Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2023

Mathematics

StemUp Model Solution

Unit M2
(With calculator)
Foundation Tier



[GMC21]

GMC21

FRIDAY 19 MAY, 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 are provided with Foundation Tier Additional Support Materials for use with this paper.**
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-five** 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.

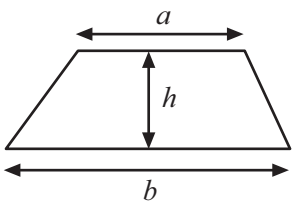
INFORMATION FOR CANDIDATES

Functional Mathematics is assessed in this unit.
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.

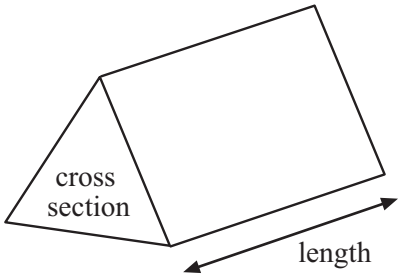
13339

Formula Sheet

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



Volume of prism = area of cross section × length



13339

1 A company gives every customer one offer when they place an order.

	Offer 1	25% off your order
or	Offer 2	$\frac{1}{3}$ off your order
or	Offer 3	£50 off your order

Gary placed an order worth £180

Which offer will save him the greatest amount of money?

You must show working to explain your answer.

Offer 1: 25% of 180 = 0.25 × 180 = £45

Offer 2: 1/3 of 180 = 180 ÷ 3 = £60

Offer 3: £50

£60 > £50 > £45

Answer Offer *2* because *it saves £60, which is more than £45 or £50*

[3]

[Turn over

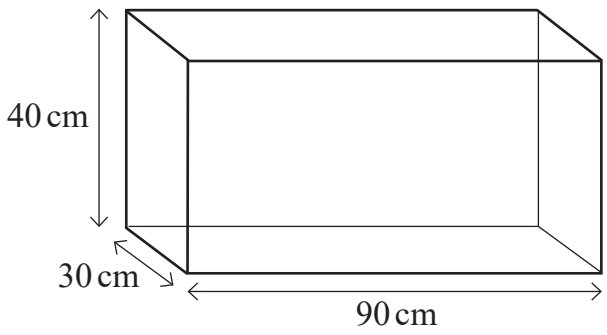
2 Decide if each of the following statements is true or false.

Circle your answer.

$\sqrt{100} = 50$	True	(False)
$5^2 = 25$	(True)	False
$33\% < \frac{1}{3}$	(True)	False

[3]

3 A fish tank is in the shape of a cuboid, as shown below.



The **base** of the tank needs to be covered with gravel.

1 kg of gravel covers 200 cm^2

How much gravel is needed to cover the base of this tank?

Area of base = 90 × 30 = 2700 cm^2

Gravel = 2700 ÷ 200 = 13.5 kg

Answer 13.5 kg [2]

4 The ages of 10 players are

18 25 23 29 36 24 31 20 21 33

Calculate the mean age.

18 + 25 + 23 + 29 + 36 + 24 + 31 + 20 + 21 + 33 = 260

260 ÷ 10 = 26

Answer 26 [3]

5 John has £100 to spend on downloading games.

Each game costs £7.99 to download.

He wants to download as many games as possible.

(a) How many games can John download?

100 ÷ 7.99 = 12.515...

so 12 whole games

Answer 12 [2]

(b) How much money will he have left?

12 × 7.99 = 95.88

100 − 95.88 = 4.12

Answer £ 4.12 [1]

[Turn over

6 A chef uses this formula to work out how long to cook turkey for.

$$T = 20W + 45$$

where T is the time (in minutes)
W is the weight of the turkey (in kilograms, kg)

He wants to cook a turkey weighing 11 kg.

(a) How long, in minutes, should he cook the turkey for?

