



Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

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Forename(s)

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Candidate signature

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# GCSE MATHEMATICS

# H

Higher Tier

Paper 1 Non-Calculator

Tuesday 5 November 2019

Morning

Time allowed: 1 hour 30 minutes

## Materials

For this paper you must have:

- mathematical instruments



You must **not** use a calculator.

## 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. Cross through any work you do not want to be marked.

## Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

## Advice

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

For Examiner's Use	
Pages	Mark
2-3	
4-5	
6-7	
8-9	
10-11	
12-13	
14-15	
16-17	
18-19	
20-21	
22-23	
24-25	
26	
<b>TOTAL</b>	



N 0 V 1 9 8 3 0 0 1 H 0 1

Answer all questions in the spaces provided

- 1 Circle the calculation that decreases 250 by 15% [1 mark]

$$100\% - 15\% = 85$$

$$\frac{85}{100} \times 250 = 0.85 \times 250$$

$250 \div 1.15$

$250 \times 0.15$

$250 \times 0.85$

$250 \div 0.85$

- 2 Solve  $3x = 2x$   
Circle your answer.

[1 mark]

$x = -1$

$x = 0$

$x = \frac{2}{3}$

$x = \frac{3}{2}$



- 3 A is (2, 13) and B is (10, 1)  
Circle the midpoint of AB.

$$\begin{aligned} \text{Midpoint} &= \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right) \\ &= \frac{2+10}{2}, \frac{13+1}{2} \\ &= (6, 7) \end{aligned}$$

(4, 6)

(5, 6.5)

(6, 7)

(8, 12)

[1 mark]

- 4 Circle the expression equivalent to  $(2x)^4$

 $2x^4$  $6x^4$  $8x^4$  $16x^4$ 

$$\begin{aligned} (2x)^4 &= 2^4 x^4 \\ &= 16x^4 \end{aligned}$$

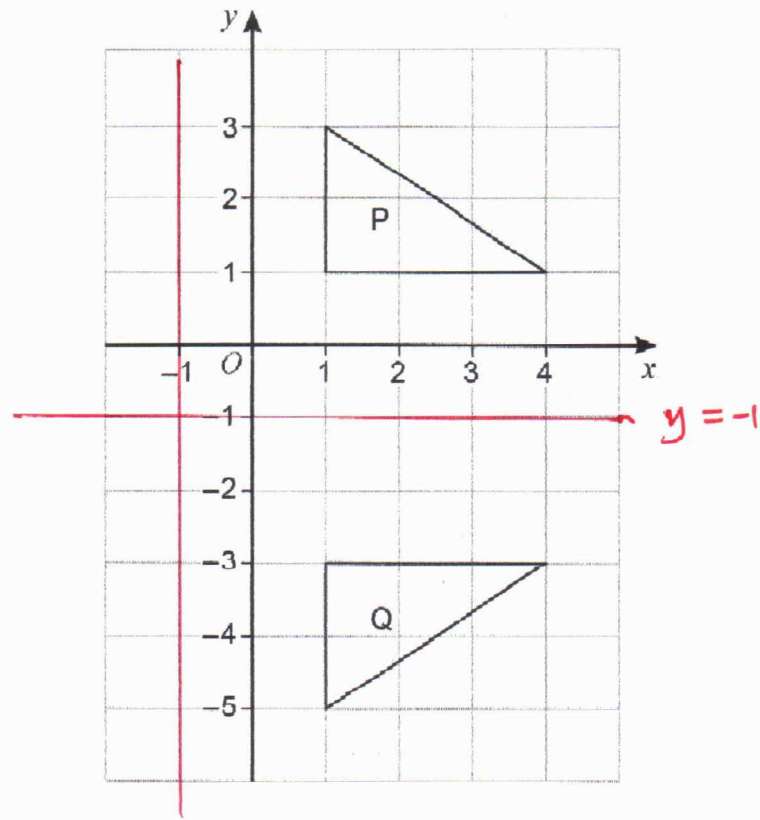
[1 mark]

Turn over for the next question

Turn over ►



5 (a) Here are two triangles, P and Q.



Here is a statement.

