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National
Qualifications
SPECIMEN ONLY

Mark

S844/75/01

Applications of Mathematics Paper 1 (Non-Calculator)

Date — Not applicable

Duration — 1 hour 5 minutes



Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth

Day

Month

Year

Scottish candidate number

Total marks — 45

Attempt ALL questions.

You may NOT use a calculator.

To earn full marks you must show your working in your answers.

State the units for your answer where appropriate.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting.

Use **blue** or **black** ink.

Before leaving the examination room you must give this booklet to the Invigilator; if you do not, you may lose all the marks for this paper.

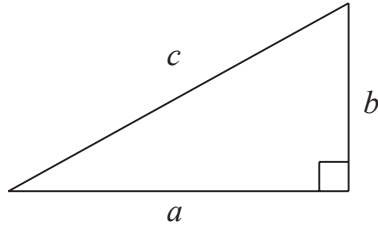


FORMULAE LIST

Circumference of a circle: $C = \pi d$

Area of a circle: $A = \pi r^2$

Theorem of Pythagoras:



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

Volume of a cylinder: $V = \pi r^2 h$

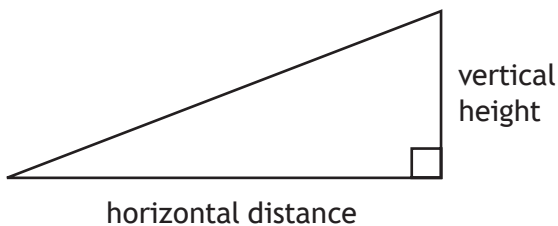
Volume of a prism: $V = Ah$

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

Volume of a sphere: $V = \frac{4}{3} \pi r^3$

Standard deviation: $s = \sqrt{\frac{\sum(x - \bar{x})^2}{n-1}} = \sqrt{\frac{\sum x^2 - (\sum x)^2/n}{n-1}}$, where n is the sample size.

Gradient:



$$\text{gradient} = \frac{\text{vertical height}}{\text{horizontal distance}}$$



Total marks — 45
Attempt ALL questions

1. Liam is on holiday in New York.
He looks at the world time app on his phone.
The display shows the times below:



His flight to Glasgow departs New York at 8:00 am local time.
The flight time is 6 hours 30 minutes.
Calculate the local time when the plane lands in Glasgow.

2



2. 56 pupils were asked to choose their favourite subject.
The results are shown in the table below.

Subject	Boys	Girls
Geography	11	7
French	9	14
Maths	18	13
Spanish	10	12
Modern Studies	18	8
Total	66	54

Calculate the probability that a boy from this group chose French as his favourite subject.

Give your answer as a fraction in its simplest form.

2

3. A company orders a bag of washers with a thickness of 2.4 ± 0.05 mm.
An inspector takes a sample from the bag of washers.
The thicknesses, in mm, of the washers in this sample are shown below.

2.44, 2.37, 2.36, 2.45, 2.35

2.35, 2.44, 2.43, 2.34, 2.40

2.40, 2.41, 2.39, 2.38, 2.46

2.41, 2.39, 2.53, 2.36, 2.37

For the bag to be accepted, at least 88% of the washers in this sample must be within tolerance.

Will the bag be accepted?

3



4. The table below shows the vehicle tax to be paid on different vehicles.

The amount of vehicle tax paid depends on the CO₂ emissions of the vehicle and the fuel type.

		Tax for Petrol and Diesel Cars				
		Non Direct Debit		Direct Debit		
Bands	CO ₂ emission figure (g/km)	12 months	Six months	Single 12 month payment	Total payable by 12 monthly instalments	Single six month payment
Band A	Up to 100	£0	–	–	–	–
Band B	101 to 110	£20	–	£20	£21	–
Band C	111 to 120	£30	–	£30	£31.50	–
Band D	121 to 130	£110	£60.50	£110	£115.50	£57.75
Band E	131 to 140	£130	£71.50	£130	£136.50	£68.25
Band F	141 to 150	£145	£79.75	£145	£152.25	£76.13
Band G	151 to 165	£180	£99	£180	£189	£94.50
Band H	166 to 175	£205	£112.75	£205	£215.25	£107.63
Band I	176 to 185	£225	£123.75	£225	£236.25	£118.13
Band J	186 to 200	£265	£145.75	£265	£278.25	£139.13
Band K	201 to 225	£290	£159.50	£290	£304.50	£152.25
Band L	226 to 255	£490	£269.50	£490	£514.50	£257.25
Band M	Over 255	£505	£277.75	£505	£530.25	£265.13

Tom buys a petrol car which has a CO₂ emission figure of 142 g/km.

Tom decides to pay his vehicle tax by direct debit in two single six month payments.

How much more expensive is this than a single 12 month payment by direct debit?

3



* S 8 4 4 7 5 0 1 0 5 *

5. This back-to-back stem and leaf diagram represents the number of hours a class spends on social networking websites in a week.