$T = 20 \times 11 + 45$
$= 220 + 45$
$= 265$

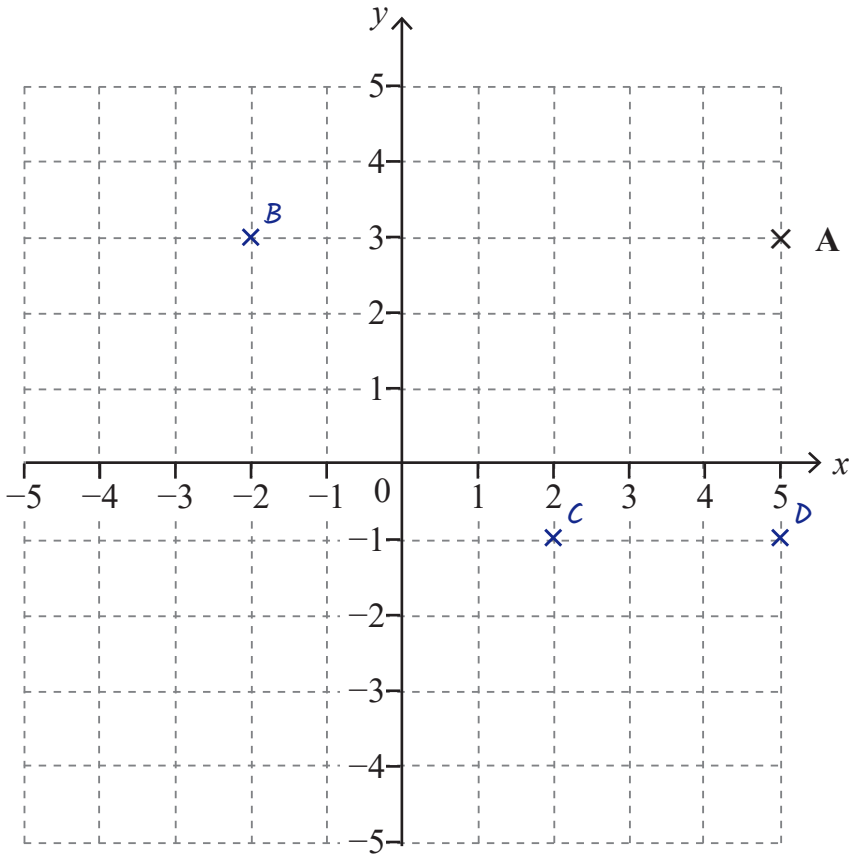
Answer 265 mins [2]

(b) Change this time to hours and minutes.

$265 \div 60 = 4$ remainder 25

Answer 4 hours 25 mins [1]

7 The point A (5, 3) is plotted on this coordinate grid.



(a) Plot the points B (−2, 3) and C (2, −1) on the grid. [2]

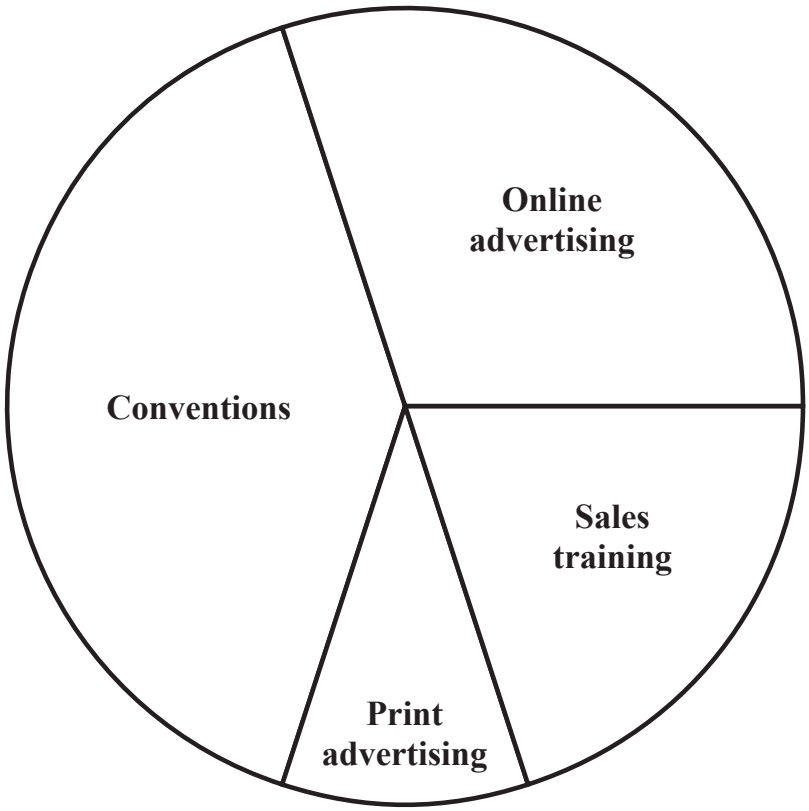
(b) Write down the coordinates of a point D that could be plotted on the grid to make ABCD a trapezium.