A transformation that maps P to Q is a reflection in the line  $x = -1$

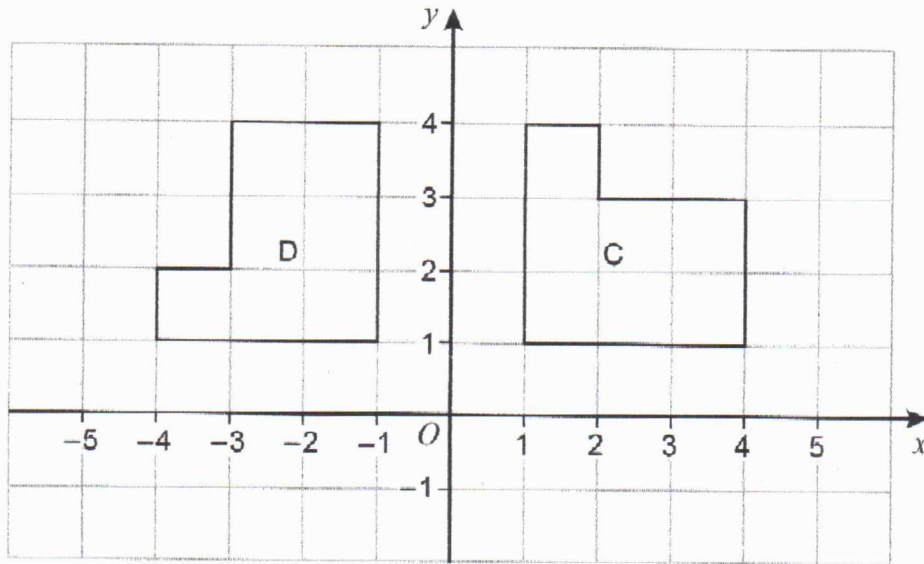
Make one criticism of the statement.

[1 mark]

The equation of the mirror line should  
be  $y = -1$ .



5 (b) Here are two shapes, C and D.



Here is a statement.

A transformation that maps C to D is a rotation through  $90^\circ$  anticlockwise.

Make one criticism of the statement.

[1 mark]

*No centre of rotation is given. The centre of rotation is (0,0)*

Turn over for the next question

Turn over ►



- 6 (a) A geometric progression starts

4 16

Work out the next term.

$$a \quad ar \quad ar^2 \quad \frac{ar}{a} = r = \frac{16}{4} = 4$$

[1 mark]

$$\begin{aligned} \text{3rd term} &= 16 \times 4 \\ &= \underline{64} \end{aligned}$$

Answer 64

- 6 (b) A Fibonacci-type sequence starts

3 -8

The sequence is continued by adding the previous two terms.

Work out the next two terms.

[2 marks]

$$T_3 = T_1 + T_2 = +3 + (-8) = -5$$

$$T_4 = T_2 + T_3 = -8 + (-5) = -13$$

Answer -5 and -13

7 Given that  $a \times 60 = b$  work out the value of  $\frac{4b}{a}$

[2 marks]

$$a \times 60 = b$$

$$\begin{aligned} \text{Substitute} \\ b = a \times 60 \quad \frac{4b}{a} &= \frac{4(a \times 60)}{a} = \frac{240a}{a} \\ &= \underline{\underline{240}} \end{aligned}$$

Answer 240

8 Write  $27 \times (3^2)^7$  as a single power of 3

[3 marks]

$$\begin{aligned} 27 \times (3^2)^7 \\ 3^3 \times 3^{14} &= 3^{3+14} \\ &= \underline{\underline{3^{17}}} \end{aligned}$$

