



General Certificate of Secondary Education
November 2023

Centre Number

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Candidate Number

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Mathematics

Unit M3
(With calculator)
Higher Tier



[GMC31]

GMC31

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-nine** 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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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 = $4\pi r^2$

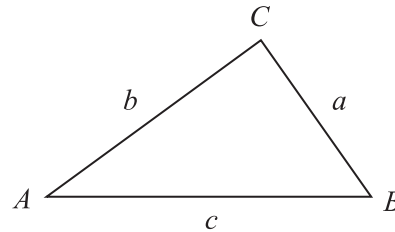


Volume of cone = $\frac{1}{3}\pi r^2 h$

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 = $\frac{1}{2} ab \sin C$



1 Part of a rail timetable is shown below.

Northbound departures	Monday to Friday				
London Euston	07:36	11:33	12:33	15:33	19:33
Milton Keynes Central	08:09	12:10	13:10	16:11	20:10
Nuneaton	08:44	12:45	13:45	16:44	20:43
Preston	10:17	14:13	15:09	18:20	22:11
Kirkham and Wesham	10:27	14:23	15:19	18:30	22:21
Poulton-le-Fylde	10:37	14:33	15:28	18:39	22:31
Blackpool North (arrive)	10:44	14:40	15:36	18:47	22:38

Amy boards the train in Nuneaton at 13:45

(a) What time will she arrive in Blackpool North?

Answer _____ [1]

(b) How long does her journey take?

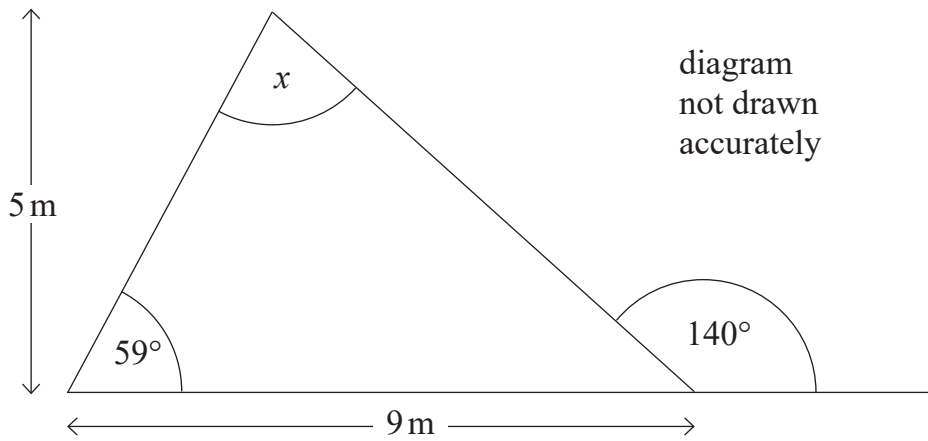
Give your answer in hours and minutes.

Answer _____ hr _____ min [2]

[Turn over



2



(a) Calculate the size of angle x .

Answer _____ ° [3]

(b) Calculate the area of the triangle.

Give the correct unit of measurement with your answer.

Answer _____ [3]



3 A PE teacher recorded the time each pupil in class 11A took to run 200 m.

The results are displayed in the stem and leaf diagram below.

23		7				
24		1	4	5	8	
25		2	3	7	7	9
26		3	5			
27		1	2	8		
28		5	6	6	7	
29		3	3			

Key: 25 | 2 = 25.2 seconds

(a) What was the median time taken?

Answer _____ seconds [1]

(b) What was the range of the times recorded?

Answer _____ seconds [1]

(c) The results for class 11B are summarised as follows.

Median = 28.3 seconds

Range = 3.5 seconds

Use this information to say whether each of these statements is true or false.

(i) On average, pupils in class 11A were faster than pupils in class 11B.

Answer _____ [1]

(ii) Pupils' times in class 11A were more consistent than in class 11B.

Answer _____ [1]

[Turn over



4 A cashier counted the notes in the till.

Type of note	Number of notes	
£5	12	
£10	9	
£20	3	
£50	1	

What was the total value of the notes in the till?

