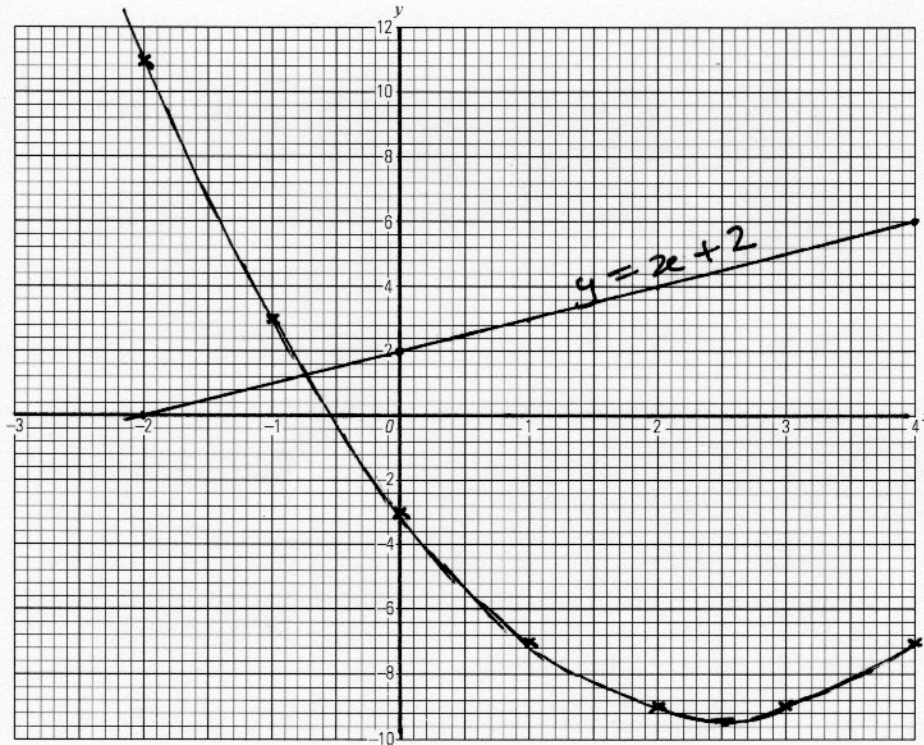
(Total for Question 4 = 2 marks)

5. a Complete the table of values for  $y = x^2 - 5x - 3$

$x$	-2	-1	0	1	2	3
$y$	11	3	-3	-7	-9	-9

(2)

b On the grid draw the graph of  $y = x^2 - 5x - 3$



(2)

c Use your graph to find an estimate for a solution of  $x^2 - 5x - 3 = 0$

$$x = -0.55$$

(2)

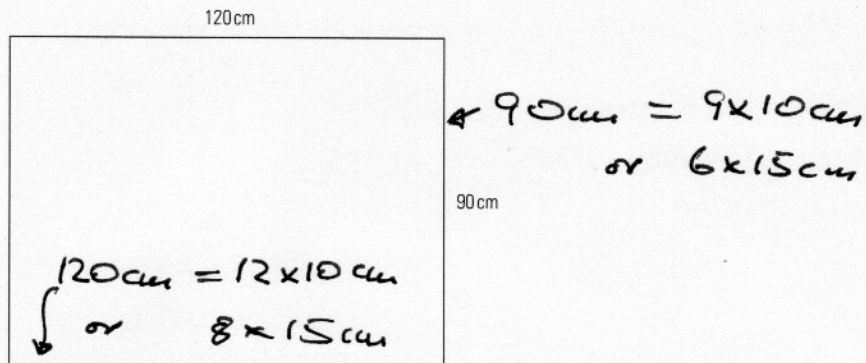
d Use your graph to find estimates of the solution of  $x^2 - 5x - 3 = x + 2$

$$x = -0.74$$

(2)

(Total for Question 5 = 8 marks)

\*6. The diagram shows a part of a wall in the shape of a rectangle.



Steve wants to tile this part of the wall.

He can use square tiles of width 10 cm, or square tiles of width 15 cm.

Tiles are sold in boxes of 10 or as single tiles.

The costs are given in the table.

