1. Express 108 as a product of prime numbers in index form.

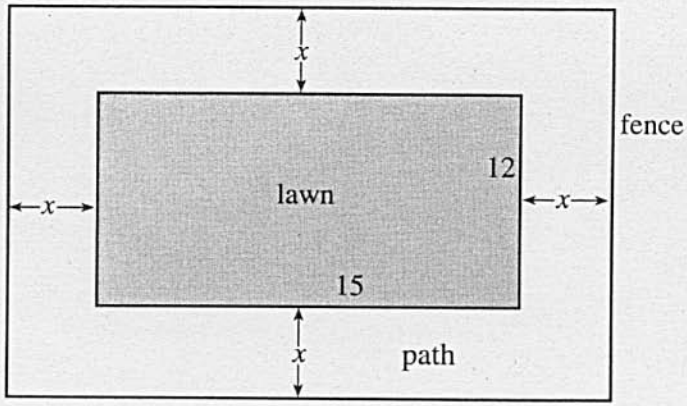
[3]

2. Solve the following equation.

$$4(2x - 5) = 2x + 1$$

[3]

3.



The diagram represents a rectangular lawn measuring 15 metres by 12 metres, surrounded by a path of width x metres. There is a fence all around the outside of the path.

(a) Given that the length of the fence is 74 metres, write down an equation that x satisfies.

.....

.....

[2]

(b) Solve the equation to find the value of x.

.....

.....

.....

.....

[2]

4. An alloy is made by using copper and zinc in the ratio of 17:3.

(a) How much zinc is used to make 4 kg of the alloy?

.....

.....

.....

.....

.....

.....

[2]

(b) There is only 1·5 kg of zinc available, but plenty of copper. What is the greatest amount of the alloy that can be made?

.....

.....

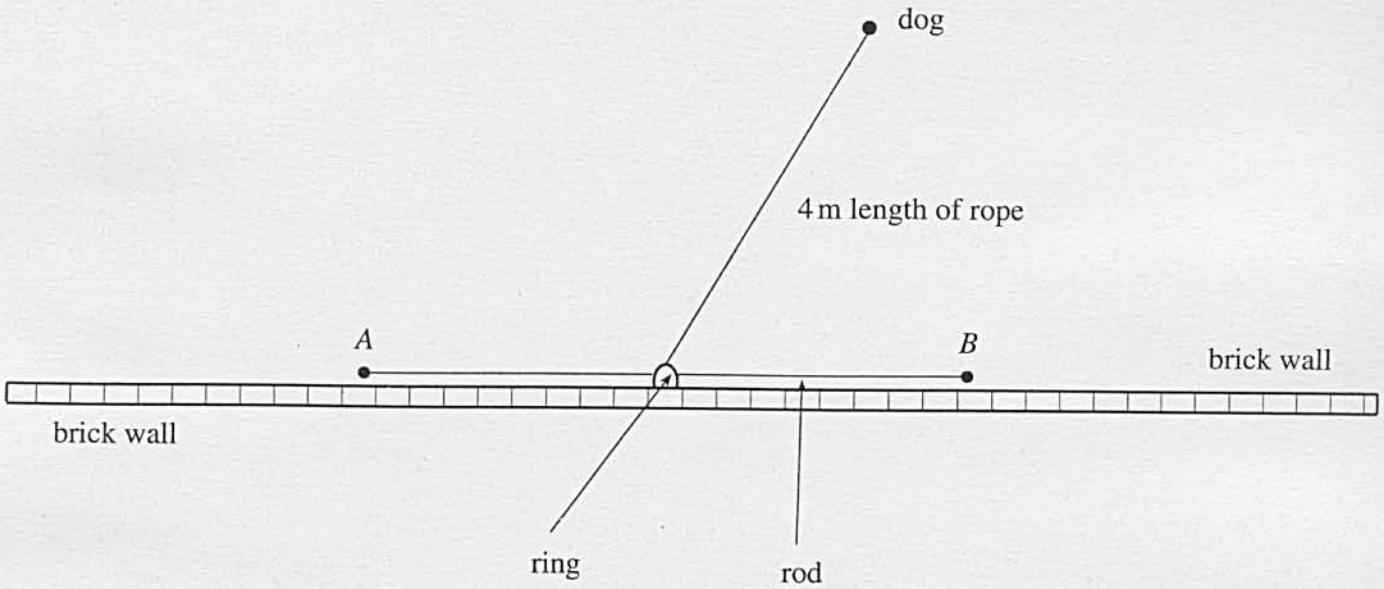
.....

.....

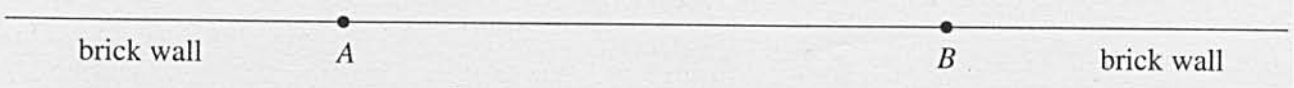
.....

