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National  
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2018

Mark

**X844/75/02**

# Applications of Mathematics Paper 2

THURSDAY, 3 MAY  
10:25 AM – 12:25 PM



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.

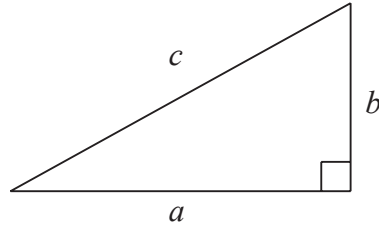


## FORMULAE LIST

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:  $V = \pi r^2 h$

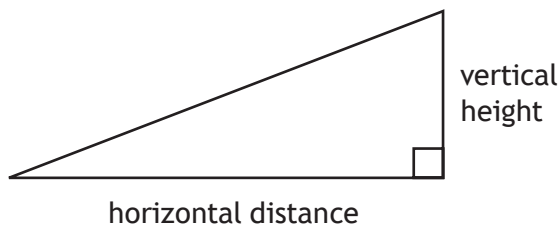
Volume of a prism:  $V = Ah$

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 — 65  
 Attempt ALL questions

1. Jack bought a car 3 years ago costing £1400.  
 The car has decreased in value by 13% each year.

- (a) Calculate the current value of the car.  
 Give your answer to **2 significant figures**.

4

Jack sells his car for £950.

- (b) Calculate his loss as a percentage of the **original price**.

2



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

2. The number of podcasts Omar downloaded each month for a year is shown in the table below.

12	34	19	22	9	13
21	19	5	26	10	28

- (a) For this data, calculate:

the median

the lower quartile

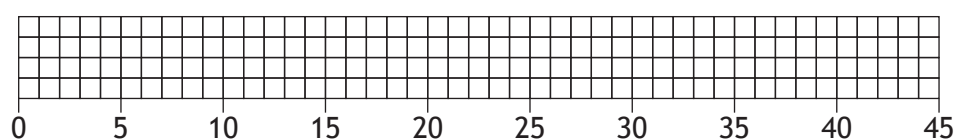
the upper quartile.

2

- (b) Construct a boxplot for this data.

2

(An additional diagram, if required, can be found on *page 21*.)



3. Ross is changing his internet package.

The table below shows the internet packages he is considering.

Package	Speed (Mbps)	Usage	Monthly line rental	Monthly broadband cost	Initial fee	Length of contract
A	52	25 GB	£8.95	£19.99	£59.99	12 months
B	52	Unlimited	£8.95	£20.99	£59.99	12 months
C	38	50 GB	£7.99	£16.99	£59.99	12 or 18 months
D	52	Unlimited	£7.99	£18.99	£109.99	12 or 18 months
E	52	50 GB	£6.99	£15.99 for 1st 12 months then £19.99	Free	24 months

Ross requires:

- a minimum speed of 52 Mbps
- at least 50 GB of usage
- a 12 month contract.

Ross will choose the package with the lowest overall **annual** price.

Which package will he choose?

Use your working to justify your answer.

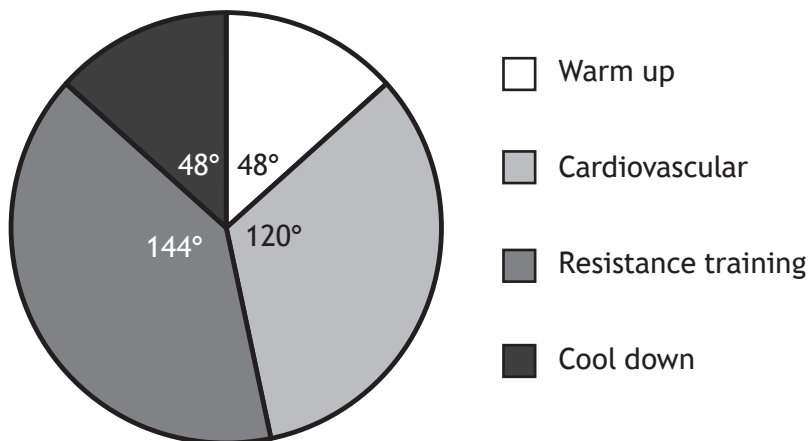
3



4. Nicola has joined a gym.

The pie chart shows the proportion of time that Nicola will spend on each type of workout exercise.