	10 cm tiles	15 cm tiles
Cost of a box	£9.95	£14.05
Cost of a single tile	£1.09	£1.99

Work out the cheapest cost of tiling the part of the wall.

10 cm tiles:  
He will need  $12 \times 9 = 108$  tiles  
 $= 10$  boxes + 8 single tiles  
cost  $10 \times 9.95 + 8 \times 1.09$   
 $= \text{£}108.22$   
(cheaper than 11 boxes,  
 $\text{£}109.45$ ).

15 cm tiles: he will  
need  $8 \times 6 = 48$  tiles  
 $\text{£}14.05 / \text{£}1.99 = 7.06$ ,  $\therefore$  a  
box is cheaper than 8 tiles.  
Use 5 boxes, cost  
 $5 \times 14.05 = \text{£}70.25$   
(cheapest)  
£ 70.25 ..... (5)

(Total for Question 6 = 5 marks)

7. a Use your calculator to work out  $\frac{2 \times 3.5^2 + \sqrt{10}}{2.4 \times 2.5}$

Write down all the figures on your calculator display.

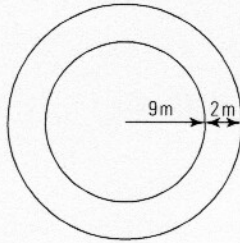
4.61037961 (2)

- b Round your answer to part a correct to 2 significant figures.

4.6 (1)

(Total for Question 7 = 3 marks)

\*8.



The diagram shows a play area in the shape of a circle of radius 9 m. Around this play area is a strip 2 m wide.

John is planning to cover the area with rubber matting.

He plans to cover the circle with regular matting and the strip with high-grade matting.

The costs of the matting are given in the table.

Description	Costs
Regular matting	£49 for each square metre
High-grade matting	£55 for each square metre

Can John cover the play area for less than £15 000? You must explain your answer.

No!

Even if there were no wastage (so just paying for a circle) and even if the cost was £49/m<sup>2</sup> for both parts, a circle of area  $\pi r^2 = \pi \times 11^2 = 380 \text{ m}^2$  would cost  $380 \times 49 = \text{£}18626.50$ .

$\therefore$  He cannot cover it for under £15000.

His actual cost would be  $> 18626$  because of the extra "high grade" cost.

(6)

(Total for Question 8 = 6 marks)

9. a Jim invested £4000 for 2 years in an account paying 3% per annum.

Work out the final amount.

$$4000 \times 1.03^2$$

£ 4243.60 (3)

Lizzie invested an amount in an account paying 4% per annum for 1 year.

At the end of the year the investment had grown to £2600

- b Work out the original value of Lizzie's investment.

$$2600 \div 1.04 = 2500$$

£ 2500 (3)

(Total for Question 9 = 6 marks)

10. a Expand  $3(2p - 3q - 1)$

$$\underline{6p - 9q - 3} \quad (1)$$

- b Factorise fully  $4y^2 - 6yz$

$$\underline{2y(2y - 3z)} \quad (2)$$

- c Factorise  $t^2 - t - 12$

$$ac = -12 = -4 \times 3$$

$$\text{so } b = -2 + 3 = -1$$

$$\underline{(t-4)(t+3)} \quad (2)$$

(Total for Question 10 = 5 marks)



11.  $y = 2\pi ra + 2\pi rh$   
 $r = 3 \times 10^7$   
 $h = 2 \times 10^7$   
 $a = 1.5 \times 10^7$

a Work out the value of  $y$ . Give your answer correct to 3 significant figures in standard form.

$$y = 2\pi r(a+h)$$

$$= 6.5973 \times 10^{15}$$

$$\underline{\underline{6.60 \times 10^{15}}} \quad (2)$$

b Rearrange the formula to make  $r$  the subject.

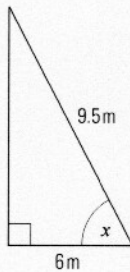
$$y = 2\pi r(a+h)$$

$$r = \frac{y}{2\pi(a+h)}$$

$$r = \underline{\underline{\frac{y}{2\pi(a+h)}}} \quad (2)$$

(Total for Question 12 = 4 marks)

12.



Calculate the size of the angle marked  $x$ .

