

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname *StemUp Model Solution*

Forename(s)

Candidate signature

GCSE MATHEMATICS

H

Higher Tier

Paper 1 Non-Calculator

Tuesday 21 May 2019

Morning

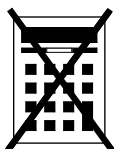
Time allowed: 1 hour 30 minutes

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.

Advice

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

For Examiner's Use

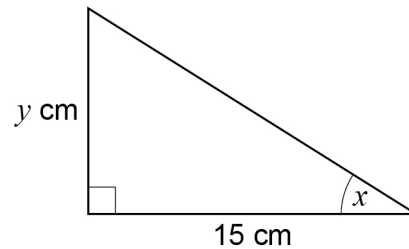
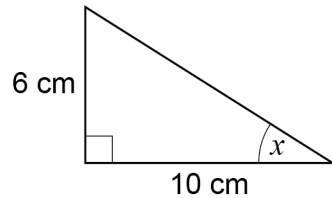
Pages	Mark
2–3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
TOTAL	



J U N 1 9 8 3 0 0 1 H 0 1

Answer **all** questions in the spaces provided

- 1 Here are two right-angled triangles.

Not drawn
accuratelyCircle the value of y .

[1 mark]

11

7.5

9

4

- 2 Work out the value of $\left(1\frac{2}{3}\right)^2$

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.

[1 mark]

 3π 6π 12π 18π 

- 4 Circle the fraction that is equivalent to 4.625

[1 mark]

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

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

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

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

- 5 (a) Write 0.00097 in standard form.

[1 mark]

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]

$$(3 \div 4) \times (10^5 \div 10^3)$$

$$= 0.75 \times 10^2$$

$$= 75$$

Answer 75

Turn over ►



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.

