

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

GCSE MATHEMATICS

H

Higher Tier

Paper 1 Non-Calculator

Tuesday 21 May 2019

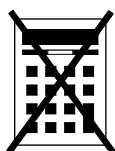
Morning

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.

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	
TOTAL	

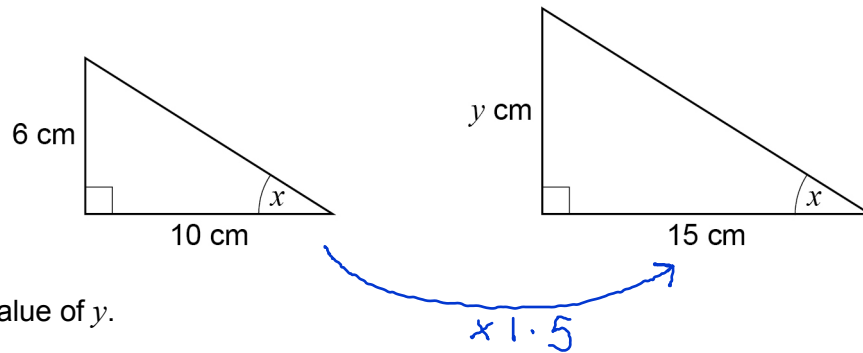
Advice

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



Answer **all** questions in the spaces provided

- 1 Here are two right-angled triangles.

Not drawn
accuratelyCircle the value of y .

$$6 \times 1.5 = 9$$

[1 mark]

11

7.5

9

4

- 2 Work out the value of $\left(1\frac{2}{3}\right)^2 = \left(\frac{5}{3}\right)^2 = \frac{25}{9} = 2\frac{7}{9}$

Circle your answer.

[1 mark]

 $1\frac{4}{9}$ $3\frac{1}{3}$ $2\frac{4}{9}$ $2\frac{7}{9}$

- 3 Work out the arc length, in metres, of a semicircle of radius 6 metres.

Circle your answer.

$$\text{diameter} = 6 \times 2 = 12$$

$$\text{Circumference} = 12\pi$$

$$\text{semicircle} = 12\pi \div 2 = 6\pi$$

[1 mark]

 3π 6 π 12π 18π 

- 4 Circle the fraction that is equivalent to $4.\overline{625} = 4\frac{5}{8} = \frac{37}{8}$ [1 mark]

$$\frac{39}{8}$$

$$\frac{37}{8}$$

$$\frac{185}{4}$$

$$\frac{17}{4}$$

- 5 (a) Write 0.00097 in standard form. [1 mark]

4 places to the left negative
between 1 and 10

Answer 9.7×10^{-4}

- 5 (b) Work out $\frac{3 \times 10^5}{4 \times 10^3}$

Give your answer as an ordinary number.

[2 marks]

$$= \frac{3}{4} \times \frac{10^5}{10^3}$$

$$= 0.75 \times 10^{5-3}$$

$$= 0.75 \times 10^2$$

Answer 75



6 Anna plays a game with an ordinary, fair dice.

If she rolls 1 she wins.

If she rolls 2 or 3 she loses.

If she rolls 4, 5 or 6 she rolls again.