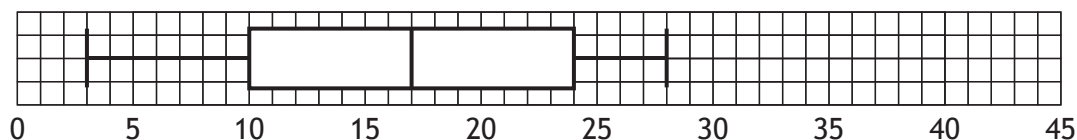
Girls		Boys
	0	3 6 8 9
8 4 3 0	1	1 2 4 7 7 8 9
9 8 7 6 2 2 1	2	2 6 7 8 8
7 2 0	3	
2	4	

n = 15 n = 16

KEY

3 | 1 | represents 13 hours
 2 | 5 | represents 25 hours

- (a) A boxplot is drawn to represent one set of data.



Which set of data does this represent?

Give a reason for your answer.

1

- (b) For the other set of data, state:

the median

the lower quartile

the upper quartile.

2

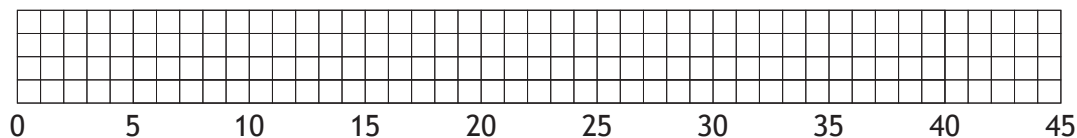


5. (continued)

(c) Construct a box plot for the second set of data.

2

(An additional diagram, if required, can be found on *page 16*.)



6. Mo is an electrician.

The table below shows the hours that Mo worked last week.

Monday	09:00 to 12:30	13:30 to 18:00	
Tuesday	09:00 to 12:30	13:30 to 18:00	
Wednesday	09:00 to 12:30	13:30 to 18:00	18:30 to 21:30
Thursday	09:00 to 12:30	13:30 to 18:00	18:30 to 21:30
Friday	09:00 to 12:30	13:30 to 18:00	

His basic hourly rate is £15.60.

Hours worked between 6 pm and 7 am are paid at time and a half.

Calculate his gross pay for last week.

3



* S 8 4 4 7 5 0 1 0 7 *

7. Jack is going to a festival in the Czech Republic from his home in Glasgow. His mum orders the tickets costing 1500 Czech Koruna. His mum lives in Poland so he must pay her back in Polish Zloty.

Rates of exchange	
Pounds Sterling (£)	Other Currencies
1	30.00 Czech Koruna
1	4.96 Polish Zloty

Calculate how many Polish Zloty he must give to his mum.

2



8. A class of pupils were asked about how they travelled to school on a particular day.

- $\frac{1}{6}$ of the pupils were driven to school in a car.
- $\frac{2}{5}$ of the pupils took the bus.
- The rest of the pupils walked to school.

Calculate the fraction of pupils who walked to school.

3

9. It takes 5 bakers 3 hours to decorate a tray of cupcakes.

All the bakers work at the same rate.

Calculate the time taken for 4 bakers working at this rate to decorate the same number of cupcakes.

Give your answer in **hours and minutes**.