Answer (5 , −1) [1]

[Turn over

8 A business spent £18 000 last year.

The pie chart shows how the money was spent.



(a) (i) Measure the angle for the sector labelled "Online advertising".

Answer 108 ° [1]

(ii) Use your answer to part **(i)** to calculate the amount of money the company spent on "Online advertising" last year.

18 000 ÷ 360 = £50 per degree

50 × 108 = 5400

Answer £ 5400 [2]

(b) Complete the following sentences correctly.

(i) The company spent _____twice_____ as much on "Sales training" as they did on "Print advertising". [1]

(ii) Spending on "Conventions" and "Print advertising" together used

_____half_____ of the total budget. [1]

[Turn over

9 Debbie works as a salesperson for an insurance company.

Her rate of pay is £11.50 per hour.

Every time she sells an insurance policy she receives a bonus of £7.25

Last week Debbie worked these hours.

Monday	8am – 4pm
Tuesday	8am – 4pm
Wednesday	8am – 4pm
Thursday	8am – 4pm
Friday	8am – 12 noon
Saturday	Off
Sunday	Off

Her total pay for the week was £537.25

How many insurance policies did she sell?

Mon to Thu: 8am to 4pm = 8 hours each day

Hours = 8 + 8 + 8 + 8 + 4 = 36 hours

Basic pay = 36 × 11.50 = £414

Bonus = 537.25 − 414 = £123.25

Policies = 123.25 ÷ 7.25 = 17

Answer 17 [4]

10 A survey was issued online, by post, by text and face to face.

The number of responses received for each method are shown in the table.

Method	No of surveys issued	No of responses
Online	240	120
Post	100	30
Text	300	150
Face to face	160	120

Frank thinks that you are most likely to get a response from surveys issued by text.

Is he right?

You must show working to justify your answer.

Online: 120 ÷ 240 = 0.5 = 50%

Post: 30 ÷ 100 = 0.3 = 30%

Text: 150 ÷ 300 = 0.5 = 50%

Face to face: 120 ÷ 160 = 0.75 = 75%

Face to face has the highest response rate.

Answer No because face to face has the highest response rate (75%), while text is only 50%, the same as online [4]

[Turn over

11

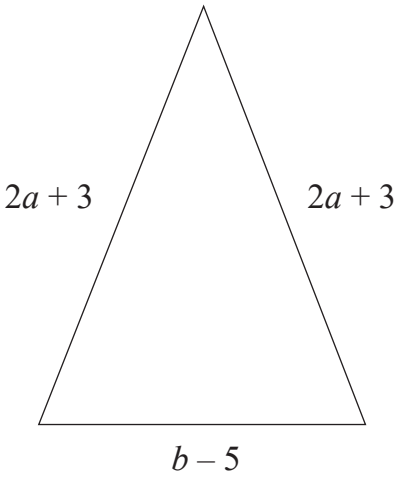


diagram not drawn accurately

(a) Write an expression for the perimeter of the triangle.

Simplify your answer.

Perimeter = 2a + 3 + 2a + 3 + b – 5
= 4a + b + 1

Answer 4a + b + 1 [2]

(b) The perimeter of the triangle is 30

You are told that $b = 9$

Work out the value of a

4a + 9 + 1 = 30
4a + 10 = 30
4a = 20
a = 20 ÷ 4 = 5

Answer $a =$ 5 [3]

12 Below are listed six data sets.

A: number of pages in a book

B: temperature of a liquid

C: mass of an apple

D: colour of students' eyes

E: age of person

F: favourite food

From the list, choose one data set that represents

(a) Qualitative data Answer D [1]

(b) Discrete data Answer A [1]

(c) Continuous data Answer B [1]

[Turn over

13 The table shows part of a train timetable from Edinburgh to St Andrews.

The Express trains travel directly. The Standard trains stop at other stations.

