Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
November 2023

Mathematics

StemUp Model Solution

Unit M2
(With calculator)
Foundation Tier



[GMC21]

GMC21

TUESDAY 21 NOVEMBER, 9.15 am – 11.00 am

TIME

1 hour 45 minutes.

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.

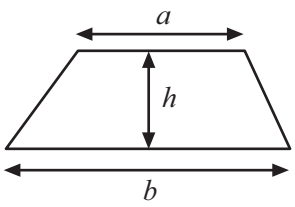
INFORMATION FOR CANDIDATES

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.

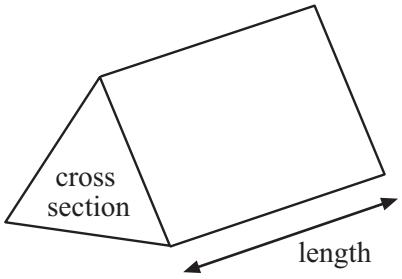
14114

Formula Sheet

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

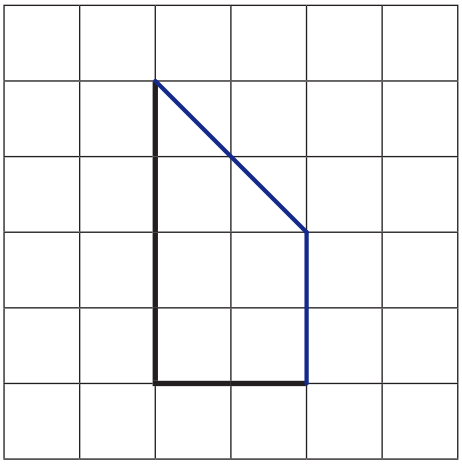


Volume of prism = area of cross section × length



14114

1 Part of a quadrilateral is drawn on a centimetre-squared grid to design a logo.

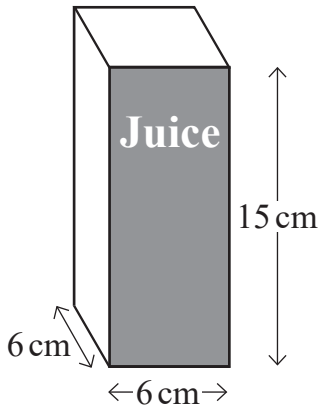


On the grid, complete the quadrilateral so that it has an area of 6 cm^2 [2]

Area = (4 + 2) ÷ 2 × 2 = 6 cm^2

[Turn over

2 A juice carton is in the shape of a cuboid, as shown in the diagram below.



(a) What is the area of the front face of the juice carton?

Answer 90 cm^2 [1]

(b) Calculate the volume of the juice carton.

$V = 6 \times 6 \times 15$

$= 540$

Answer 540 cm^3 [2]

(c) John says "The carton will hold more than half a litre of juice."

Is he correct?

Explain your answer clearly.

Volume = 540 cm^3 = 540 ml

Half a litre = 500 ml

Answer Yes because 540 ml is more than half a litre (500 ml)

since 1 cm^3 = 1 ml, the carton holds 540 ml [1]

3 A restaurant owner recorded the number of meals served each night for 8 nights, as shown below.

26 18 17 32 29 30 19 21

(a) Calculate the mean number of meals served per night.

26 + 18 + 17 + 32 + 29 + 30 + 19 + 21 = 192

Mean = 192 ÷ 8

= 24

Answer 24 [3]

(b) The next night the restaurant served 23 meals.

Without doing any further calculations, decide what will happen to the mean.