Give your answer correct to 3 significant figures.

$$\cos(x) = \frac{6}{9.5}$$

$$x = \cos^{-1}\left(\frac{6}{9.5}\right) = 50.833^\circ$$

$$\underline{\underline{50.8}} \quad (3)$$

(Total for Question 12 = 3 marks)

13. The total cost of 3 apples and 4 pears is £1.72

The total cost of 2 apples and 3 pears is £1.23

Work out the cost of an apple and the cost of a pear.

$$\begin{array}{l} \textcircled{1} \times 3 : 9a + 12p = 5.16 \\ \textcircled{2} \times 4 : 8a + 12p = 4.92 - \\ \hline a = 0.24 \end{array}$$

Then  $0.48 + 3p = 1.23,$

$$3p = 1.23 - 0.48 = 0.75,$$

$$p = 0.25$$

Substitute back & check:

$$\textcircled{1} = 1.72 \checkmark \quad \textcircled{2} = 1.23 \checkmark$$

$$3a + 4p = 1.72 \quad \textcircled{1}$$

$$2a + 3p = 1.23 \quad \textcircled{2}$$

Cost of an apple ..... 24 p

Cost of a pear ..... 25 p (4)

(Total for Question 13 = 4 marks)

14. Solve  $(2x - 1)(x + 3) = x + 3$

$$2x^2 + 6x - x - 3 = x + 3$$

$$2x^2 + 5x - 6 = x + 3$$

$$2x^2 + 4x - 6 = 0$$

halve  $\left( x^2 + 2x - 3 = 0 \right)$

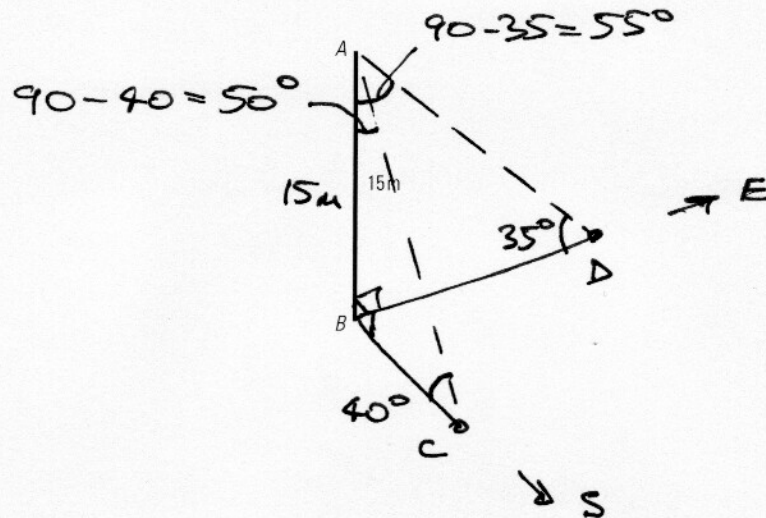
$$ac = -3 = 3 \times -1 \quad (3 + (-1) = 2 = b)$$

$$\therefore (x + 3)(x - 1) = 0$$

$$x = -3, x = 1 \quad \dots \dots \dots (4)$$

(Total for Question 14 = 4 marks)

15.



A vertical pole  $AB$  stands on horizontal ground.

$AB = 15\text{ m}$

$C$  is a point due south of  $B$ .

$D$  is a point due east of  $B$ .

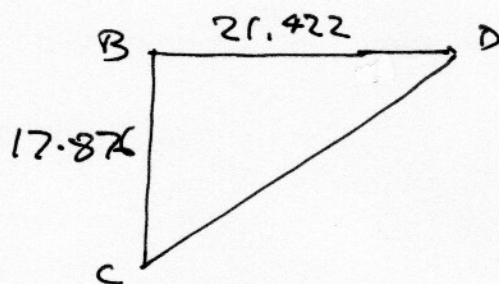
The angle of elevation of  $A$  from  $C$  is  $40^\circ$

The angle of elevation of  $A$  from  $D$  is  $35^\circ$

Calculate the distance  $CD$ . Give your answer correct to 3 significant figures.

$$\frac{BC}{15} = \tan 50^\circ, \quad BC = 15 \tan 50 = 17.8763\text{ m}$$

$$\frac{BD}{15} = \tan 55^\circ, \quad BD = 15 \tan 55 = 21.4222\text{ m}$$

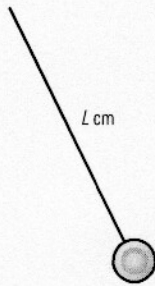


..... 27.9 ..... m (6)

$$\begin{aligned} CD &= \sqrt{17.876^2 + 21.422^2} \\ &= 27.9011\text{ m} \\ &= 27.9\text{ m to 3 s. figs} \end{aligned}$$

(Total for Question 15 = 6 marks)

\*16.