Answer £ _____ [2]

5 From the list

6 15 16 25 27 29 36

(a) Which is a multiple of 12? Answer _____ [1]

(b) Which is a power of 2? Answer _____ [1]



6 Rebecca has a 5 kg sack of rice.

She pours the rice into smaller bags, each bag holding 360 g.

(a) How many bags can Rebecca fill completely from the sack of rice?

Answer _____ [2]

(b) Sue bought a 10 kg sack of rice.

She thinks the maximum number of smaller bags she could fill would be **exactly** double the number Rebecca filled using the 5 kg sack.

Is Sue correct?

You must show work to justify your answer.

Answer _____ [2]

[Turn over



7 (a) Simplify $5x + 2y - 7x + 4y$

Answer _____ [2]

(b) Expand $4(3 - 2p)$

Answer _____ [2]

(c) Factorise

(i) $5k + 15$

Answer _____ [1]

(ii) $c - c^2$

Answer _____ [1]



8 A packet of biscuits contains x biscuits.

In a special offer an extra 2 biscuits are added to each packet.

- (a) Write an expression in terms of x for the number of biscuits in each special offer packet.

Answer _____ [1]

- (b) Alice buys 3 packets in the special offer.

Write an expression, in terms of x , for the total number of biscuits she will have.

Answer _____ [1]

- (c) Each packet of biscuits costs t pence.

Alice buys her 3 packets of biscuits and pays with a £5 note.

Write an expression in terms of t for the change, in pence, she will receive.

Answer _____ pence [2]

[Turn over



9 A lorry needs to be driven 156 miles to a ferry port.

It needs to arrive at 4pm.

The lorry is driven at an average speed of 48 mph.

What is the latest time the journey should start?

Answer _____ [3]



10 Harry wanted to investigate the relationship between how much money people spent on fuel for their car and how many miles they drove.

To get some data, he decided to post a survey to some people for them to fill in and return.

(a) Describe a possible problem with Harry's **method** of collecting data.

Answer _____
_____ [1]

(b) He posted the survey to 10 people.

Explain why it may be unwise for Harry to draw any **conclusions** from his data.

Answer _____ [1]

(c) Circle the correct word to describe the data Harry collected.