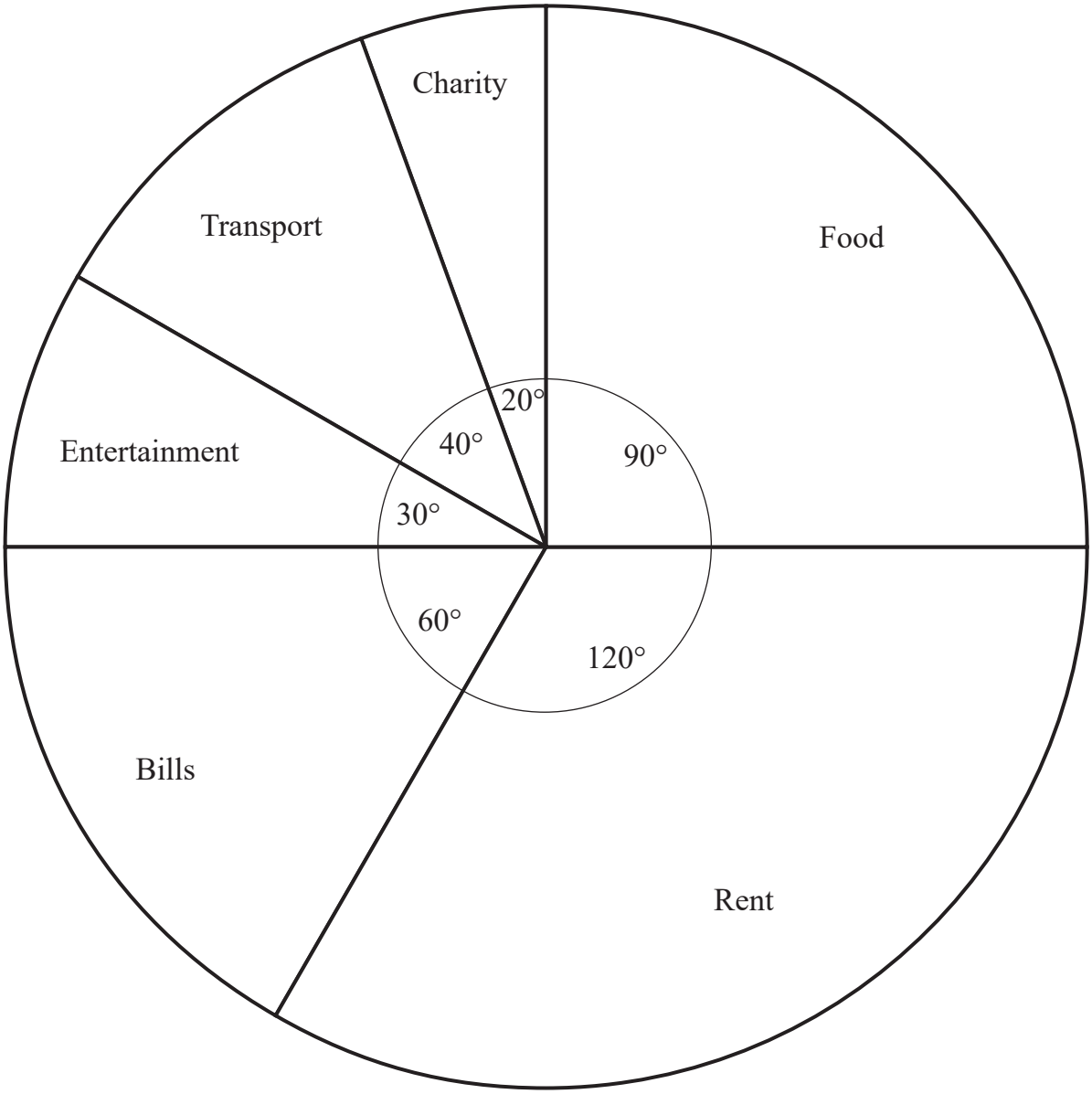
Circle the correct answer.

increase (decrease) stay the same

[1]

[Turn over

4 A family recorded what they spent their money on last week.



(a) What fraction of their spending was on rent?

Rent = 120°

$\frac{120}{360} = \frac{1}{3}$

Answer $\frac{1}{3}$ [1]

(b) The family spent £150 on bills.

(i) How much did they spend on entertainment?

Bills 60° = £150, so 30° = 150 ÷ 2 = £75

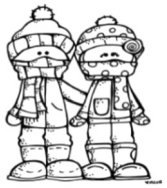
Answer £ 75 [1]

(ii) How much did they spend in total?

360 ÷ 60 = 6, 6 × 150 = £900

Answer £ 900 [1]

5 **(a)** In Belleek the temperature on Monday was –2°C.



On Tuesday the temperature fell by 3°C.

What was the temperature on Tuesday?

−2 − 3 = −5

Answer −5 °C [1]

(b) Mike, Nuala and Ollie have 30 T-shirts in total.

Mike has the most T-shirts.

What is the **least** number of T-shirts Mike could have?

