Surname	StemUp Model Solution	Centre Number	Candidate Number
Other Names			0

GCSE

3310U40-1

S18-3310U40-1

MATHEMATICS – NUMERACY
UNIT 2: CALCULATOR-ALLOWED
INTERMEDIATE TIER

THURSDAY, 10 MAY 2018 – MORNING

1 hour 45 minutes

ADDITIONAL MATERIALS

A calculator will be required for this paper.

A ruler, a protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided.

If you run out of space, use the continuation page at the back of the booklet. Question numbers must be given for the work written on the continuation page.

Take π as 3·14 or use the π button on your calculator.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

In question **2***(a)*, the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**6**	
2.	**9**	
3.	**6**	
4.	**4**	
5.	**9**	
6.	**6**	
7.	**5**	
8.	**6**	
9.	**9**	
10.	**8**	
11.	**5**	
12.	**7**	
Total	**80**	

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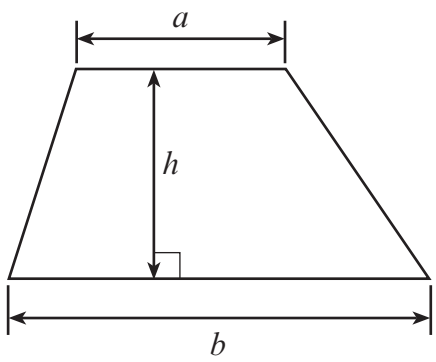
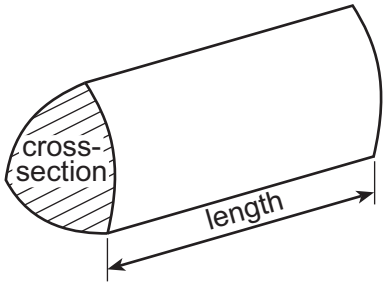
Formula List – Intermediate Tier

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



Volume of prism = area of cross-section × length



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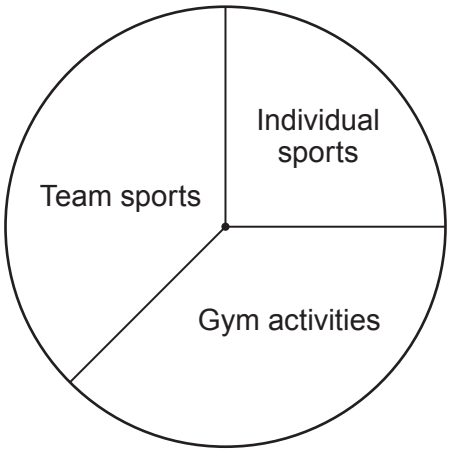
1. In a survey, 720 students were asked if they preferred to take part in *gym activities*, *team sports* or *individual sports*.
They were asked to choose just one of these options.
The results are displayed in the pie chart below.



(a) How many students selected *individual sports*?
Circle your answer. [1]

90 180 270 405 540

(b) Carwyn plans to split *team sports* on the pie chart into *football* and *other team sports*.
Of the students who selected *team sports*, $\frac{2}{5}$ said their preferred team sport was *football*.
What angle should Carwyn draw to represent *football*? [3]

Angle for team sports (measured) = 135°

Angle for football = $\frac{2}{5} \times 135°$

= 54°

Angle is 54 °

(c) 720 students took part in the survey. Only 45% were **female**.
How many **males** took part in the survey? [2]

Percentage male = 100% − 45% = 55%

Number of males = 0.55 × 720 = 396

Number of males is 396

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2. Miss Price has received her total bill for water.
It is based on estimates of how much fresh water is used and how much waste water is produced.
Her bill is £58.80.

Miss Price's **actual** use of water was as follows:
- fresh water used 25·25 m^3,
- waste water produced 22·31 m^3.

Fresh water used costs £1.08 per m^3.
Waste water produced costs £1.70 per m^3.

