



General Certificate of Secondary Education
November 2023

Centre Number

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Candidate Number

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Mathematics

Unit M4
(With calculator)
Higher Tier



[GMC41]

GMC41

TUESDAY 21 NOVEMBER, 9.15 am – 11.15 am

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

You must answer the questions in the spaces provided.

Do not write outside the boxed area on each page or on blank pages.

Complete in black ink only. **Do not write with a gel pen.**

Answer **all twenty-six** questions.

All working should be clearly shown in the spaces provided. Marks may be awarded for partially correct solutions.

You **may** use a calculator for this paper.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

You should have a calculator, ruler, compasses and a protractor.

The Formula Sheet is on page 2.

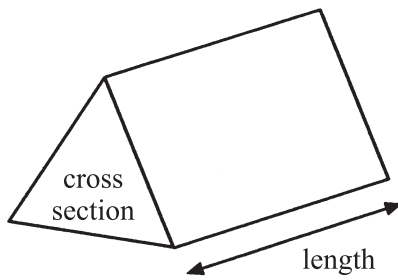
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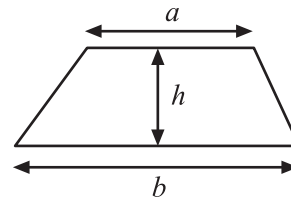
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Formula Sheet

Volume of prism = area of cross section \times length

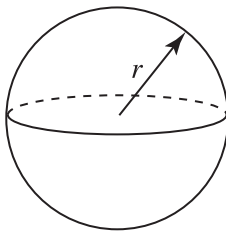


Area of trapezium = $\frac{1}{2}(a+b)h$



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

Surface area of sphere = $4\pi r^2$

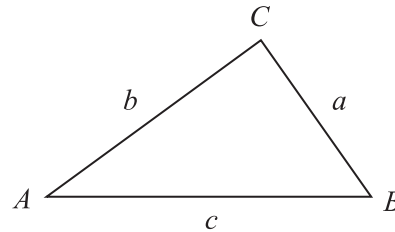


Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = $\pi r l$



In any triangle ABC



Quadratic Equation

The solutions of $ax^2 + bx + c = 0$
where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Sine Rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine Rule: $a^2 = b^2 + c^2 - 2bc \cos A$

Area of triangle = $\frac{1}{2} ab \sin C$





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(Questions begin overleaf)

