Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2022

# Mathematics

StemUp Model Solution

Unit M1
**(With calculator)**
Foundation Tier



**[GMC11]**

*GMC11*

**TUESDAY 24 MAY, 9.15am–11.00am**

**TIME**

1 hour 45 minutes.

**INSTRUCTIONS TO CANDIDATES**

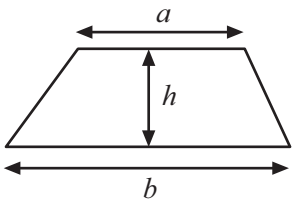
Write your Centre Number and Candidate Number in the spaces provided at the top of this page. **You are provided with Foundation Tier Additional Support Materials for use with this paper.**
**You must answer the questions in the spaces provided.**
**Do not write outside the boxed area on each page or on blank pages.**
Complete in black ink only. **Do not write with a gel pen.**
Answer **all twenty-eight** 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**

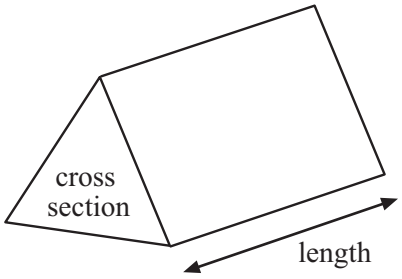
Functional Mathematics is assessed in this unit.
The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

# Formula Sheet

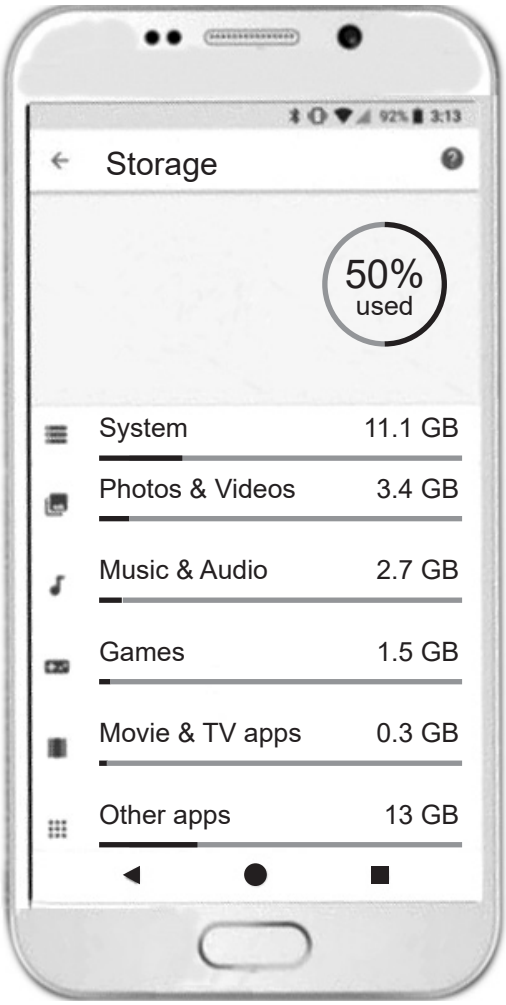
**Area of trapezium** $= \frac{1}{2}(a + b)h$




**Volume of prism** = area of cross section × length



**1** The display shows details of storage on Orla's mobile phone.




**(a)** How much more storage is used on Photos & Videos than on Games?

3.4 − 1.5 = 1.9

Answer 1.9 GB [1]

**(b)** How many gigabytes (GB) of storage have been used in total?

11.1 + 3.4 + 2.7 + 1.5 + 0.3 + 13 = 32

Answer 32 GB [1]

**(c)** What is the storage capacity of Orla's phone?

50% = 32 GB, so 100% = 2 × 32 = 64

Answer 64 GB [1]

**[Turn over**

**2** The lengths of some Northern Irish rivers are shown.

| River | Length (km) |
|---|---|
| Bann | 140 |
| Blackwater | 57 |
| Bush | 54 |
| Derg | 45 |
| Lagan | 86 |

**(a)** Write the rivers in order of length.

Start with the shortest.

Answer Derg, Bush, Blackwater, Lagan, Bann

[2]

**(b)** Ollie thinks River Bann is more than three times the length of River Derg.

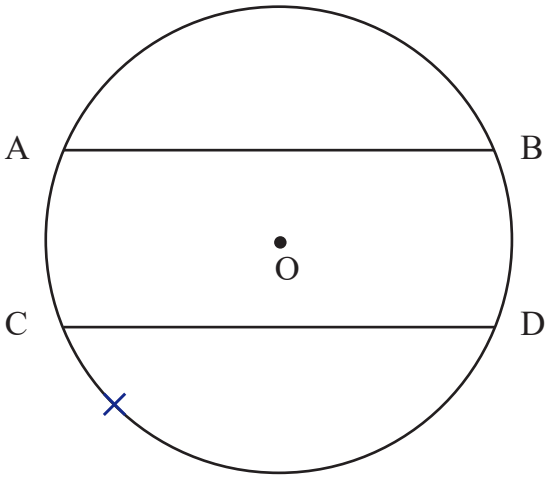
Do you agree?