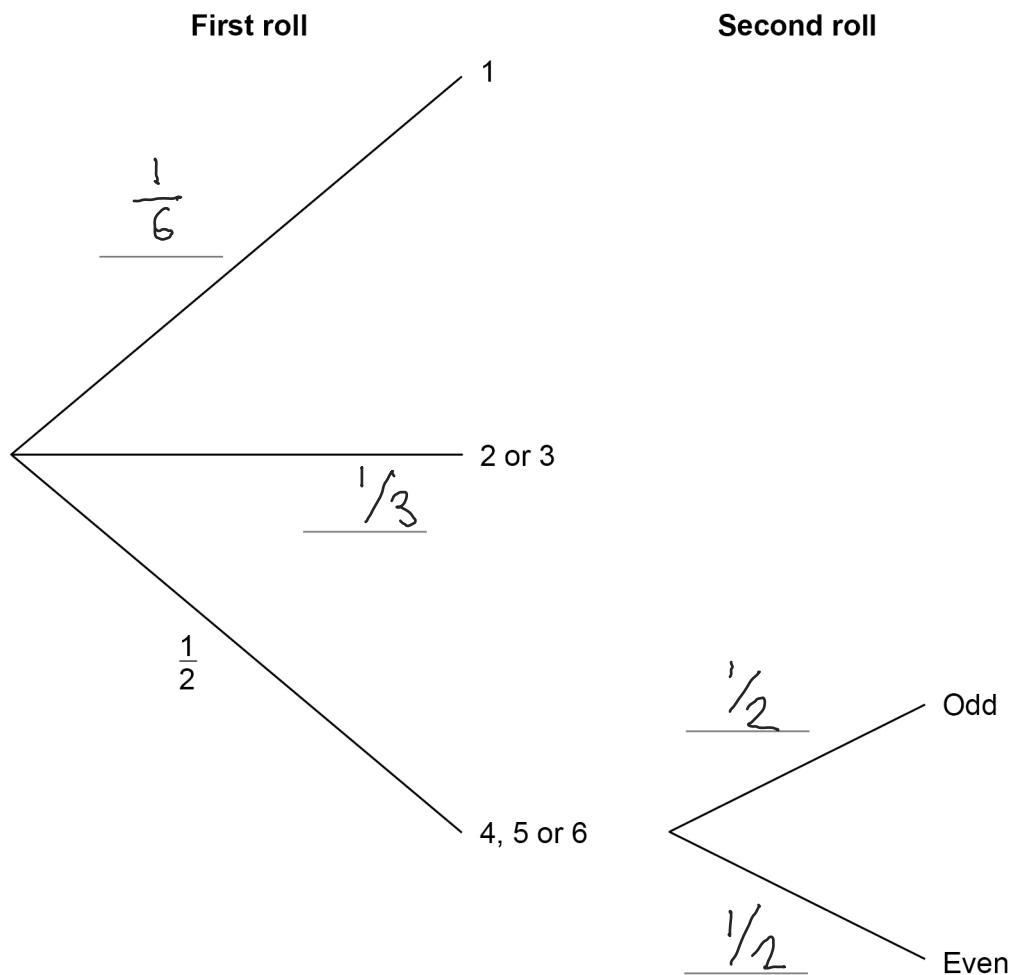
When she has to roll again,

if she rolls an odd number she wins

if she rolls an even number she loses.

6 (a) Complete the tree diagram with the four missing probabilities.

[2 marks]



6 (b) Is Anna more likely to win or to lose?

You **must** work out the probability that she wins.

[4 marks]

$$P(\text{Lose}) = P(\text{lose 1st Time}) \text{ OR } P(\text{lose 2nd})$$

$$P(\text{lose 1st}) = \frac{1}{3}$$

$$P(\text{lose 2nd}) = \frac{1}{2} \overset{\text{To roll twice}}{\times} \frac{1}{2} = \frac{1}{4}$$

$$\frac{1}{3} + \frac{1}{4} = \frac{3+4}{12} = \frac{7}{12}$$

$$\begin{aligned} P(\text{win}) &= 1 - P(\text{lose}) \\ &= 1 - \frac{7}{12} = \frac{5}{12} \end{aligned}$$

$$\frac{7}{12} > \frac{5}{12}$$

More likely to lose

Turn over for the next question



7 Three friends arrive at a party.

Their arrival increases the number of people at the party by 20%

In total, how many people are now at the party?

$$\begin{aligned} &= 100\% + 20\% \\ &= 120\% = 1.2 \end{aligned}$$

[2 marks]