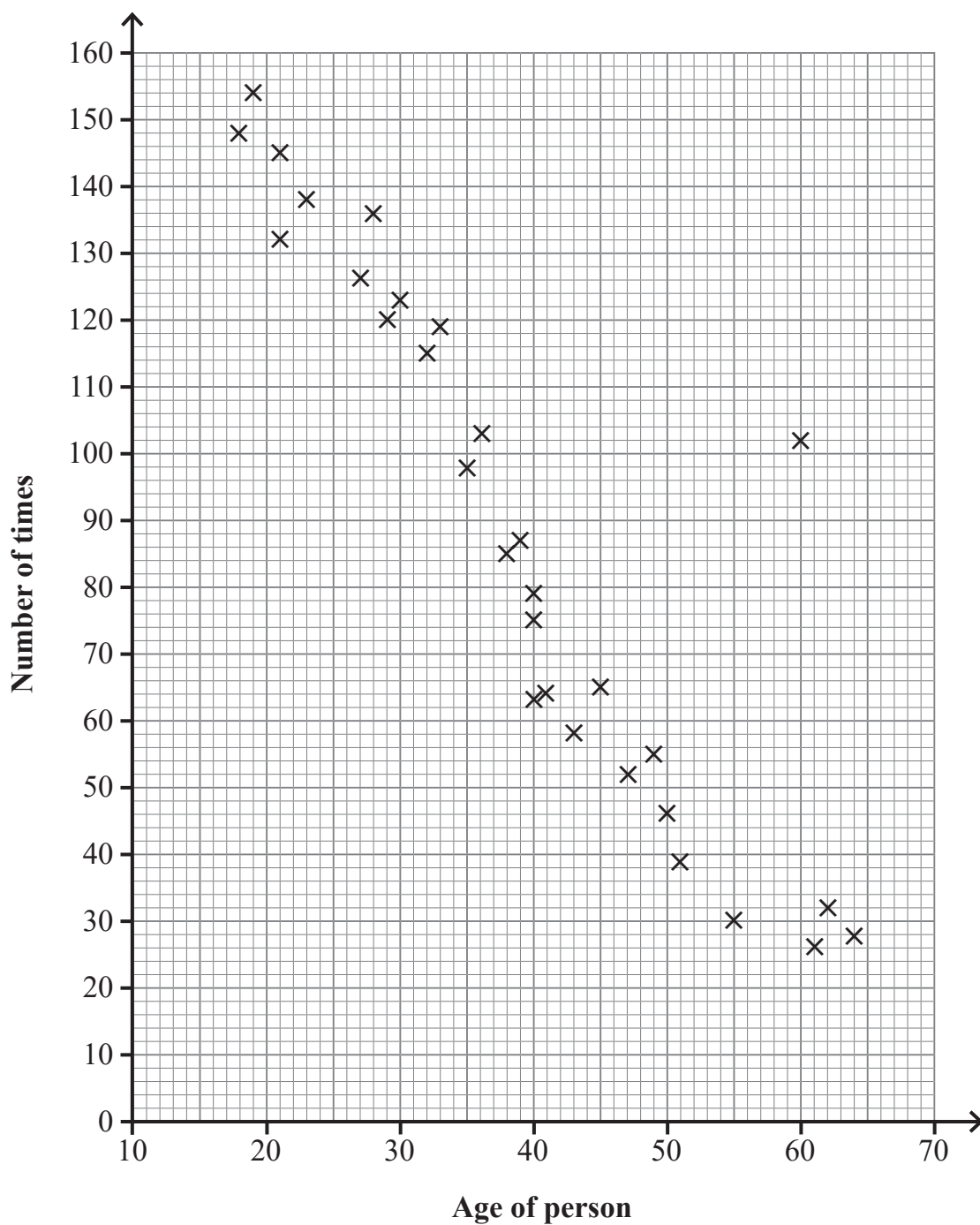
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[Turn over



32GMC4103

- 1 The scatter graph shows information about how many times a day people checked their phones.



- (a) Describe the correlation between the age of a person and the number of times they checked their phone.

Answer _____ [1]

- (b) Insert the correct word to complete the following sentence.

The data point at (60, 102) is an _____ . [1]

[Turn over



- 2 A sports referee trains by running diagonally across a rectangular pitch, as shown in the diagram below.

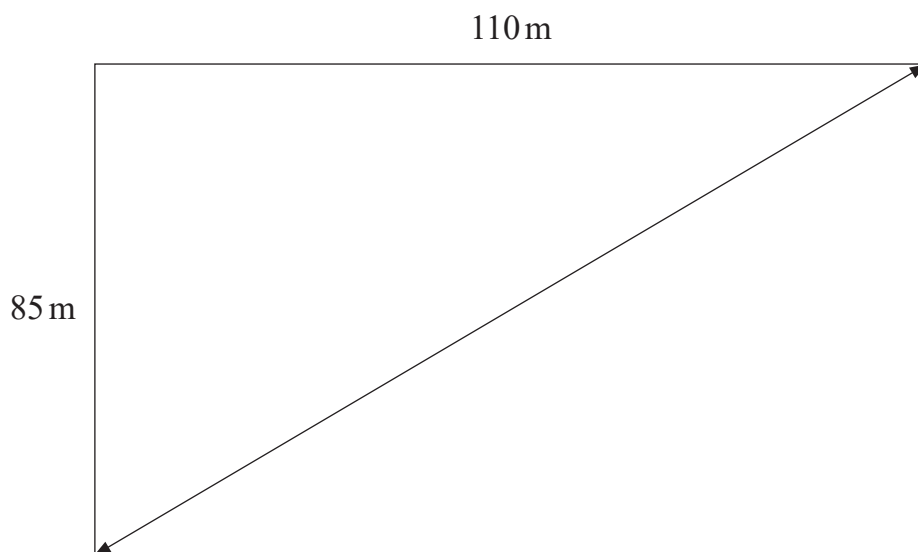


diagram
not drawn
to scale

The referee wants to run a distance of **at least** 1 km.

How many diagonal runs are needed?

