

Surname	Centre Number	Candidate Number
First name(s)		0



GCSE

C300UB0-1



A24-C300UB0-1



FRIDAY, 8 NOVEMBER 2024 – MORNING

MATHEMATICS – Component 2
Calculator-Allowed Mathematics
HIGHER TIER

2 hours 15 minutes

ADDITIONAL MATERIALS

An additional formulae sheet.

A calculator will be required for this examination.

A ruler, protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

Take π as 3.142 or use the π button on your calculator.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the need for good English and orderly, clear presentation in your answers.



NOV24C300UB0101

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	6	
2.	3	
3.	4	
4.	8	
5.	1	
6.	6	
7.	5	
8.	8	
9.	3	
10.	2	
11.	4	
12.	3	
13.	4	
14.	3	
15.	5	
16.	2	
17.	7	
18.	9	
19.	6	
20.	1	
21.	9	
22.	4	
23.	4	
24.	7	
25.	6	
Total	120	

C300UB01
01

Formula list

Area and volume formulae

Where r is the radius of the sphere or cone, l is the slant height of a cone and h is the perpendicular height of a cone:

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

Kinematics formulae

Where a is constant acceleration, u is initial velocity, v is final velocity, s is displacement from the position when $t = 0$ and t is time taken:

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$



C300UB01
03

1. A right-angled triangle and a square are shown below.



Calculate the area of the square.
You must show all your working.



2. Elijah has a large cylinder of wax.
It has a radius of 7 cm and a height of 21 cm.

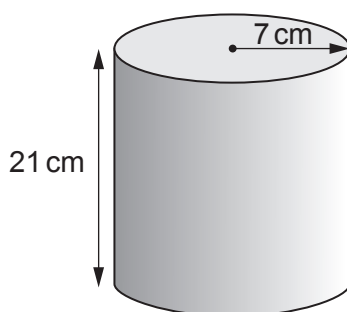


Diagram not drawn to scale

He melts down the large cylinder of wax to make small wax cylinders each with a volume of 102 cm^3 .

How many complete small wax cylinders can Elijah make?

[3]

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3. The density of copper is 8.96 g/cm^3 .
A solid copper statue has a volume of 1540 cm^3 .
Calculate its mass in kilograms.
Give your answer correct to two significant figures.

[4]

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Mass = ... kg



4. (a) Simplify $4x^3y^5 \times 7x^2y$. [2]

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- (b) (i) Solve $n + 11 < 4n - 5$. [3]

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- (ii) n is an integer.
What is the least possible value of n ? [1]

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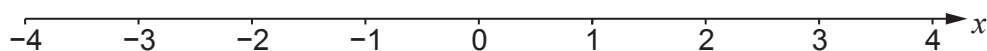
- (c) Make x the subject of the formula. [1]

$$\frac{a}{x} = b$$

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- (d) Represent the inequality $-3 < x \leq 1$ on the number line below. [1]



5. 1 micrometre = 1×10^{-4} centimetres.
Which of the answers below represents 2.4 micrometres in **metres**?
Circle your answer. [1]

2.4×10^{-4}

2.4×10^{-6}

2.4×10^2

2.4×10^{-2}

2.4×10^{-5}

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6. A new supermarket is about to open in a town with 8000 houses.
For the first four weeks, £10 vouchers will be sent out to encourage people to visit the supermarket.

At the start of the first week, 30% of the houses in the town will each be sent a voucher.
At the start of each of the next three weeks, a voucher will be sent to 30% of the houses that have **not yet received** a voucher.
The vouchers need to be used in the supermarket by the end of the four weeks.

- (a) John, the supermarket manager, says

"By the end of the four weeks, 6079 of the vouchers will have been used."

Show that John could be correct. [4]

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- (b) (i) State an assumption that John has made in part (a).

[1]

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- (ii) If John's assumption was not correct, what effect would this have on the number of vouchers used by the end of the four weeks?