[2]

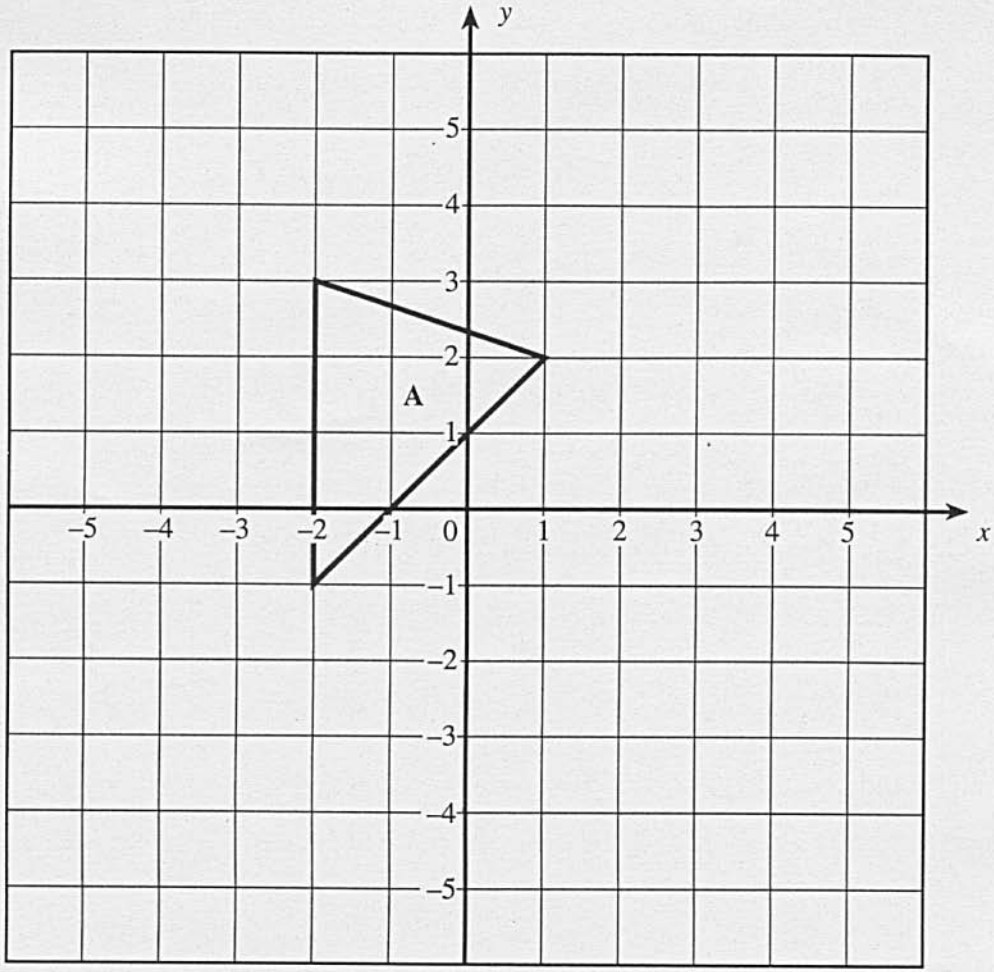
5. A dog is tied to a 4 m length of rope, at the other end of which is a ring. This can slide over a rod AB, attached to a brick wall. The ring cannot slide off the rod due to stoppers at A and B.