Answer _____ [5]



3 Find the area of the kite below.

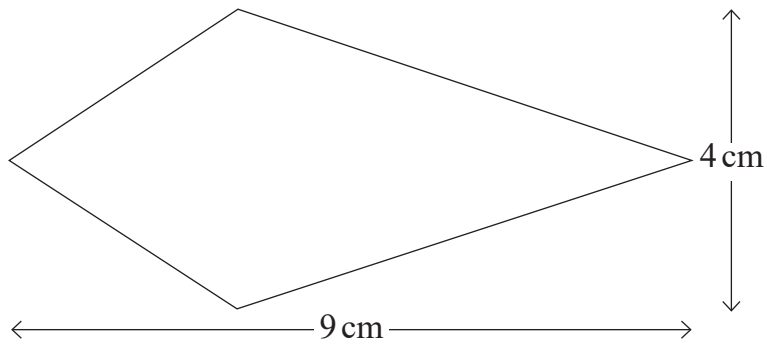


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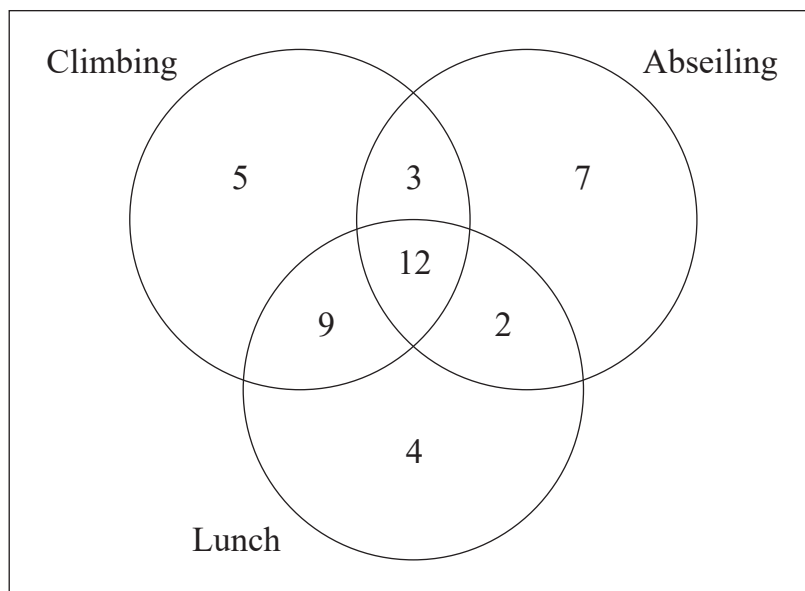
Answer _____ cm^2 [2]



- 4 A company took 42 employees on a team-building day.

Each person was able to choose which sporting activities to do and whether or not to have lunch.

The Venn diagram shows what choices they made.



- (a) How many people did not take part in either of the sporting activities?

Answer _____ [1]

- (b) How many people did not have lunch?

Answer _____ [1]



(c) The cost for someone to take part in one sporting activity and have lunch was £16

How much did the company pay for people who took part in one sporting activity and had lunch?

Answer £ _____ [2]