Give a reason for your answer.

Answer Yes because 3 × 45 = 135 km

and 140 km is more than 135 km [2]

**3** The diagram below shows a circle, centre O.




**(a)** Measure the length of the line AB in cm.

Answer 5.7 cm [1]

**(b)** On the diagram, place an X at any point on the circumference of the circle. [1]

**(c)** Insert the correct word from the list to make the following sentence correct.

perpendicular diagonal parallel

"The lines AB and CD are parallel to each other." [1]

**(d)** Kevin says

"CD is a diameter of the circle."

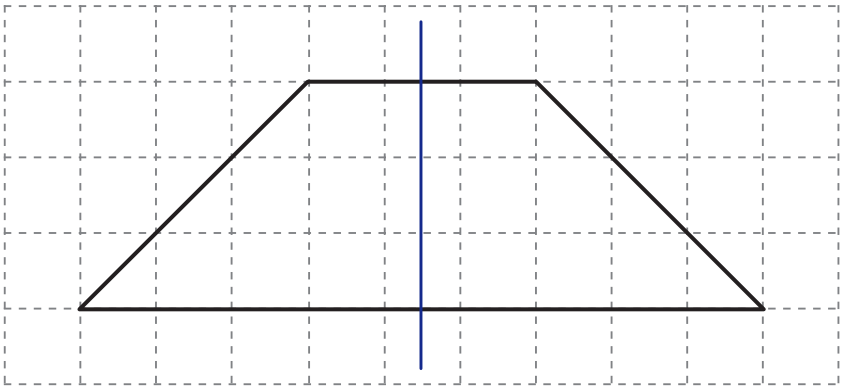
Explain why Kevin is wrong.

Answer CD does not go through the centre O

(a diameter must pass through the centre) [1]

**[Turn over**

**4** A shape is drawn on a centimetre squared grid.



**(a)** What is the name of this shape?

Answer trapezium [1]

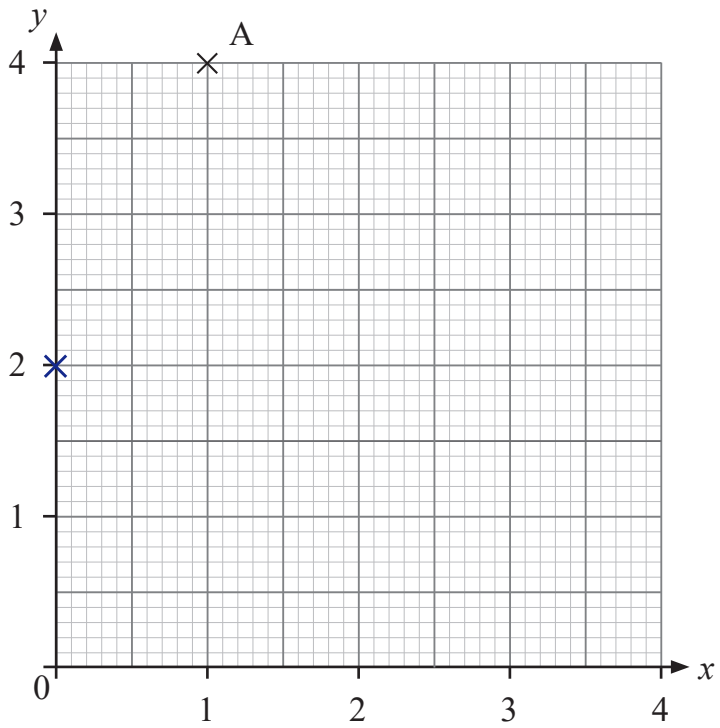
**(b)** What is the area of the shape?

Area = (9 + 3) ÷ 2 × 3 = 18

Answer 18 $cm^2$ [1]

**(c)** On the diagram, draw a line of symmetry of the shape. [1]

**5**




**(a)** Write down the coordinates of the point marked A.

Answer ( 1 , 4 ) [1]

**(b)** Plot the point (0, 2) with an × [1]

**[Turn over**

**6** Kelly's postcode is made up of 4 letters and 3 single-digit numbers.



*Source: © Getty Images*

The first digit is a factor of 20

The second digit is a multiple of 4

The third digit is a square number.

The sum of the three digits is 21

Fill in the missing boxes to show Kelly's postcode.