3

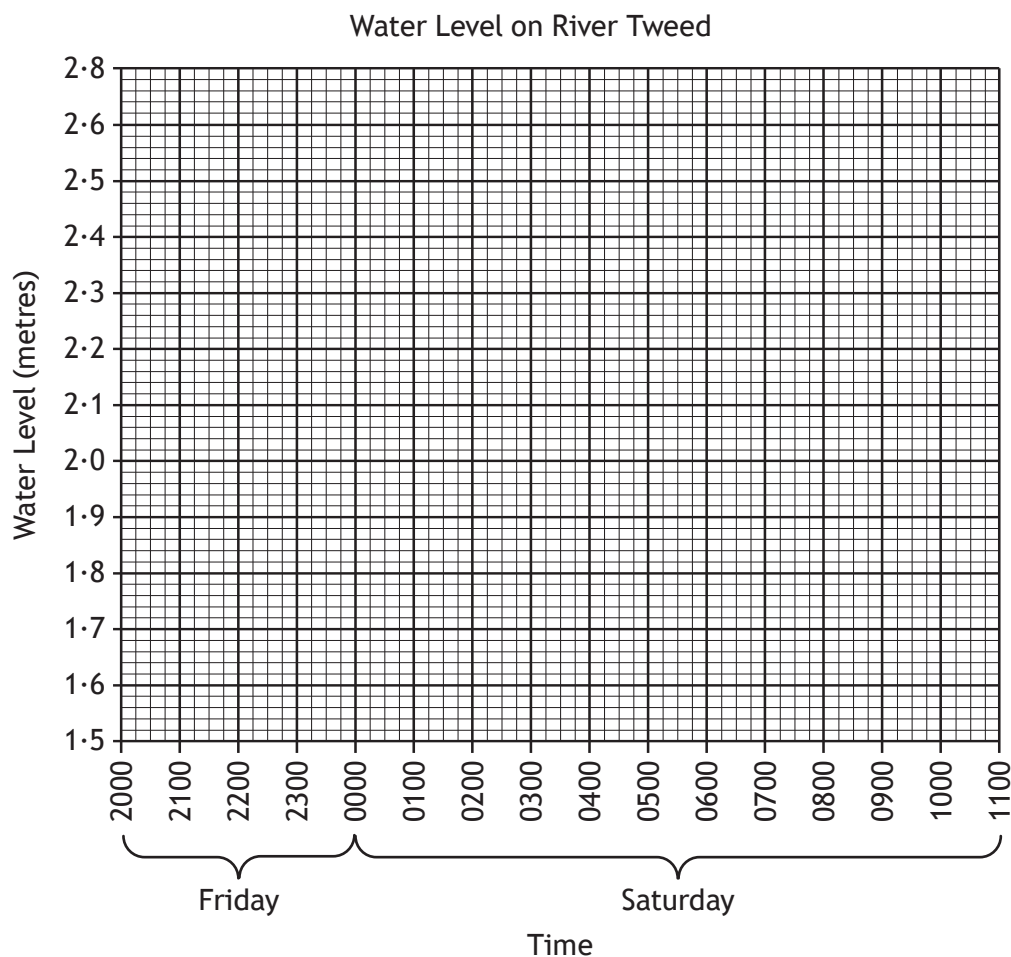


10. Canoeists in Scotland use water level data to decide if there is enough water in a river to canoe down it.

The data for the River Tweed is shown below.

Table 1

Time	Water Level (metres)
Friday 2015	1.55
Friday 2200	1.58
Friday 2315	1.67
Saturday 0015	1.70
Saturday 0100	1.88
Saturday 0300	1.97
Saturday 0415	2.05



- (a) (i) Plot the water levels on the scattergraph. 2
(ii) Draw a line of best fit on the scattergraph. 1

(An additional graph, if required, can be found on page 16.)



10. (continued)

- (b) The water level is predicted to rise at the same rate until 1100 on Saturday.

The canoeists use their line of best fit to predict the water level of the River Tweed at 0830 on Saturday.

They hope that it will be “Very High”.

Table 2

River Tweed	
Water level:	
Huge	> 3.5
Very High	2.5 - 3.5
High	2.0 - 2.5
Medium	1.7 - 2.0
Low	1.2 - 1.7
Scrapeable	0.0 - 1.2
Empty	never

Will the Tweed be “Very High” at 0830?

Justify your answer.

2



* S 8 4 4 7 5 0 1 1 1 *

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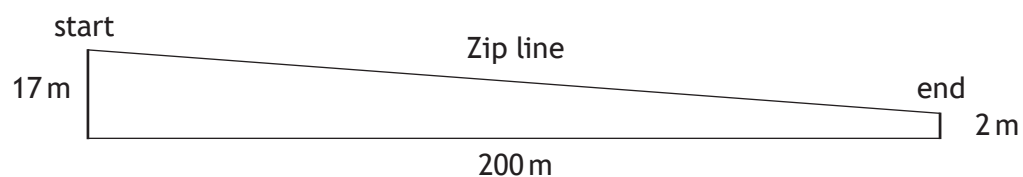
11. Mhairi bought 200 shares for £700.
She decides to sell them, but the share price has dropped to £2.75 per share.
She also has to pay a fee of $2\frac{1}{2}\%$ of her selling price when she sells her shares.
Calculate the loss that she has made.

4



* S 8 4 4 7 5 0 1 1 2 *

12. The diagram shows a planned zip line for a play park.



It is recommended that the average gradient of the zip line should be between 0.06 and 0.08 to be safe.

Does the planned zip line meet these safety recommendations?

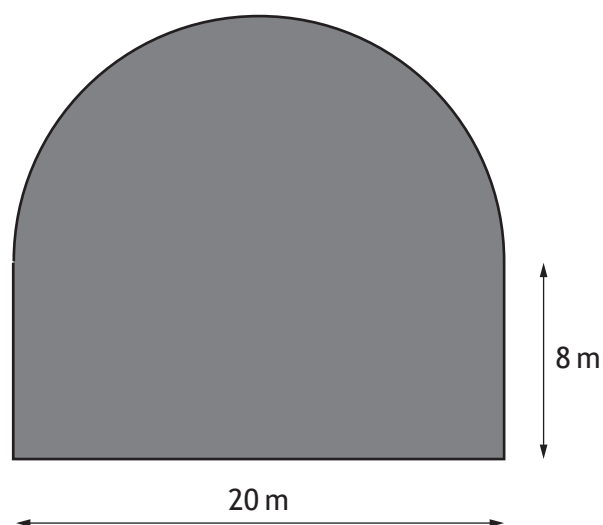
Use your working to justify your answer.

3



* S 8 4 4 7 5 0 1 1 3 *

13. Joe buys a plot of land in the shape of a rectangle and a semi-circle, as shown below.



He plans to put a fence around the plot of land.

He employs Fence Direct to build the fence.