5 C has the coordinates $(-2, 4)$ and D has the coordinates $(8, 7)$.

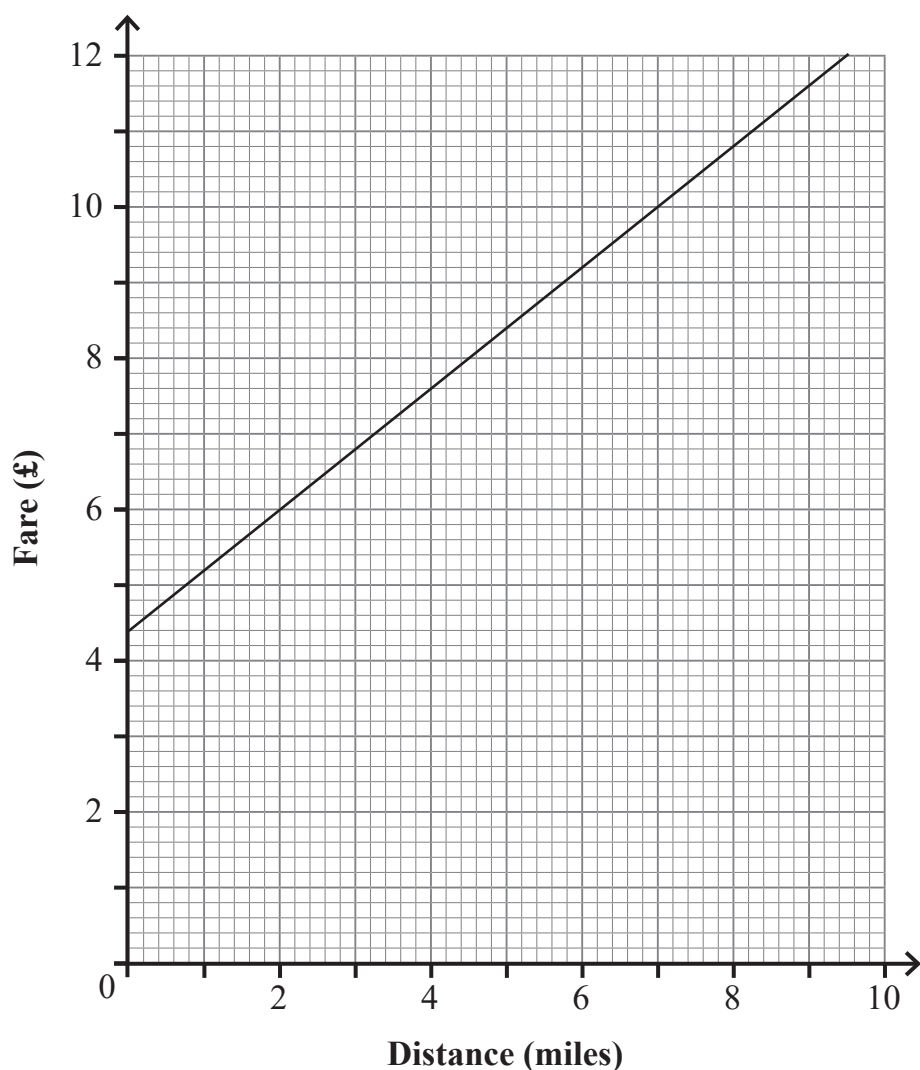
Find the coordinates of the midpoint of the line CD.

Answer (_____ , _____) [2]

[Turn over



6 The graph represents the fare (in £) for a taxi journey of a distance in miles.



(a) Paula was charged £8.40 for her journey to work.

How many miles did Paula travel?

Answer _____ miles [1]

(b) What is the cost per mile charged by the taxi firm?

Answer _____ [2]



7 (a) Raymond's car insurance quote is £1200 for a year.

He is entitled to 30% off for his no claims discount.

If he pays online, he will get a 5% discount off this reduced price.

How much will the online price be?

Answer £ _____ [3]

(b) Raymond's father says the total discount was 35%

Is he correct?

You must show work to justify your answer.

Answer _____ [2]

[Turn over



8 Solve $\frac{x}{3} - 5 = 2$

Answer $x =$ _____ [2]

9 Find the lowest common multiple (LCM) of 60 and 36

Answer _____ [3]



10 A rectangle has length $(x + 5)$ cm and breadth $(x + 2)$ cm.

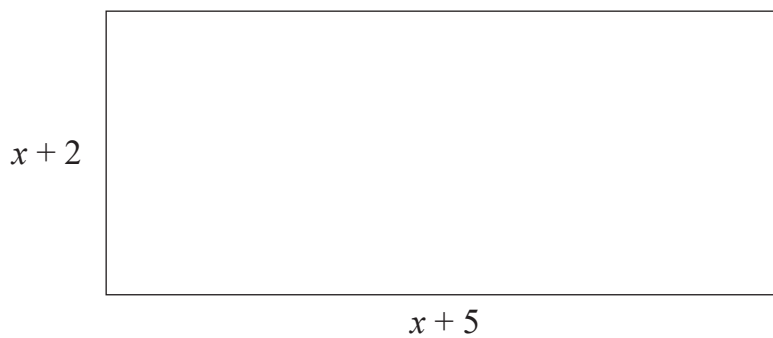


diagram
not drawn
to scale

The area of the rectangle is 54 cm^2

Jacob is asked to find the value of x .

He starts his solution as shown.

$$(x + 5)(x + 2) = 54$$

$$x^2 + 5x + 2x + 10 = 54$$

$$x^2 + 7x + 10 = 54$$

Continue the solution of this equation to find the value of x for this rectangle.