	Express	**Standard**	**Express**	**Standard**	**Express**
Edinburgh	1318	1343	1424	1441	1520
Haymarket		1406		1504	
Kirkcaldy		1418		1516	
Ladybank		1423		1521	
St Andrews	1403	1439	1509	1537	1605

(a) Alex arrives at Edinburgh Airport at 1306

It takes him 26 minutes to collect his luggage.

By taxi, he arrives at Edinburgh Train Station 18 minutes later.

How long will he have to wait at the station for the next train to St Andrews?

1306 + 26 mins = 1332
1332 + 18 mins = 1350
Next train to St Andrews leaves at 1424
1350 to 1424 = 10 + 24 = 34 minutes

Answer 34 minutes [3]

(b) The distance between Edinburgh and St Andrews is 54 miles.

Calculate the average speed at which the Express train travels between Edinburgh and St Andrews.

Express: 1424 to 1509 = 45 mins = 0.75 hours
Speed = 54 ÷ 0.75
= 72 miles/hr

Answer 72 miles/hr [3]

14

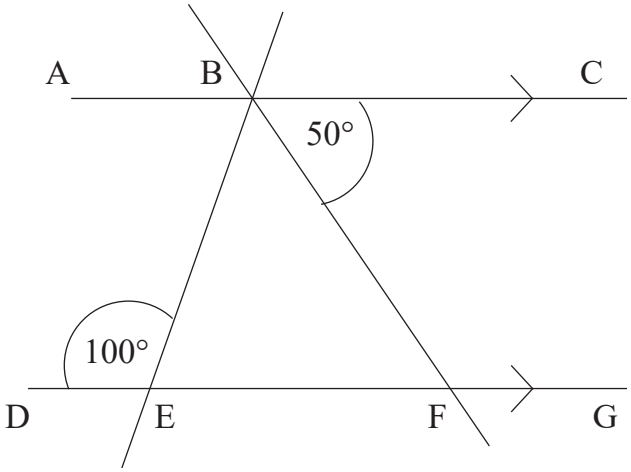


diagram not drawn accurately

AC and DG are parallel lines.

Angle CBF = 50° and angle BED = 100°

What type of triangle is BEF?

Give a reason for each angle found.

Angle BFE = 50°
(alternate angles are equal)
Angle BEF = 180 – 100 = 80°
(angles on a straight line add up to 180°)
Angle EBF = 180 – 50 – 80 = 50°
(angles in a triangle add up to 180°)
Two angles are equal (50° and 50°),
so triangle BEF is isosceles.

Answer Isosceles [3]

[Turn over

15 Greg bought a mobile phone for £180

A year later he sold it for £54

What was Greg's percentage loss on the phone?

Loss = 180 − 54 = £126

126 ÷ 180 × 100

= 70%

Answer 70 % [3]

16 Solve the equation $4(y + 2) = 22$

4(y + 2) = 22

4y + 8 = 22

4y = 22 − 8 = 14

y = 14 ÷ 4 = 3.5

Answer $y =$ 3.5 [3]

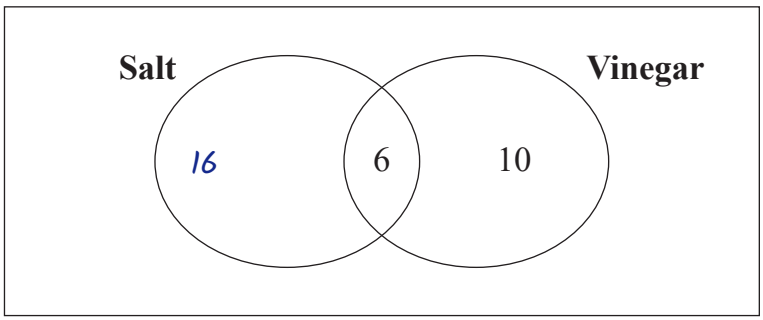
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17 40 customers order chips in a takeaway.

6 customers take **both** salt and vinegar on their chips.

10 customers take vinegar **only**.

This information is shown on the Venn diagram.



22 customers take salt on their chips.