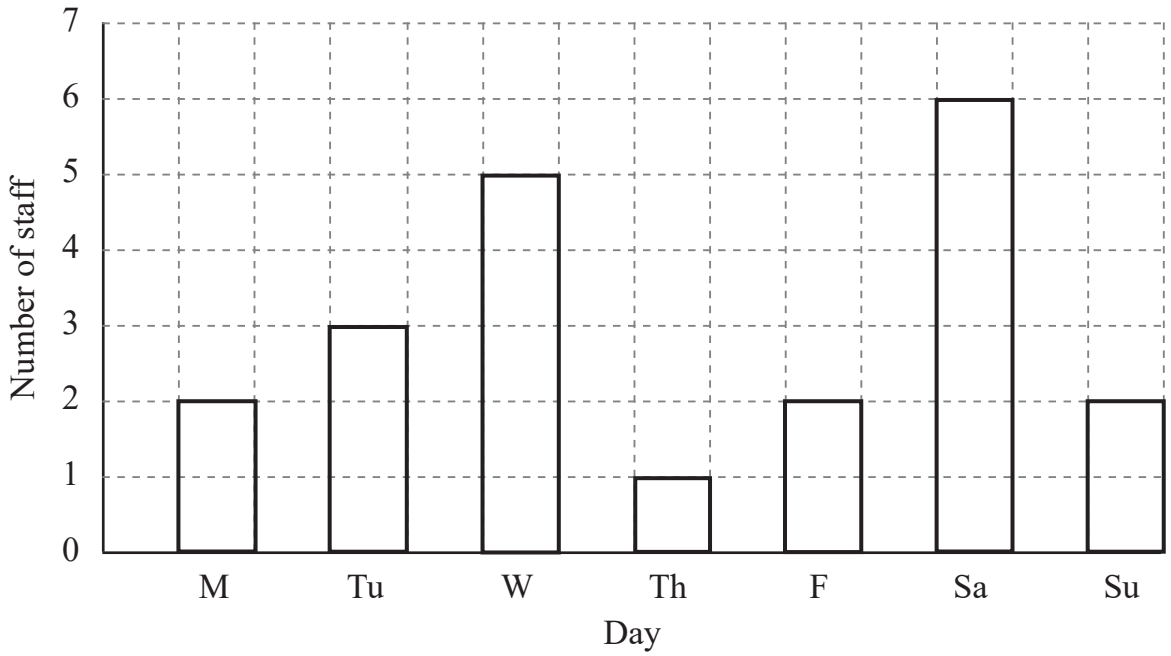
| | | | | | | |
|---|---|---|---|---|---|---|
| B | T | 4 | 8 | 9 | W | X |

[3]

Factors of 20: 1, 2, 4, 5  Multiples of 4: 4, 8
Square numbers: 1, 4, 9
4 + 8 + 9 = 21 ✓


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**7** The bar chart shows the number of staff absences each day last week.




**(a)** On how many days were there 3 or more staff absences?

Answer 3 days [1]

**(b)** What was the modal number of staff absences last week?

Answer 2 [1]

**(c)** How many staff absences were there altogether last week?

2 + 3 + 5 + 1 + 2 + 6 + 2 = 21

Answer 21 [2]

**[Turn over**

**(d)** The number of absences each week for 20 weeks is shown.

| | | | | |
|---|---|---|---|---|
| 11 | 14 | 7 | 13 | 19 |
| 5 | 12 | 18 | 21 | 15 |
| 16 | 8 | 14 | 10 | 17 |
| 9 | 4 | 20 | 16 | 8 |

Use this information to complete the frequency table below.

| Number of absences | Tally | Frequency |
|---|---|---|
| 0–5 | \|\| | 2 |
| 6–10 | 𝍸 | 5 |
| 11–15 | 𝍸 \| | 6 |
| 16–20 | 𝍸 \| | 6 |
| 21–25 | \| | 1 |

[2]

**8** **(a)** The warmest place in the world is in Ethiopia.

It has an average temperature of 34°C.



*Source: © Getty Images*

The coldest place in the world is in Antarctica.

It has an average temperature of –58°C.



*Source: © Getty Images*

What is the difference between these temperatures?

$34 - (-58) = 34 + 58 = 92$

Answer 92 °C [1]

**(b)** The formula below can be used to convert between temperatures in Celsius and Fahrenheit.

$$F = 1.8C + 32$$

where F is the temperature in Fahrenheit and C is the temperature in Celsius.

The average temperature in Northern Ireland is 8° Celsius.

**(i)** Convert this temperature into Fahrenheit.

$F = 1.8 \times 8 + 32$
$= 14.4 + 32 = 46.4$

Answer 46.4 °F [2]

**(ii)** Water freezes at 32° Fahrenheit.

What temperature is this in Celsius?