Qualitative

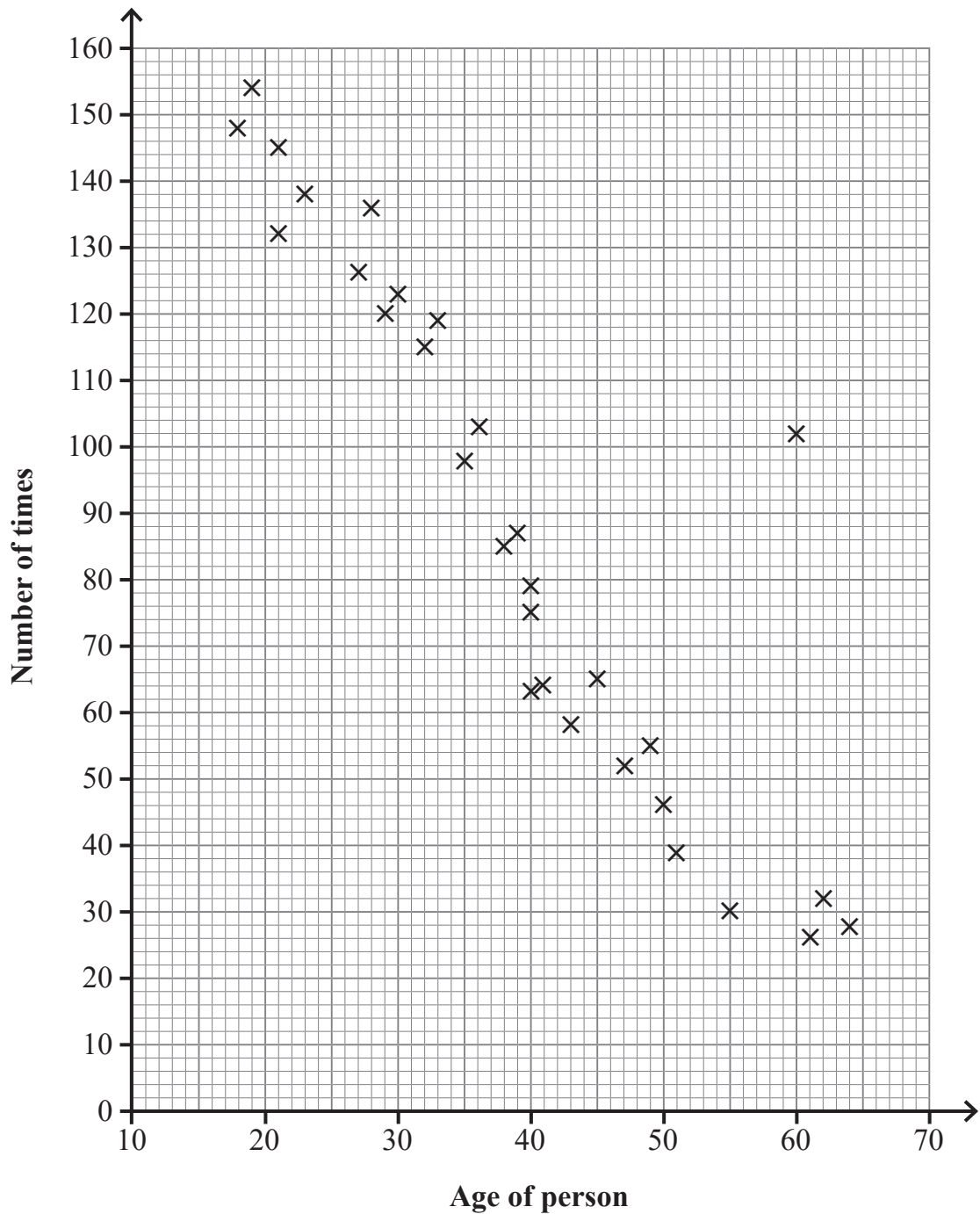
Quantitative

[1]

[Turn over



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



- (a) What was the greatest number of times someone checked their phone?

Answer _____ [1]



(b) How many times did the person aged 49 check their phone?

Answer _____ [1]

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

Answer _____ [1]

(d) Write a suitable sentence to describe the **relationship** between the age of a person and the number of times they checked their phone.

Answer _____
_____ [1]

(e) Insert the correct word to complete the following sentence.

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

[Turn over



12 (a) Solve $\frac{x}{4} = 12$

Answer $x =$ _____ [1]

(b) Solve $5y + 3 = 2y - 9$

Answer $y =$ _____ [3]

13 Pete's wage was £480 last week.

£72 was for working overtime.

What percentage of his wage was **not** for working overtime?

Answer _____ % [3]



14 An English exam consists of 2 papers.

Paper 1 has 85 marks available.

Paper 2 has 80 marks available.

To pass the English exam, a student must get $\frac{2}{3}$ of the total marks.

David's percentage score in Paper 1 is 60%.

How many of the 80 marks does he need in Paper 2 to pass the English exam?

Answer _____ [3]

[Turn over



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

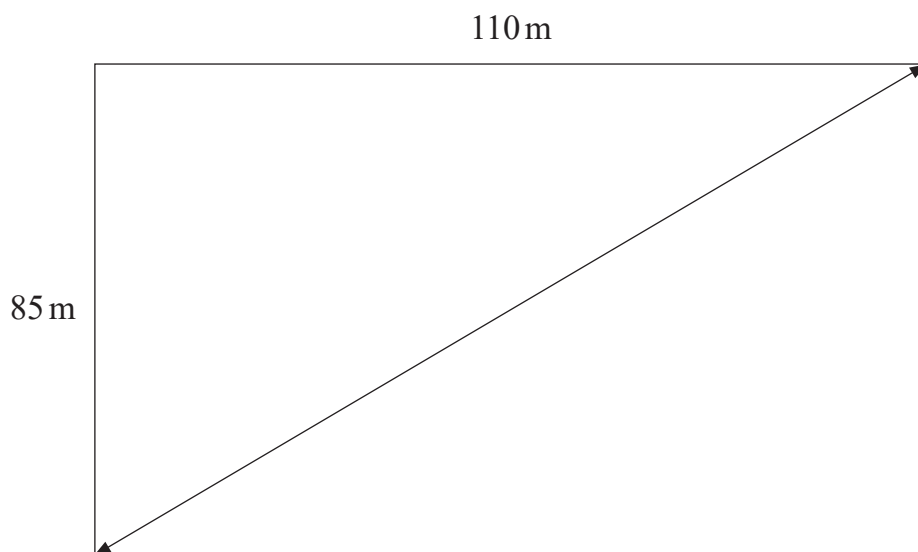


diagram
not drawn
to scale

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

How many diagonal runs are needed?