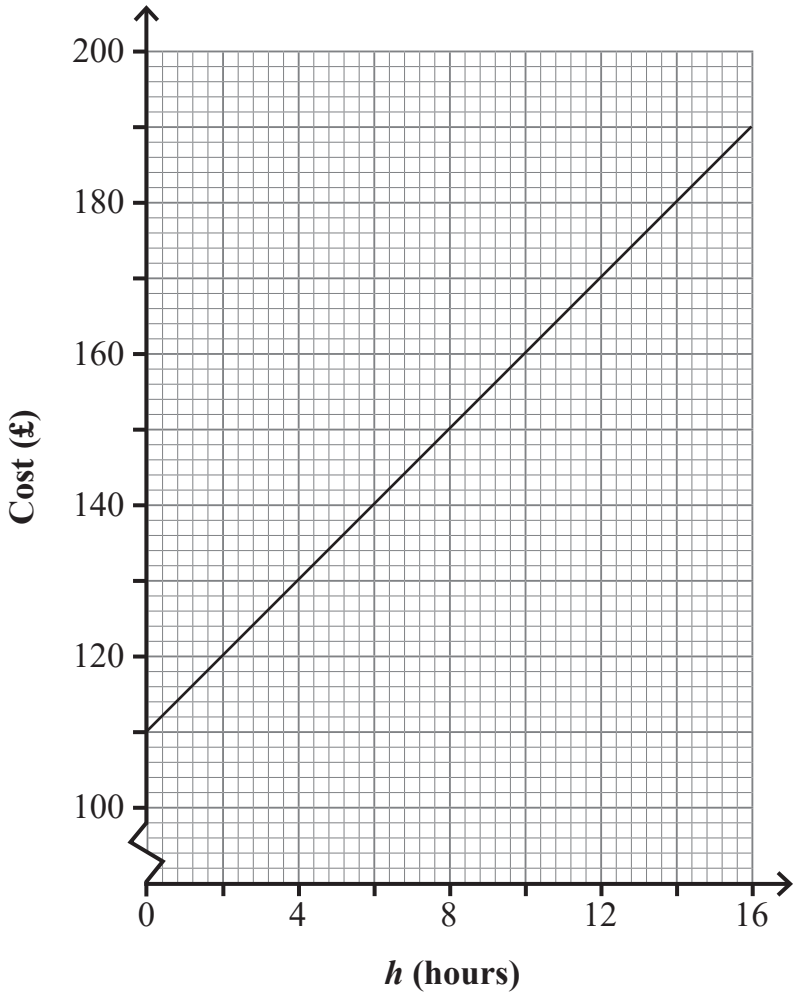
30 ÷ 3 = 10 each if shared equally

Mike has the most, e.g. 11, 10, 9

Answer 11 [2]

[Turn over

6 The cost to hire a party bus for h hours is shown on the graph.



(a) What is the cost for 14 hours?

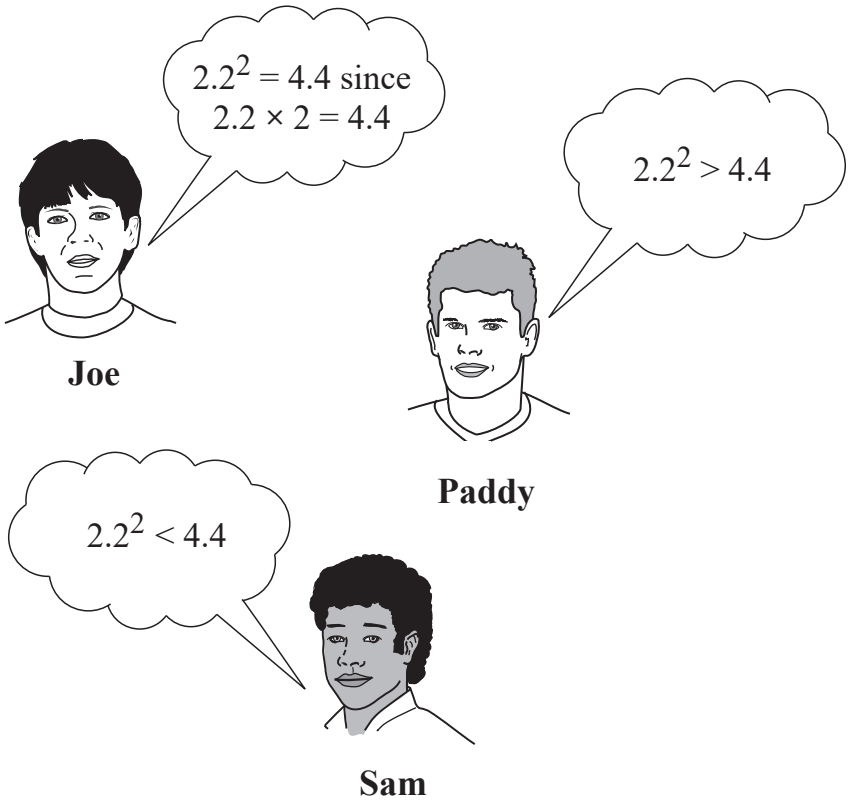
Answer £ 180 [1]