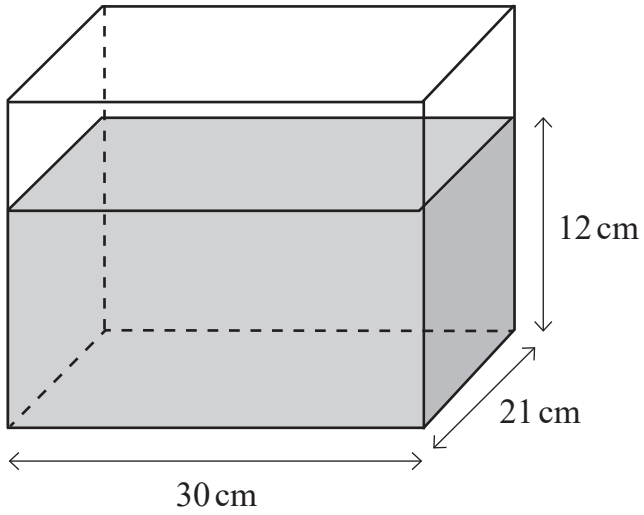
$32 = 1.8C + 32, \quad 1.8C = 0, \quad C = 0$

Answer 0 °C [1]

**[Turn over**

**9** A chip shop keeps gravy in a tin.

The tin is a cuboid.




**(a)** What is the volume of gravy in the tin?

Include units with your answer.

$V = 30 \times 21 \times 12$
$= 7560 \text{ cm}^3$

Answer $7560 \text{ cm}^3$ [3]

**(b)** The gravy is sold in 120 ml tubs.

How many tubs can be filled using the gravy in the tin?

$120 \text{ ml} = 120 \text{ cm}^3$
$7560 \div 120 = 63$

Answer 63 [2]

**10** **(a)** Priya earns £11.158 per hour.

Write this amount in pounds (£) correct to the nearest penny.

Answer £ 11.16 [1]

**(b)** Diesel costs 131.9p per litre.

Write this amount in pounds (£) correct to the nearest penny.

131.9p = £1.319

Answer £ 1.32 [1]

**(c)** Priya drove 11 760 miles last year.

$\frac{5}{7}$ of the miles driven were for work.

How many miles were for work?

11760 ÷ 7 = 1680
1680 × 5 = 8400

Answer 8400 miles [2]

**(d)** Priya's firm pays 70% of her car service.

Last year it cost £260 for her car service.

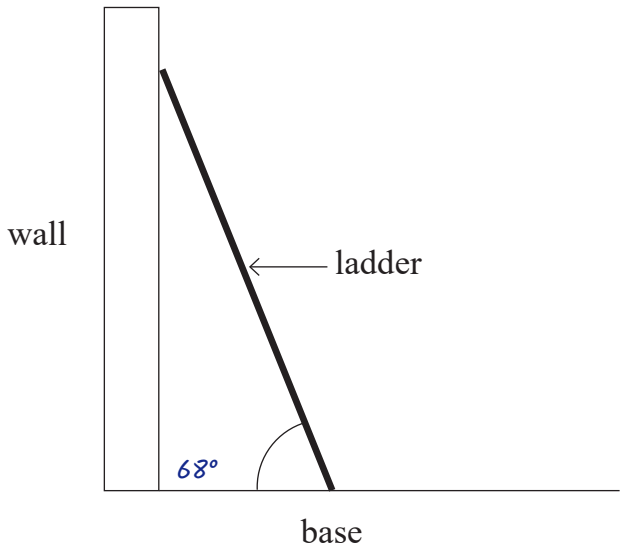
How much did Priya's firm pay?

70% of 260 = 0.7 × 260
= 182

Answer £ 182 [2]

**[Turn over**

**11** The diagram shows a ladder leaning against a wall.




In order to be safe, the angle at the base of a ladder should be between 72° and 78°

Is this ladder safe?

Explain your answer.

Answer No because the angle is 68°, less than 72° [2]