(a) *In this part of the question, you will be assessed on the quality of your organisation, communication and accuracy in writing.*

By how much has Miss Price been overcharged or undercharged?
You must show all your working. [4 + 2 OCW]

Cost of fresh water = 25.25 × £1.08 = £27.27

Cost of waste water = 22.31 × £1.70 = £37.927

Actual total cost = £27.27 + £37.927

= £65.197

= £65.20 (to the nearest penny)

Difference = £65.20 − £58.80 = £6.40

The bill of £58.80 is less than the actual cost of £65.20,

so Miss Price has been undercharged by £6.40.

(b) (i)

Remember 1 m^3 ≈ 220 gallons

Use this conversion to calculate how much fresh water Miss Price used in gallons. [2]

Fresh water in gallons = 25.25 × 220 = 5555

5555 gallons

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(ii) Explain why your answer in part *(b)*(i) is not the exact number of gallons Miss Price used. [1]

The conversion 1 m^3 ≈ 220 gallons is only approximate,

so my answer is not exact.

3. Emrys, Layla and Rhys go shopping together for fruit.
They buy pears and apples from a market stall.

Emrys buys 3 pears and 1 apple for £1.22.

Layla buys 3 apples for 78p.

Rhys buys 5 pears and 2 apples.

How much change will Rhys receive from £5 when paying for 5 pears and 2 apples? [6]

Cost of 1 apple = 78p ÷ 3 = 26p

Cost of 3 pears = £1.22 − 26p = 122p − 26p = 96p

Cost of 1 pear = 96p ÷ 3 = 32p

Cost of 5 pears = 5 × 32p = 160p = £1.60

Cost of 2 apples = 2 × 26p = 52p = £0.52

Rhys pays £1.60 + £0.52 = £2.12

Change = £5 − £2.12 = £2.88

Change from £5 is £ 2.88

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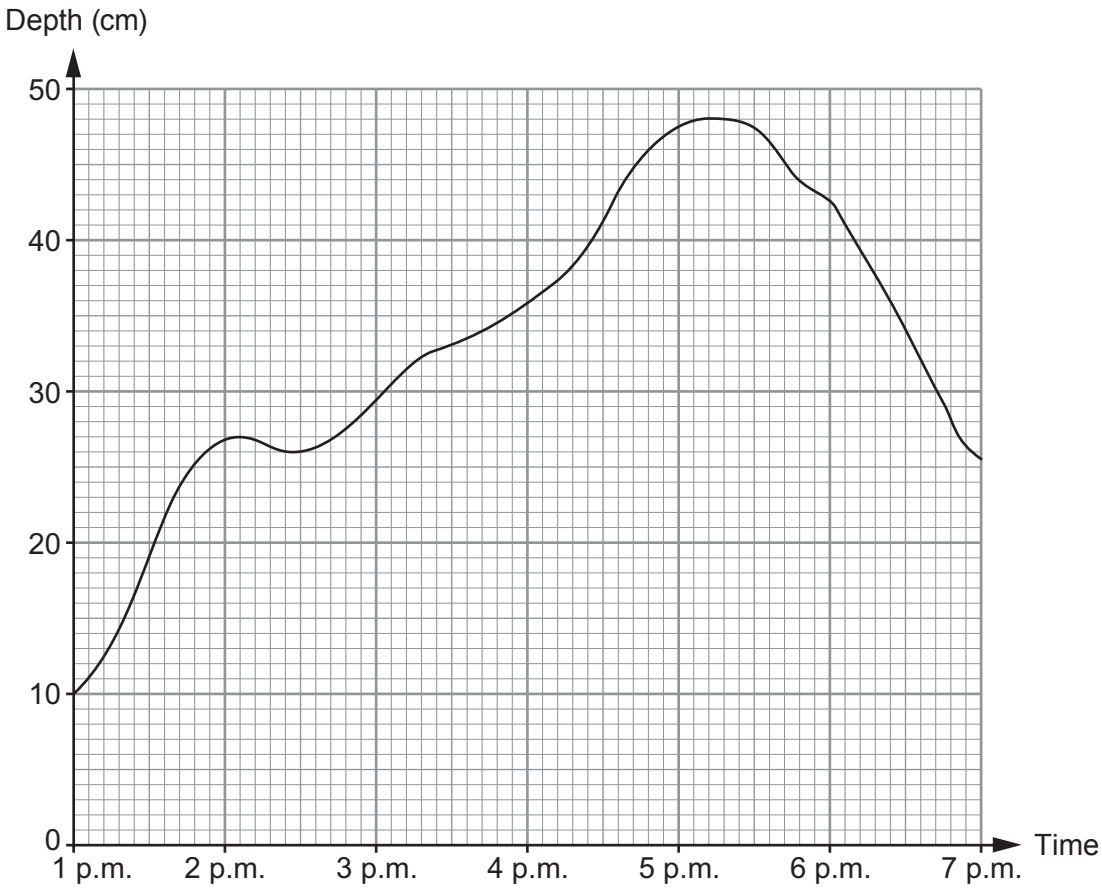
4. Carys has to write a report on the water levels of the River Tad.
She has recorded the depth of the water in the River Tad between 1 p.m. and 7 p.m.
This is shown in her graph below.