Answer $x =$ _____ [3]

[Turn over



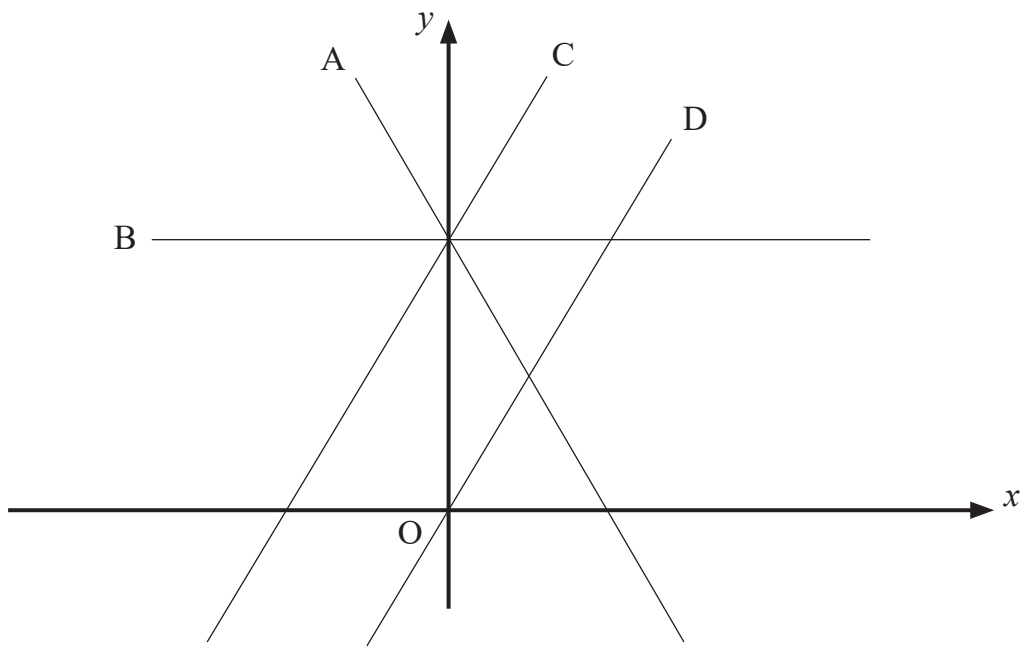
11 Show that $\frac{3x-1}{2} + \frac{11-7x}{6}$ simplifies to the single fraction $\frac{x+4}{3}$

Show each stage of your working clearly.

[3]



12



A, B, C and D are four straight lines.

C and D are parallel.

The equations of three of these lines are

$$y = 4x \quad y = 5 - 4x \quad y = 5$$

Use this information to find the equation of the fourth line.

Answer _____ [4]

[Turn over



13 A force of 240 N is applied to a brake pad with an area of 0.32 m^2

Calculate the pressure produced by the brake pad.

Give units with your answer.

Answer _____ [3]



14 A circular pizza is cut into six equal slices.

The pizza has a diameter of 10 inches.

If two slices of pizza are eaten, what area of pizza remains?

Answer _____ square inches [3]



15 (a) Calculate the interquartile range (IQR) for the following data.

24, 25, 25, 27, 28, 30, 30, 31, 34, 92

Answer _____ [2]

(b) For the data in (a) which average would be most representative?

Give a reason for your answer.