Fence Direct charges £15 per metre including all materials and labour.

- (a) Calculate the cost of the fence.

Take $\pi = 3 \cdot 14$.

3



13. (continued)

MARKS

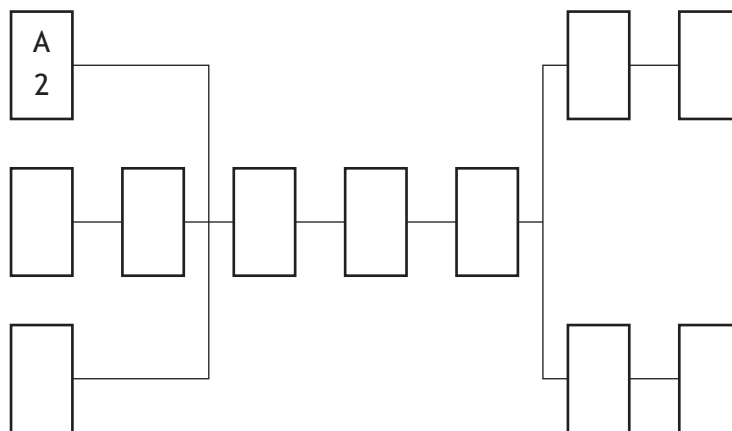
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- (b) Fence Direct provides a team of workers to build the fence.

The table shows the list of tasks and the time taken to complete them.

Task	Detail	Preceding Task	Time (hours)
A	Take down old fence	None	2
B	Measure length of fence needed	None	0.5
C	Mark on the ground where new posts must go	None	0.5
D	Collect materials and tools from yard	B	1
E	Hammer posts into the ground	A, C, D	4
F	Attach metal fencing to posts	E	2
G	Attach barbed wire to top of posts	F	1
H	Gather up rubbish	G	2
I	Gather up tools	G	0.5
J	Take rubbish to recycling centre	H	1
K	Put tools back in yard	I	0.5

Complete the diagram below by writing these tasks and times in the boxes. 2



(An additional diagram, if required, can be found on page 17.)

- (c) Fence Direct claims that all of these tasks can be completed in 10 hours.

Is this a valid claim?

Use your working to justify your answer.

2

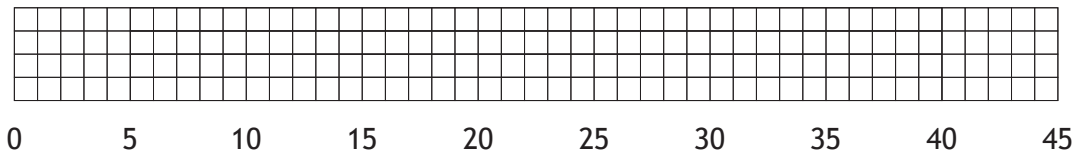
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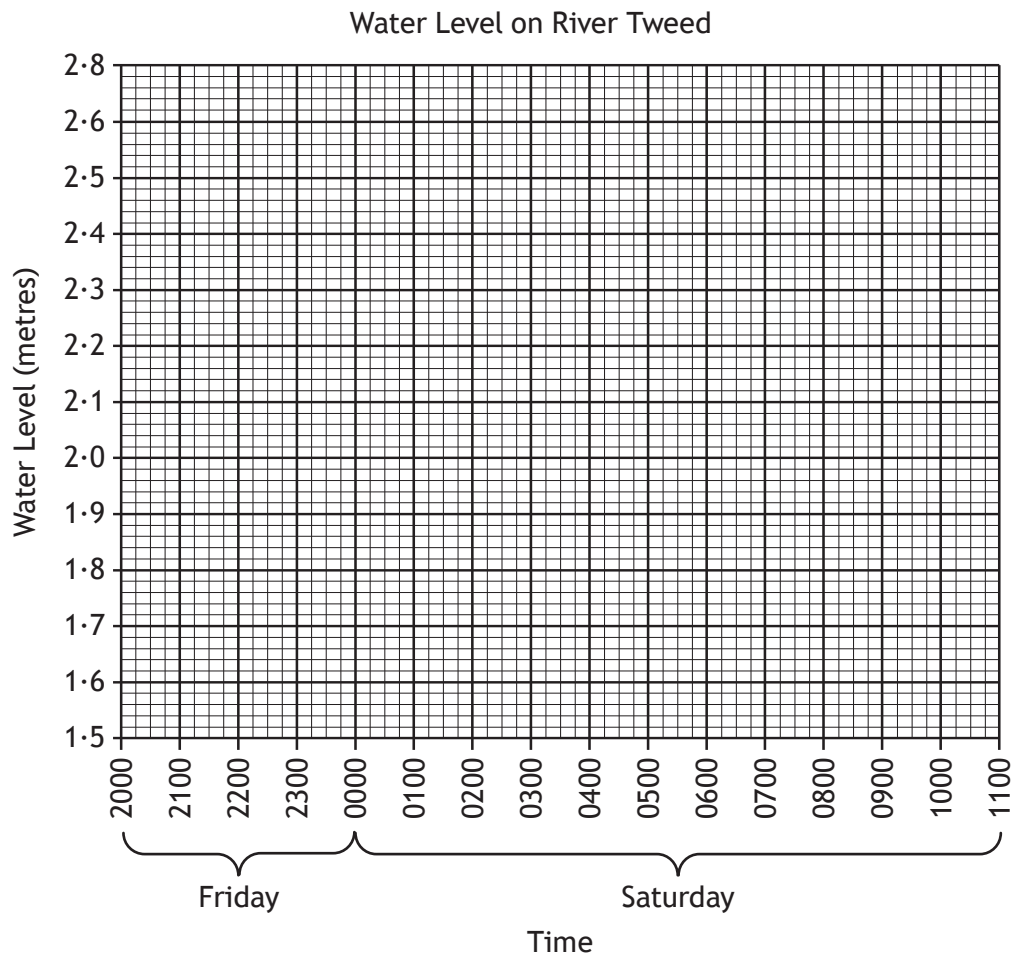
* S 8 4 4 7 5 0 1 1 5 *