(a) What was the greatest recorded depth of water in the river?
Circle your answer. [1]

26 cm 27 cm 46 cm 48 cm 50 cm

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(b) In which of these 15-minute periods was the depth of water increasing most rapidly? Circle your answer. [1]

1:15 p.m. to 1:30 p.m. 4:15 p.m. to 4:30 p.m. 5:00 p.m. to 5:15 p.m.

6:00 p.m. to 6:15 p.m. 6:15 p.m. to 6:30 p.m.

(c) Carys looks at the part of the graph for the period 6 p.m. to 7 p.m. Describe what this tells her about the river. [1]

The depth of the water in the river is decreasing (the water level is falling).

(d) For what period of time was the depth of water in the river greater than 45 cm? Circle your answer. [1]

48 minutes 1 hour 1 hour 12 minutes

1 hour 24 minutes 1 hour 30 minutes

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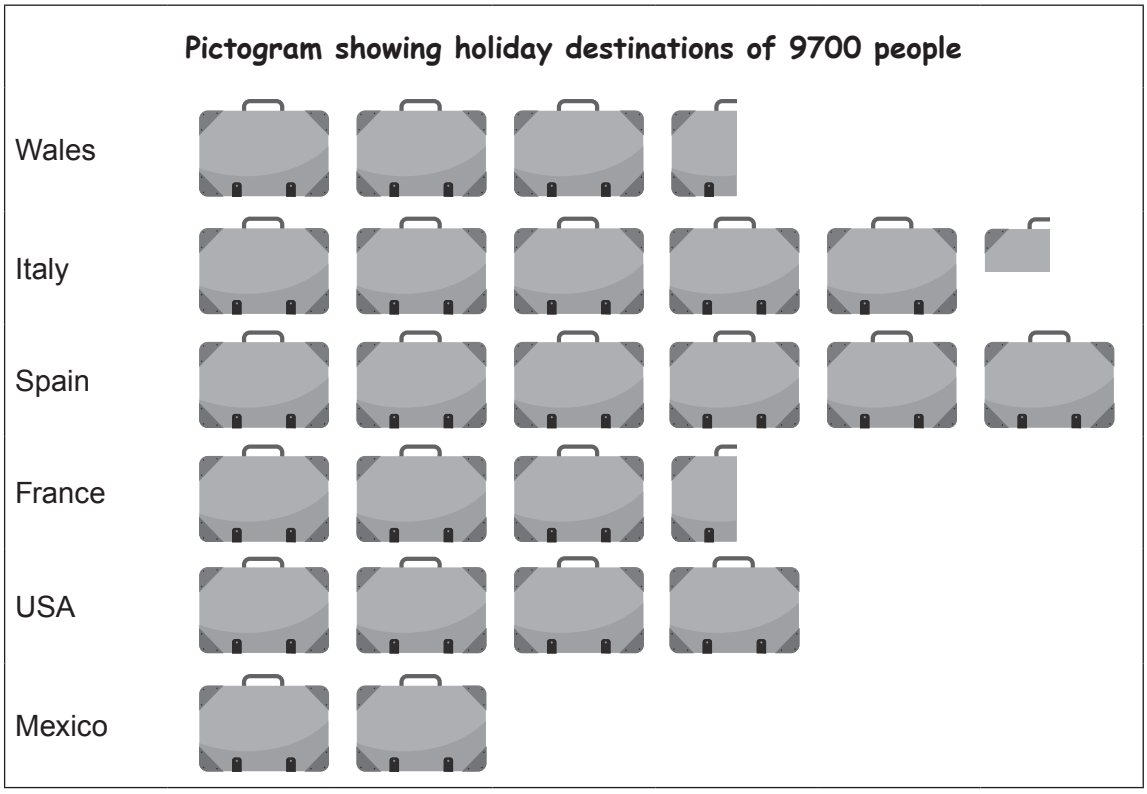
5. Mena is going on holiday.
She hasn't decided where to go yet.
In a travel brochure, Mena sees a pictogram showing the holiday destinations of 9700 people.