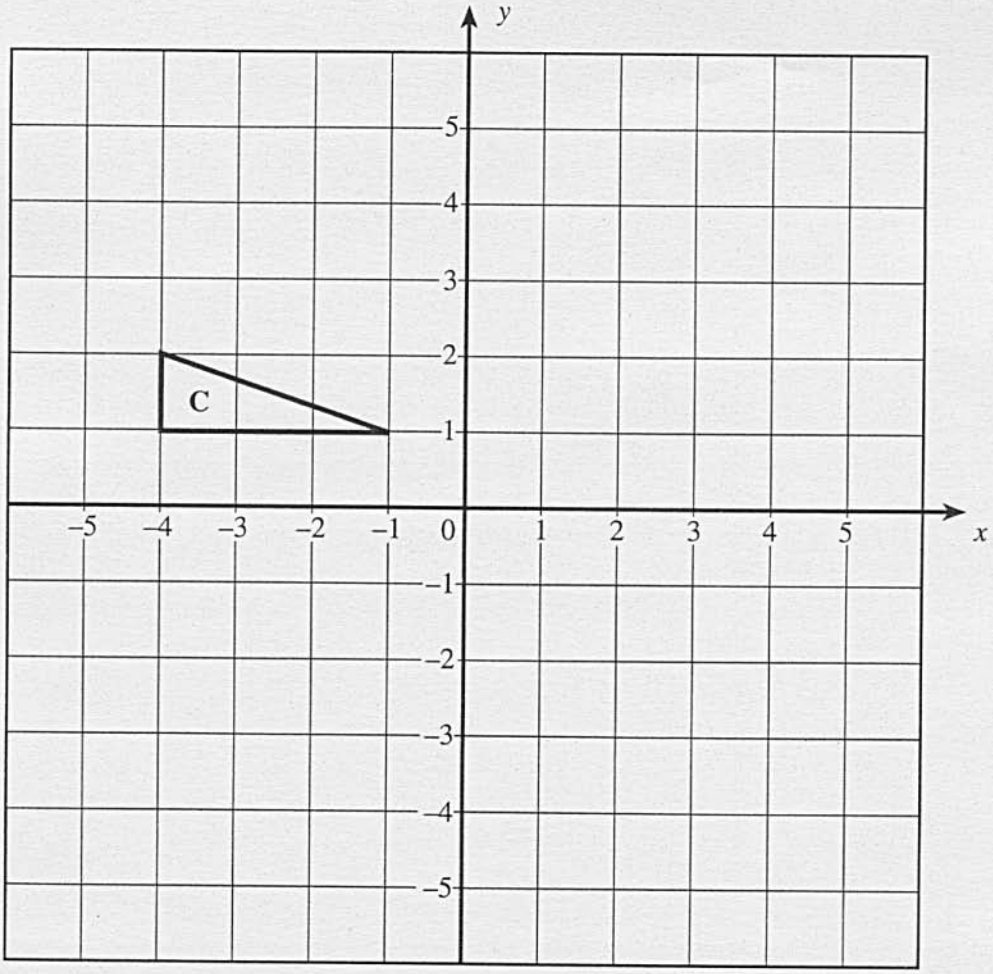
Using a scale of 1 cm to represent 1 m, draw on the diagram below the region in which the dog can move. [3]



6. *(a)* Draw the image of the triangle **A** after a translation of 4 units in the x direction and -2 units in the y direction. Label the image **B**. [2]



(b) Rotate the triangle **C** through 90° clockwise about the point (–1, –1).
Label the image **D**. [2]



7. A random sample of people at work revealed the following information regarding their type of job and their gender.

	Management	Clerical	Other
Female	16	63	82
Male	14	70	105

(a) Use this information to estimate the probability that a randomly chosen person at work is in management.

.....

.....

.....

[1]

(b) Estimate the number of people in management jobs in a workforce of 700 000.

.....

.....

.....

.....

[2]

8. Solve the following simultaneous equations by an algebraic (not graphical) method. Show all your working.

$$4x + 2y = 17$$
$$5x + 3y = 23$$

[4]

9. Factorise

(a) $4x^2y - 6xy^2$,

[2]

(b) $x^2 - 4x - 12$.

[2]

10. A group of 120 volunteers were invited to complete an experiment. The time taken, measured to the nearest minute, by each volunteer was noted and the results were as shown in the following table.

Time taken (to the nearest minute)	11-15	16-20	21-25	26-30	31-35	36-40	41-45
Number of volunteers	2	12	26	48	20	9	3

(a) Complete the following cumulative frequency table.

Time taken (less than)	10·5	15·5	20·5	25·5	30·5	35·5	40·5	45·5
Cumulative frequency	0							

[1]

(b) On the graph paper opposite, draw a cumulative frequency diagram to show this information. [3]

(c) Use your cumulative frequency diagram to find the interquartile range.

.....

.....

.....