Number of ppl before = x

$$1.2x = x + 3$$

$$0.2x = 3$$

$$x = 15 \text{ - before}$$

Now $x + 3$

$$= 15 + 3$$

Answer 18

8 Work out the value of $(3^{12} \div 3^5) \div (3^2 \times 3)$

[3 marks]

$$= 3^{12-5} \div 3^{2+1}$$

$$= 3^7 \div 3^3$$

$$= 3^{7-3} = 3^4$$

$$3^4 = 3 \times 3 \times 3 \times 3$$

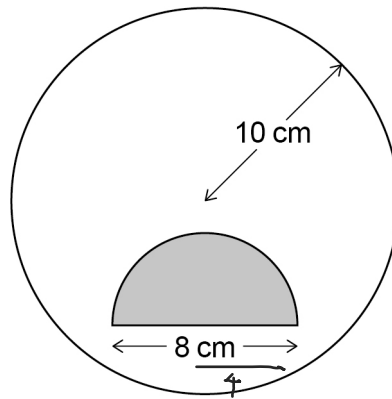
$$= 9 \times 9$$

Answer 81



9

A shaded semicircle is inside a circle as shown.

Not drawn
accuratelyThe **radius** of the circle is 10 cmThe **diameter** of the semicircle is 8 cm

$$\text{Aq of circle} = \pi r^2$$

How many times bigger is the unshaded area than the shaded area?

$$\begin{array}{r} \div 2 \\ 1 \end{array}$$

[4 marks]

$$\text{Area of unshaded} = \text{Area of circle} - \text{Area of semicircle}$$

$$= \pi \times 10^2 - (\pi \times 4^2) \div 2$$

$$= 100\pi - 8\pi = 92\pi$$

$$\text{Area of shaded} = 8\pi$$

Semi
circle

$$\text{Scale factor: } \frac{92\pi}{8\pi} = \frac{23}{2}$$

$$\text{Answer } \frac{23}{2} \text{ times}$$

Turn over for the next question

Turn over ►



- 10** The number of items, n , made in 1 hour by a machine is given by $n = \frac{60}{t}$
 t is the time in minutes the machine takes to make one item.
 The value of t changes for different types of item.

- 10 (a)** On the grid below, draw the graph of $n = \frac{60}{t}$ for values of t from 1 to 4

[2 marks]

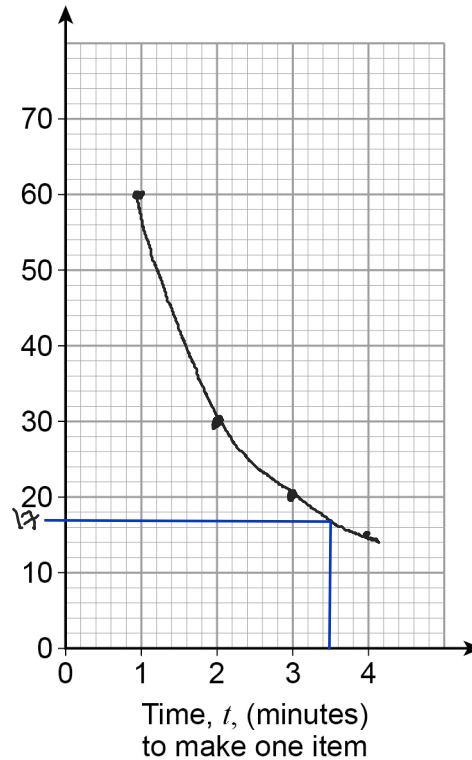
$$t=1 \quad n = \frac{60}{1} = 60$$

$$t=2 \quad n = \frac{60}{2} = 30$$

$$t=3 \quad n = \frac{60}{3} = 20$$

$$t=4 \quad n = \frac{60}{4} = 15$$

Number of items, n ,
made in 1 hour



- 10 (b)** The machine takes 3 minutes 30 seconds to make one item.

$$t = 3.5$$

Use your graph to estimate the value of n .

[2 marks]

Answer _____

17



- 11 Ed and Fay shared £330 in the ratio 7 : 4
Ed gives Fay some of his money.
Fay now has the same amount as Ed.