Answer  $3^{17}$

Turn over for the next question

Turn over ►

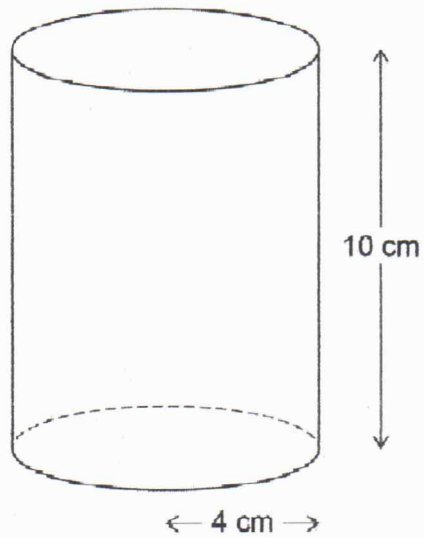


9

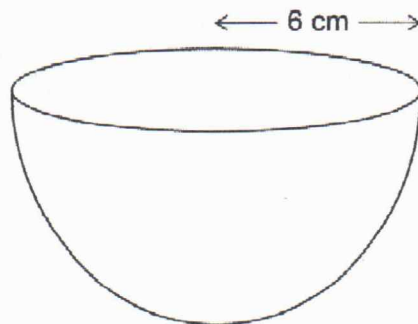
Here are two solids.

**Cylinder**

radius 4 cm    height 10 cm

**Hemisphere**

radius 6 cm



volume of a hemisphere =  $\frac{2}{3} \pi r^3$  where  $r$  is the radius





Which solid has the greater volume?

You must show your working.

[4 marks]

$$\begin{aligned} \text{Volume of cylinder} &= \pi r^2 h \\ &= \pi \times 4 \times 4 \times 10 \\ &= \underline{160\pi \text{ cm}^3} \end{aligned}$$

$$\begin{aligned} \text{Volume of hemisphere} &= \frac{2}{3} \pi r^3 \\ &= \frac{2}{3} \pi \times 6 \times 6 \times 6 \\ &= \underline{144\pi \text{ cm}^3} \end{aligned}$$

$160\pi$  is greater than  $144\pi$   
The cylinder has greater volume than  
the hemisphere.

Answer \_\_\_\_\_

Turn over for the next question

Turn over ►



- 10 Saj makes Rose Pink paint and Cherry Pink paint.  
He mixes red paint with white paint as shown.

<p><b>Rose Pink</b> red : white = 1 : 2</p>
---

<p><b>Cherry Pink</b> red : white = 4 : 3</p>
---

He makes 60 litres of Rose Pink paint.  
To this Rose Pink paint he adds  
80 litres of red paint and 28 litres of white paint.

Has he now made Cherry Pink paint?  
You **must** show your working.

[4 marks]

Red : White	
1 : 2    1+2=3	Add: 20 : 40
60 Litres $\div$ 3 = <u>20</u>	80 : 28
60 Litres of rose Pink	<u>100</u> : <u>68</u>
R. W	4    4
20 $\times$ 1 : 2	25 : 17
20 : 40 $\swarrow$ $\times 20$	

= No, this is not Cherry Pink, it is  
in the ratio 25:17 but not 4:3.



11 (a) Work out  $\frac{2 \times 10^{14}}{8 \times 10^9}$

Give your answer in standard form.

[2 marks]

$$\begin{array}{l} \frac{2 \times 10^{14}}{8 \times 10^9} = \frac{200000000000000}{8000000000} \\ = 25,000 \\ = 2.5 \times 10^4 \end{array} \quad \left| \quad \begin{array}{l} 10^{14} \div 10^9 = 10^5 \\ 0.25 \times 10^5 \\ = \underline{\underline{2.5 \times 10^4}} \end{array} \right.$$

Answer 2.5 × 10<sup>4</sup>

11 (b)  $6200.07 = 6.2 \times 10^c + 7 \times 10^d$

Work out the values of  $c$  and  $d$ .

[2 marks]

$$\begin{array}{l} 6200.07 = 6200 \rightarrow 6.2 \times 10^3 + 7 \times 10^{-2} \\ = 6.2 \times 10^3 + 7 \times 10^{-2} \end{array}$$

$c = \underline{3} \quad d = \underline{-2}$

Turn over for the next question



12

$$V = \frac{k}{H} \quad \text{where } k \text{ is a constant.}$$

Which **two** statements are correct?Tick **two** boxes.

$$V \propto \frac{1}{H}$$

$$V = \frac{k}{H}$$

[1 mark]

 $V$  is directly proportional to  $H$  $V$  is inversely proportional to  $H$  $V$  is directly proportional to  $\frac{1}{H}$  $V$  is inversely proportional to  $\frac{1}{H}$ 

13

The  $n$ th term of a sequence is  $\frac{n(n-4)}{\sqrt{n+3}}$

Work out the sum of the 1st and 6th terms.