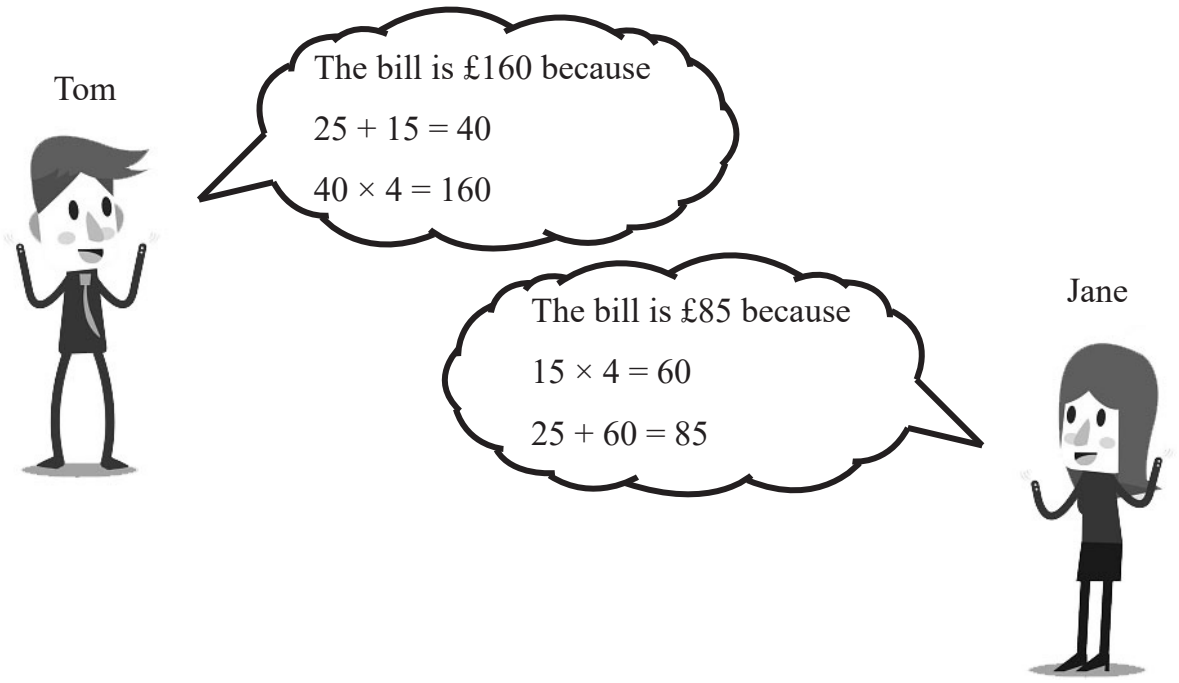
Angle measured with a protractor = 68°
68° is not between 72° and 78°

**12** A plumber charges a callout fee of £25 and an hourly rate of £15

His bill for a 4 hour job is found by working out

$$25 + 15 \times 4$$

Tom thinks the bill is £160 and Jane thinks it is £85




*Source: © Getty Images*

**(a)** Who is correct and why?

Answer Jane because she multiplied before adding

(BODMAS: × is done before +) [2]

**(b)** The plumber has taps for sale with 10% off.

How much would be saved on a tap costing £12.50?

10% of £12.50 = 12.50 ÷ 10 = £1.25

Answer £ 1.25 [1]

**[Turn over**

**13** The weights, in kg, of members of a rowing crew are

92.4 91.7 93.5 96.2 88.9 94.1

**(a)** Calculate the mean weight of the members.

92.4 + 91.7 + 93.5 + 96.2 + 88.9 + 94.1
= 556.8
556.8 ÷ 6 = 92.8

Answer 92.8 kg [3]

**(b)** Work out the range of the weights.

96.2 − 88.9 = 7.3

Answer 7.3 kg [1]

**(c)** The manager of the rowing crew says

"I cannot find the median weight of my crew because there are 6 of them, so none of their weights can be the middle value."

Is the manager correct?

Answer No because put them in order, the median is halfway between the 3rd and 4th values

(92.4 + 93.5) ÷ 2 = 92.95 kg [1]

**14**



*Source: © Getty Images*

Belfast Zoo has 120 different species of animals.

One quarter of the species are birds.

40% of the species are mammals.

What **fraction** of the species are neither birds nor mammals?

$\frac{1}{4}$ of 120 = 30 birds

40% of 120 = 0.4 × 120 = 48 mammals

120 − (30 + 48) = 42 neither

$\frac{42}{120} = \frac{7}{20}$

Answer $\frac{7}{20}$ [4]

**[Turn over**

**15** Work out the size of angle $y$ in the diagram below.

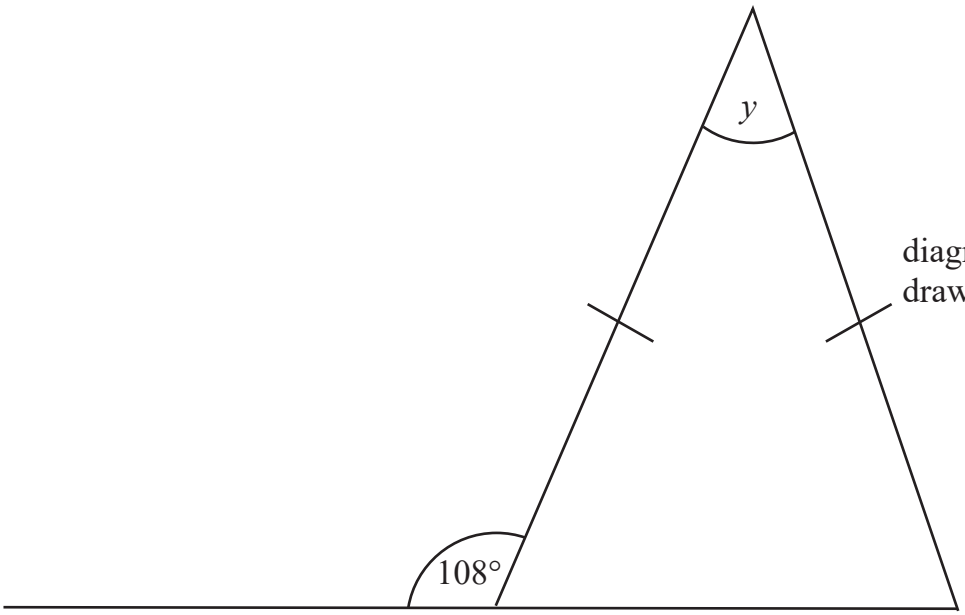



diagram not drawn accurately

180 – 108 = 72° (angles on a straight line add to 180°)
Isosceles triangle so the base angles are equal: 72° and 72°
y = 180 – (72 × 2) = 180 – 144 = 36° (angles in a triangle)