Answer _____ [5]



16 Find the area of the kite below.

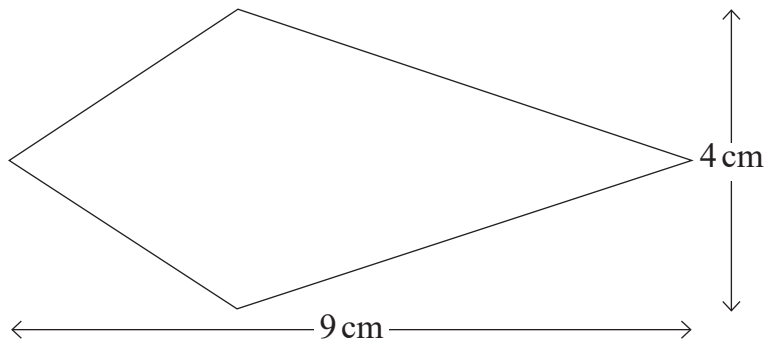


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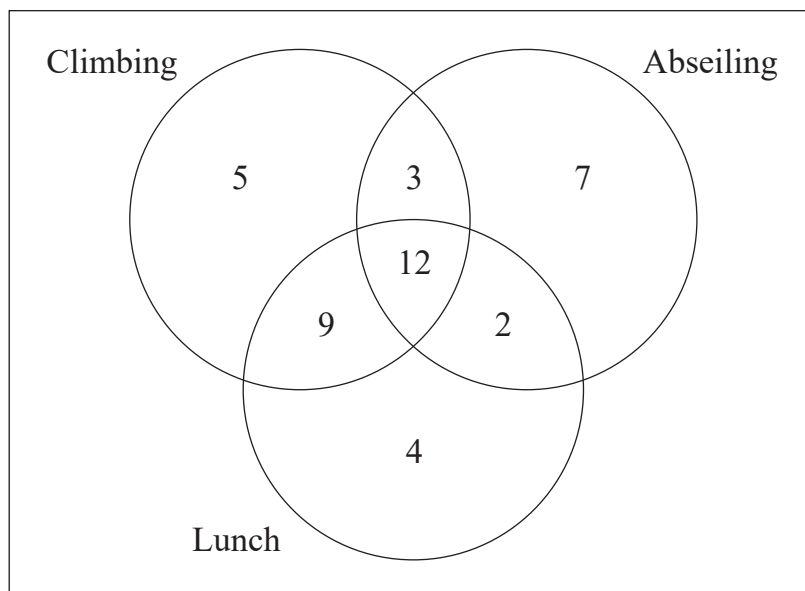
Answer _____ cm² [2]



17 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]