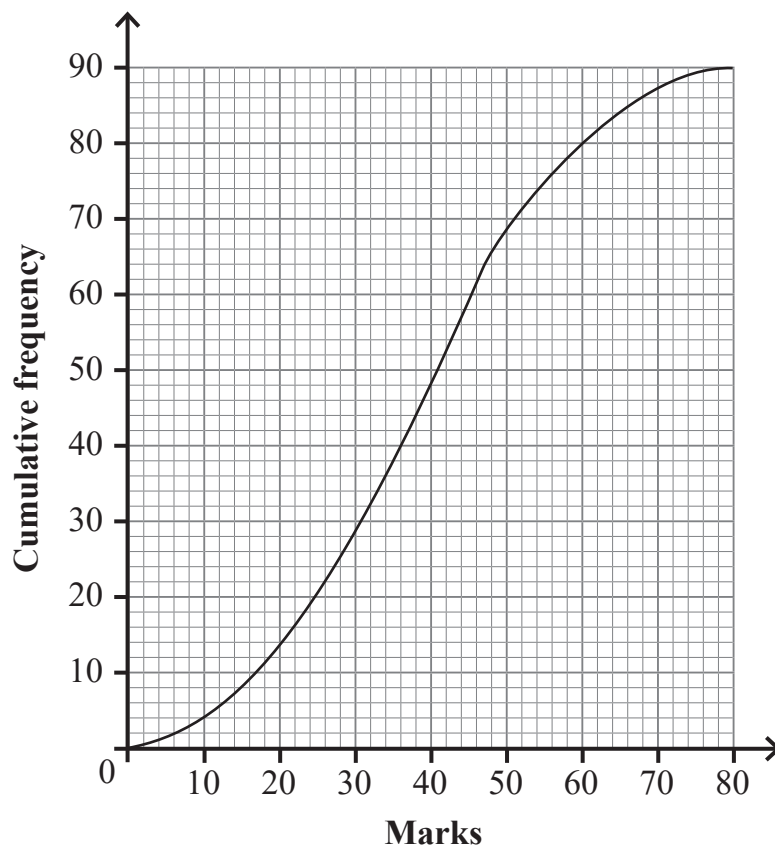
Answer _____ because _____

_____ [2]



16 90 apprentices sat an engineering examination.

The cumulative frequency graph for the results is shown.



(a) Use the graph to estimate the median mark.

Answer _____ [1]

(b) The pass mark was 34

Use the graph to estimate how many apprentices passed.

Answer _____ [2]

[Turn over



17 The table below shows information about the ages of a company's workforce.

Age (years)	Number of workers
21–30	340
31–40	712
41–50	405
Over 50	127

The owner of the company wants to carry out a survey on health and well-being.

He decides to take a stratified sample of 100 workers.

(a) Explain why it is appropriate to take a stratified sample.

[1]

(b) Calculate the number of workers he should sample from each age group.

Answer 21–30 _____

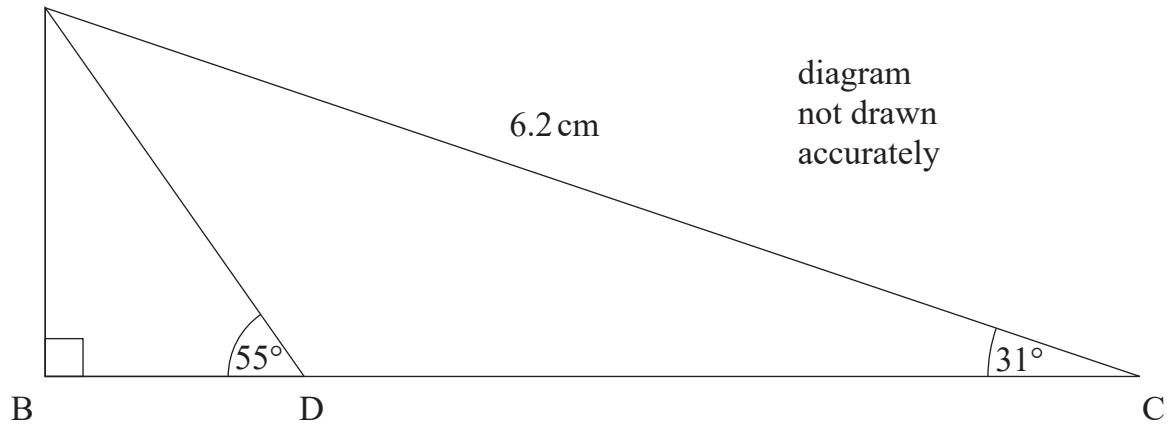
31–40 _____

41–50 _____

Over 50 _____ [3]



18 A



ABC is a right-angled triangle with angle $BCA = 31^\circ$

$AC = 6.2$ cm

D is a point on the line BC such that angle $ADB = 55^\circ$

Calculate the length of the line BD.

Give your answer to 3 significant figures.