Answer $y$ = 36 ° [3]

**16** **(a)** Which of these is correct?

Circle the answer.

$2^3 = 6$ $3^3 = 81$ $5^3 = 125$

[1]

**(b)** **(i)** Calculate $8.5^3$

Answer 614.125 [1]

**(ii)** Round this answer to 1 significant figure.

Answer 600 [1]

**[Turn over**

**17** A building firm needs to put fencing around the perimeter of a rectangular site.

The dimensions of the site are shown in the diagram.

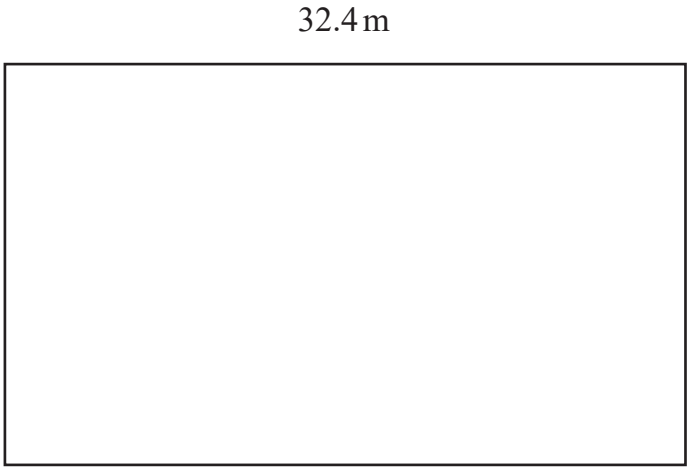



diagram not drawn accurately

**(a)** Calculate the total perimeter of the site.

32.4 + 22.8 + 32.4 + 22.8 = 110.4

Answer 110.4 m [1]

**(b)** Each section of fencing is 180 cm wide.

How many sections are needed to go around the perimeter of the site?

180 cm = 1.8 m
110.4 ÷ 1.8 = 61.333...
so 62 sections are needed

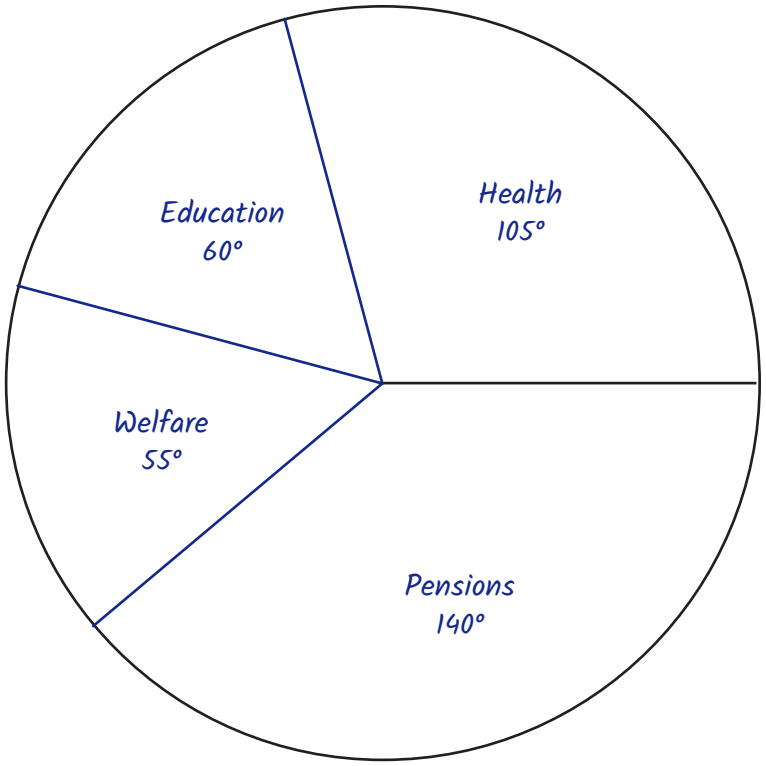
Answer 62 [2]

**18** The table below shows how an organisation spent its annual budget.

| Spending area | £ (millions) | Angle |
|---|---|---|
| Health | 21 | 21 × 5 = 105° |
| Education | 12 | 12 × 5 = 60° |
| Welfare | 11 | 11 × 5 = 55° |
| Pensions | 28 | 28 × 5 = 140° |

Draw a labelled pie chart to show this information.