[1]

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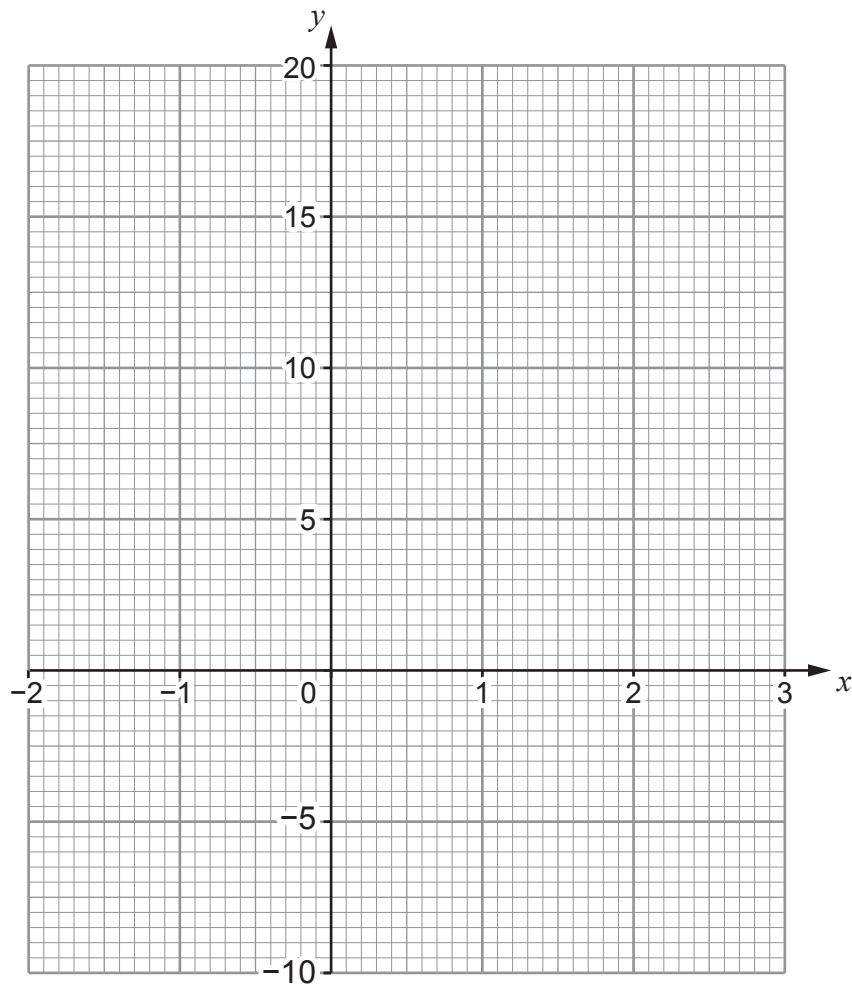
7. (a) The table below shows some of the values of $y = 2x^2 - 3x - 4$ for values of x from -2 to 3 .
Complete the table by finding the value of y for $x = -1$ and for $x = 3$. [2]

x	-2	-1	0	1	2	3
$y = 2x^2 - 3x - 4$	10		-4	-5	-2	

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- (b) On the graph paper below, draw the graph of $y = 2x^2 - 3x - 4$ for values of x from -2 to 3 . [2]



- (c) What is the equation of the straight line that intersects the curve $y = 2x^2 - 3x - 4$ to give the solutions to the equation $2x^2 - 3x - 7 = 0$? [1]

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- Use an algebraic method (not trial and improvement) to calculate Tiana and Kamal's hourly pay rates.
You must show all your working.

[5]

Tiana's hourly pay rate is Kamal's hourly pay rate is



- (b) Fran also works at the bank part-time.
She earns 35% less than the full-time salary at her pay rate.
Fran's annual part-time salary is £24 570.
What would Fran's annual salary be if she worked full time?

[3]

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9. There are 1800 eels in a lake.

On Saturday morning, Sadia captured a random sample of x eels from the lake and tagged them.

She then released them back into the lake.

On Sunday morning, Sadia captured a second random sample of 150 eels from the lake. Seven of the eels in this sample were already tagged.