(a) Complete the key for the pictogram. [3]

represents ....400.... people

Number of symbols = 3.5 + 5.25 + 6 + 3.5 + 4 + 2 = 24.25

One symbol = 9700 ÷ 24.25 = 400 people

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(b) What is the following ratio in its **simplest form**?

number of people who went to Spain : number of people who went to the USA

Circle your answer. [1]

6 : 4 4 : 6 400 : 600 3 : 2 2 : 3

(c) Look at the pictogram. The ratio of the number of people who went to Wales to the number of people who went to another country is 2 : 3.
Which country is this? [1]

2 : 3

Wales : Italy

Wales : Italy = 3.5 : 5.25 = 2 : 3

(d) Mena goes on holiday to France.
She takes 590 euros with her on holiday.

Mena only spends 40% of her euros.

When she returns from holiday, she exchanges her remaining euros for pounds.
The exchange rate is £1 = 1.18 euros.
How many pounds does Mena receive? [4]

Euros spent = 40% of 590 = 0.4 × 590 = 236 euros

Euros left = 590 − 236 = 354 euros

Pounds received = 354 ÷ 1.18 = £300

Mena receives £300.

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6. Grace sees a newspaper advertisement for *Blake's Mopeds*.

Blake's Mopeds

Best deal!
Valid if you show this advertisement.

Moped £400

Helmet should be £80, we offer 15% off this price

Other costs payable are
- insurance £151.20, and
- vehicle tax £37.

Grace is planning to save for this offer.
She also wants to save enough money for the first month's fuel.

The moped travels 20 miles on each litre of fuel.
A litre of fuel costs £1.26.
Grace estimates she will travel approximately 350 miles each month on her moped.

Starting this month, Grace will be able to save £60 per month.

After how many **complete** months will Grace have saved enough money for this offer, including the first month's fuel?
You must show all your working. [6]

Helmet = £80 − 15% of £80 = 0.85 × £80 = £68

Fuel for first month = 350 ÷ 20 = 17.5 litres

Cost of fuel = 17.5 × £1.26 = £22.05

Total cost = £400 + £151.20 + £37 + £68 + £22.05

= £678.25

Months needed = 678.25 ÷ 60 = 11.304...

After 11 months: 11 × £60 = £660, not enough.

After 12 months: 12 × £60 = £720, enough.

Grace will have saved enough after 12 complete months.

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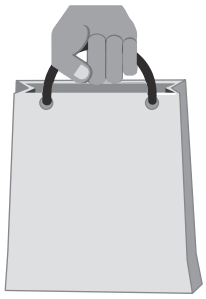
7. In October 2011, a charge of 5p for a carrier bag was introduced in Wales.
Money raised from this charge is given to charity.



For the period 1st October 2011 to 31st January 2015, it was estimated that a total of between £16.8 million and £21.9 million was donated to charity. This is as a result of people buying 5p carrier bags.

(a) Calculate an estimate of how much per month was given to charity between 1st October 2011 and 31st January 2015.