[3 marks]

$$T_1 = \frac{n(n-4)}{\sqrt{n+3}}$$

Substitute  $n=1$  and  $6$ .

$$= \frac{1(1-4)}{\sqrt{1+3}}$$

$$= \frac{1(-3)}{\sqrt{4}}$$

$$= \frac{-3}{2} \text{ or } -1.5$$

$$T_6 = \frac{6(6-4)}{\sqrt{6+3}} = \frac{12}{3}$$

$$= 4$$

$$T_1 + T_6 = -\frac{3}{2} + 4$$

$$= 2\frac{1}{2} \text{ or } \underline{\underline{2.5}}$$

Answer \_\_\_\_\_

14

$$8300 = 100 \times 83$$

Circle the number that is closest in value to  $\sqrt{8300}$

[1 mark]

19

90

830

900

$$\sqrt{8300} = \sqrt{100 \times 83}$$

$$= \sqrt{100} \times \sqrt{83}$$

approximate  $\sqrt{83}$

$$= 10 \times 9$$

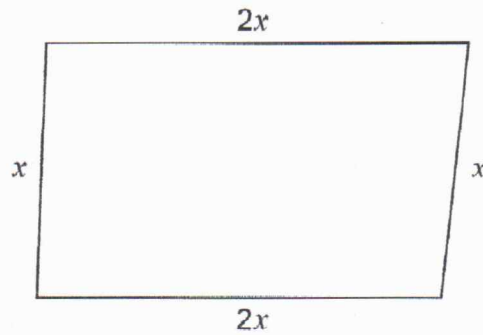
$$= \underline{\underline{90}}$$

Turn over ►



15

Here is a **sketch** of a quadrilateral.  
All lengths are in centimetres.



Not drawn  
accurately

Tick **one** box for each statement.

[3 marks]

	True	May be true	Not true
The quadrilateral is a rectangle		✓	
The quadrilateral is a parallelogram	✓		
The quadrilateral is a rhombus			✓
The quadrilateral is a kite			✓



16

In a box there are some buttons.

45 are large and the rest are small.

Some are yellow and the rest are green.

The number of small is  $\frac{5}{3}$  of the number of large.

The number of green is 300% of the number of yellow.

There are 12 small yellow buttons.

How many large green buttons are there?

You may use the two-way table to help you.

[4 marks]

	Large	Small	
Yellow	18	12	30
Green	27	63	90
	45	75	

$$\text{Number of small} = \frac{5}{3} \times 45 =$$

$$= \underline{\underline{75}}$$

$$\text{Number of green: yellow}$$

$$300 : 100 = 3:1$$

12 small yellow buttons.

$$3:1$$

$$\text{Total} = 120$$

$$\frac{3}{4} \times 120 = 90$$

$$\frac{1}{4} \times 120 = 30$$

Answer 27



17  $a = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$  and  $b = \begin{pmatrix} 1 \\ -5 \end{pmatrix}$

Work out  $a - 3b$ 

Circle your answer.

$$\begin{pmatrix} -3 \\ 2 \end{pmatrix} - 3 \begin{pmatrix} 1 \\ -5 \end{pmatrix}$$

$$\begin{pmatrix} -3 \\ 2 \end{pmatrix} - \begin{pmatrix} 3 \\ -15 \end{pmatrix} = \begin{pmatrix} -6 \\ 17 \end{pmatrix}$$