Use these values to calculate an estimate for x , the number of eels tagged in Sadia's first sample.

[3]

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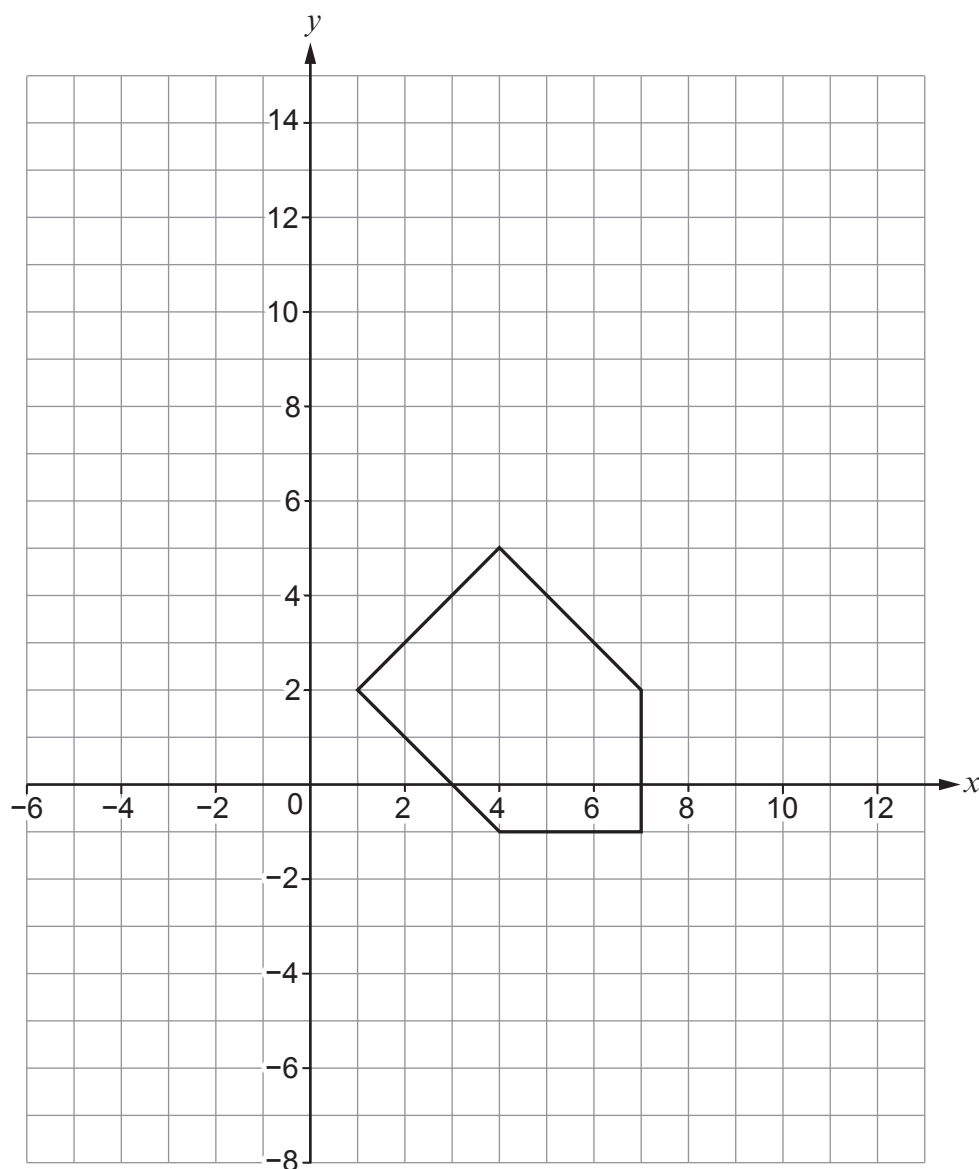


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10. Enlarge the shape shown on the grid by scale factor $\frac{1}{3}$, using (4,2) as the centre of enlargement. [2]



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11. A ship sails 11 km due south from port A.
It then travels 17 km due east and arrives at port B.