ADDITIONAL SPACE FOR ANSWERS

Additional diagram for Question 6(c)

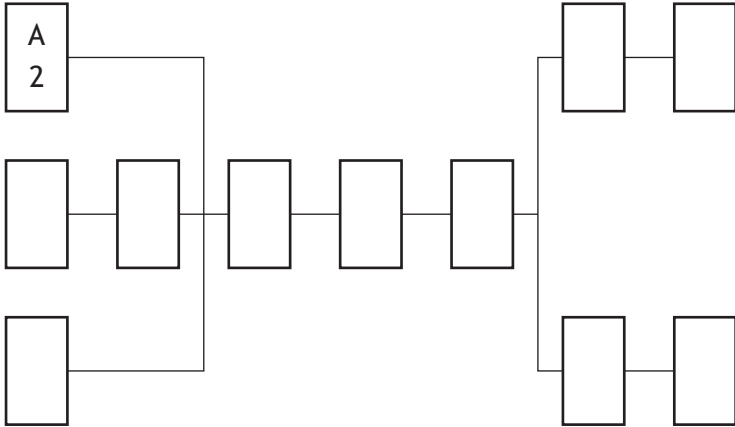


Additional graph for Question 10(a)



ADDITIONAL SPACE FOR ANSWERS

Additional diagram for Question 13 (b)



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Applications of Mathematics Paper 2

Date — Not applicable

Duration — 2 hours



Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth

Day

Month

Year

Scottish candidate number

Total marks — 65

Attempt ALL questions.

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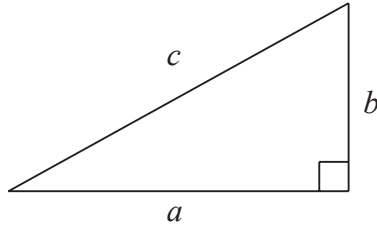


FORMULAE LIST

Circumference of a circle: $C = \pi d$

Area of a circle: $A = \pi r^2$

Theorem of Pythagoras:



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

Volume of a cylinder: $V = \pi r^2 h$

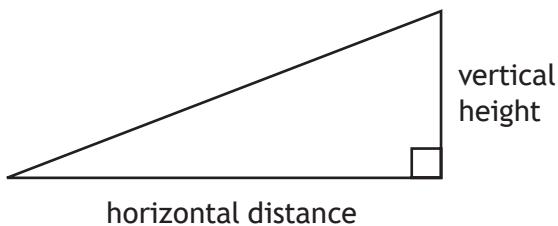
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Volume of a sphere: $V = \frac{4}{3} \pi r^3$

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Gradient:



$$\text{gradient} = \frac{\text{vertical height}}{\text{horizontal distance}}$$



MARKS

DO NOT
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THIS
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Total marks — 65
Attempt ALL questions

1. Erin bought a yacht costing £780 000 in February 2013.
For the next three years the value of the yacht decreased by 4.1% per annum.
Calculate the value of the yacht in February 2016.
Give your answer to **3 significant figures**.

4



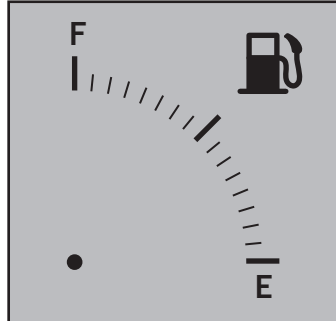
* S 8 4 4 7 5 0 2 0 3 *

MARKS

DO NOT
WRITE IN
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MARGIN

2. The fuel tank in Colin's car holds 64 litres of fuel.
Colin started with a full tank and used 40 litres of fuel.
Mark the amount of fuel **remaining** in the tank on the gauge shown below.

2



3. An athlete without a coach runs a series of 400 metre races. A sample of his times, in seconds, is shown below.

47.8 48.3 50.2 49.5 46.9 49.5

(a) For these times, calculate:

(i) the mean;

1

(ii) the standard deviation.