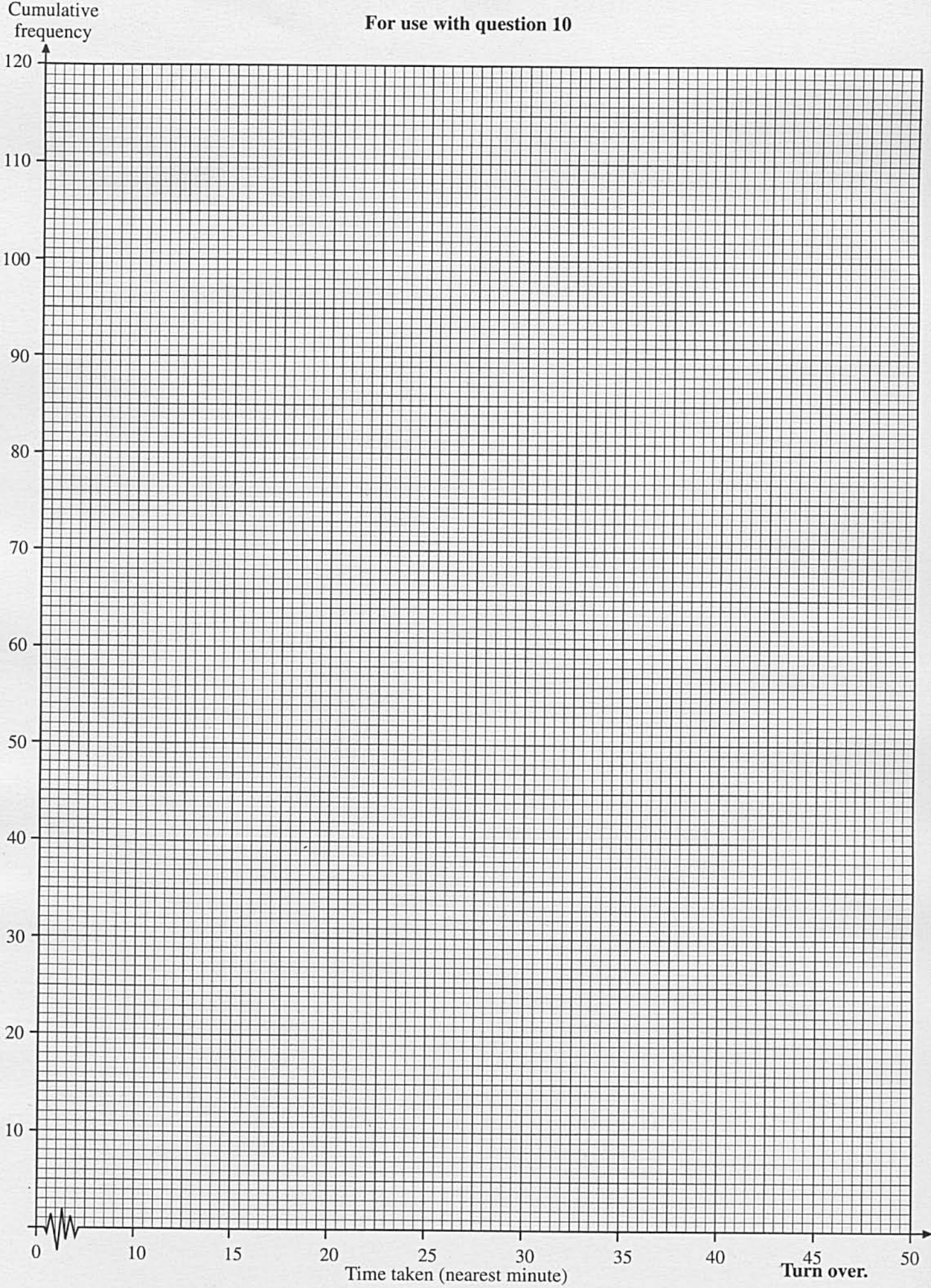
.....

[2]

(d) Use your cumulative frequency diagram to complete the following statement.

80% of the volunteers took less than ..... minutes to complete the experiment. [1]

For use with question 10



11.

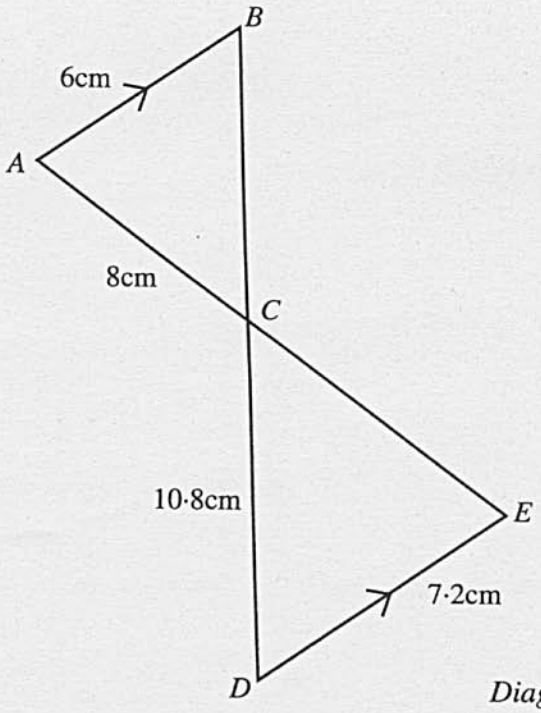


Diagram not drawn to scale.

In the diagram, AB is parallel to DE, and the triangles ABC and EDC are similar.
$AB = 6\,\text{cm}$, $AC = 8\,\text{cm}$, $DE = 7{\cdot}2\,\text{cm}$ and $CD = 10{\cdot}8\,\text{cm}$.

Showing all your working, find the length of

(a) CE,

.....

.....

.....

.....

[2]

(b) BC.

.....

.....

.....

.....

[2]

12. In each of the following formulae, every letter stands for the measurement of a length. By considering the dimensions implied by the formulae, write down, for each case, whether the formulae could be for a length, an area, a volume or none of these.

The first one has been done for you.

	Formula could be for:
$6r^2h + 4r^3$	volume
$6r^2 + 4dh$	.....
$6(r + 4d)h$	.....
$6r^2 + 4dh + 3h$	.....
$6r + 4d + 3h$	.....