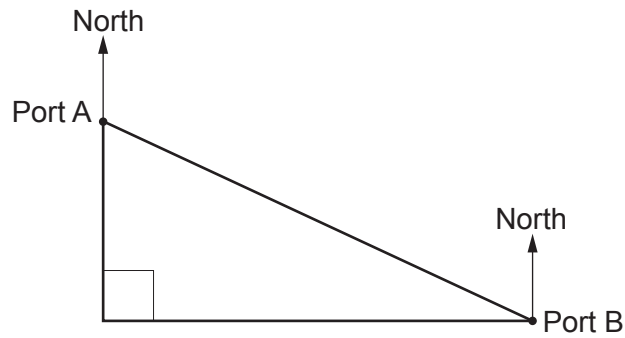


Diagram not drawn to scale

Calculate the bearing of port B from port A.

[4]

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The bearing of port B from port A is



12. The points A , B , C and D lie on the circumference of the circle.
The line EF is a tangent to the circle at point D .

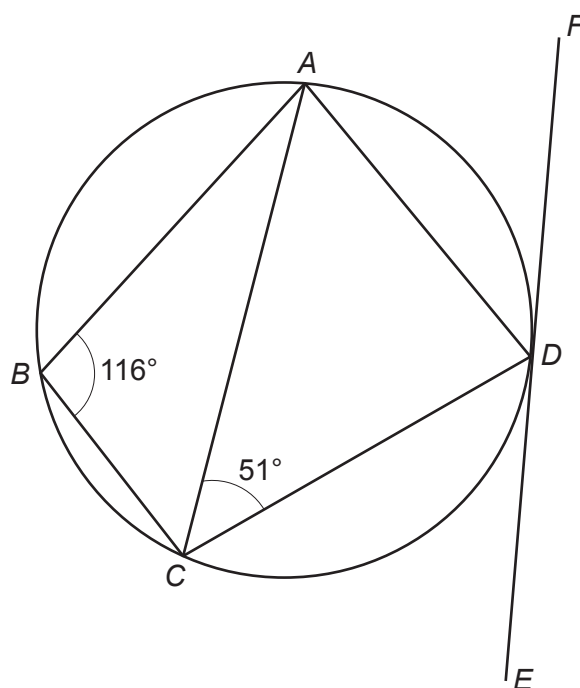


Diagram not drawn to scale

Prove that $\hat{CDE} = 65^\circ$.
Give reasons for your answer.

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[4]



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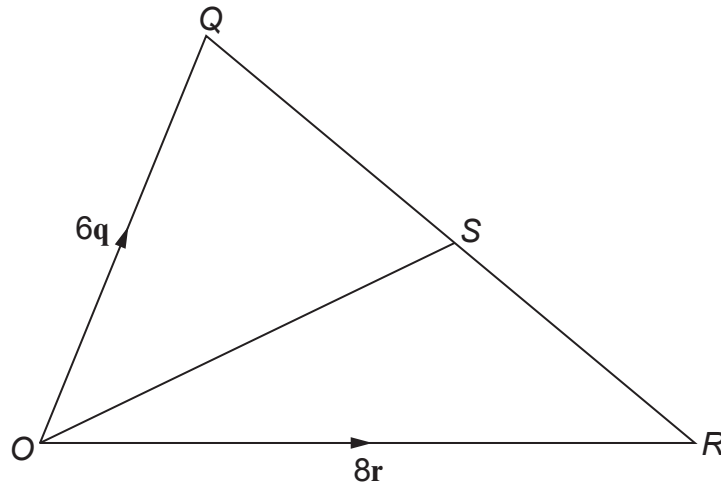
How many times would you expect Marcus to select the two cards with the letter A? [3]

- [5]

Kiera ran km



16.

*Diagram not drawn to scale*

In the triangle OQR , $\mathbf{OQ} = 6\mathbf{q}$ and $\mathbf{OR} = 8\mathbf{r}$.
 S is the mid-point of QR .

Find $\mathbf{RS}$ in terms of $\mathbf{q}$ and $\mathbf{r}$.