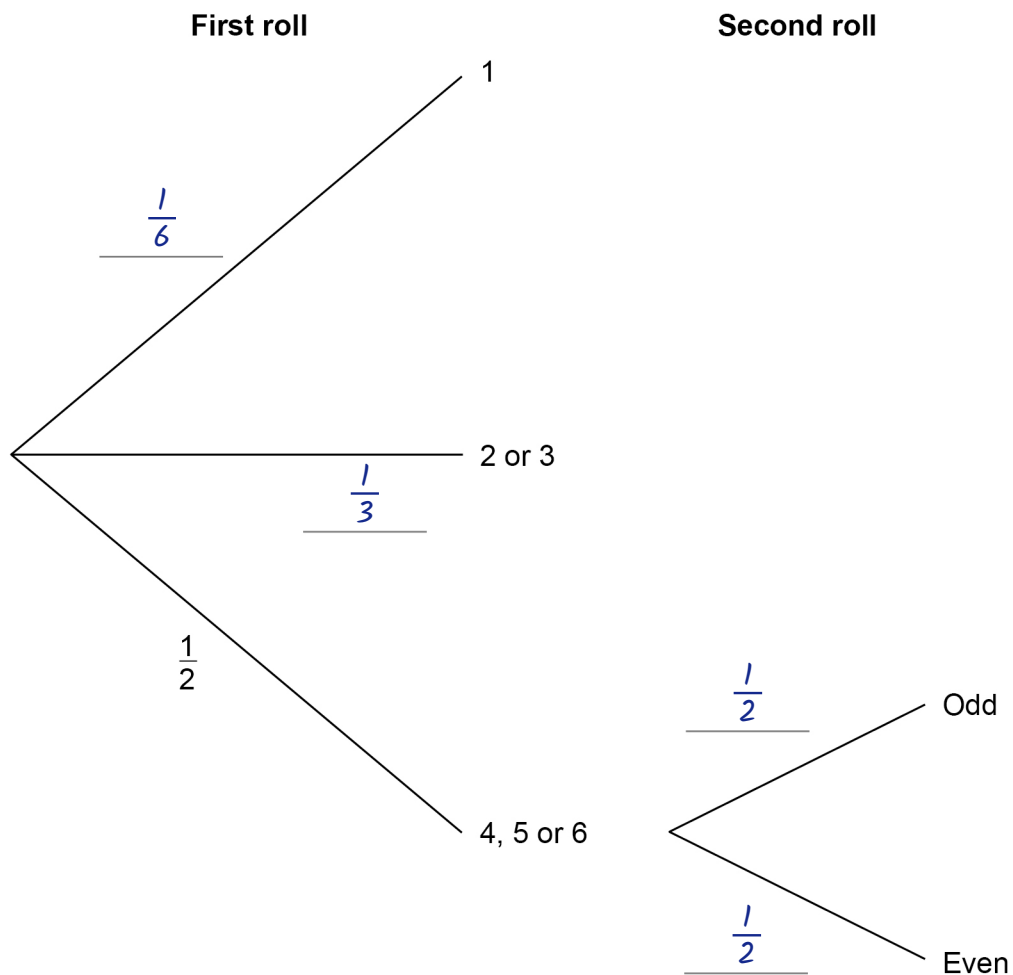
When she has to roll again,

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]

$$P(\text{win}) = P(1) + P(4, 5 \text{ or } 6 \text{ then odd})$$

$$= \frac{1}{6} + \frac{1}{2} \times \frac{1}{2} = \frac{1}{6} + \frac{1}{4}$$

$$= \frac{2}{12} + \frac{3}{12} = \frac{5}{12}$$

$$P(\text{lose}) = 1 - \frac{5}{12} = \frac{7}{12}$$

$$\frac{7}{12} > \frac{5}{12} \text{ so Anna is more likely to lose}$$

Turn over for the next question

Turn over ►



- 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?
- [2 marks]**

$$20\% \text{ of the people at the start} = 3$$

$$100\% = 3 \times 5 = 15 \text{ people at the start}$$

$$15 + 3 = 18$$

Answer 18

- 8 Work out the value of $(3^{12} \div 3^5) \div (3^2 \times 3)$
- [3 marks]**

$$3^{12} \div 3^5 = 3^{12-5} = 3^7$$

$$3^2 \times 3 = 3^3$$

$$3^7 \div 3^3 = 3^4$$

$$3^4 = 3 \times 3 \times 3 \times 3 = 81$$

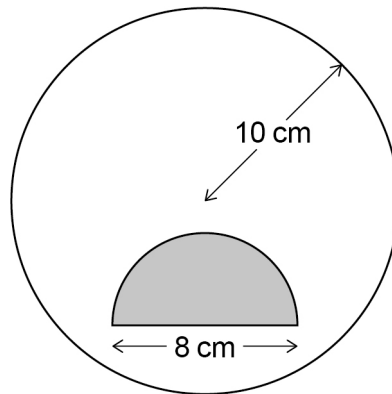
Answer 81



9

A shaded semicircle is inside a circle as shown.

Not drawn
accurately



The **radius** of the circle is 10 cm

The **diameter** of the semicircle is 8 cm

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

[4 marks]