(b) Jim paid £150

How many hours did he hire the party bus for?

Answer 8 hours [1]

7 **(a)** Who is correct, Joe, Paddy or Sam?



$2.2^2 = 2.2 \times 2.2 = 4.84 > 4.4$

Answer Paddy [1]

(b) **(i)** Write the following statement using digits and symbols.

three plus two multiplied by five does not equal twenty-five

Answer $3 + 2 \times 5 \neq 25$ [1]

(ii) What is the correct answer to **three plus two multiplied by five**?

$2 \times 5 = 10, \quad 3 + 10 = 13$

Answer 13 [1]

[Turn over

8 **(a)** Zara earns £18 000 a year as a trainee hairdresser.



When her training is complete she will receive a 6% pay rise.

How much will this pay rise be worth per **month** to Zara?

6% of 18 000 = 0.06 × 18 000 = £1080 a year

1080 ÷ 12 = £90 per month

Answer £ 90 [3]

(b) Zara pays £360 rent each month.

Her landlord plans to increase Zara's rent by $\frac{2}{9}$

How much **extra** will Zara have to pay each month?

$\frac{2}{9}$ × 360 = 360 ÷ 9 × 2 = £80

Answer £ 80 [1]

9 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 15:36 [1]

(b) How long does her journey take?

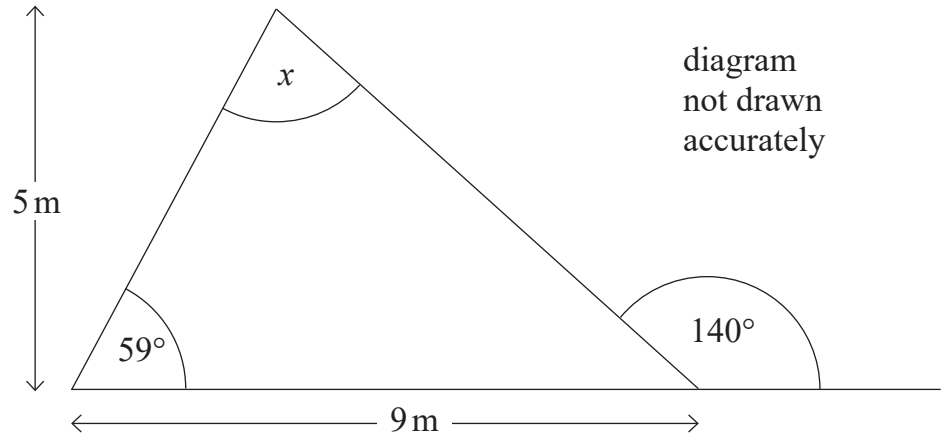
Give your answer in hours and minutes.

13:45 to 14:00 = 15 min
14:00 to 15:00 = 1 hr
15:00 to 15:36 = 36 min
Total = 1 hr + 15 + 36 min = 1 hr 51 min

Answer 1 hr 51 min [2]

[Turn over

10



(a) Calculate the size of angle x.

Angle in triangle = 180 − 140 = 40°

x = 180 − (59 + 40)

x = 81°

Answer 81 ° [3]

(b) Calculate the area of the triangle.

Give the correct unit of measurement with your answer.

Area = base × height ÷ 2

= 9 × 5 ÷ 2

= 22.5

Answer 22.5 m^2 [3]

11 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?

21 times, median = 11th value

Answer 26.3 seconds [1]

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

29.3 – 23.7 = 5.6

Answer 5.6 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.