[1 mark]

$$\begin{pmatrix} -6 \\ 17 \end{pmatrix}$$

$$\begin{pmatrix} -6 \\ -13 \end{pmatrix}$$

$$\begin{pmatrix} 0 \\ 17 \end{pmatrix}$$

$$\begin{pmatrix} 0 \\ -13 \end{pmatrix}$$

18 Solve  $\frac{x+15}{3} = 2(x+10)$

[4 marks]

$$\frac{x+15}{3} = 2x+20$$

Multiply by 3 both sides

$$x+15 = 3(2x+20)$$

$$x+15 = 6x+60$$

$$x-6x = 60-15$$

$$\begin{array}{r} -5x = 45 \\ \hline -5 \quad -5 \end{array}$$

$$x = -9$$

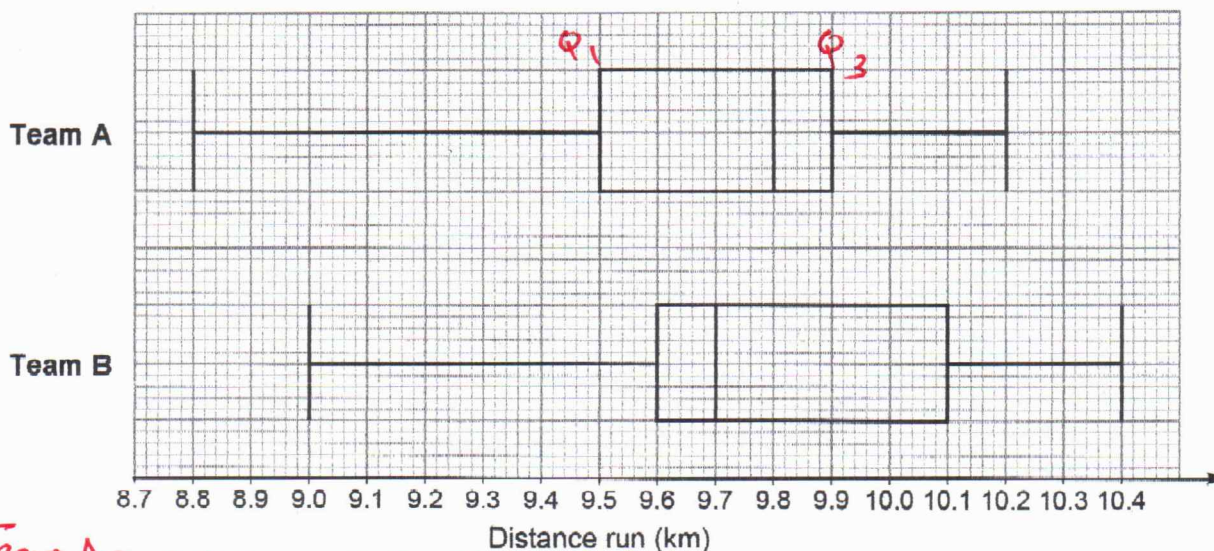
$$x = \underline{\quad -9 \quad}$$





Do not write outside the box

19 The box plots represent the distances run by the players in a football match.



Team A = IQR =  $9.9 - 9.5$   
 $= 0.4$

Team B = IQR =  $10.1 - 9.6$   
 $= 0.5$

19 (a) On average, which team's players ran further?  
 Tick a box.

Team A

Team B

Give a reason for your answer.

[1 mark]

Team A Median is 9.8 while Team B median is 9.7.

19 (b) The players in Team A ran more consistent distances.

How do the box plots show this?

[1 mark]

Interquartile range of team A is 0.4 and Interquartile range of team B is 0.5. Thus Team A is more consistent.