Give your answer in the form $a\mathbf{q} + b\mathbf{r}$, where a and b are integers.

[2]

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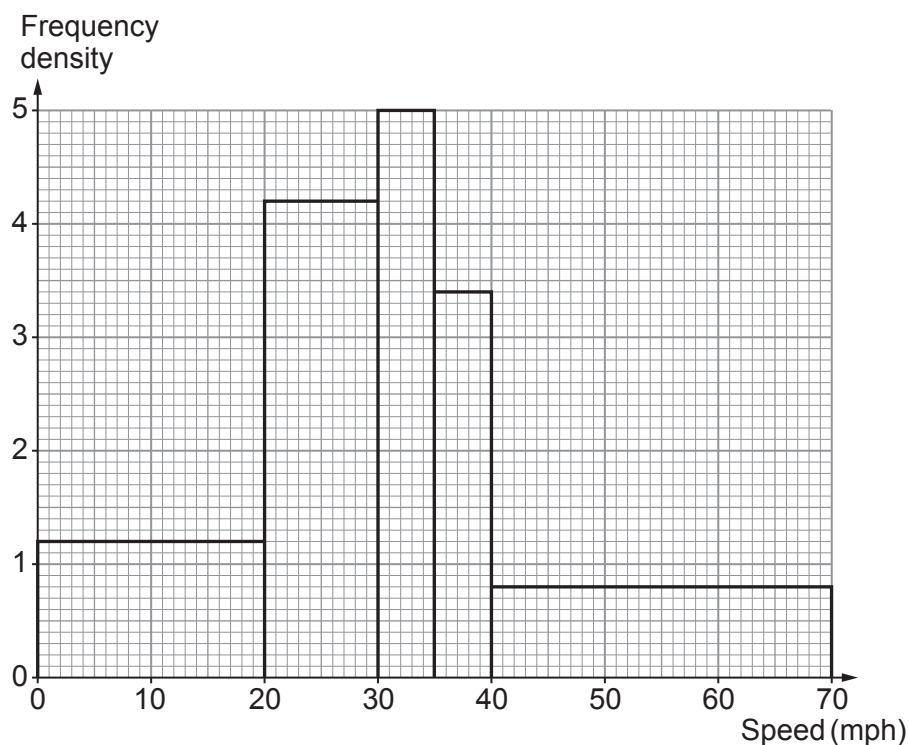
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17. A town council wishes to trial traffic-calming measures along a particular road in the town where the speed limit is 30 mph (miles per hour).

- (a) For the first trial, additional **30 mph signs** were put in place. Irene surveyed the average speed at which cars travelled along the road. The results are shown in the histogram below.



Use the histogram to calculate an estimate for the median speed, in mph, of the cars Irene surveyed.

You must show all your working.

[3]

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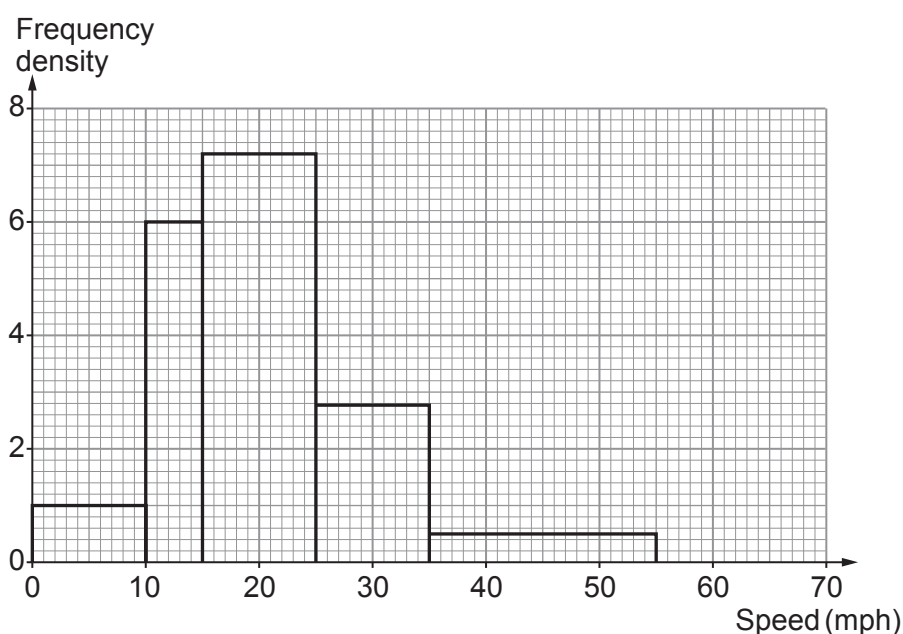
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Estimated median speed = ... mph