How much does Ed give Fay?

[3 marks]

$$\begin{array}{r|l}
 \begin{array}{l}
 \times 30 \swarrow \\
 7 : 4 \\
 \searrow \times 30
 \end{array}
 & \begin{array}{l}
 \text{Total} \\
 11 \\
 330
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 165 \\
 2 \overline{)330}
 \end{array}$$

to have equal amounts
both have £165

$$\begin{array}{r}
 \text{Ed gives} \quad \begin{array}{r}
 165 \\
 -165 \\
 \hline
 \end{array}
 \end{array}$$

Answer £ 45

- 12 The next term of a sequence is made by adding the previous two terms.
Which of these sequences follows this rule?
Circle your answer.

[1 mark]

$$\begin{array}{l}
 -9 + 2 = -7 \\
 -7 - 5 = -12 \\
 \hline
 -9 \quad 2 \quad -7 \quad -5 \quad -12 \\
 \hline
 2 - 7 = -5
 \end{array}$$

$$0 \quad -3 \quad -3 \quad 0 \quad -3$$

$$\begin{array}{l}
 0 - 3 = -3 \\
 -3 - 3 = -6 \quad X
 \end{array}$$

$$-3 + 5 = 2$$

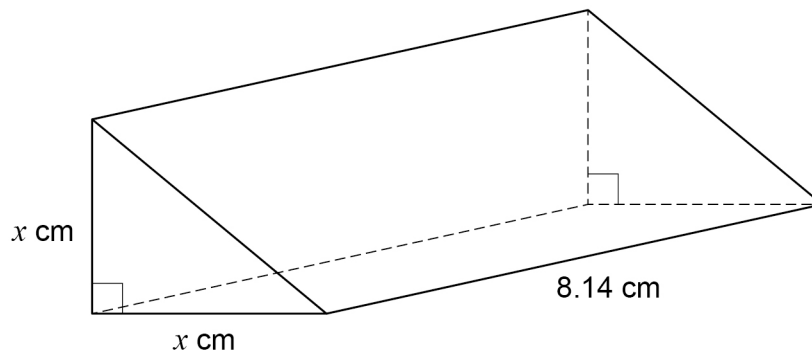
$$-3 \quad 5 \quad -2 \quad 3 \quad 1 \quad X$$

$$\begin{array}{l}
 -1 - 1 = -2 \\
 -2 - 1 = -3 \\
 -3 - 2 = -5 \\
 \hline
 -1 \quad -1 \quad -2 \quad -3 \quad 1 \quad X
 \end{array}$$



13

The triangular cross section of a prism is an isosceles right-angled triangle.



The volume of the prism is 102 cm^3

Use approximations to estimate the value of x .

You **must** show your working.

[3 marks]

$$\text{Volume} = \text{Area of cross section} \times \text{depth}$$

$$102 = \frac{1}{2} x x \times x \times 8.14$$

Approximate to 1sf

$$100 \approx \frac{x^2}{2} \times 8 \approx 4x^2$$

$$25 \approx x^2$$

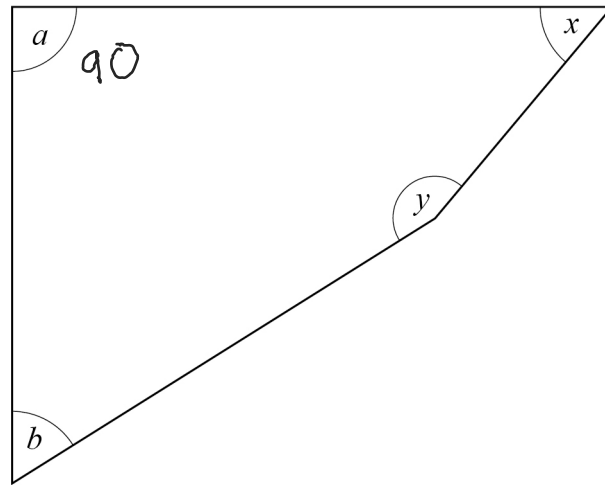
$$x \approx \sqrt{25} \approx 5 \text{ cm}$$

Answer 5



14

Here is a quadrilateral.