Use the Venn diagram to work out how many customers take neither salt nor vinegar on their chips.

Salt only = 22 − 6 = 16

16 + 6 + 10 = 32

Neither = 40 − 32 = 8

Answer 8 [3]

[Turn over

18 A local sports club runs a tuck shop during matches.

Before last week's match the club bought

25 packs, each containing 6 drinks, costing £3 per pack,

15 packs, each containing 12 bags of crisps, costing £2.40 per pack,

35 packs, each containing 5 chocolate bars, costing £1 per pack.

(a) Calculate the total cost to the club.

Drinks: 25 × £3 = £75

Crisps: 15 × £2.40 = £36

Chocolate bars: 35 × £1 = £35

Total = 75 + 36 + 35 = £146

Answer £ 146 [2]

(b)

Tuck shop prices

Drinks	80p each
Crisps	50p per bag
Chocolate Bars	30p each

Special Deal ***1 drink, 1 bag of crisps, 1 chocolate bar for £1.50***

During the match, 115 people bought the Special Deal.

By the end of the match the tuck shop had sold **all** the drinks, crisps and chocolate bars.

What was the tuck shop's profit for that day?

Drinks: 25 × 6 = 150, crisps: 15 × 12 = 180, bars: 35 × 5 = 175

Special Deal: 115 × £1.50 = £172.50

Drinks left: 150 − 115 = 35, 35 × £0.80 = £28

Crisps left: 180 − 115 = 65, 65 × £0.50 = £32.50

Bars left: 175 − 115 = 60, 60 × £0.30 = £18

Income = 172.50 + 28 + 32.50 + 18 = £251

Profit = 251 − 146 = £105

Answer £ 105 [4]

[Turn over

19 The ages of 21 workers in an office are recorded as

28	32	38	40	42	49	51	23	26	27	53
49	45	36	38	37	62	23	46	58	47	

(a) Draw a stem and leaf diagram to display this set of data.

2	3 3 6 7 8
3	2 6 7 8 8
4	0 2 5 6 7 9 9
5	1 3 8
6	2

Key: 2 | 3 = 23 years

[3]

(b) A new worker joins the office. He is aged 34

What effect will this have on the median age?

Median was the 11th value = 40; now (38 + 40) ÷ 2 = 39

Answer The median will decrease (from 40 to 39) [1]

20 Colm wants to put £4500 into a savings account for 2 years.

He can choose one of the following options.

Option A	**Option B**
3.5% compound interest per year for 2 years	5% compound interest per year for the first year followed by 2% compound interest per year for the second year

Which option is better and by how much?

Show your working.

