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Mark

S844/75/02

# Applications of Mathematics Paper 2

Date — Not applicable

Duration — 2 hours



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

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.

You may 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.



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

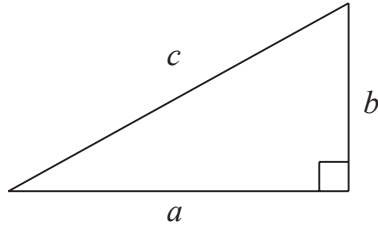


## FORMULAE LIST

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:  $V = \pi r^2 h$

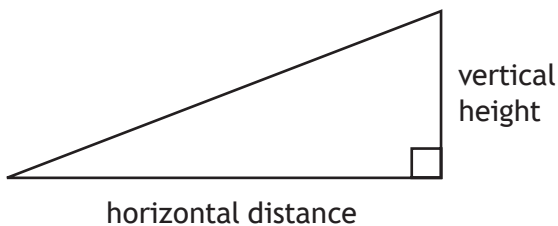
Volume of a prism:  $V = Ah$

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:



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



MARKS

DO NOT  
WRITE IN  
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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



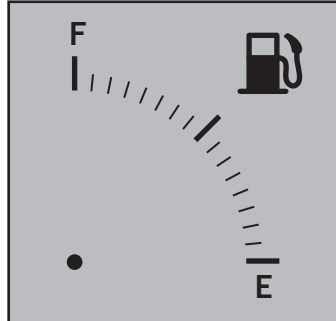
\* S 8 4 4 7 5 0 2 0 3 \*

MARKS

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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.

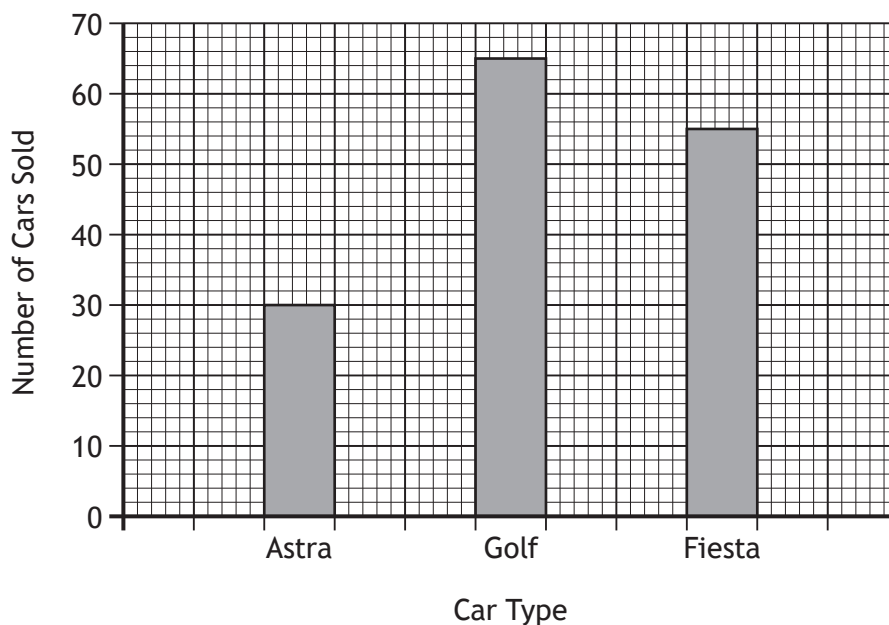
After training with the coach, the athlete runs a series of races which produces a mean of 49.3 seconds and a standard deviation of 0.23.

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

2

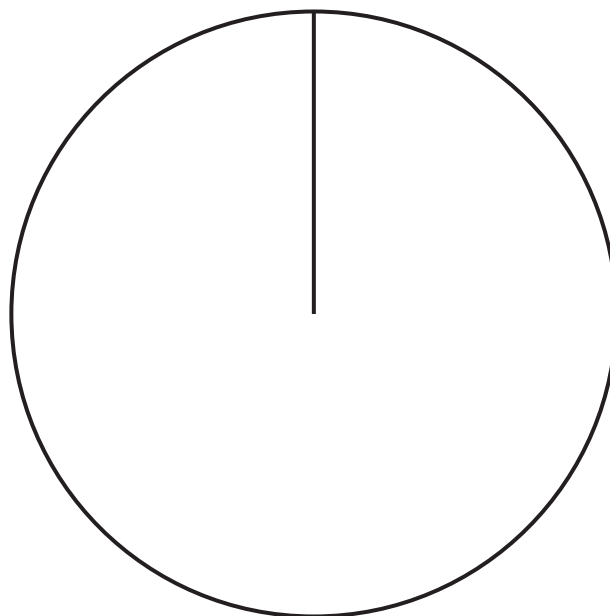


4. A garage sells 150 cars in a month.  
The bar chart below shows how many cars of each type are sold.



Construct a pie chart to show this information.

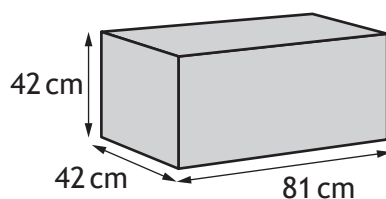
3



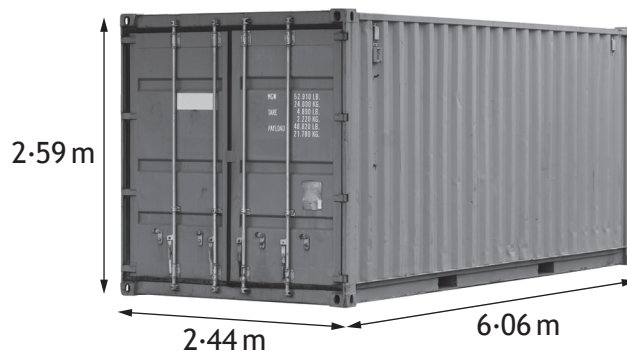
(An additional diagram, if required, can be found on *page 17*.)