Not drawn
accurately

$a = 90^\circ$ and $a : b = 5 : 3$
 $x : y = 1 : 3$ $\left(\begin{array}{l} \times 18 \\ 5 \times 90 \end{array} \right) \rightarrow \times 18$
 $k : 3k \leftarrow \times \text{constant}$
 Show that $b = x$

[3 marks]

$$b = 3 \times 18 = 54^\circ$$

Angles add to
360

$$90 + 54 + k + 3k = 360^\circ$$

$$144 + 4k = 360$$

$$4k = 216^\circ$$

$$k = 54^\circ$$

$$k = x = 54^\circ$$

b and x are both 54°

Turn over ►



15 Here is some information about the test marks of 120 students.

Mark, m	$0 < m \leq 10$	$10 < m \leq 20$	$20 < m \leq 30$	$30 < m \leq 40$	$40 < m \leq 50$
Frequency	20	28	40	20	12

15 (a) Complete the cumulative frequency table.

[1 mark]

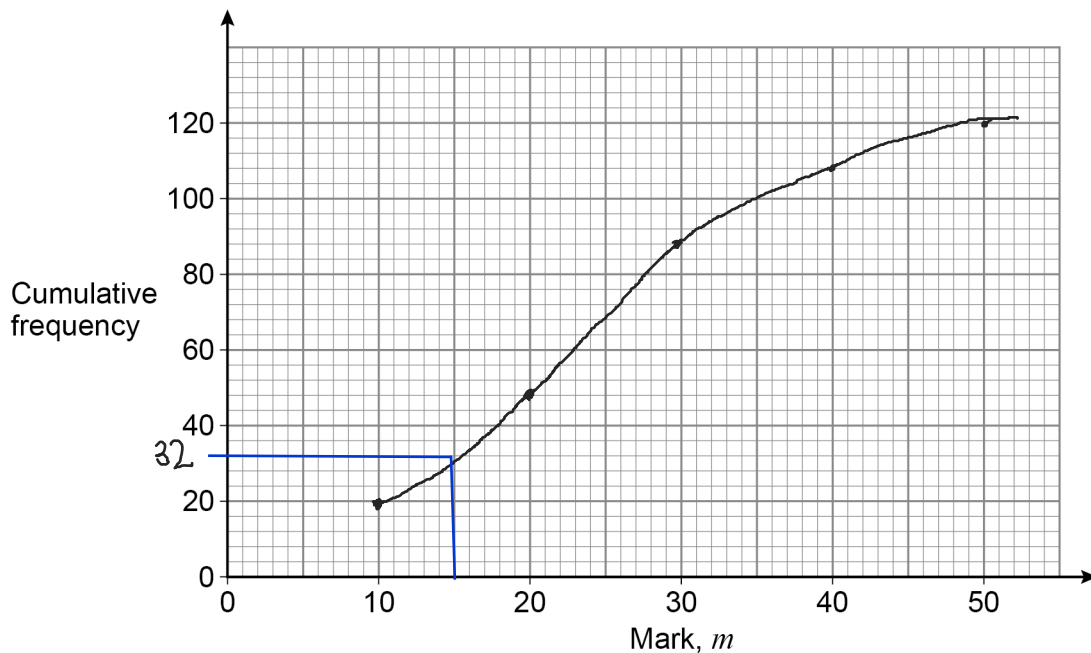
$48 + 40$ $88 + 20$ $108 + 12$

Mark, m	$m \leq 10$	$m \leq 20$	$m \leq 30$	$m \leq 40$	$m \leq 50$
Cumulative frequency	20	48	88	108	120

15 (b) Draw a cumulative frequency graph.

plot at the upper bound

[2 marks]



15 (c) Students who scored 15 marks or fewer take another test.