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

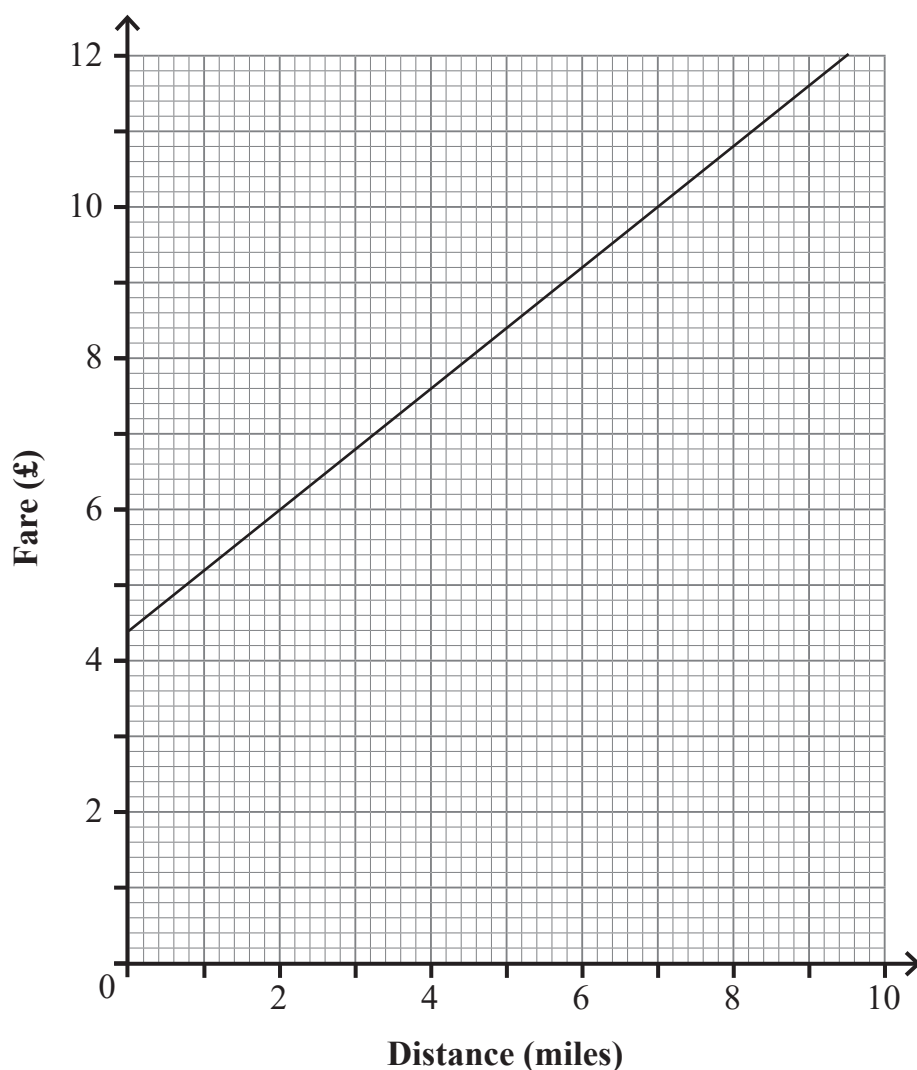
Find the coordinates of the midpoint of the line CD.

Answer (_____ , _____) [2]

[Turn over



19 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]



20 (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



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

Answer _____ [3]

22 A rectangle has length $(x + 5)$ and breadth $(x + 2)$

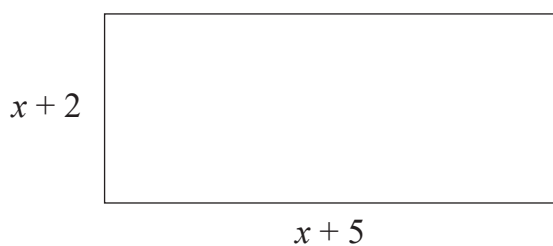


diagram
not drawn
to scale

Work out an expression for the area of the rectangle.

Answer $x^2 + \square x + \square$ [2]



23 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.

Answer _____ N/m^2 [2]



24 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]

25 Calculate the interquartile range (IQR) for the following data.

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

Answer _____ [2]



26 At a barbeque there are 3 options.



PRICE PER OPTION

STEAK - £8.50

CHICKEN - £7.95

VEGETARIAN - £6.20

© Getty Images

30% of the people choose steak.

$\frac{1}{4}$ of the people choose chicken.

The remaining 36 people choose the vegetarian option.

Calculate the total spent on these options.