Answer _____ cm [4]

[Turn over



19 A box, open at the top, has a total external surface area of 140 cm^2

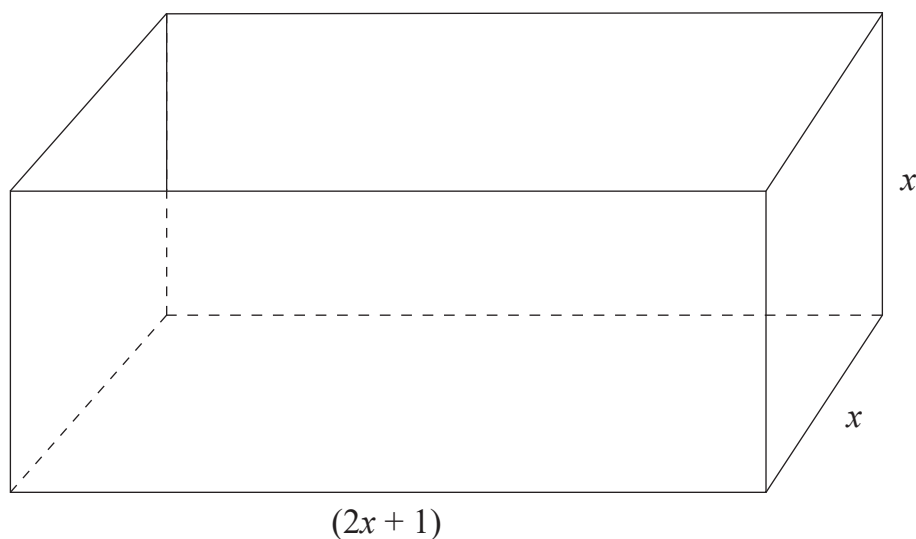


diagram
not drawn
accurately

The length of the box is $(2x + 1)$ cm.

The width and height of the box are both x cm.

(a) Show that $8x^2 + 3x - 140 = 0$

[3]



(b) Calculate the volume of the box.

Answer _____ cm³ [4]



20 The length of a rectangle is 5.4 cm correct to 1 decimal place.

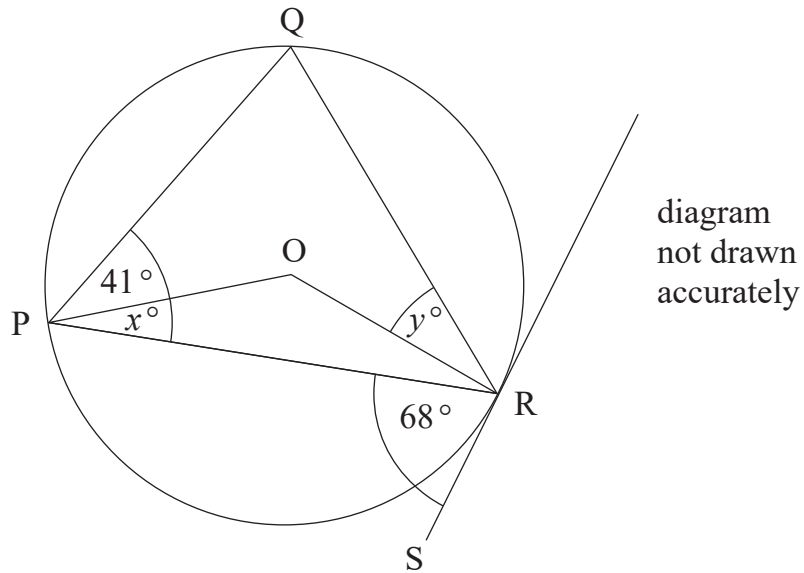
The area of the rectangle is 23.21 cm^2 correct to 4 significant figures.

Calculate the minimum value of the width of the rectangle.

Write down all the figures on your calculator display.

Answer _____ cm [3]





The diagram shows a circle with centre O.

SR is a tangent to the circle.

Find the size of angles x and y giving reasons for each stage of your working.