Use your graph to estimate how many students take another test.

[2 marks]

Answer 32

16 Simplify fully

$$\frac{4x - 8x^2}{12x - 6}$$

[3 marks]

$$= \frac{4x(1-2x)}{6(2x-1)} \quad \begin{matrix} x-1 \\ \times -1 \end{matrix} = \frac{4x(1-2x)}{-6(1-2x)}$$

$$= \frac{-4x}{6} \quad \begin{matrix} \div 2 \\ \div 2 \end{matrix}$$

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

Answer $-\frac{2}{3}x$

Turn over for the next question

Turn over ►



17 Toby is forming and solving equations.

17 (a)

The product of half of a number and three more than the number
is the same as
the square of the number

Toby uses y to represent the number.

Write an equation that Toby could form.

[2 marks]

$$y^2 = \frac{1}{2}y \times (y+3)$$

$$= \frac{1}{2}y(y+3)$$

Answer $y^2 = \frac{1}{2}y(y+3)$

17 (b) Toby forms another equation.

$$x = \frac{9}{8x}$$

He wants to work out the values of x .

Here is his working.

$$x = \frac{9}{8x}$$

$$\begin{array}{l} 8x^2 = 9 \\ \div 8 \\ 8x = 3 \text{ or } 8x = -3 \end{array}$$

$$x = \frac{3}{8} \text{ or } x = -\frac{3}{8}$$

What error has he made in his working?

[1 mark]

Toby should have $\div 8$ first before
square rooting



18 Here is an identity.

$$x^2 - y^2 \equiv (x + y)(x - y)$$

18 (a) Use the identity to work out the value of $193^2 - 7^2$
You **must** show your working.

[2 marks]

$$\begin{aligned} x &= 193 & y &= 7 \\ &= (193 + 7)(193 - 7) \\ &= 200 \times 186 \\ &= 37200 \end{aligned}$$

Answer 37200

18 (b) Factorise $100a^2 - 81b^2$ - difference of two squares

[1 mark]

Answer $(10a + 9b)(10a - 9b)$

19 Circle the fraction that is equivalent to $0.\dot{1}$

[1 mark]

$\frac{1}{9}$

 $\frac{1}{99}$

 $\frac{1}{10}$

 $\frac{11}{100}$

7

Turn over ►

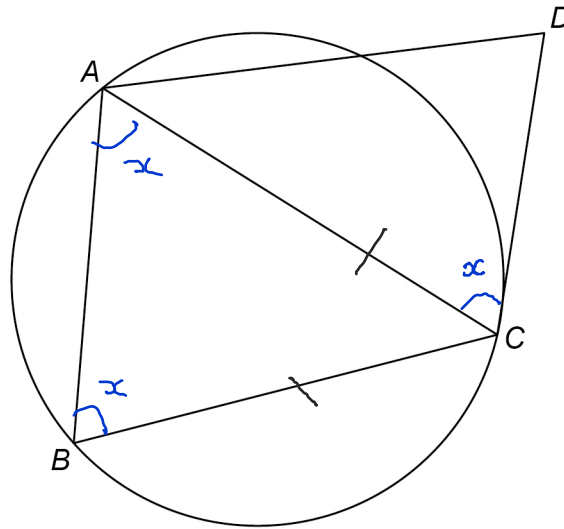


20

A , B and C are points on a circle.

CD is a tangent.

Not drawn
accurately



20 (a) Assume that triangle ABC is isosceles with $AC = BC$

Prove that AB is parallel to DC .

[4 marks]

$$\angle ACD = \angle ABC \quad \text{alternate segment theorem}$$

$$\angle ABC = \angle BAC \quad \text{isosceles triangle}$$

$$\angle BAC = \angle ACD$$

both are x

$\angle BAC$ and $\angle ACD$ are alternate angles
therefore AB is parallel to DC



20 (b) In fact, triangle ABC is equilateral.

Tick the **two** boxes for the statements that **must** be correct.