Option A: 4500 × 0.035 = 157.50, 4500 + 157.50 = 4657.50

4657.50 × 0.035 = 163.01, 4657.50 + 163.01 = 4820.51

Interest A = 4820.51 − 4500 = £320.51

Option B: 4500 × 0.05 = 225, 4500 + 225 = 4725

4725 × 0.02 = 94.50, 4725 + 94.50 = 4819.50

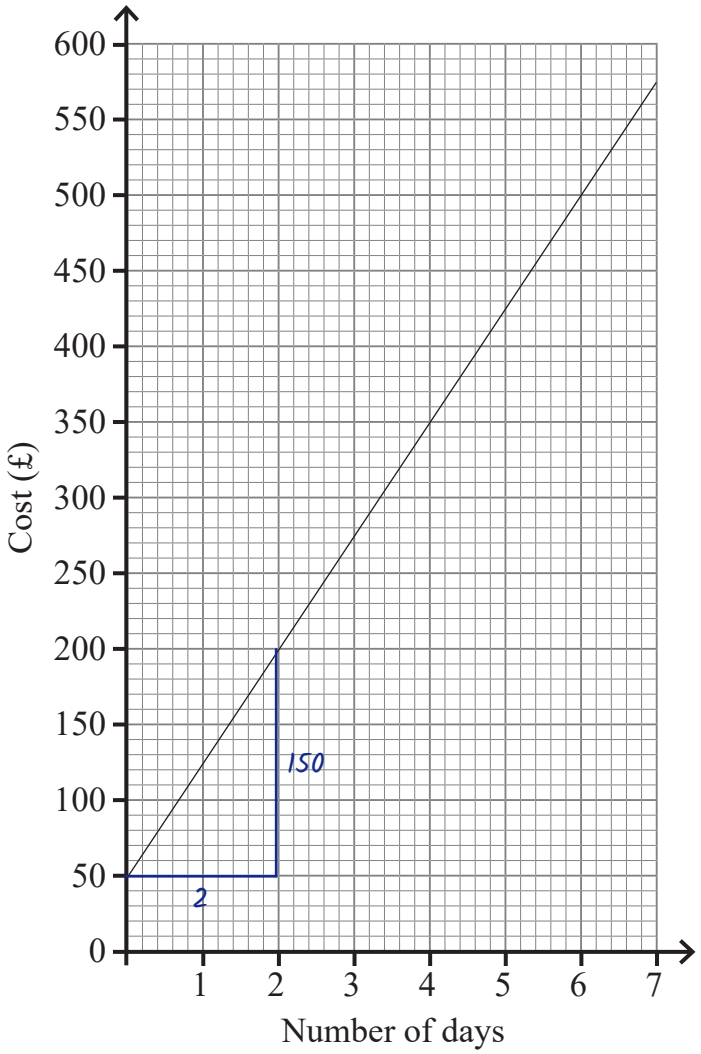
Interest B = 4819.50 − 4500 = £319.50

Difference = 320.51 − 319.50 = £1.01

Answer Option A by £ 1.01 [5]

[Turn over

21 The graph shows the costs of hiring a mini digger for up to seven days, including the delivery charge.



(a) Use the graph to find

(i) the delivery charge,

Answer £ 50 [1]

(ii) the gradient of the line.

Gradient = (200 − 50) ÷ (2 − 0)
= 150 ÷ 2 = 75

Answer 75 [2]

(b) What does the gradient represent when hiring the mini digger?

Answer the cost per day: it costs £75 for each day of hire [1]

22 Expand and simplify $2y(3y - 7) - 8y$

$2y \times 3y - 2y \times 7 - 8y$
$= 6y^2 - 14y - 8y$
$= 6y^2 - 22y$

Answer $6y^2 - 22y$ [3]

[Turn over

23 The diagram shows a net which is to be folded to make an open box.

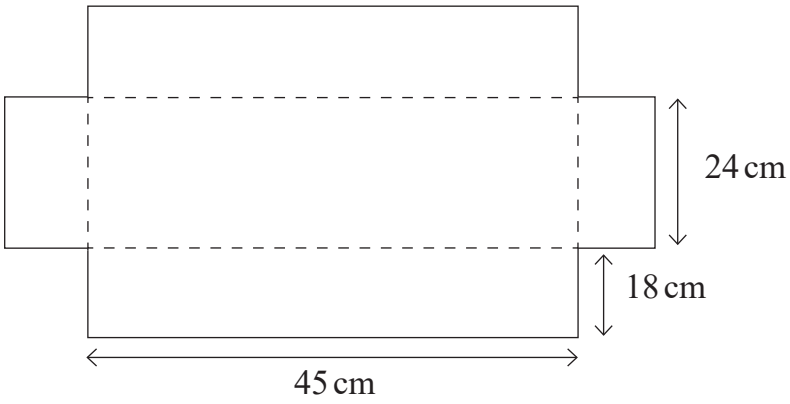


diagram not drawn accurately

(a) Calculate the volume of the box.

You should include units with your answer.

Box: length 45 cm, width 24 cm, height 18 cm
V = 45 × 24 × 18
= 19 440 cm^3

Answer 19 440 cm^3 [3]

(b) Calculate the total external (outside) surface area of the box.

Base: 45 × 24 = 1080
Front and back: 2 × 45 × 18 = 1620
Ends: 2 × 24 × 18 = 864
Total = 1080 + 1620 + 864 = 3564

Answer 3564 cm^2 [3]

(c) Calculate the length of the longest straight line that can be drawn on the base of the box.