7
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Turn over ►

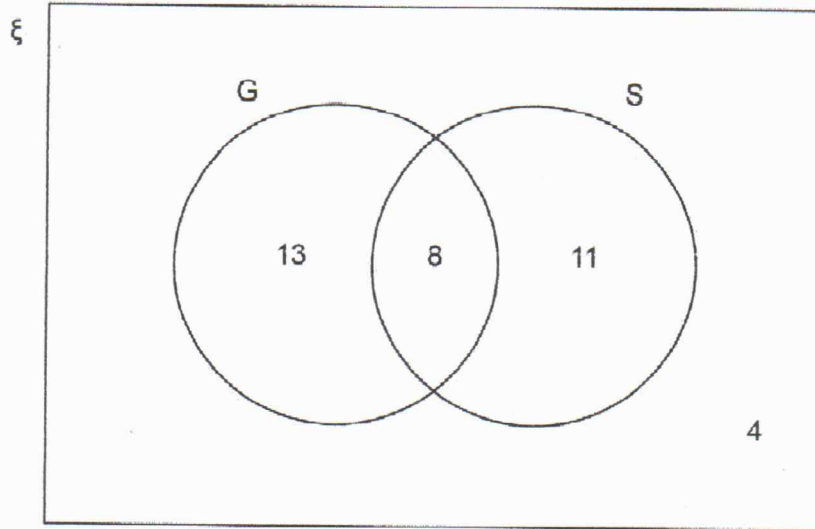


20

The Venn diagram shows information about some houses.

G = houses with a garage

S = houses with a shed



A house is chosen at random.

20 (a) The house has a garage.

What is the probability that it has a shed?

$$P(\text{shed}) = \frac{\text{total of } 8+13}{21} = 21$$

[1 mark]

$$P(\text{shed}) = \frac{8}{21}$$

Answer

$$\frac{8}{21}$$

20 (b) The house does not have a garage.

What is the probability that it does not have a shed?

$$P(\text{Not shed}) =$$

[1 mark]

$$\text{total} = 11+4 = 15$$

Answer

$$\frac{4}{15}$$

$$P(\text{Not shade}) = \frac{4}{15}$$



20 (c) Show that  $P(G \cap S)' > P(G \cup S')$ 

[2 marks]

$$\begin{aligned}
 P(G \cap S)' &= \frac{13+11+4}{36} \\
 &= \frac{28}{36}
 \end{aligned}$$

$$\begin{aligned}
 P(G \cup S') &= \frac{13+8+4}{36} \\
 &= \frac{25}{36}
 \end{aligned}$$

$\frac{28}{36}$  is greater than  $\frac{25}{36}$ .

21 Work out  $0.70\dot{4}8 - 0.001$ 

Circle your answer.

[1 mark]

0.7038

0.7038

0.70383

0.70384

$$\begin{array}{r}
 0.70484848 \\
 - 0.0010000 \\
 \hline
 0.70384848 \\
 = 0.70384848 \\
 \approx 0.70384
 \end{array}$$

Turn over for the next question

Turn over ►

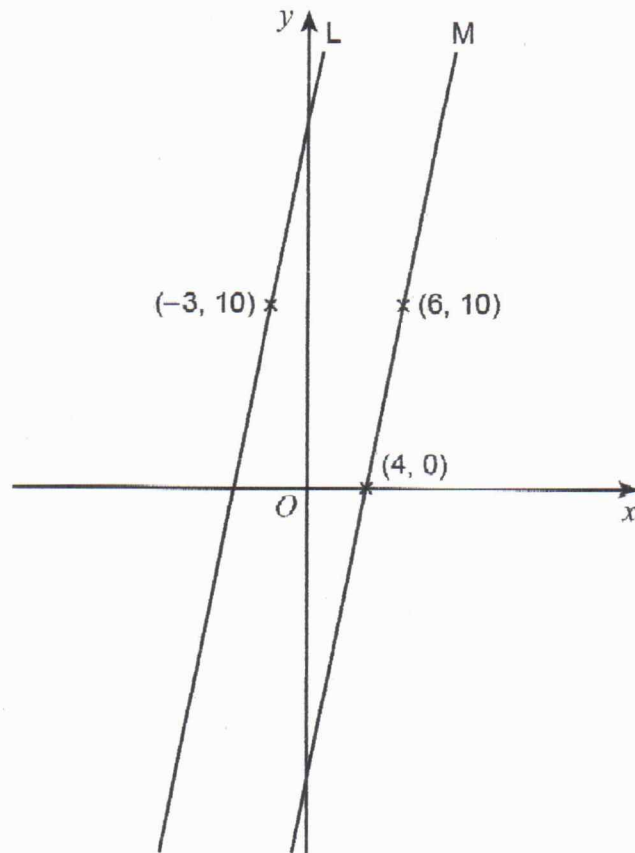


22

$(-3, 10)$  is a point on line L.