3

(b) The same athlete then decides to train with a coach.

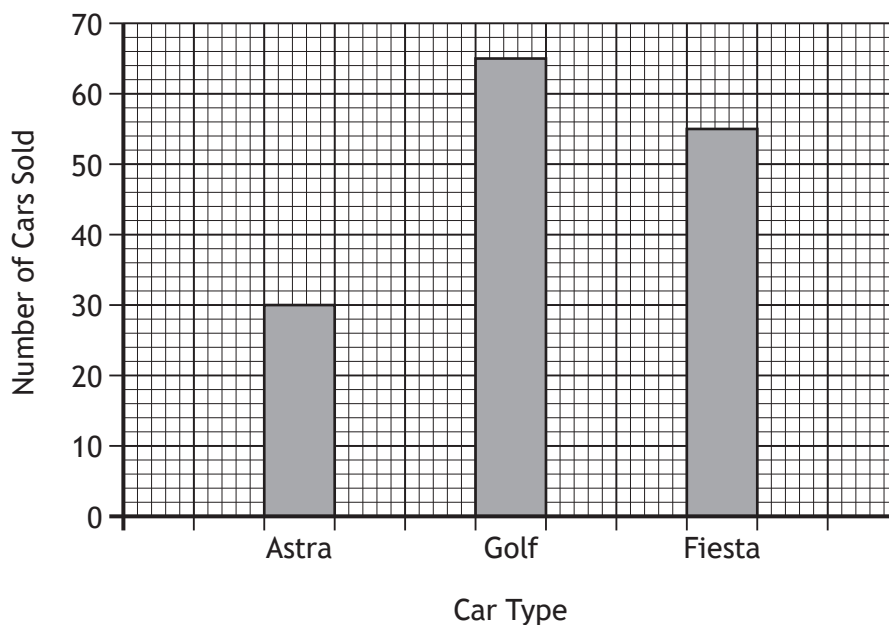
After training with the coach, the athlete runs a series of races which produces a mean of 49.3 seconds and a standard deviation of 0.23.

Make two valid comparisons about the times taken by the athlete before and after training with the coach.

2

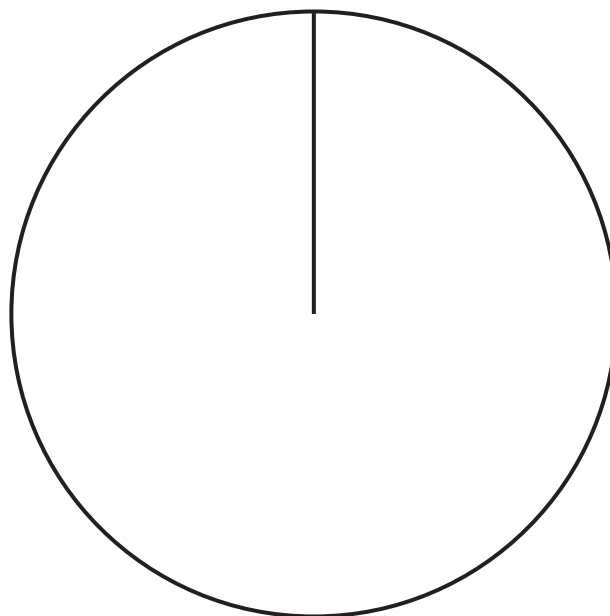


4. A garage sells 150 cars in a month.
The bar chart below shows how many cars of each type are sold.



Construct a pie chart to show this information.

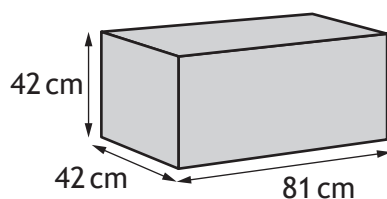
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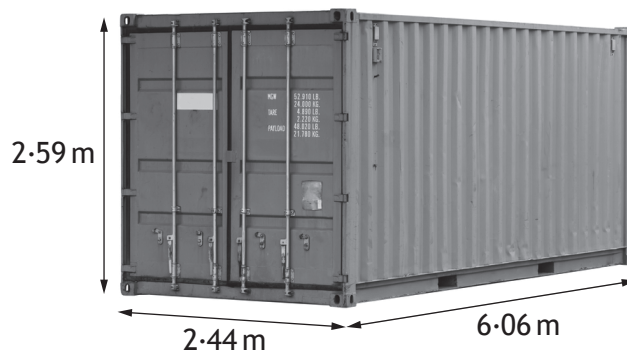
(An additional diagram, if required, can be found on *page 17*.)



5. Donna makes tartan handbags.
She puts the bags into boxes. The boxes have the dimensions shown below.



Donna exports her handbags to the USA in a container. The container has the internal dimensions shown below.



All the boxes must be aligned in the same direction.

- (a) Calculate the maximum number of boxes that can fit in the container.
Use your working to justify your answer.

3

- (b) The rental and shipping of the container costs £1755.
Each box costs £2.99.
Each box holds 4 handbags.
Calculate the cost of shipping per handbag.