Answer £ _____ [5]

[Turn over

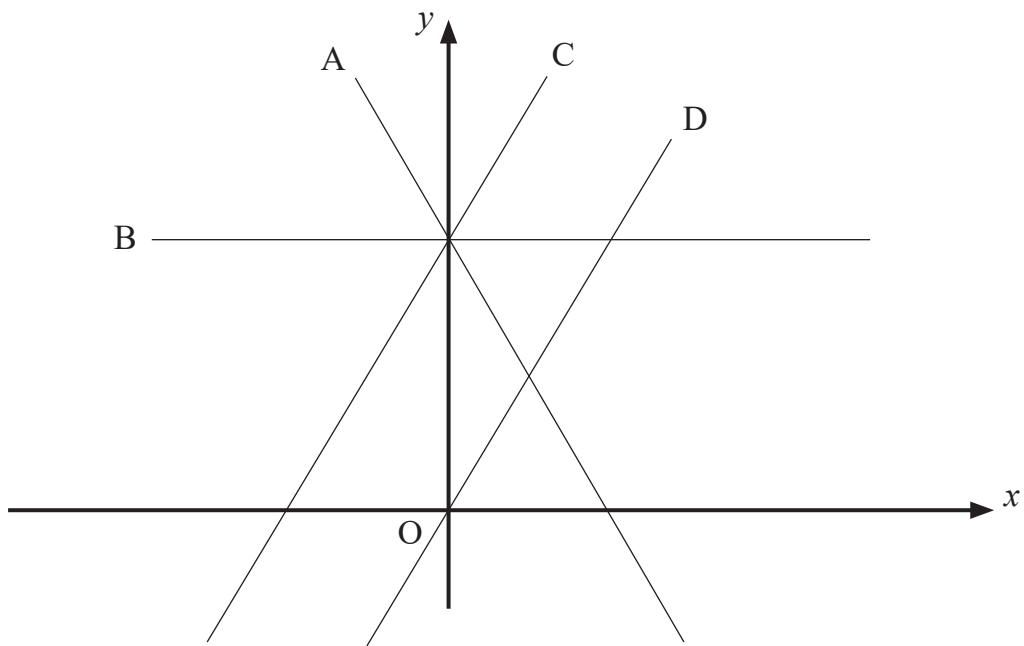


27 Show that $\frac{3x-1}{2} + \frac{11-7x}{6}$ simplifies to the single fraction $\frac{x+4}{3}$

Show each stage of your working clearly.

[3]





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.

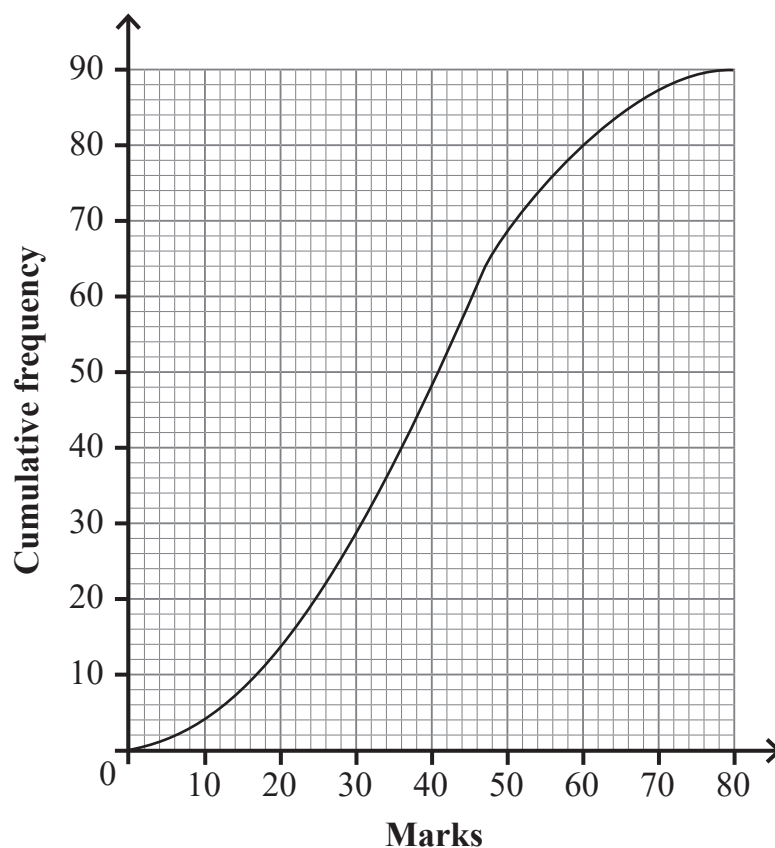
Answer _____ [4]

[Turn over



29 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]





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Examiner Number

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