$(4, 0)$  and  $(6, 10)$  are points on line M.

L and M are parallel.



Not drawn  
accurately

Work out the equation of line L.

Give your answer in the form  $y = mx + c$

[3 marks]

$$\begin{aligned} \text{Gradient} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{10 - 0}{6 - 4} \\ &= \frac{10}{2} \\ &= \underline{\underline{5}} \end{aligned}$$

For parallel lines gradients are same.

$$y = mx + c \quad (-3, 10)$$

$$y = 5x + c \quad \text{Equation of L}$$

$$10 = 5(-3) + c$$

$$10 = -15 + c$$

$$c = 10 + 15 \quad c = \underline{\underline{25}}$$

Answer

$$y = \underline{\underline{5x + 25}}$$



23 (a) Factorise  $5x^2 + 6x - 8$ 

[2 marks]

$$\text{Product} = -40 \quad (0, -4)$$

$$\text{Sum} = 6$$

$$5x^2 + 10x - 4x - 8$$

$$5x(x+2) - 4(x+2)$$

$$\underline{(5x-4)(x+2)}$$

Answer

$$\underline{(5x-4)(x+2)}$$

23 (b)

Simplify fully

$$\frac{x^2 + 9x + 14}{x^2 - 4}$$

$$x^2 + 9x + 14$$

$$P = 14 \quad (7, 2)$$

$$S = 9$$

$$x^2 + 7x + 2x + 14$$

$$x(x+7) + 2(x+7)$$

$$= \underline{\underline{(x+7)(x+2)}}$$

$$x^2 - 4 = (x-2)(x+2) \quad \text{Difference of two squares}$$

[3 marks]

$$\frac{(x+7)(x+2)}{(x-2)(x+2)}$$

$$\frac{(x+7)}{(x-2)}$$

$$= \underline{\underline{x+7}}$$

$$\underline{\underline{x-2}}$$

Answer

$$\underline{\underline{\frac{x+7}{x-2}}}$$

Turn over for the next question

Turn over ►



24

Work out  $\sqrt{18} - \frac{28}{\sqrt{50}}$ Do not write  
outside the  
boxGive your answer in the form  $\frac{\sqrt{a}}{b}$  where  $a$  and  $b$  are integers.

[4 marks]

$$\sqrt{18} - \frac{28}{\sqrt{50}}$$

$$= \frac{\sqrt{9 \times 2} - \frac{28}{\sqrt{25 \times 2}}}$$

$$= \frac{3\sqrt{2} - \frac{28}{5\sqrt{2}}}{10}$$

$$= \frac{3\sqrt{2} - \frac{28 \times \sqrt{2}}{5\sqrt{2} \times \sqrt{2}}}{10}$$

$$= \frac{3\sqrt{2} - \frac{28\sqrt{2}}{10}}{10}$$

$$= \frac{\frac{30\sqrt{2}}{10} - \frac{28\sqrt{2}}{10}}{10}$$

$$= \frac{2\sqrt{2}}{10} = \frac{\sqrt{2}}{5} = \frac{\sqrt{2}}{5}$$

$$= \frac{2\sqrt{2}}{10} = \frac{\sqrt{2}}{5} = \frac{\sqrt{2}}{5}$$

Answer  $\frac{\sqrt{2}}{5}$        $a=2, b=5$



- 25 A bag contains 8 balls.  
3 are red and 5 are blue.  
2 balls are taken from the bag at random without replacement.

- 25 (a) Write down the probability that there is at least 1 red ball still in the bag.

[1 mark]

$P(RR), (RB) \text{ or } BB$

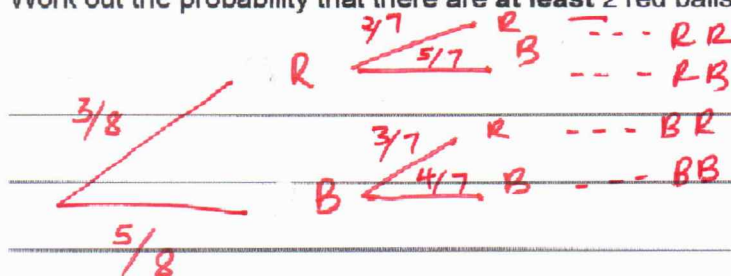
Answer

1 .