2



6. Graham earns £49 920 per annum.

National Insurance is calculated on a person's salary **before** deductions such as pension contributions.

National Insurance Rates	
Up to £8060	0%
From £8060 to £42 380	12%
Over £42 380	2%

(a) Calculate Graham's annual National Insurance payment.

3

(b) Graham pays 9% of his annual salary into his pension.

Graham's annual income tax is £6870.04.

Graham is paid in 12 monthly payments.

Calculate Graham's monthly net pay.

3



6. (continued)

(c) He wants to buy a new car.

The car loan and running costs would be £460 per month.

He makes a table to show his monthly income and outgoings.

	Income	Outgoings
Take home pay		
Rent		£750
Bills		£450
Food		£625
Entertainment		£125
Child care		£350

Will Graham have enough money each month to get this particular car?

Use your working to justify your answer.

2



* S 8 4 4 7 5 0 2 0 9 *

7. The boat leaves from the harbour on a bearing of 045° for a distance of 22 miles to Puffin Island.

The boat leaves Puffin Island on a bearing of 170° and travels for a further 37 miles to Gull Isle.

- (a) Construct a scale drawing to illustrate this journey.

Use a scale of 1 cm : 5 miles.

(An additional diagram, if required, can be found on *page 18*.)

3



The boat continues back to the harbour.

- (b) Use the scale drawing to determine the bearing and distance of the harbour from the boat.

2



MARKS

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WRITE IN
THIS
MARGIN

7. (continued)

(c) The boat leaves the harbour at 0930.

It stops for 1 hour 15 minutes at Puffin Island and 2 hours 50 minutes at Gull Isle.

The boat arrives back at the harbour at 1800 the same day.

Calculate the average speed of the boat whilst it is moving.

3



* S 8 4 4 7 5 0 2 1 1 *

8. Fiona is planning to stay in New York, USA, for three days.
The table shows the attractions Fiona wants to visit and how much they cost.

Attraction	Full price in US Dollars
Empire State Building	\$32
Top of the Rock Observation Deck	\$30
Statue of Liberty Cruise	\$40
9/11 Memorial and Museum	\$24
Waxworks	\$37
One World Observatory	\$32

Fiona plans to buy a discount card to reduce the cost of visiting these attractions.

There are three different discount cards.

Not all of the attractions are included in all of the cards. Fiona must pay full price for these.

Card 1: NY Card

NY Card

Attractions:

★ Sea and Space Museum ★ ★ Top of the Rock Observation Deck ★

★ Museum of Natural History ★ ★ 9/11 Memorial and Museum ★

★ Statue of Liberty Cruise ★ ★ Empire State Building ★

★★★★ Total Cost \$114 ★★★★★

Benefits:

These six attractions can be visited for a single payment of \$114.
This card can only be used once per attraction.
It is valid for 30 days from first use.

Card 2: Explore NY Card

Explore NY Card

Attractions:

9/11 Memorial and Museum • Statue of Liberty Cruise
Museum of Natural History • Sea and Space Museum
Empire State Building • Top of the Rock Observation Deck
Waxworks • Carnegie Hall • Rockefeller Centre Tour

Cost for any 3 attractions \$71

Benefits:

This card can be used for any 3 attractions from the list.
This card can only be used once per attraction.
It is valid for 30 days from first use.



8. (continued)

Card 3: NY Town Pass

NY Town Pass

80+ attractions are included for one price.
The card is valid for 1, 2, 3 or 5 days.

Cost

\$90	1 day pass	\$180	3 day pass
\$140	2 day pass	\$190	5 day pass

Benefits:

All of Fiona's chosen attractions can be visited with this card.

- (a) During her three-day visit, Fiona will visit two attractions each day.
Fiona is going to buy one discount card.

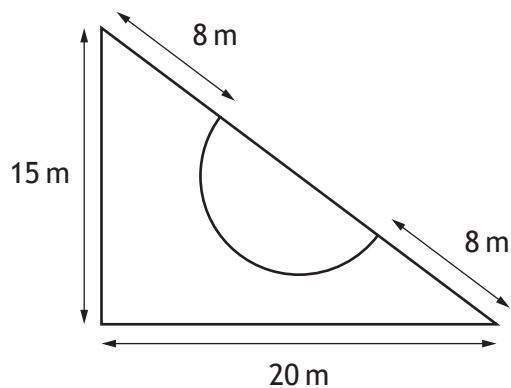
(i) Calculate the total cost of all six attractions if Fiona buys Card 1. 2

(ii) Calculate the cheapest price that Fiona could pay for entry to her six chosen attractions. 4

- (b) Fiona pays the cheapest price for entry to her six chosen attractions.
She pays before leaving the UK.
The cost is £100.96.
Calculate the exchange rate that Fiona received.
Give your answer correct to **3 decimal places**. 2