- (b) In the second trial, **speed bumps** were put in place. Irene surveyed the average speed of 150 cars. The results are shown in the histogram below.



Irene says,

"84% of cars travel at 30mph or less when speed bumps are in place."

- (i) Show that Irene could be correct. [2]

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- (ii) Explain why Irene could be incorrect. [1]

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- (c) Use information from the histograms to decide which traffic-calming measure is most effective.

30mph signs ☐

Speed bumps ☐

Give a reason to justify your answer. [1]

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- A diagram of a cone. A vertical dashed line from the apex to the center of the base is labeled 5 cm . A horizontal dashed line from the center of the base to the edge is labeled $(x + 1)\text{ cm}$.

The volume of the shape is $24\pi \text{ cm}^3$.

- [5]



- (b) A solution to the equation $2x^3 + 11x^2 + 16x = 65$ lies between 1.6 and 1.7.
Use the method of trial and improvement to find the solution correct to two decimal places. [4]

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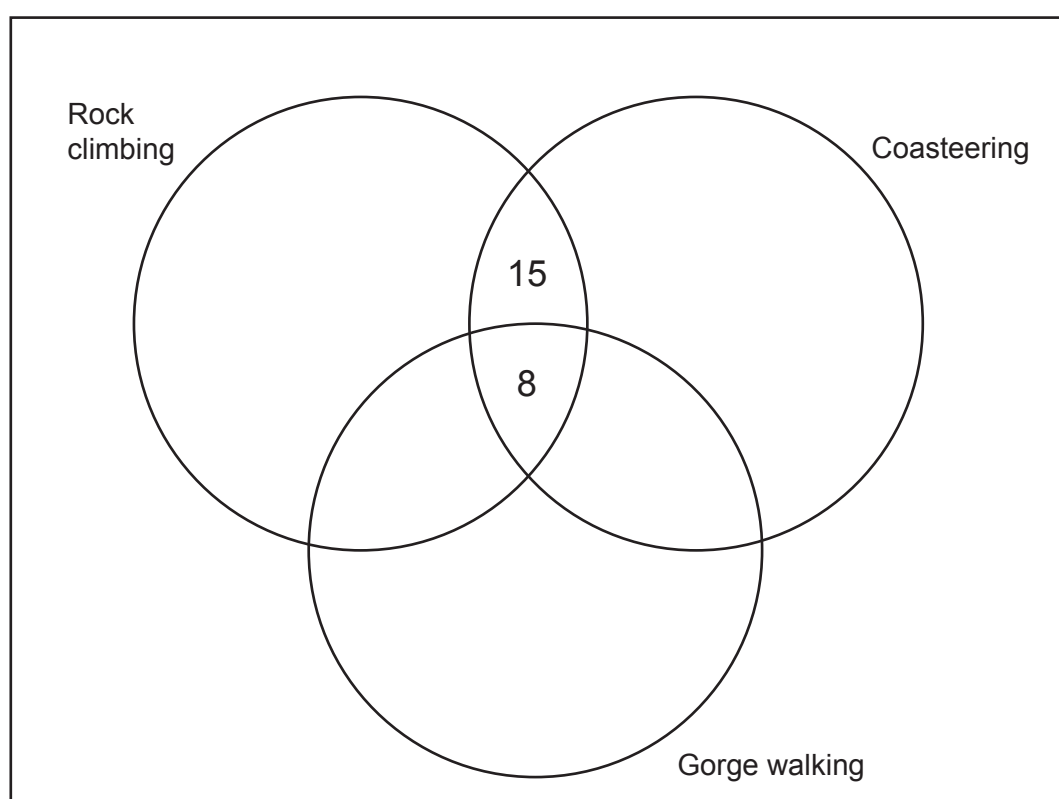
19. There are 143 Year 6 pupils going on a school trip to an adventure centre. They can choose to take part in up to three activities.