Total = 21 + 12 + 11 + 28 = 72, 360 ÷ 72 = 5° per £1 million




[4]

**[Turn over**

**19** Debbie earns £9.50 an hour.

She is paid **double time** for overtime.

Robbie earns £12 an hour.

He is paid overtime at a rate of **time and a half**.

They both worked 6 hours on Saturday at their normal rate and 2 hours overtime.

Who earned more and how much more?

Debbie: 6 × 9.50 = 57
overtime rate = 2 × 9.50 = 19, 2 × 19 = 38
57 + 38 = £95

Robbie: 6 × 12 = 72
overtime rate = 1.5 × 12 = 18, 2 × 18 = 36
72 + 36 = £108

108 − 95 = £13

Answer Robbie earned £ 13 more [3]

**20** A club shop sold T-shirts and polo shirts in sizes small, medium and large.

They sold

- 4 small T-shirts
- 9 large polo shirts
- 8 medium T-shirts
- a total of 21 polo shirts
- a total of 11 small items
- a total of 15 large items

Use this information to complete the two-way table below.

| | T-shirt | Polo shirt | Total |
|---|---|---|---|
| **Small** | 4 | 7 | 11 |
| **Medium** | 8 | 5 | 13 |
| **Large** | 6 | 9 | 15 |
| **Total** | 18 | 21 | 39 |

[3]

**[Turn over**

**21** Clare buys some buns and a gift box for them.

The buns cost 55p each.

The gift box costs 80p.

She pays with a £10 note and receives £2.60 change.

How many buns did Clare buy?

Show all your working.

£10 − £2.60 = £7.40
£7.40 − £0.80 = £6.60 for buns
660p ÷ 55p = 12

Answer 12 [3]

**22** Jenny has $p$ paintbrushes and $c$ crayons.

**(a)** Kev has twice as many paintbrushes and three times as many crayons as Jenny.

Write an expression for Kev's total, in terms of $p$ and $c$.

Answer $2p + 3c$ [1]

**(b)** Lily has the same number of paintbrushes and three-quarters of the number of crayons that Jenny has.

Write an expression for Lily's total, in terms of $p$ and $c$.

Answer $p + \frac{3}{4}c$ [1]

**(c)** Dan has 3 fewer paintbrushes and 4 more crayons than Jenny.

Write an expression for Dan's total, in terms of $p$ and $c$.

Give your answer in its simplest form.

$(p - 3) + (c + 4) = p + c + 1$

Answer $p + c + 1$ [1]

**[Turn over**

**23** 20 patients were asked how many weeks they had been waiting for an appointment to see a consultant.

Their answers were

| | | | | |
|---|---|---|---|---|
| 38 | 15 | 4 | 3 | 56 |
| 42 | 28 | 21 | 39 | 12 |
| 8 | 17 | 47 | 58 | 43 |
| 30 | 16 | 34 | 29 | 39 |

Display these results in a stem and leaf diagram.

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

Key: 2 | 1 means 21 weeks

[3]

**24** In a class, 3 of the 10 girls wear glasses.

In the same class, 3 of the 18 boys wear glasses.

What percentage of the class wear glasses?

**Give your answer correct to 2 decimal places.**

$3 + 3 = 6$ wear glasses, $10 + 18 = 28$ in class

$\frac{6}{28} \times 100 = 21.428571\ldots = 21.43$

Answer 21.43 % [3]

**[Turn over**

**25** Gail wants to do some research into people's spending on food.

**(a)** She decides to use the following question in her survey.

How much money do you spend on food?

£0–10 ☐ £20–30 ☐ £40–50 ☐ over £50 ☐

Give two possible reasons why people may be confused by this question.

Reason 1 *It gives no time period (per week, per month or per year?)*

Reason 2 *There are gaps, e.g. £15 or £35 have no box to tick* [2]

**(b)** Gail decides to survey 10 people.

Why might this lead her to make unreliable conclusions?

Answer *a sample of 10 people is too small* [1]

**26** I spent $2\frac{1}{2}$ hours on my homework last night.

One third of that time was spent on Geography and half of the time spent on Geography was on map work.

What **fraction** of my homework time was spent on map work?