26.3 < 28.3

Answer true [1]

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

5.6 > 3.5

Answer false [1]

[Turn over

12 A cashier counted the notes in the till.

Type of note	Number of notes	Value
£5	12	£60
£10	9	£90
£20	3	£60
£50	1	£50

(a) What was the total value of the notes in the till?

(5 × 12) + (10 × 9) + (20 × 3) + (50 × 1)
= 60 + 90 + 60 + 50 = 260

Answer £ 260 [2]

(b) What was the mean value of the notes in the till?

Notes = 12 + 9 + 3 + 1 = 25
260 ÷ 25 = 10.40

Answer £ 10.40 [1]

13 From the list

6 15 16 25 27 29 36

(a) Which is a cube number? Answer 27 [1]

(b) Which is a multiple of 12? Answer 36 [1]

(c) Which is a power of 2? Answer 16 [1]

(d) Which two numbers have a product of 375? Answer 15 and 25 [1]

14 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?

5 kg = 5000 g

5000 ÷ 360 = 13.888...

so 13 bags can be filled completely

Answer 13 [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.

10 kg = 10 000 g

10 000 ÷ 360 = 27.777...

so Sue can fill 27 bags

Double Rebecca's = 2 × 13 = 26 bags

27 ≠ 26, so Sue is not correct:

she will be able to fill 27 bags, not 26

Answer No [2]

[Turn over

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

$5x - 7x + 2y + 4y$

Answer $-2x + 6y$ [2]

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

$4 \times 3 - 4 \times 2p$

Answer $12 - 8p$ [2]

(c) Factorise $5k + 15$

Answer $5(k + 3)$ [1]

16 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 $x + 2$ [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 $3(x + 2)$ [1]

17 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?

Time = distance ÷ speed

= 156 ÷ 48

= 3.25 hours

= 3 hours 15 minutes

4 pm − 3 hours 15 minutes = 12:45 pm

Answer 12:45 pm [3]

[Turn over

18 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 *people may not fill in the survey and return it,*

so he may not get enough data back [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 *the sample of 10 people is too small* [1]

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

Qualitative (Quantitative)

[1]

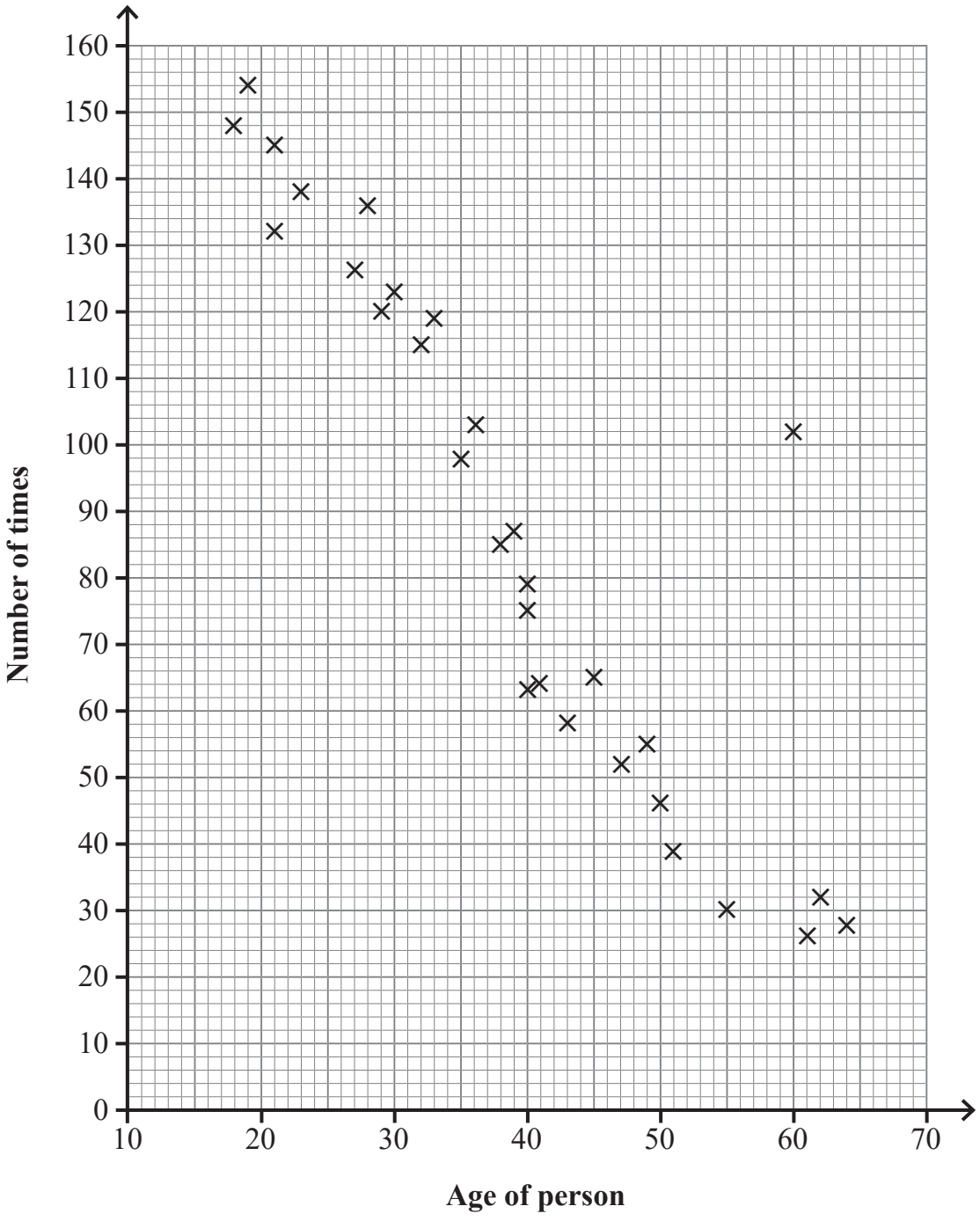
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(Questions continue overleaf)