- All the pupils took part in at least one activity.
- 8 pupils took part in all three activities.
- 23 pupils took part in rock climbing and coasteering.
- 29 pupils took part in rock climbing and gorge walking.
- 22 pupils took part in coasteering and gorge walking.
- 65 pupils took part in coasteering.
- 76 pupils took part in rock climbing.

- (a) Complete the Venn diagram below to display this information.

[3]

Year 6
pupils



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- (b) A Year 6 pupil is chosen at random.
Find the probability that this pupil takes part in gorge walking and coasteering **only**. [1]

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- (c) Given that a randomly chosen pupil from Year 6 took part in gorge walking, find the probability they also took part in rock climbing. [2]

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20. Simplify $\frac{2(y-7)^5}{(y-7)^{-3}}$. [1]

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- 21.** The circle below is split into sectors, segments and triangles.
 A , B , C and D are points on the circumference of the circle with centre O .
 The lines AC and BD are diameters of the circle.

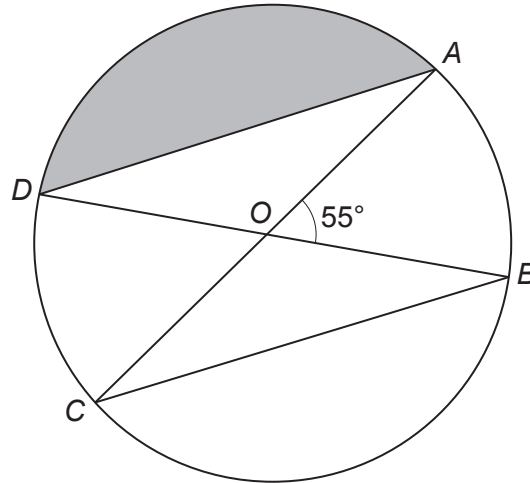


Diagram not drawn to scale

The area of sector AOB is 12 cm^2 .
Find the perimeter of the shaded segment.
You must show all your working.

[9]



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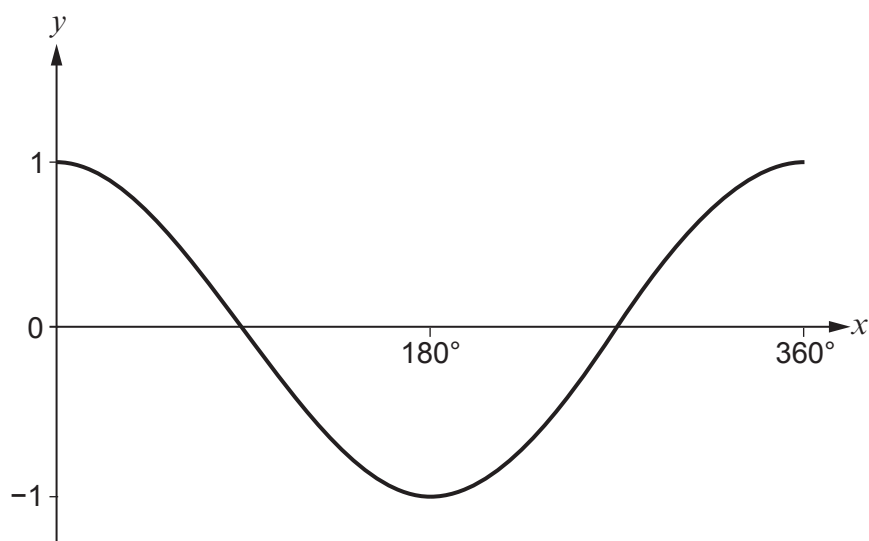
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The perimeter of the shaded segment is cm



22. The diagram shows a sketch of $y = \cos x$ for the values of x from 0° to 360° .



(a) Solve the equation $\cos x = -0.731$ for all values of x from 0° to 360° .