$2\frac{1}{2}$ hours = 150 minutes

$\frac{1}{3}$ of 150 = 50 minutes (Geography)

$\frac{1}{2}$ of 50 = 25 minutes (map work)

$\frac{25}{150} = \frac{1}{6}$

Answer $\frac{1}{6}$ [3]

**27** Solve $5(p - 3) = 20$

$5p - 15 = 20$
$5p = 20 + 15$
$5p = 35$
$p = 35 \div 5 = 7$

Answer $p =$ 7 [3]

**[Turn over**

**28** The diagram shows a "figure of 8" shaped race track, which has a semi-circular section at either end.

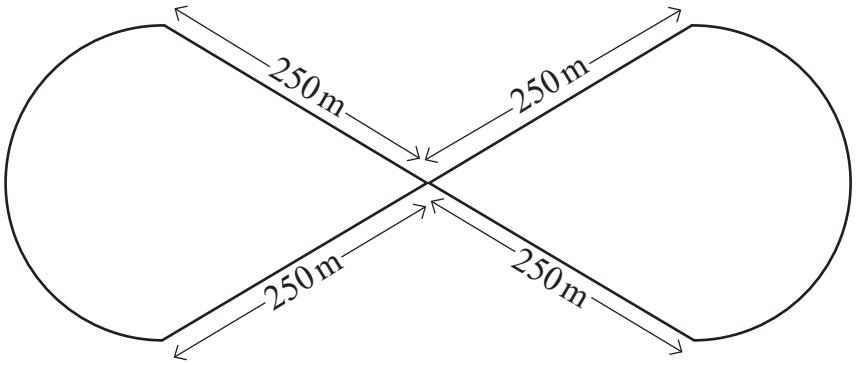



diagram not drawn accurately

**(a)** Calculate the total distance travelled during one complete lap of the track.

Two semicircles make one circle, d = 250 m
π × 250 = 785.3981...
Straights: 4 × 250 = 1000
785.3981... + 1000 = 1785.3981...

Answer 1785.4 m [3]

**(b)** A horse runs 2000 metres at an average speed of 14.5 m/s.

How long does this take?

Give your answer in minutes and seconds, to the nearest second.

time = distance ÷ speed
2000 ÷ 14.5 = 137.9310... seconds
2 minutes = 120 seconds
137.9310... − 120 = 17.93... ≈ 18 seconds

Answer 2 minutes 18 seconds [3]

**THIS IS THE END OF THE QUESTION PAPER**

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|---|---|
| **Question Number** | **Marks** |
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| **Total Marks** | |

**Examiner Number**

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Rewarding Learning

General Certificate of Secondary Education
Summer 2022

# GCSE Mathematics

# FOUNDATION TIER
# ADDITIONAL SUPPORT MATERIALS
# (For use in Summer 2022)



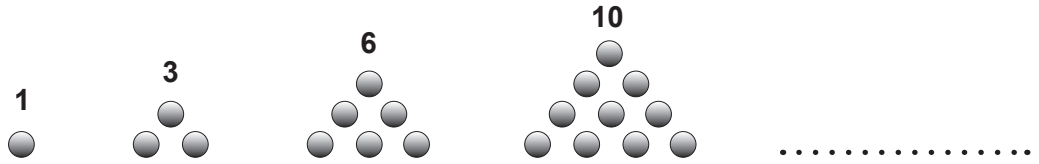
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## FOUNDATION TIER ADDITIONAL SUPPORT MATERIALS (Summer 2022)

**Numbers**

Lowest common multiple (LCM): The lowest common multiple is the lowest multiple shared by 2 or more numbers.

Triangular numbers – are a pattern of numbers which form triangles. Each number in the sequence adds a new row of dots to the triangle.




**Trial and Improvement**

This is a method of trying different values in an equation until you get a suitable solution (e.g to 1 decimal place).

**Measures**

**Conversion from metric to imperial units**

1 kg = 2.2 pounds (lb)

**Metric units**

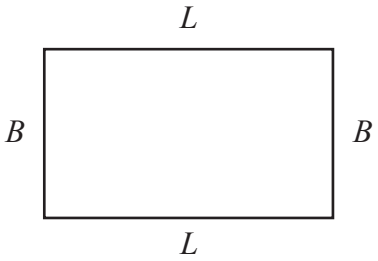
1 ml = 1 $cm^3$

**Compound Measures**

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

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

**Perimeter and Volume**




The perimeter of a rectangle is the distance around the outside of the rectangle. It is found by adding the lengths of the 4 sides of the rectangle.

$P = 2L + 2B$ where $P$ is perimeter, $L$ 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 circumference (perimeter) of a circle is $C = 2\pi r$ where $r$ is the radius of the circle. An alternative formula is $C = \pi d$ where $d$ is the diameter of the circle.

**Geometry and Angles**

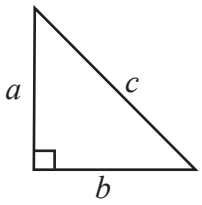
There are 180° on a straight line.
There are 180° inside a triangle.
An isosceles triangle is a triangle with 2 equal sides and 2 equal angles.
The sum of all the angles inside a polygon is given by $180(n - 2)$ where $n$ is the number of sides in the polygon.


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**Pythagoras' Theorem**

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

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




**Range**

The range of a set of data is the difference between the largest value and the smallest value in the data set.

**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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