If-  $RRR$   
 $BB, B$  The probability at least 1-red = 1

- 25 (b) Work out the probability that there are at least 2 red balls still in the bag.

[3 marks]



Probability at least 2 red balls

$$= 1 - \left( \frac{3}{8} \times \frac{2}{7} \right)$$

$$= 1 - \frac{6}{56}$$

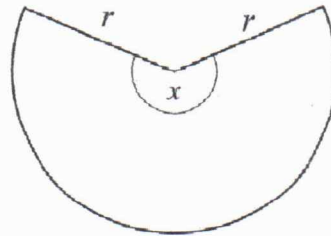
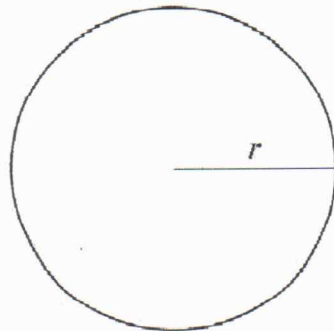
$$= \frac{50}{56}$$

Answer



26

Here are a circle and a sector of the circle.  
They each have radius  $r$ .

Not drawn  
accurately

circumference of circle = perimeter of sector

Work out the size of angle  $x$ .

Give your answer in terms of  $\pi$

[4 marks]

$$\text{Circumference} = 2\pi r$$

$$\text{Perimeter of sector} = \frac{x}{360} \times 2\pi r + 2r$$

$$2\pi r = \frac{x}{360} \times 2\pi r + \frac{2\pi r}{\pi}$$

Divide by  $2\pi r$

$$1 = \frac{x}{360} + \frac{1}{\pi}$$

$$1 - \frac{1}{\pi} = \frac{x}{360}$$

$$x = 360 - \frac{360}{\pi}$$

$$360 - \frac{360}{\pi}$$

Answer \_\_\_\_\_ degrees





27 A curve has the equation  $y = x^2 - 6x + 17$

The turning point of the curve is at  $(a, 8)$

27 (a) By completing the square, or otherwise, work out the value of  $a$ .

[2 marks]

$$y = x^2 - 6x + 17$$

$$y = (x-3)^2 - 9 + 17$$

$$y = (x-3)^2 + 8$$

Turning point is  $(3, 8)$  so  $a = 3$

Answer 3

27 (b) The turning point of the curve  $y = x^2 + 4x + b$  also has  $y$ -coordinate 8

Work out the value of  $b$ .

[2 marks]

$$y = x^2 + 4x + b$$

$$y = (x+2)^2 - 4 + b$$

Turning point  $(-2, b-4)$

$$b - 4 = 8$$

$$b = \underline{\underline{12}}$$

Answer 12



28

Work out the value of  $100^{-\frac{1}{2}}$ Any number  $a^{\frac{1}{2}} = \sqrt{a}$ 

[2 marks]

$$100^{-\frac{1}{2}}$$

$$= \frac{1}{100^{\frac{1}{2}}} = \frac{1}{\sqrt{100}} = \frac{1}{10}$$

Answer  $\frac{1}{10}$  or 0.1

29

Show that the value of  $5 \sin 30^\circ \times \cos 30^\circ \times 8 \tan 30^\circ$  is an integer.

[4 marks]

$$\sin 30^\circ = \frac{1}{2}$$

$$\cos 30^\circ = \frac{\sqrt{3}}{2}$$

$$\tan 30^\circ = \frac{\sqrt{3}}{3}$$

$$5\left(\frac{1}{2}\right) \times \frac{\sqrt{3}}{2} \times 8\left(\frac{\sqrt{3}}{3}\right)$$

$$\frac{5}{2} \times \frac{\sqrt{3}}{2} \times \frac{8\sqrt{3}}{3}$$

$$\sqrt{3} \times \sqrt{3} = 3$$

$$= \frac{40 \times 3}{12}$$

$$= \frac{120}{12} = \underline{\underline{10}}$$

END OF QUESTIONS