[2]

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(b) Draw a sketch of $y = \cos x - 1$ for the values of x from 0° to 360° .
You must indicate any important values on the axes.

[2]



23. Bert and Rehan use six-digit codes to lock their phones.
They must use these digits to create their code:

3	4	5	6	7	8
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Each digit can only be used once in a code.

Bert's code must meet the following conditions:

- The first digit is a multiple of four.
- The second and third digits are both prime numbers.
- There are no conditions for the remaining digits.

Rehan does not have any conditions for his code.

How many more code combinations can Rehan choose from than Bert?

[4]

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- $$y = \frac{1}{9} \text{ and } x = 4 \text{ when } w = 6.$$

[7]



25. By first completing the square, draw a sketch of $y = 4x^2 - 16x - 6$.
You must clearly indicate the coordinates of any stationary points and the intercept with the y -axis.

[6]

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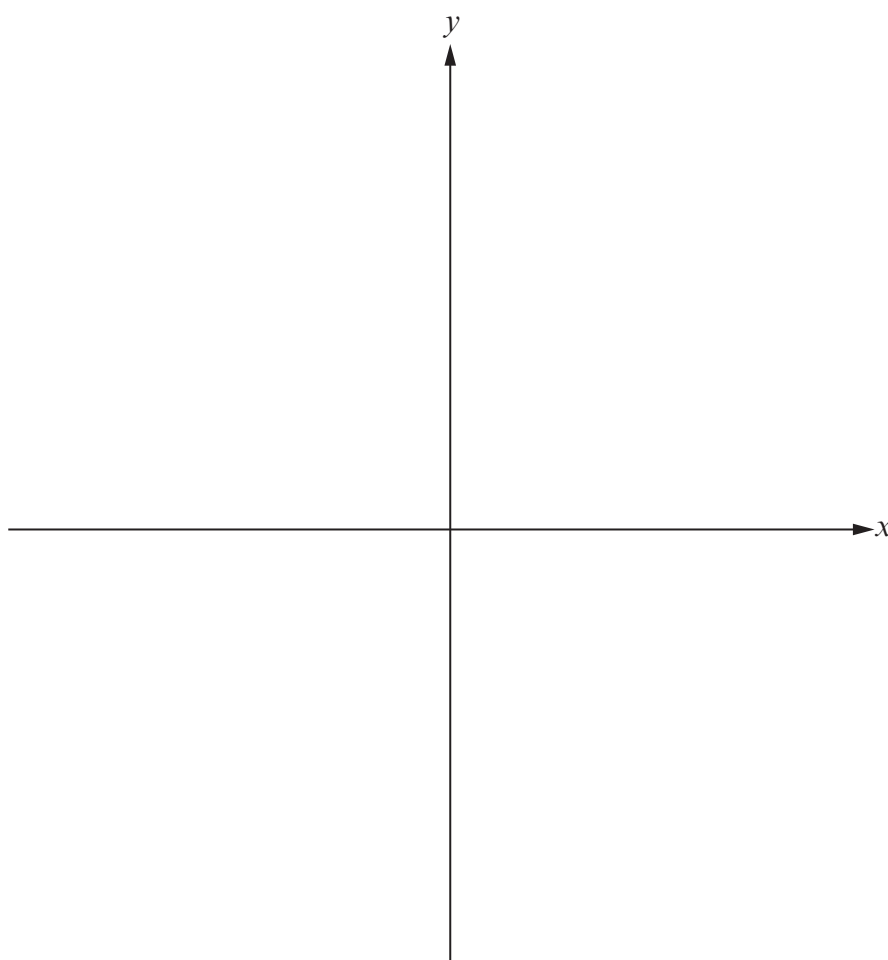
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