You must show all your working. [4]

Time from 1st Oct 2011 to 31st Jan 2015 = 3 years 4 months

= 3 × 12 + 4 = 40 months

Estimate of total = (16.8 + 21.9) ÷ 2 = £19.35 million

Amount per month = £19.35 million ÷ 40

= £0.48375 million

≈ £484 000 per month (about £0.48 million)

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(b) Over time, there has been a reduction in the use of 5p carrier bags. This is because more people are using their own bags.

What impact might this have had on the amount given to charity for the month of September 2014 when compared with September 2012? [1]

Less money would have been given to charity in September 2014 than in September 2012, as fewer 5p bags were being bought.

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8. *(a)* Megan and Rhodri both set out at the same time from home to go to the swimming pool.
Rhodri travels by car.
Megan cycles straight through the park.

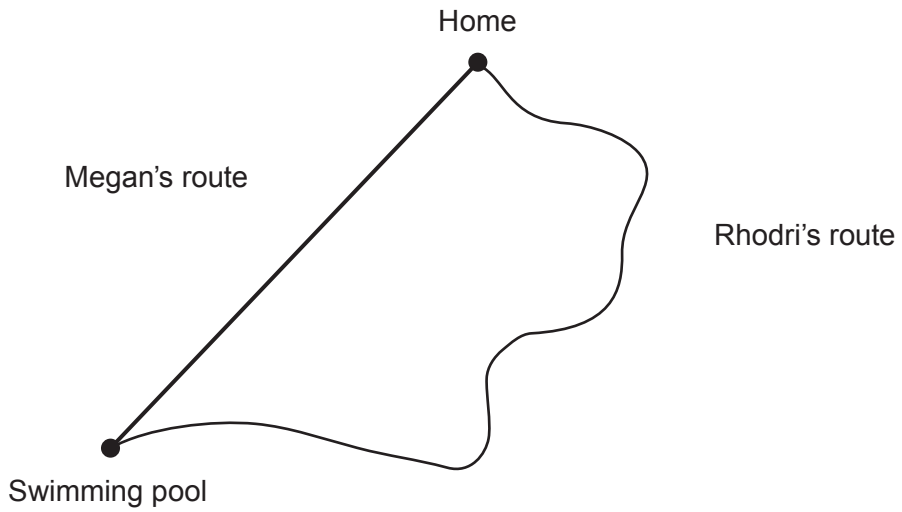

Diagram not drawn to scale

Rhodri's journey by car is 5·5 miles.
His average speed for the journey is 22 mph.

Megan's average speed on her bike is 12 mph.
Megan arrives at the swimming pool 5 minutes before Rhodri.

Calculate the distance Megan cycles.
Give your answer in miles.
You must show all your working. [5]

Rhodri's time = distance ÷ speed = 5.5 ÷ 22 = 0.25 hours

0.25 hours = 0.25 × 60 = 15 minutes

Megan's time = 15 − 5 = 10 minutes = 10 ÷ 60 hours

Megan's distance = speed × time = 12 × 10 ÷ 60

= 2 miles

Distance Megan cycles is 2 miles

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(b) Gary travelled a distance of 231 km in 3 hours and 30 minutes.
Calculate Gary's average speed in km/h.
Circle your answer. [1]

0·015 1·1 66 70 77

3 hours 30 minutes = 3.5 hours, 231 ÷ 3.5 = 66 km/h

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9. Yared is going to make a door wedge.

(a) The cross-section of the wedge is shown below.
The horizontal length is 12 cm and the vertical height is 3 cm.

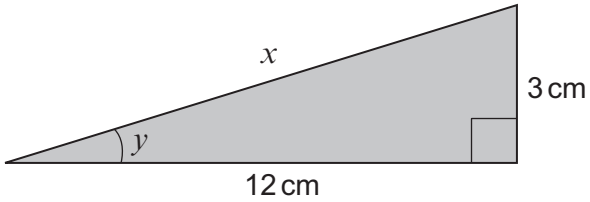

Diagram not drawn to scale

(i) Calculate the length x.