[1 mark]

AB is parallel to DC - just proved

AC bisects angle BCD - $\angle BCD = 120^\circ$
 $120 \div 2 = 60^\circ$

AC bisects angle BAD

don't know
 $\angle CAD$

21 Solve the simultaneous equations

$$2x + 3y = 5p$$

$$y = 2x + p$$

$$\quad -2x$$

where p is a constant.

Give your answers in terms of p in their simplest form.

[4 marks]

$$\begin{array}{r} 2x + 3y = 5p \\ -2x + y = p \quad + \\ \hline \end{array}$$

$$4y = 6p$$

$$\quad \div 4$$

$$y = \frac{3}{2}p$$

$$1.5p = 2x + p$$

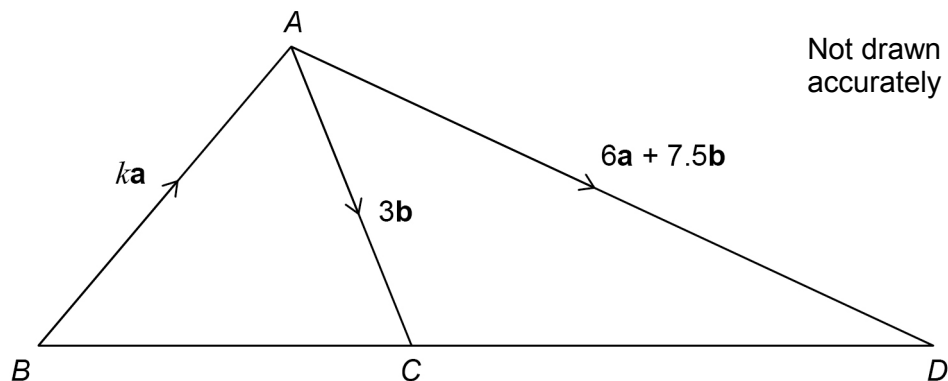
$$0.5p = 2x$$

$$0.25p = x$$

$$x = 0.25p \quad y = 1.5p$$



- 22 ABC and ACD are triangles.
 k is a constant.



- 22 (a) Show that $\vec{CD} = 6a + 4.5b$

[1 mark]

$$\begin{aligned} \vec{CD} &= \vec{CA} + \vec{AD} \\ &= -3b + 6a + 7.5b \\ &= \underline{6a} + \underline{4.5b} \end{aligned}$$

- 22 (b) BCD is a straight line.

Work out the value of k .You **must** show your working.

Equal ratios

[3 marks]

$$\begin{aligned} BC &= \overset{\times 1.5}{ka} + 3b \quad \downarrow \times 1.5 \\ CD &= 6a + 4.5b \end{aligned}$$

$$1.5k = 6$$

$$k = 6 \div 1.5$$

Answer $\underline{k = 4}$



23 Simplify $8^4 \div 32^{\frac{2}{5}}$

Give your answer in the form 2^m where m is an integer.

[3 marks]

$$2^3 = 8 \quad 2^5 = 32$$

$$= (2^3)^4 \div (2^5)^{\frac{2}{5}}$$

$$= 2^{12} \div 2^2$$

$$= 2^{12-2} = 2^{10}$$

Answer 2^{10}

24 $f(x) = \sin(x - 90^\circ)$

Circle the value of $f(0^\circ)$

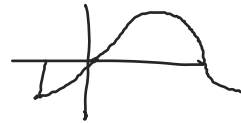
$$f(x) = \sin(-90) =$$

1

0

$-\frac{1}{2}$

-1



[1 mark]