[2]

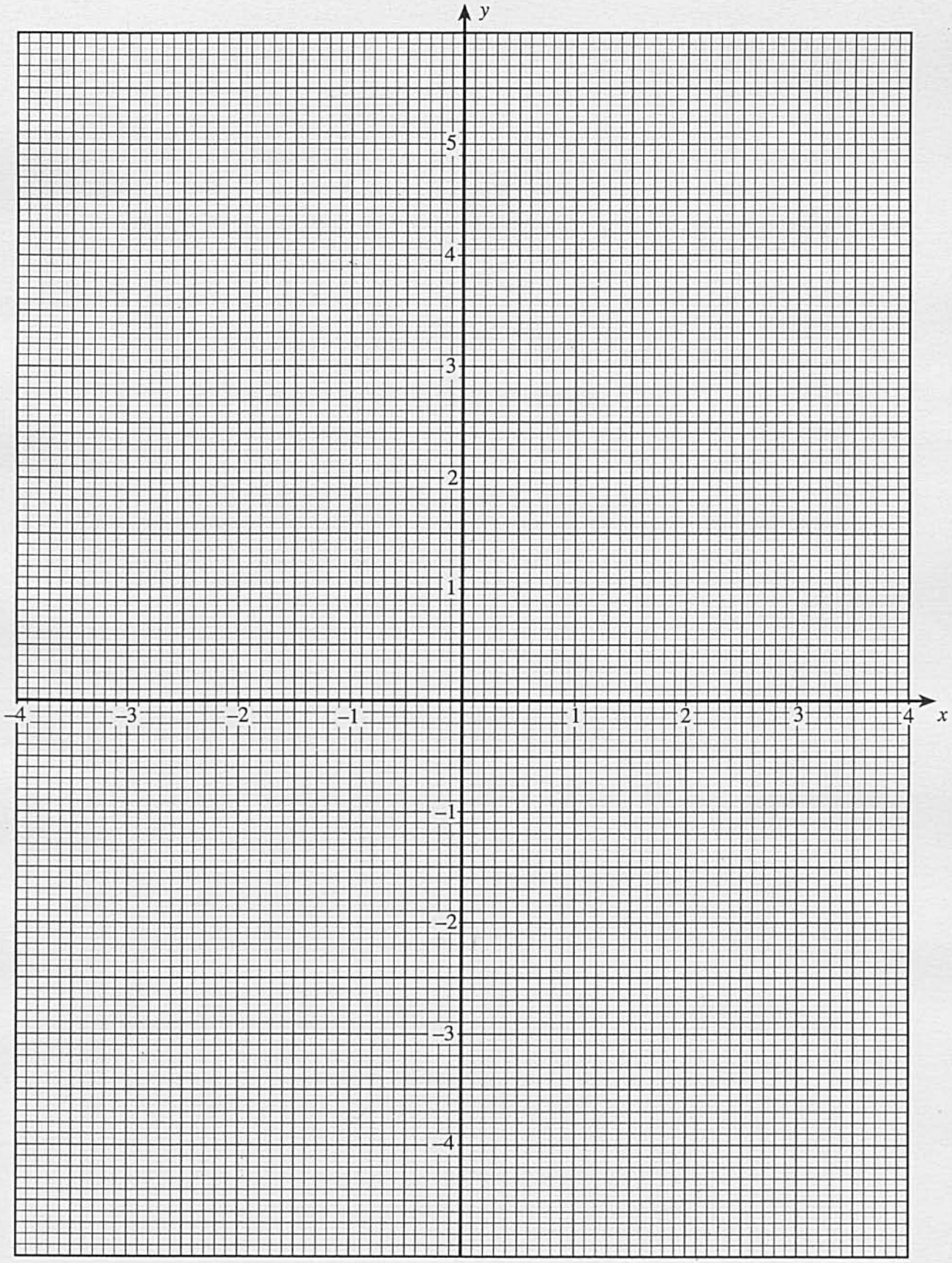
13. On the graph paper opposite, draw the region, which satisfies all of the following inequalities.

$$\begin{aligned} x &< 4 \\ y &> -3 \\ 2y - x &< -2 \end{aligned}$$

Make sure that you clearly indicate the region that represents your answer.

[3]

For use with question 13



14. Express $0\dot{3}\dot{7}$ as a fraction.

.....

.....

.....

[2]

15. Simplify $64^{\frac{2}{3}} \times 3^{-4}$ leaving your answer in fractional form.

.....

.....

.....

[2]

16. *(a)* Show clearly that the equation $3x - \frac{10}{x} = \frac{7}{2}$ maybe written as $6x^2 - 7x - 20 = 0$.

.....

.....

.....

.....

.....

[2]

(b) Factorise $6x^2 - 7x - 20$.

.....

.....

[2]

(c) Hence solve the equation $3x - \frac{10}{x} = \frac{7}{2}$.

.....

.....

.....

[2]

17. The diagram shows A, B, C and D are four points on the circumference of a circle centre O.
The diameter AOB is extended to P, so that $BP = BC$.
The tangent RT touches the circle at A.