Give your answer correct to 3 significant figures. [4]

$x^2 = 3^2 + 12^2$

$x^2 = 9 + 144 = 153$

$x = \sqrt{153} = 12.369...$

x = 12.4 cm

(ii) The wedge must fit under Yared's door.
The angle y must be less than 15°.
Show that this wedge will fit under Yared's door.
You must show all your working. [3]

$\tan y = \text{opp} \div \text{adj} = 3 \div 12 = 0.25$

$y = \tan^{-1}(0.25) = 14.036...°$

$y = 14.0°$, which is less than 15°,

so the wedge will fit under Yared's door.

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(b) Yared decides to make a larger wedge that is mathematically **similar** to the one shown in part *(a)*.
This wedge is to have a vertical height of 4·5 cm.

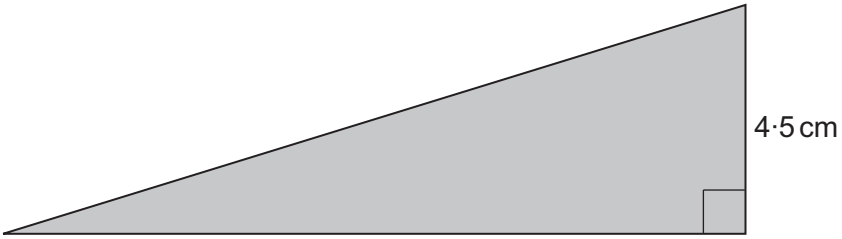

Diagram not drawn to scale

Calculate the horizontal length of this door wedge. [2]

Scale factor = 4.5 ÷ 3 = 1.5

Horizontal length = 12 × 1.5 = 18 cm

The wedge will be 18 cm long

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10. A grass racetrack is shown in the diagram below.
This is the region shaded in the diagram.
Each end of the grass racetrack is created from semicircles.
The inner semicircles have a radius of 15 m.
The outer semicircles have a radius of 20 m.
Each of the straight sections of the racetrack has a length of 65 metres.

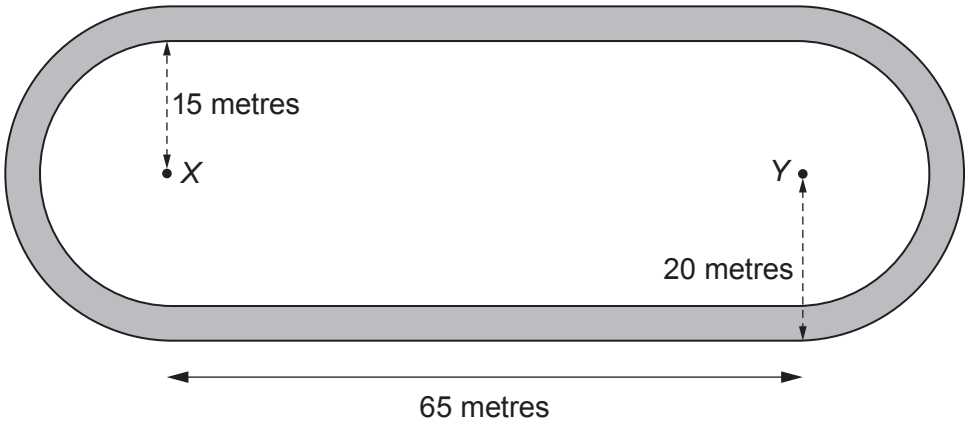

Diagram not drawn to scale

(a) What is the total area of grass in the two **straight** sections of the racetrack?
You must show all your working. [2]

Width of track = 20 − 15 = 5 m

Area of one straight section = 65 × 5 = 325 m^2

Area of two straight sections = 2 × 325 = 650 m^2

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(b) Calculate the area of the grass racetrack.
You must show all your working. [4]

The two ends together make a full circle (2 semicircles).

Area of outer circle = $\pi \times 20^2$ = 1256.637... m^2

Area of inner circle = $\pi \times 15^2$ = 706.858... m^2

Area of grass at the ends = 1256.637... − 706.858...