Answer $x =$ _____ $^{\circ}$

$y =$ _____ $^{\circ}$ [6]

[Turn over



22 Factorise $8ax^2 - 6axy - 5ay^2$

Answer _____ [3]



23 Solve the following equation, giving your answers to 2 decimal places.

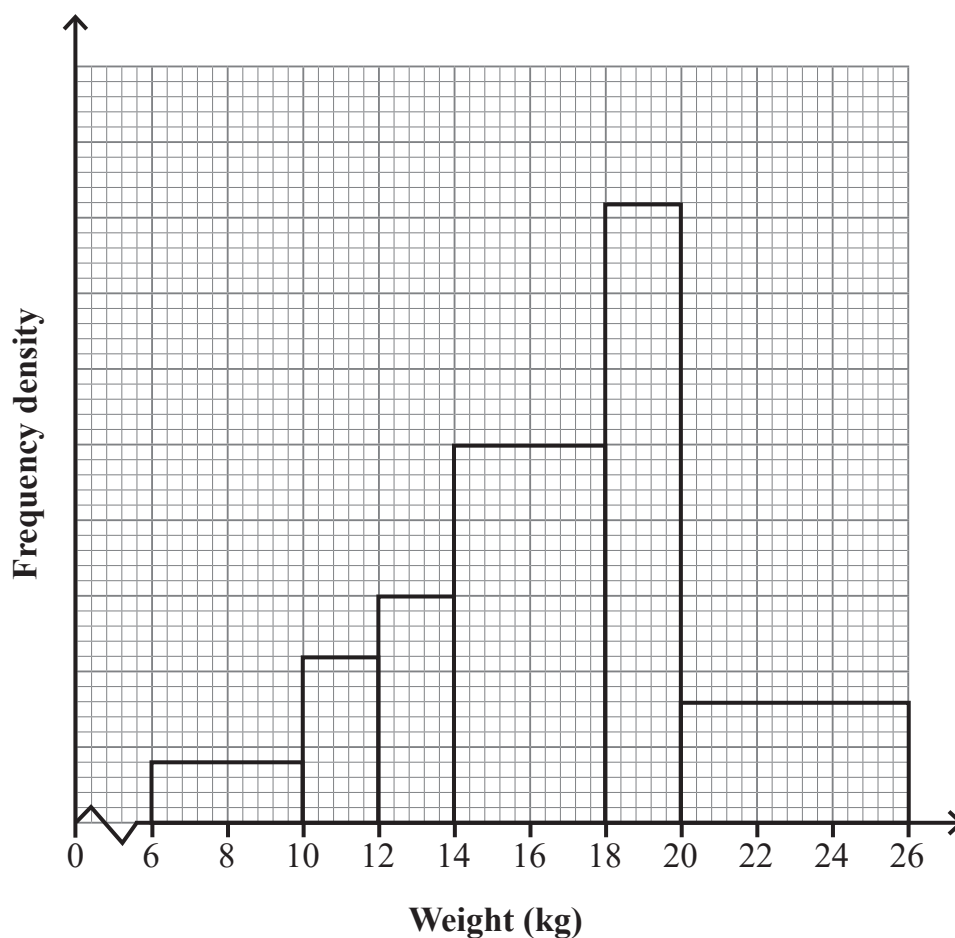
$$\frac{4}{3x+1} + \frac{5}{2x-3} = \frac{1}{3}$$

Answers $x =$ _____ [7]

[Turn over



24 The histogram shows the weights in kg of 894 dogs registered with a vet.



48 dogs weigh under 10 kg.

(a) Calculate an estimate of the number of dogs weighing between 14 kg and 21 kg.

Answer _____ dogs [3]



(b) Calculate an estimate for the median weight of the dogs.

Answer _____ kg [3]

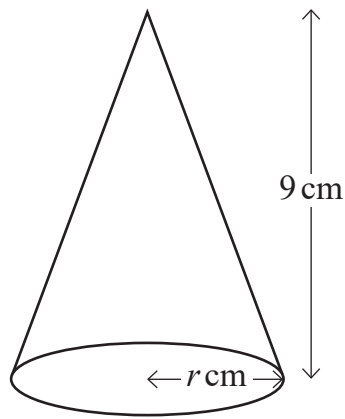
25 Simplify $\frac{x^3 - 3x^2}{x^2 - 9}$

Answer _____ [3]

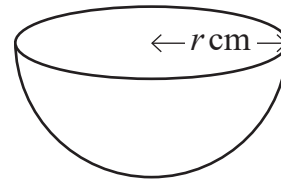
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26



diagrams
not drawn
accurately



A solid cone has a radius of r cm and a perpendicular height of 9 cm.

A solid hemisphere also has a radius of r cm.

The surface areas of both shapes are equal.

Calculate the value of the radius r .

Answer $r =$ _____ [6]





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Examiner Number

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