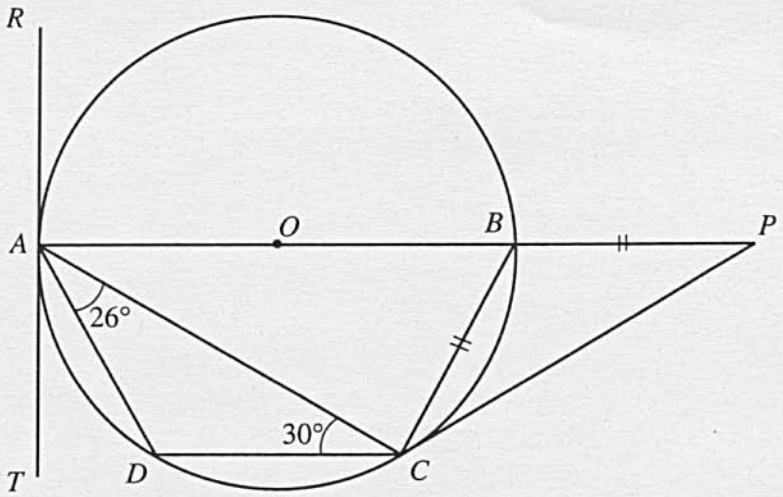


Diagram not drawn to scale.

Given that $A\hat{C}D = 30°$ and $C\hat{A}D = 26°$, find **each** of the following angles.

(a) $D\hat{A}T$

.....

[1]

(b) $B\hat{C}A$

.....

[1]

(c) $B\hat{P}C$

.....

[2]

(d) $D\hat{O}C$

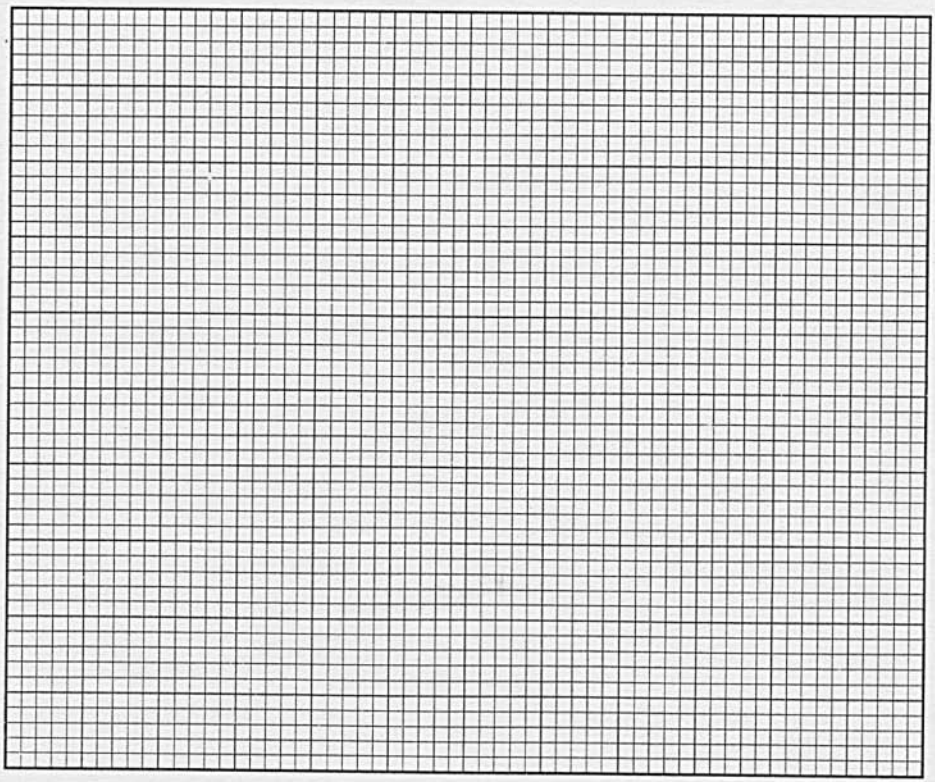
.....

[1]

18. A survey of time wasted by pupils at a school in one hour of unsupervised study time was carried out. The lengths of times wasted were noted by an observer. The results are summarised in the grouped frequency distribution below.