$$\text{Area of circle} = \pi \times 10^2 = 100\pi$$

$$\text{Area of semicircle} = \pi \times 4^2 \div 2 = 16\pi \div 2 = 8\pi$$

$$\text{Unshaded area} = 100\pi - 8\pi = 92\pi$$

$$92\pi \div 8\pi = 92 \div 8 = 11.5$$

Answer 11.5

Turn over for the next question

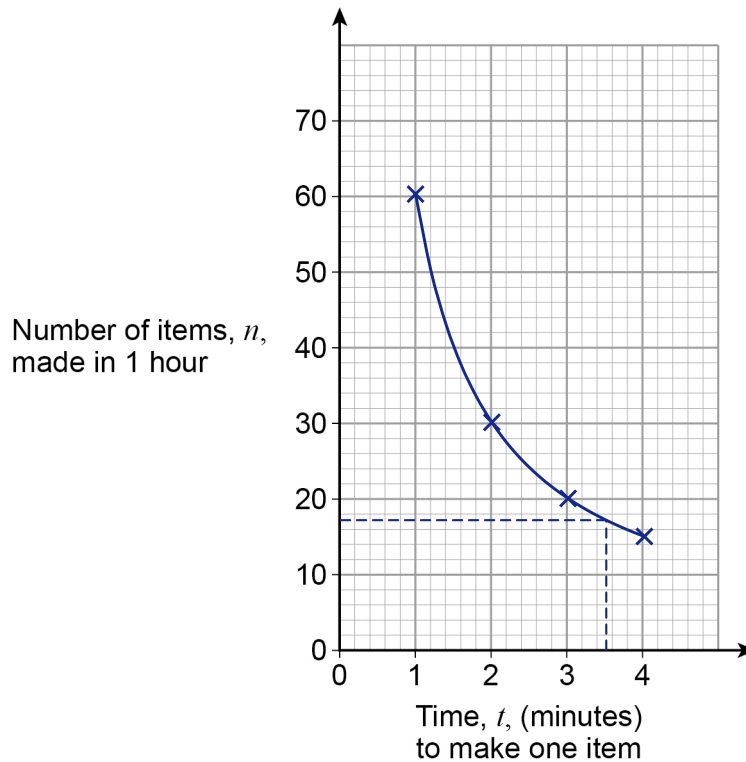
Turn over ►



- 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	2	3	4
n	60	30	20	15

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

Use your graph to estimate the value of n .

[2 marks]

$$3 \text{ min } 30 \text{ s} = 3.5 \text{ min}$$

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]

$$330 \div (7 + 4) = 330 \div 11 = 30$$

$$\text{Ed: } 7 \times 30 = \text{£}210 \quad \text{Fay: } 4 \times 30 = \text{£}120$$

$$\text{Same amount each: } 330 \div 2 = \text{£}165$$

$$\text{Ed gives Fay } 210 - 165 = \text{£}45$$

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]

-9 2 -7 -5 -12

-3 5 -2 3 1

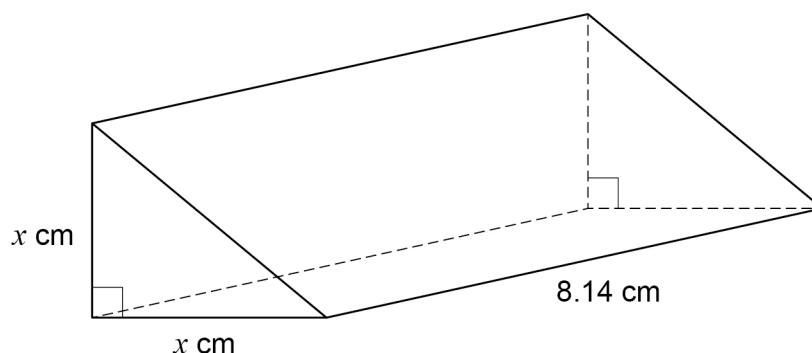
0 -3 -3 0 -3

-1 -1 -2 -3 1



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]

$$102 \approx 100 \quad \text{and} \quad 8.14 \approx 8$$

$$\text{Volume} = \text{area of triangle} \times \text{length}$$

$$100 = (x \times x \div 2) \times 8 = 4x^2$$

$$x^2 = 100 \div 4 = 25$$

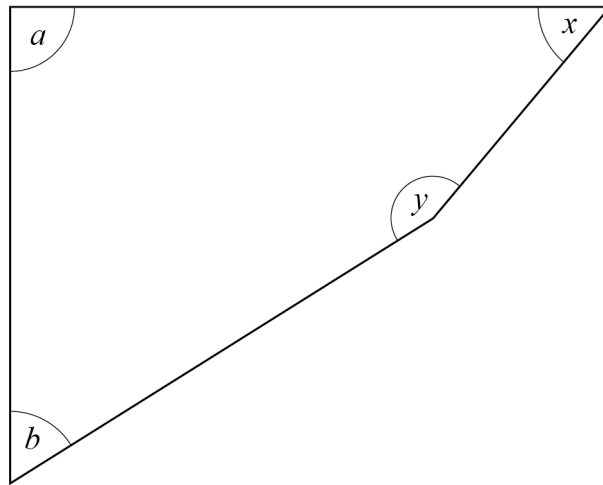
$$x = \sqrt{25} = 5$$

Answer 5



14

Here is a quadrilateral.