[Turn over

19 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 154 [1]

14114

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

Answer 55 [1]

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

Answer negative [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 the older the person, the fewer times they checked their phone [1]

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

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

20 Solve $5y + 3 = 2y - 9$

$5y - 2y = -9 - 3$

$3y = -12$

$y = -12 \div 3 = -4$

Answer $y =$ −4 [3]

[Turn over

21 Pete's wage was £480 last week.

£72 was for working overtime.

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

$\frac{72}{480} \times 100 = 15\%$ (overtime)

$100 - 15 = 85\%$

Answer 85 % [3]

22 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?

Total marks = 85 + 80 = 165

$\frac{2}{3} \times 165 = 110$ marks needed to pass

$\frac{60}{100} \times 85 = 51$ marks in Paper 1

Paper 2: 110 − 51 = 59 marks

Answer 59 [3]

[Turn over

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

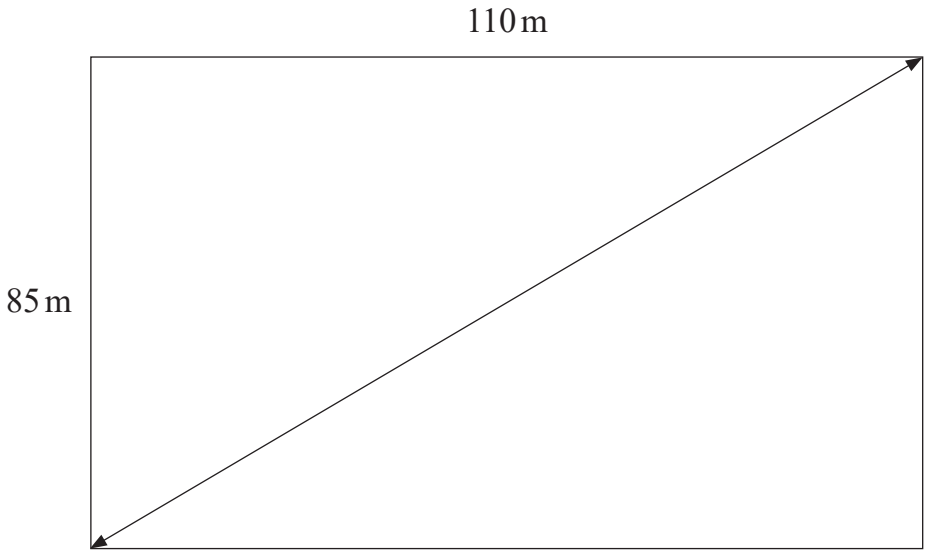


diagram not drawn to scale

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

How many diagonal runs are needed?