Diagonal of base: $d^2 = 45^2 + 24^2$

$= 2025 + 576 = 2601$

$d = \sqrt{2601} = 51$

Answer 51 cm [3]

[Turn over

24 The times which members at a gym spend on a treadmill are recorded in the table.

Time (t mins)	Frequency	Midpoint (x)	f × x
$0 < t \leq 15$	8	7.5	60
$15 < t \leq 30$	3	22.5	67.5
$30 < t \leq 45$	5	37.5	187.5
$45 < t \leq 60$	4	52.5	210

(a) (i) Estimate the mean time spent on the treadmill.

Total f = 8 + 3 + 5 + 4 = 20

Total fx = 60 + 67.5 + 187.5 + 210 = 525

Mean = 525 ÷ 20 = 26.25

Answer 26.25 mins [4]

(ii) Explain why your answer in **(i)** is only an estimate of the mean time.

the data is grouped, so we do not know the exact times;

the midpoint of each group is used instead [1]

(b) What type of correlation would you expect between the time spent on the treadmill and the number of calories burnt?

Answer Positive [1]

25 A circle of diameter 12 cm just fits inside a semicircle as shown.

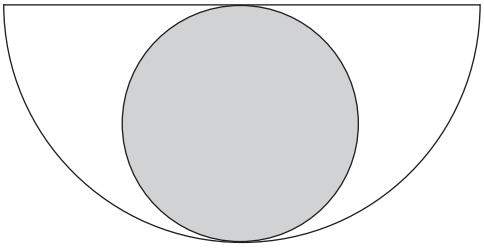


diagram not drawn accurately

Show that the shaded area and unshaded area are exactly the same.

You must show all your work clearly.

Radius of shaded circle = 12 ÷ 2 = 6 cm

Shaded area = $\pi \times 6^2 = 36\pi$ (= 113.097... cm^2)

Radius of semicircle = diameter of circle = 12 cm

Semicircle area = $0.5 \times \pi \times 12^2 = 72\pi$ (= 226.194... cm^2)

Unshaded area = $72\pi - 36\pi = 36\pi$ (= 113.097... cm^2)

∴ shaded area = unshaded area = 36π cm^2

[4]

THIS IS THE END OF THE QUESTION PAPER

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Question Number	**Marks**
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Examiner Number

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General Certificate of Secondary Education
Summer 2023

GCSE Mathematics

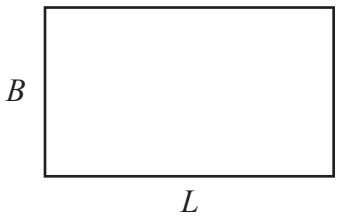
FOUNDATION TIER
ADDITIONAL SUPPORT MATERIALS
(For use in Summer 2023)

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$$\text{Average Speed} = \frac{\text{Distance}}{\text{Time}}$$

Perimeter, Area and Volume

The perimeter of a polygon is the distance around the outside of the polygon.



The area of a rectangle is found by multiplying the length of the rectangle by the breadth.

$A = L \times B$, where A is the area, L is length and B is breadth.

The volume of a cuboid is found by multiplying the length by the breadth by the height of the cuboid.

$V = L \times B \times H$ where V is volume, L is length, B is breadth and H is height.

The area of a circle is $A = \pi r^2$ where r is the radius of the circle.

Gradient of Line

$$\text{Gradient of line} = \frac{\text{increase in vertical distance}}{\text{increase in horizontal distance}}$$

Geometry and Angles

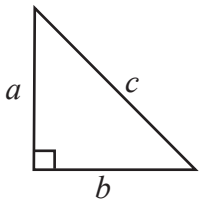
There are 180° on a straight line.
There are 180° inside a triangle.
An isosceles triangle is a triangle with 2 equal sides and 2 equal angles.
The sum of all the angles inside a polygon is given by $180(n - 2)$ where n is the number of sides in the polygon.

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Pythagoras' Theorem

If a, b and c are the sides of a right angled triangle shown below, then

$$a^2 + b^2 = c^2$$



Mean

The mean of a set of data is the sum of all the data values divided by the number of data values.

Estimate for the mean of a grouped frequency distribution

Estimated mean = sum of (mid interval values multiplied by their frequency) divided by the sum of all the frequencies.

Pie Chart

In a pie chart, the total angle that corresponds to the entire data set is 360°

Probability

The sum of the probabilities of all outcomes equals 1

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