Turn over for the next question

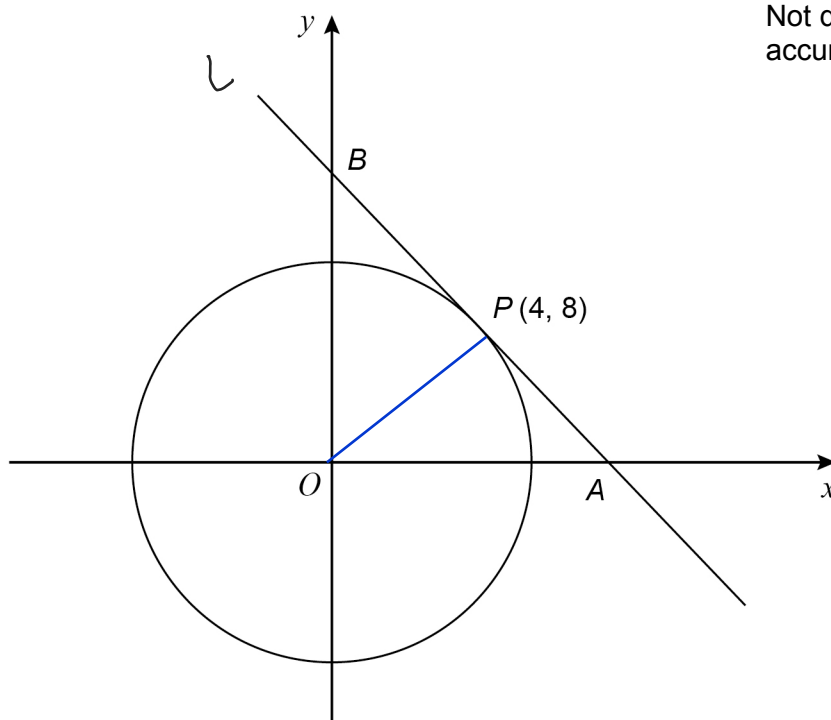
Turn over ►



25

$P(4, 8)$ is a point on a circle, centre O .

The tangent at P intersects the axes at points A and B .



Not drawn
accurately

25 (a) Show that the gradient of the tangent is $-\frac{1}{2}$

[2 marks]

$$\text{Gradient } OP: \frac{8-0}{4-0} = 2$$

Tangent = perpendicular therefore gradient is
negative reciprocal

$$-1 \div 2 = -\frac{1}{2}$$



25 (b) Work out the length AB.

Give your answer in the form $a\sqrt{5}$ where a is an integer.

You **must** show your working.

[4 marks]

Equation of l : $y = -\frac{1}{2}x + c$

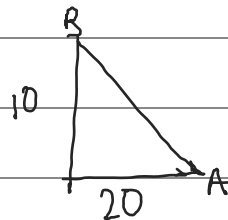
$$8 = -\frac{1}{2} \times 4 + c$$

$$8 + 2 = c = 10$$

$$y = -\frac{1}{2}x + 10$$

$$B = (0, 10)$$

$$A = (20, 0)$$



Pythagoras: $AB^2 = 10^2 + 20^2$

$$= 100 + 400$$

$$AB^2 = 500$$

$$AB = \sqrt{500} = 10\sqrt{5}$$

Answer 10√5 units

Turn over for the next question



26

The turning point of the graph $y = (x + a)^2 + b$ has x -coordinate -2
 $(3, 1)$ is another point on the graph.

Work out the y -coordinate of the turning point.

[3 marks]

$$1 = (3 + 2)^2 + b = 25 + b$$

$$b = -24$$

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

$$= (x + 2)^2 - 24$$

Turning point $(-2, -24)$

Answer -24



27

Angle x is acute.

$$\cos x = \sin 60^\circ \times \tan 30^\circ$$

Work out the size of angle x .You **must** show your working.**[3 marks]**

$$\sin 60 = \frac{\sqrt{3}}{2} \quad \tan 30 = \frac{1}{\sqrt{3}}$$

$$\cos x = \frac{\sqrt{3}}{2} \times \frac{1}{\sqrt{3}} = \frac{1}{2}$$

$$\cos 60 = \frac{1}{2}$$

$$x = 60^\circ$$

Answer 60 degrees**END OF QUESTIONS**

There are no questions printed on this page

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2 4



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