$d^2 = 85^2 + 110^2$

$= 7225 + 12\,100 = 19\,325$

$d = \sqrt{19\,325} = 139.0143...$ m

1 km = 1000 m

$1000 \div 139.0143... = 7.193...$

7 runs is less than 1 km, so 8 runs

Answer 8 [5]

24 Find the area of the kite below.

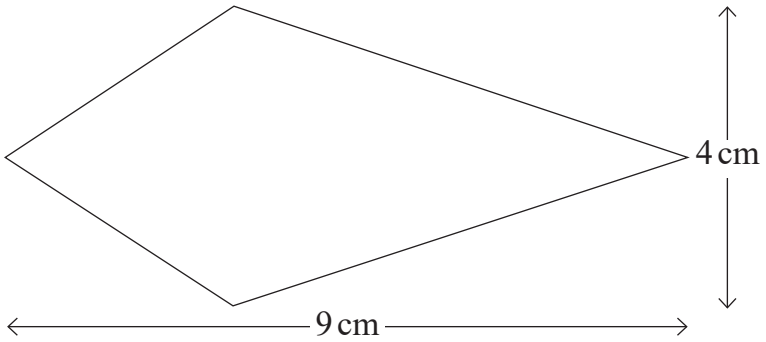


diagram
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to scale

Area = 0.5 × 9 × 4

= 18

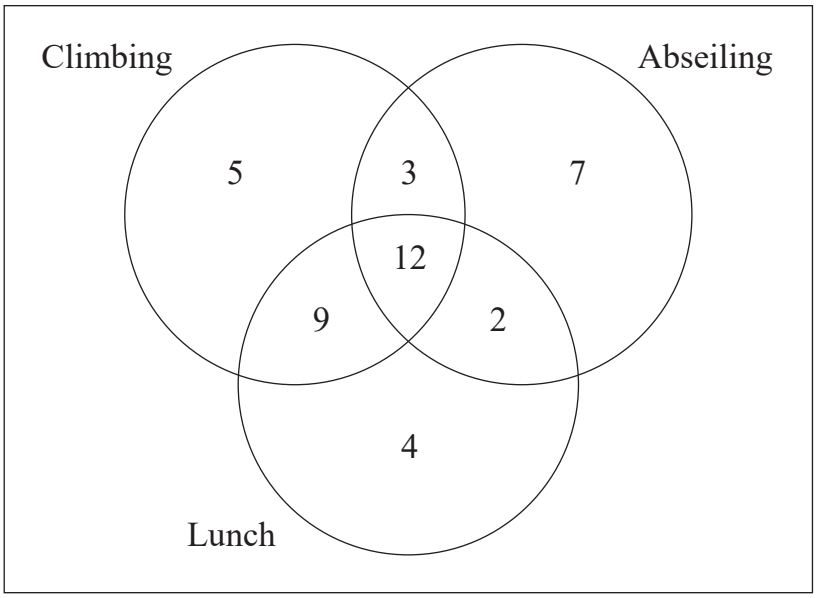
Answer 18 cm^2 [2]

[Turn over

25 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 4 [1]

(b) How many people did not have lunch?

5 + 3 + 7 = 15

Answer 15 [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?

9 + 2 = 11 people

11 × 16 = £176

Answer £ 176 [2]

26 C has the coordinates (–2, 4) and D has the coordinates (8, 7).

Find the coordinates of the midpoint of the line CD.