Not drawn
accurately

$$a = 90^\circ \quad \text{and} \quad a : b = 5 : 3$$

$$x : y = 1 : 3$$

Show that $b = x$ **[3 marks]**

$$a : b = 5 : 3 \text{ and } a = 90^\circ, \text{ so } 1 \text{ part} = 90 \div 5 = 18^\circ$$

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

Angles in a quadrilateral add up to 360°

$$x + y = 360 - 90 - 54 = 216^\circ$$

$$x : y = 1 : 3, \text{ so } x = 216 \div 4 = 54^\circ \quad (y = 3 \times 54 = 162^\circ)$$

$$b = 54^\circ \text{ and } x = 54^\circ, \text{ so } b = x$$

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

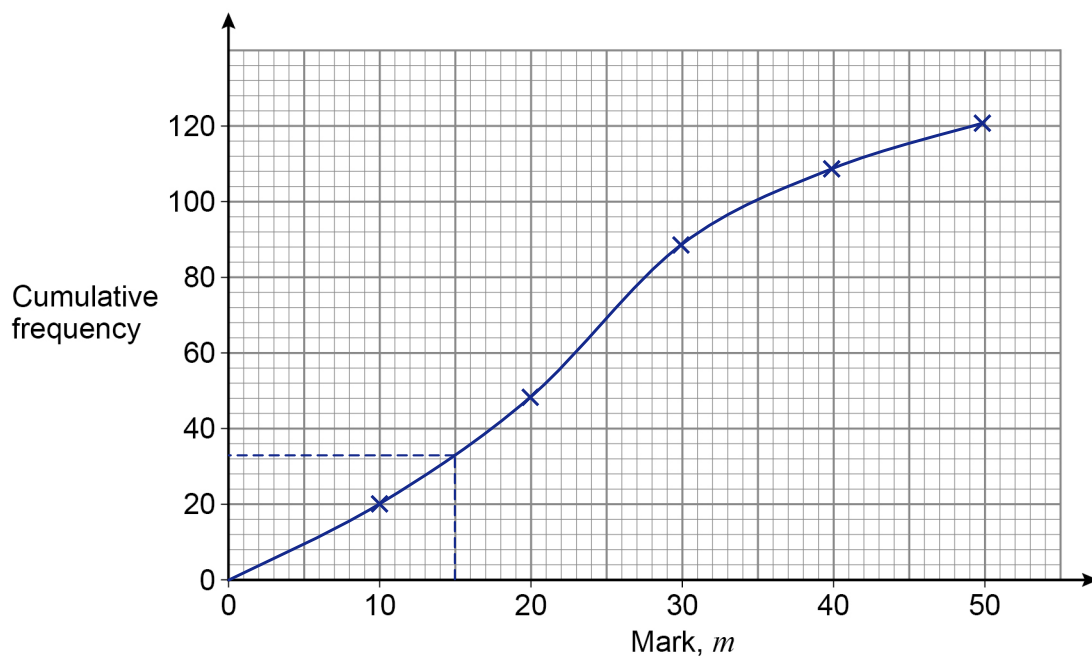
- 15 (a) Complete the cumulative frequency table.

[1 mark]

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.

[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]

Reading up from 15 marks to the curve gives 33

Answer 33

- 16** Simplify fully

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

[3 marks]

Numerator: $4x - 8x^2 = 4x(1 - 2x)$

Denominator: $12x - 6 = 6(2x - 1)$

and $(1 - 2x) = -(2x - 1)$

$$\frac{4x(1 - 2x)}{6(2x - 1)} = \frac{-4x}{6} = -\frac{2x}{3}$$

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

Turn over for the next question



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]

half the number = $y \div 2$, three more than it = $y + 3$

product of these = square of the number

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

17 (b) Toby forms another equation.

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

He wants to work out the values of x .

Here is his working.

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

$$8x^2 = 9$$

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

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

What error has he made in his working?