The period,  $T$  seconds, of a pendulum is proportional to the square root of its length  $L$  cm.

For a length of 16 cm, the period is 0.8 seconds.

Uzma wants to make a pendulum with a period of 1 second.

What length should she make her pendulum?

$$T \propto \sqrt{L} \quad \therefore L \propto T^2$$

$$L = \left(\frac{1}{0.8}\right)^2 \times 16 \text{ cm}$$

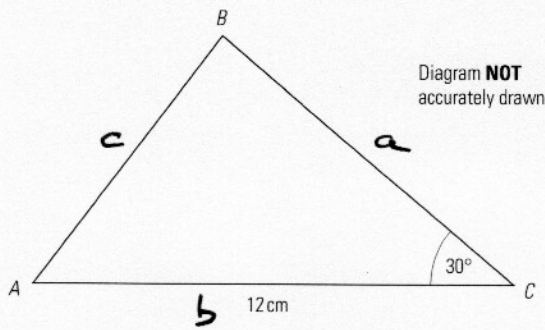
(enlargement factor)<sup>2</sup>

$$L = 25 \text{ cm}$$

..... 25 cm ..... cm (4)

(Total for Question 16 = 4 marks)

17.



The area of triangle  $ABC$  is  $18 \text{ cm}^2$ .

$AC = 12 \text{ cm}$

Angle  $ACB = 30^\circ$

Work out the perimeter of triangle  $ABC$ .

Give your answer correct to 3 significant figures.

$$\begin{aligned} \text{Area} &= \frac{1}{2} ab \sin C = 18 \text{ cm}^2 \\ &= \frac{(12 \sin 30) a}{2} = 3a \quad (\sin 30 = \frac{1}{2}) \end{aligned}$$

$$\therefore a = 6 \text{ cm}$$

Use cosine rule to find  $c$ ,

$$\begin{aligned} c^2 &= a^2 + b^2 - 2ab \cos C \\ &= 6^2 + 12^2 - 144 \cos 30 = 55.29, \\ c &= 7.436 \text{ cm} \end{aligned}$$

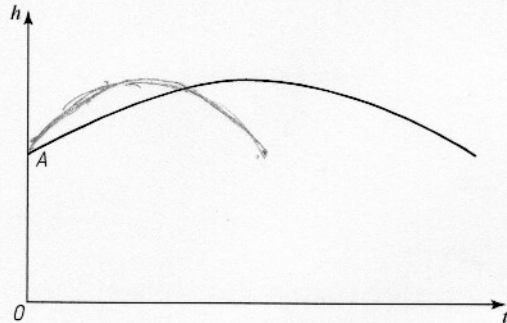
..... 25.4 ..... cm (6)

$$\begin{aligned} \therefore \text{Perimeter} &= 6 + 12 + 7.436 \\ &= 25.436 \text{ cm} \\ &= 25.4 \text{ cm to 3 sig. figures.} \end{aligned}$$

(Total for Question 17 = 6 marks)

18. The height  $h$  m of water in a dock  $t$  hours after noon is modelled by the equation  $h = 4 + 2 \sin(30t)^\circ$ .

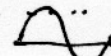
The diagram shows a sketch of the graph of  $h = 4 + 2 \sin(30t)^\circ$ .



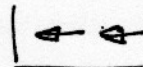
- a What are the coordinates of the point marked A?

$(0, 4)$  ..... (1)

- b What is the maximum height of the water?

Max = 1 -   $\sin(x)$   $4+2=6$  ..... 6 m (1)

- c On the same diagram sketch the graph of  $h = 4 + 2 \sin(60t)^\circ$ . (2)

Twice the frequency, squashed 

(Total for Question 18 = 4 marks)

TOTAL FOR PAPER = 80 MARKS