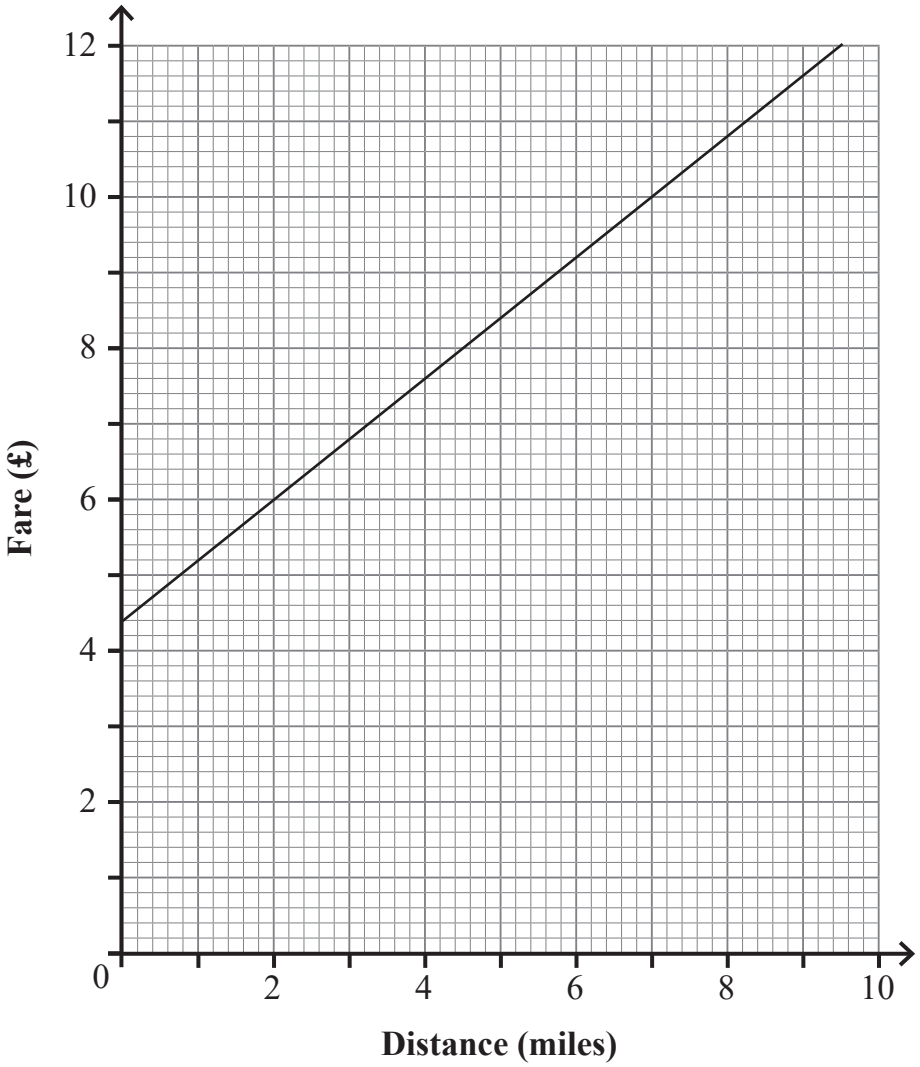
x: (–2 + 8) ÷ 2 = 6 ÷ 2 = 3

y: (4 + 7) ÷ 2 = 11 ÷ 2 = 5.5

Answer (3 , 5.5) [2]

[Turn over

27 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 5 miles [1]

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

0 miles = £4.40, 5 miles = £8.40

£4.00 ÷ 5 = £0.80 per mile

Answer 80p per mile [2]

28 **(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?

30% of £1200 = 0.3 × 1200 = £360
£1200 − £360 = £840
5% of £840 = 0.05 × 840 = £42
£840 − £42 = £798

Answer £ 798 [3]

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

Is he correct?

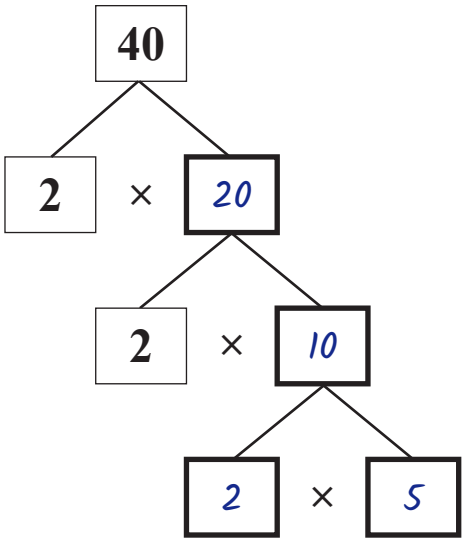
You must show work to justify your answer.

Total saving = £1200 − £798 = £402
35% of £1200 = 0.35 × 1200 = £420
£402 ≠ £420
Actual discount = 402 ÷ 1200 × 100 = 33.5%
so the total discount is 33.5%, not 35%

Answer No [2]

[Turn over

29 **(a)** Complete the following to show the prime factor decomposition of 40



[1]

(b) Find the highest common factor (HCF) of 24 and 40

Factors of 24: 1, 2, 3, 4, 6, 8, 12, 24

Factors of 40: 1, 2, 4, 5, 8, 10, 20, 40

HCF = 8

Answer 8 [2]

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