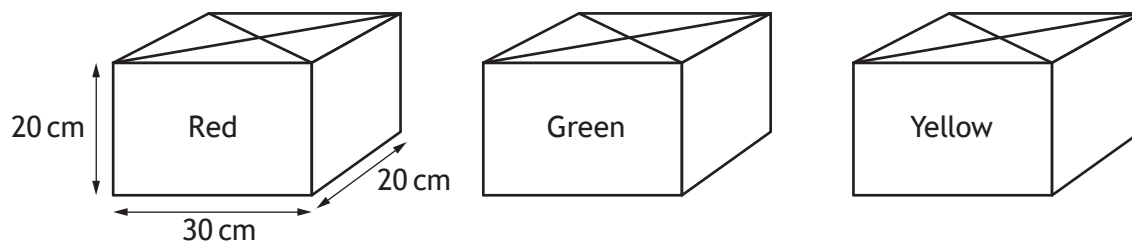
9. A garden in the shape of a **right-angled triangle** has a semi-circular pond on the hypotenuse as shown below.



- (a) Calculate the diameter of the pond. 2
- (b) The garden, excluding the pond, is to be covered with stone chips. Calculate the area to be covered with stone chips. 3
- (c) The stone chips come in 25 kg bags costing £2.59 each. 1000 kg of chips covers an area of 20 m². Calculate the cost of the stone chips for the garden. 3



10. Brendan makes candles from blocks of wax.
Each block of wax is a cuboid measuring 30 cm by 20 cm by 20 cm as shown.



Each candle contains the colours red, green and yellow in the ratio 3 : 1 : 2 respectively.

Each candle is a cube with volume 729 cm^3 .

- (a) Brendan only has 1 block of each colour.

What is the maximum number of candles that he can make?

3

- (b) Brendan makes the maximum number of candles.

Any wax that is left over is thrown away.

Each block of wax costs £13.75.

Brendan also buys wicks which cost 18p per candle.

Brendan adds 65% to his costs when calculating the selling price of each candle.

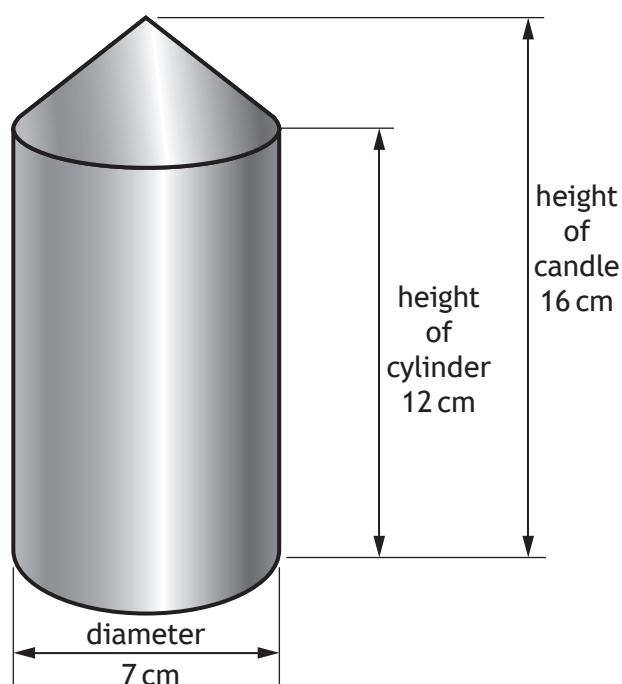
What is Brendan's selling price for each candle?

3



10. (continued)

Brendan also makes blue candles in the shape of a cylinder with a cone on top as shown.



(c) He buys blue wax in blocks with volume $12\,000\text{ cm}^3$.

Brendan thinks that he can make 25 of these candles from one block of wax.

Is he correct?

Use your working to justify your answer.

7

[END OF SPECIMEN QUESTION PAPER]

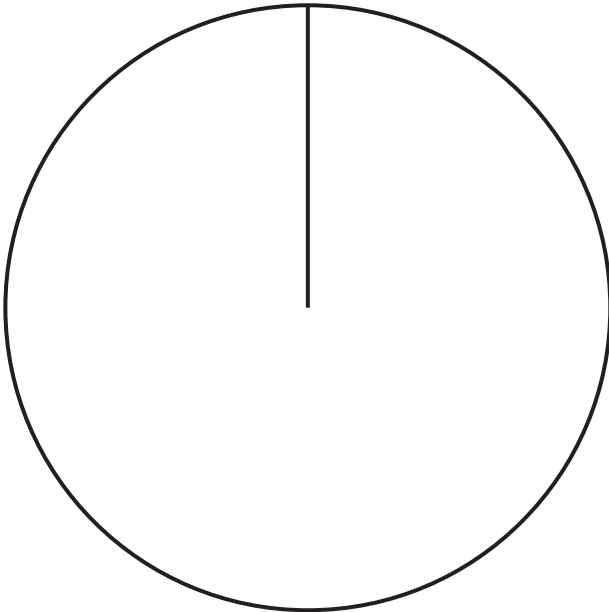


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ADDITIONAL SPACE FOR ANSWERS

Additional diagram for Question 4



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Additional diagram for Question 7(a)



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