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  $045^\circ$  for a distance of 22 miles to Puffin Island.

The boat leaves Puffin Island on a bearing of  $170^\circ$  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

DO NOT  
WRITE IN  
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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.



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

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.

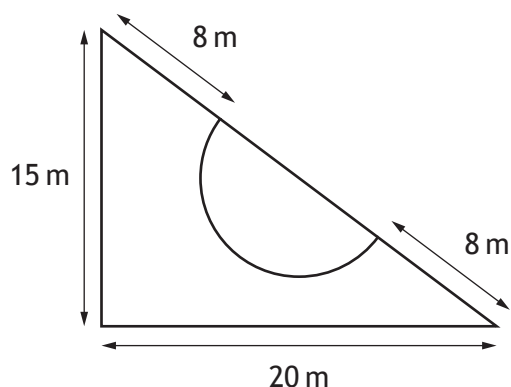
(i) Calculate the total cost of all six attractions if Fiona buys Card 1. 2

(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



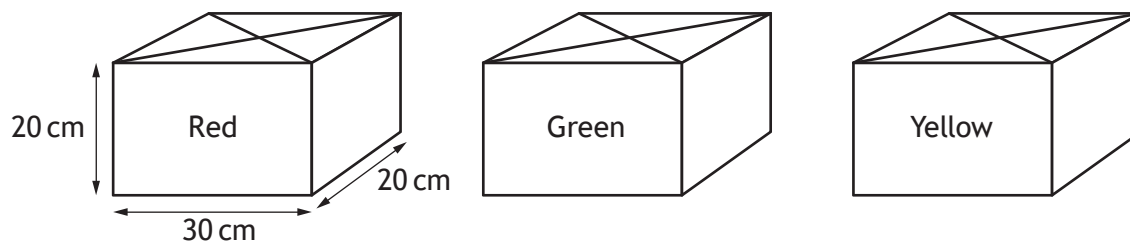
9. A garden in the shape of a **right-angled triangle** has a semi-circular pond on the hypotenuse as shown below.



- (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 m<sup>2</sup>. 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  $729 \text{ cm}^3$ .

- (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.

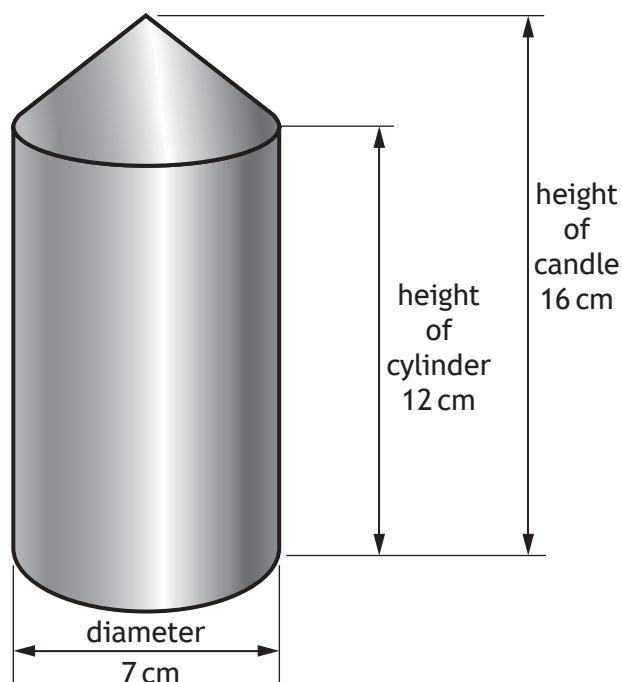
What is Brendan's selling price for each candle?

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]



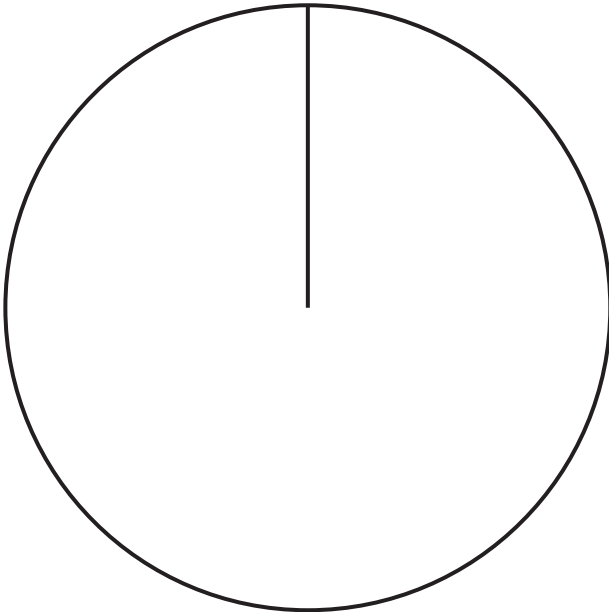


MARKS

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ADDITIONAL SPACE FOR ANSWERS

Additional diagram for Question 4



ADDITIONAL SPACE FOR ANSWERS

Additional diagram for Question 7(a)



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