[1 mark]

He square rooted $8x^2$ as if it were $(8x)^2$. He should divide

by 8 first: $x^2 = 9 \div 8$, so $x = \pm\sqrt{9 \div 8}$



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]

$$193^2 - 7^2 = (193 + 7)(193 - 7)$$

$$= 200 \times 186$$

$$= 2 \times 18600 = 37200$$

Answer 37200

18 (b) Factorise $100a^2 - 81b^2$

[1 mark]

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

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

[1 mark]

$$\left(\frac{1}{9} \right)$$

$$\frac{1}{99}$$

$$\frac{1}{10}$$

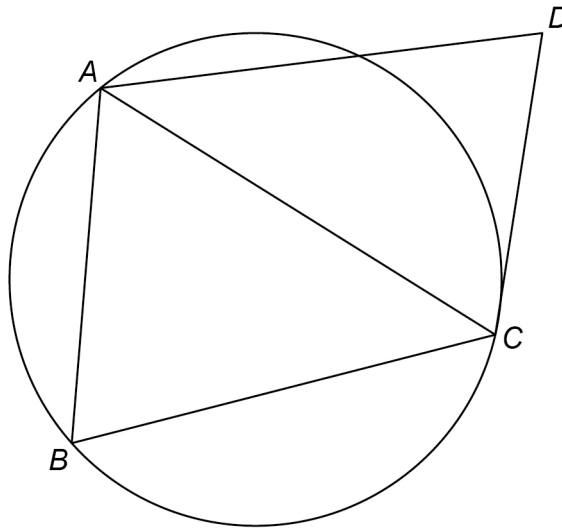
$$\frac{11}{100}$$



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]

Let angle $ABC = x$

$AC = BC$ so angle $BAC = \text{angle } ABC = x$

(base angles of an isosceles triangle are equal)

Angle $ACD = \text{angle } ABC = x$ (alternate segment theorem)

So angle $BAC = \text{angle } ACD = x$

These are alternate angles between AB and DC , and they

are equal, so AB is parallel to DC

(alternate angles are equal on parallel lines)



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

☒

AC bisects angle BCD

☐

AC bisects angle BAD

21 Solve the simultaneous equations

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

$$y = 2x + p$$

where p is a constant.

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

[4 marks]

$$2x + 3(2x + p) = 5p$$

$$2x + 6x + 3p = 5p$$

$$8x = 2p$$

$$x = \frac{2p}{8} = \frac{p}{4}$$

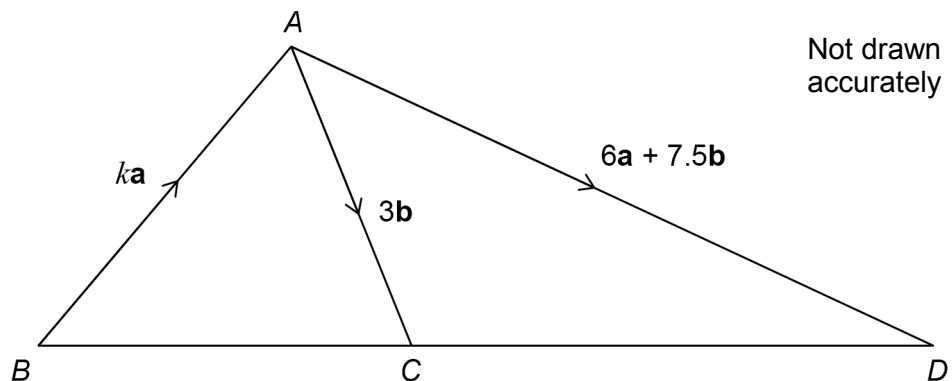
$$y = 2 \times \frac{p}{4} + p = \frac{p}{2} + p = \frac{3p}{2}$$

$$x = \frac{p}{4} \quad y = \frac{3p}{2}$$

Turn over ►



22

 ABC and ACD are triangles. k is a constant.22 (a) Show that $\overrightarrow{CD} = 6\mathbf{a} + 4.5\mathbf{b}$

[1 mark]

$$\overrightarrow{CD} = \overrightarrow{CA} + \overrightarrow{AD}$$

$$= -3\mathbf{b} + 6\mathbf{a} + 7.5\mathbf{b}$$

$$= 6\mathbf{a} + 4.5\mathbf{b}$$

22 (b) BCD is a straight line.Work out the value of k .You **must** show your working.