= 549.778... m^2

Total area = 549.778... + 650 = 1199.778... m^2

Area of grass racetrack ≈ 1200 m^2

(c) The grass is to be treated with a fertiliser.
It costs 20p to treat each 3 m^2 of grass.
How much will it cost to treat the grass racetrack?
Give your answer correct to the nearest pound.
You must show all your working. [2]

Number of 3 m^2 lots = 1199.778... ÷ 3 = 399.926...

Cost = 399.926... × £0.20 = £79.985... ≈ £80

Cost is £ 80

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11. Hot water is often stored in cylinders.
The water in the cylinder is heated for use in the shower.

A plumbing engineer wants to calculate how long a shower can be used continuously before the water runs cold. He uses the following formulae:

$$C = \frac{H(X - M)}{M - Y} \quad \text{and} \quad T = \frac{C + H}{F}$$

Where:

C is the additional volume of water that feeds into the cylinder, in litres.

H is the volume of hot water that the cylinder holds, in litres.

M is the temperature of the water in the shower, in °C.

X is the temperature of the hot water in the cylinder, in °C.

Y is the temperature of the cold water that feeds into the cylinder, in °C.

T is the time spent using the shower before the water runs cold, in minutes.

F is the rate of flow of water in the shower, in litres per minute.

Daisy's cylinder holds 300 litres of hot water.
The temperature of the hot water in her cylinder is 60°C.
The temperature of the cold water that feeds into Daisy's cylinder is 8°C.

The water in Daisy's shower is set at a temperature of 32°C.
Her shower has a rate of flow of 26 litres per minute.

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Use the formulae to calculate

- the additional volume of water that feeds into Daisy's cylinder, in litres,
- the number of minutes Daisy's shower will run continuously before the water runs cold.

[5]

$H = 300, \quad X = 60, \quad Y = 8, \quad M = 32, \quad F = 26$

$C = H(X - M) \div (M - Y)$

$C = 300 \times (60 - 32) \div (32 - 8)$

$C = 300 \times 28 \div 24 = 8400 \div 24$

$C = 350$ litres

$T = (C + H) \div F$

$T = (350 + 300) \div 26$

$T = 650 \div 26 = 25$ minutes

The additional volume of water that feeds in is 350 litres.

Daisy's shower will run for 25 minutes before the water runs cold.

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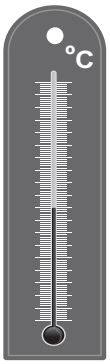
12. Dr Khan and her daughter Faryl have different opinions about the mean temperature in their hallway.



Dr Khan and Faryl recorded the temperature in the hallway at 4 p.m. each day during the 30 days of April.

(a) In her note pad, Dr Khan summarised the temperatures in a grouped frequency table.

Unfortunately, Dr Khan has torn the page containing the table from her note pad and has lost some of the original data.

Temperature, t (°C)	Number of days
$20 \leqslant t < 21$	4
$21 \leqslant t < 22$	8
$22 \leqslant t < 23$	8
$23 \leqslant t < 24$	10

Calculate an estimate of the mean temperature at 4 p.m. for these 30 days in Dr Khan's hallway. [5]

Missing number of days = 30 − (4 + 8 + 8) = 10

Midpoints: 20.5, 21.5, 22.5, 23.5

$\Sigma fx = 20.5 \times 4 + 21.5 \times 8 + 22.5 \times 8 + 23.5 \times 10$

$= 82 + 172 + 180 + 235 = 669$

Estimate of mean = 669 ÷ 30 = 22.3 °C

Estimate of the mean temperature at 4 p.m. for April in the hallway is 22.3 °C

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(b) What assumption have you made in calculating an estimate of the mean temperature at 4 p.m. for April in Dr Khan's hallway? [1]

I assumed that every temperature in each group was equal to the midpoint of its group.

(c) Faryl recorded the same temperatures as her mother at 4 p.m. each day during April. She found that the **actual** mean temperature in the hallway during April was **lower** than the correctly calculated estimate of the mean.

Explain how this can be true. [1]

Many of the actual temperatures were towards the lower end of their groups (below the midpoints), so the actual mean is lower than the estimate calculated using the midpoints.

END OF PAPER

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Question number	Additional page, if required. Write the question number(s) in the left-hand margin.	Examiner only

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