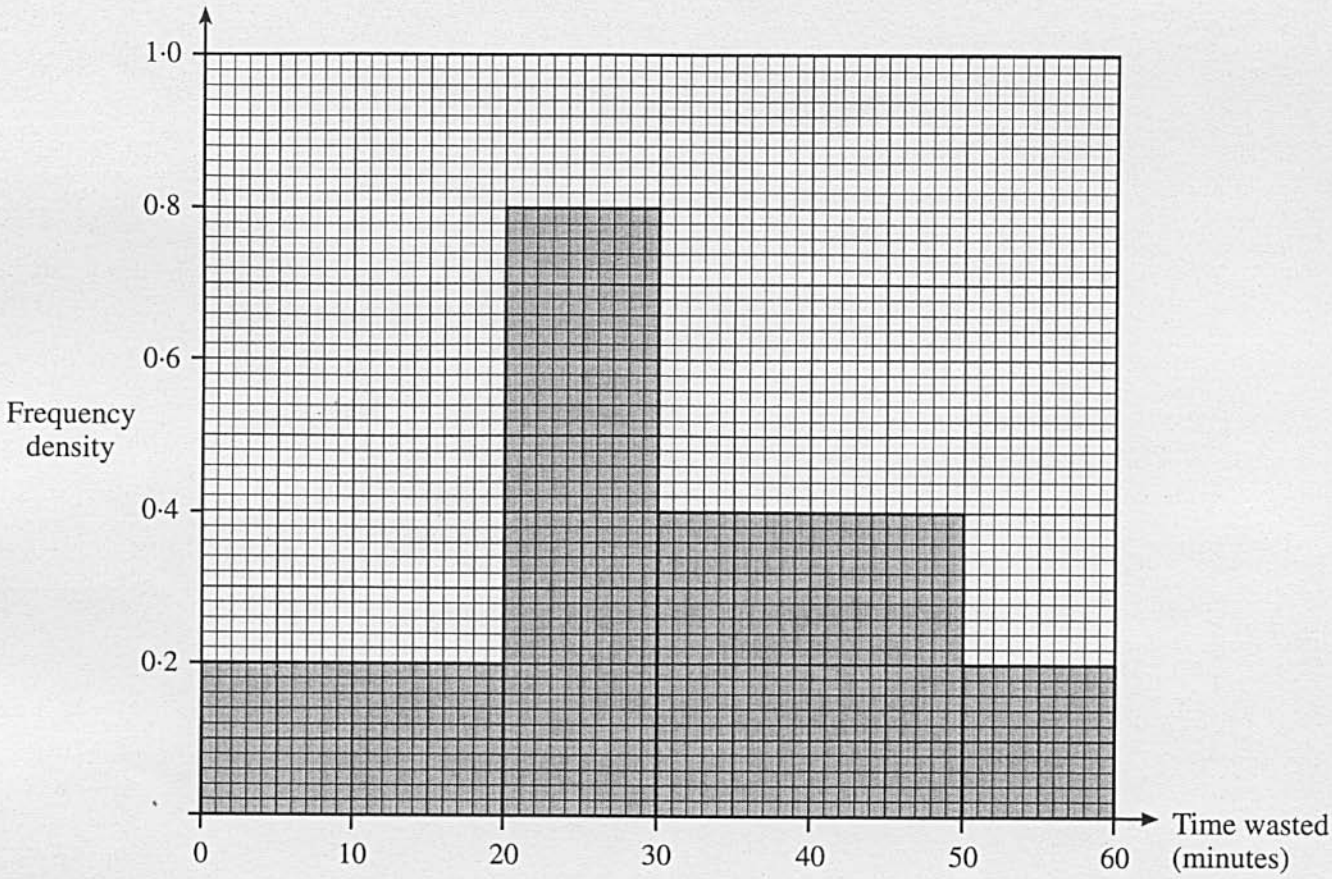
Time wasted, x minutes	Number of pupils, f	Frequency density
$0 \leqslant x < 5$	3	0·6
$5 \leqslant x < 15$	8	
$15 \leqslant x < 25$	3	
$25 \leqslant x < 45$	18	
$45 \leqslant x < 55$	4	
$55 \leqslant x < 60$	4	

(a) Draw a histogram of the data in the table.



[3]

(b) The survey was repeated one month later. The results are shown in the histogram below.



Calculate the total number of pupils in this second survey.

.....

.....

.....

.....

[3]

19. A survey is to be carried out on a Monday afternoon by the cinema management to ascertain views of the public on the choice of films screened at a local cinema.
Give reasons why asking every tenth person outside the cinema will not give

(a) a representative sample,

.....

.....

[1]

(b) a random sample.

.....

.....

[1]

20. A bag contains coloured counters, 3 green, 4 blue, 1 yellow and 2 red.
Two counters are selected at random **without replacement** from the bag.
Calculate the probability that

(a) the two counters are both red,

.....

.....

.....

[2]

(b) exactly one of the counters is red.

.....

.....

.....

.....

[3]

21.

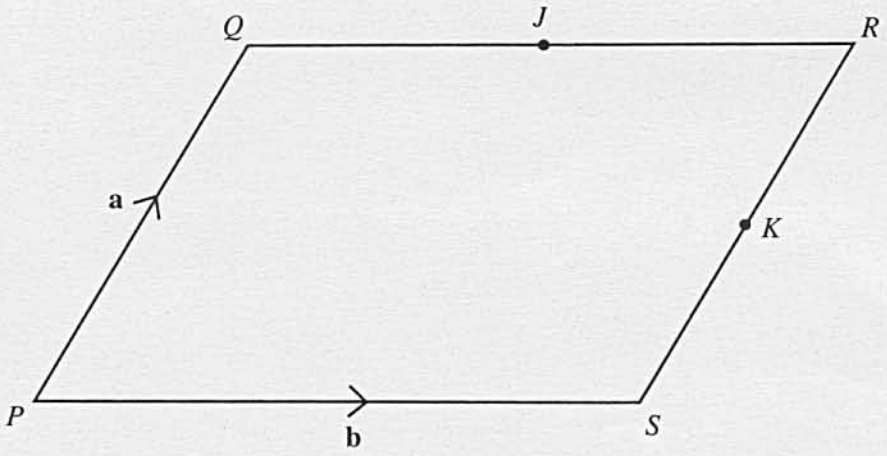


Diagram not drawn to scale.