[3 marks]

$$\overrightarrow{BC} = \overrightarrow{BA} + \overrightarrow{AC} = k\mathbf{a} + 3\mathbf{b}$$

BCD is a straight line so $\overrightarrow{BC}$ is a multiple of $\overrightarrow{CD}$

$$k : 6 = 3 : 4.5$$

$$k = 6 \times 3 \div 4.5 = 18 \div 4.5 = 4$$

$$(\text{so } \overrightarrow{BC} = 4\mathbf{a} + 3\mathbf{b})$$

Answer 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]

$$8^4 = (2^3)^4 = 2^{12}$$

$$32 = 2^5, \text{ so } 32^{2/5} = (2^5)^{2/5} = 2^2$$

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

Answer 2^{10}

24

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

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

[1 mark]

1

0

 $-\frac{1}{2}$

-1

Turn over for the next question

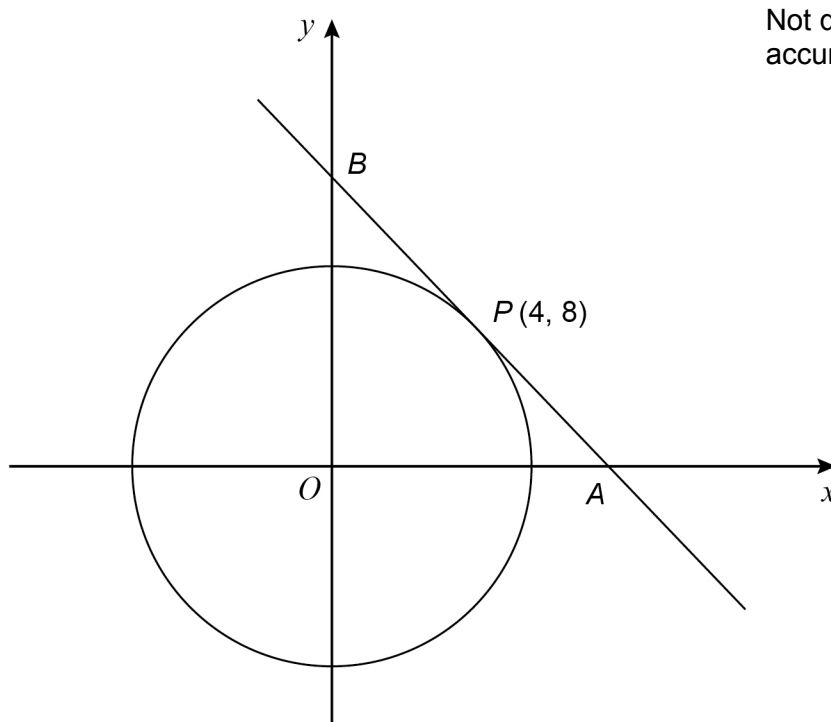
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25

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

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



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

[2 marks]

$$\text{Gradient of } OP = (8 - 0) \div (4 - 0) = 8 \div 4 = 2$$

The tangent is perpendicular to the radius OP ,

$$\text{so } (\text{gradient of tangent}) \times 2 = -1$$

$$\text{gradient of tangent} = -1 \div 2 = -\frac{1}{2}$$



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]

$$\text{Tangent: } y = -\frac{1}{2}x + c$$

$$\text{At } P(4, 8): 8 = -2 + c, \text{ so } c = 10$$

$$B = (0, 10)$$

$$\text{At } A, y = 0: 0 = -x \div 2 + 10, \text{ so } x = 20$$

$$A = (20, 0)$$

$$AB^2 = 20^2 + 10^2 = 400 + 100 = 500$$

$$AB = \sqrt{500} = \sqrt{(100 \times 5)} = 10\sqrt{5}$$

Answer 10√5 units

Turn over for the next question



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

[3 marks]

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]**

$$\sin 60^\circ = \frac{\sqrt{3}}{2} \text{ and } \tan 30^\circ = \frac{1}{\sqrt{3}}$$

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

$$x = \cos^{-1} \frac{1}{2} = 60^\circ$$

Answer 60 degrees**END OF QUESTIONS**

There are no questions printed on this page

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2 4



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