PQRS is a parallelogram. The mid-point of *QR* is *J* and the mid-point of *RS* is *K*.

(a) Given that **PQ = a, PS = b**, express each of the following in terms of **a** and **b**.

(i) **PR**

.....

(ii) **QJ**

.....

(iii) **PK**

.....

(iv) **QS**

.....

(v) **JK**

.....

[5]

(b) Describe fully the geometrical relationships between *QS* and *JK*.

.....

.....

[2]

22. Given that $x = \sqrt{12}, y = \sqrt{3}$ and $z = \sqrt{6}$, simplify **each** of the following, indicating in each case whether your answer is rational or irrational.

(a) $xy - 4$

.....

.....

(b) $\dfrac{x}{yz^2}$

.....

.....

(c) $(y + z)^2$

.....

.....

[5]

23. Make c the subject of the following formula. Simplify your answer.

$$c(5b - a) = a(c - 3b)$$

.....

.....

.....

.....

.....

.....

.....

.....

[4]

24. Simplify the expression $\dfrac{6x^3 + 18x^2}{x^2 - 9}$.

.....

.....

.....

.....

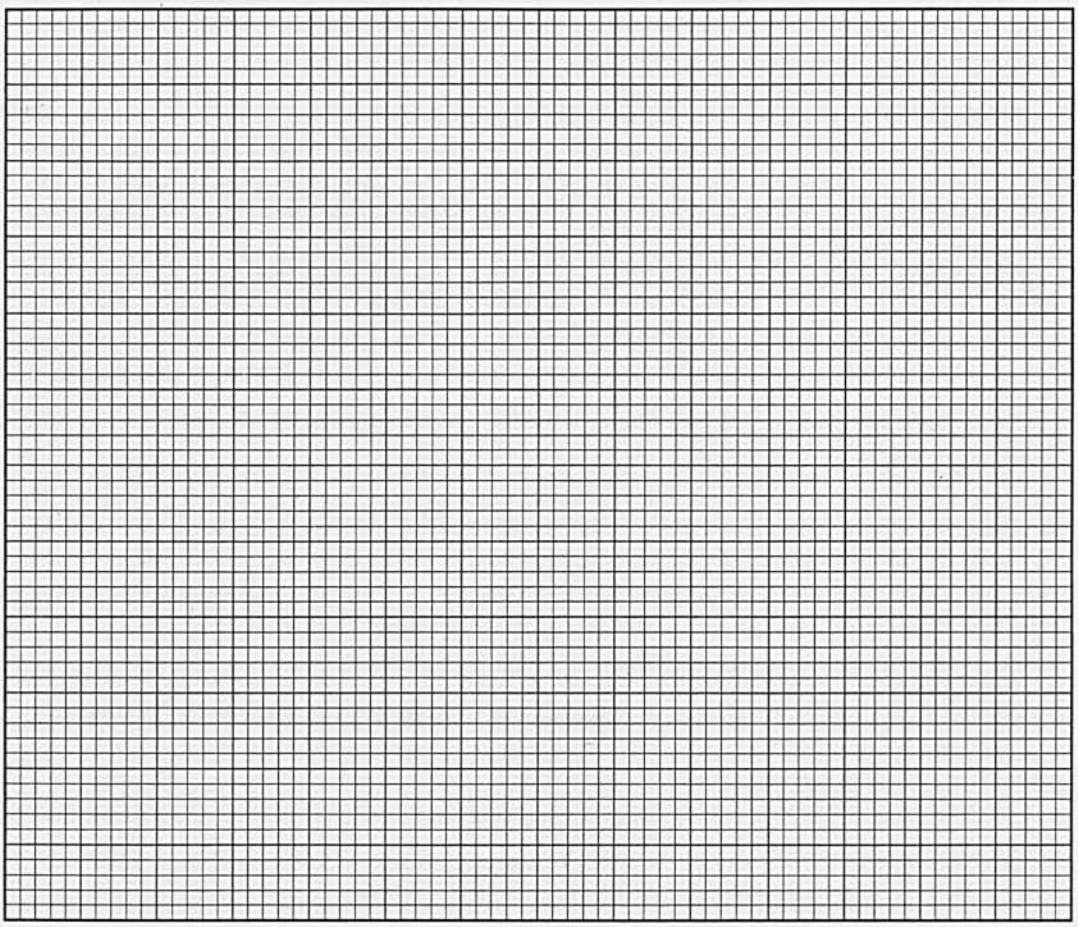
.....

[3]

25. The data in the table was recorded during an experiment. Results were recorded for two variables x and y.

x	1	2	3	4
y	11·5	21·9	50·4	105·9

(a) On the graph paper plot the values of y against the values of x^3.



[2]

(b) Before starting the experiment it was already known that y is approximately equal to $px^3 + q$.
Use your graph to estimate p and q.

.....

.....

.....

[3]