Types of workout exercises



Nicola spent 1 hour and 45 minutes exercising in the gym.

(a) Calculate how long, in minutes, Nicola spent on resistance training. 2

Nicola spent 21 minutes exercising on a treadmill.

Her average speed was 6.6 km/h.

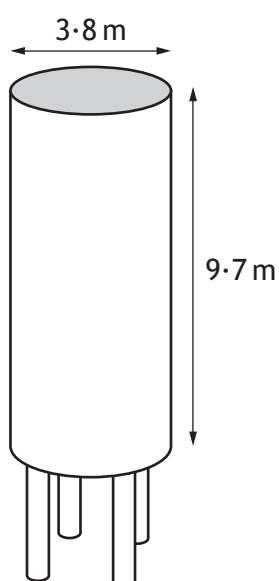
(b) Calculate the distance she ran on the treadmill. 2



5. Three tonnes of sheep food will feed 350 sheep for 18 days.  
The number of sheep **increases** by 100.
- (a) How long will the same weight of food now last?

3

The storage container for the sheep food is in the shape of a cylinder, with dimensions as shown below.



- (b) Calculate the volume of the storage container.

2



MARKS

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6. Ali, Kate and Jim are paid to deliver leaflets advertising a new restaurant. They shared the money they were paid in a ratio of 3 : 5 : 7. Jim received £154. Calculate how much the restaurant paid, in total, to deliver the leaflets.

2



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

7. Sam drives from Paris in France to Zurich in Switzerland.

He knows:

- his car will cover an average of 47 miles per gallon of fuel
- the fuel tank holds 50 litres of fuel when it is full
- it is 650 km from Paris to Zurich.

Will Sam be able to complete his journey with one full tank of fuel?

4

Use your working to justify your answer.

1 mile = 1.609 km

1 gallon = 4.545 litres



\* X 8 4 4 7 5 0 2 0 9 \*

8. Scott decides to build a new track bike.

Scott needs to buy a frame, a handlebar, a pair of pedals, a saddle, 2 wheels and 2 tyres.

Different retailers offer these parts.

The prices, in pounds, are shown in the table.

Retailer	Handlebar	Pedals (pair)	Wheels (each)	Saddle	Tyres (each)
Bikes 2 Go	63.33	33.33	51.25	41.66	54.98
Bikevelo	55.49	42.50	46.66	62.37	58.33
Velo cycles	68.83	36.66	61.20	53.99	61.66
Cycle trax	59.50	43.33	52.25	63.33	69.99
EP bikes	71.58	41.66	44.49	47.85	49.99

Scott can buy the parts from different retailers.

The bike frame costs £2640.95.

- (a) Calculate the **minimum** total cost of the frame and parts.

2



8. (continued)

MARKS  
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Scott cannot afford to pay for the bike all at once.

The cash price of the complete bike from EP bikes is £2991.00.

He chooses to buy the complete bike from EP bikes, as they are the only retailer offering a finance package.

The finance package consists of:

- a deposit of 15% of the cash price
- 36 payments of £76.50.

(b) Calculate how much more this finance package will cost compared to the **minimum** total cost.

4



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

8. (continued)

MARKS

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Scott trains at the velodrome on his new bike.  
He records his top speed, in kilometres per hour, for each lap.  
Six of these speeds are shown below.

61.2      58.3      59.1      58.8      60.4      59.8

(c) For these speeds, calculate:

(i) the mean;

1

(ii) the standard deviation.

3

Scott had a mean top speed on his old bike of 57.3 km/h and a standard deviation of 1.21 km/h.

(d) Make two valid comments comparing his top speed on the two different bikes.

2

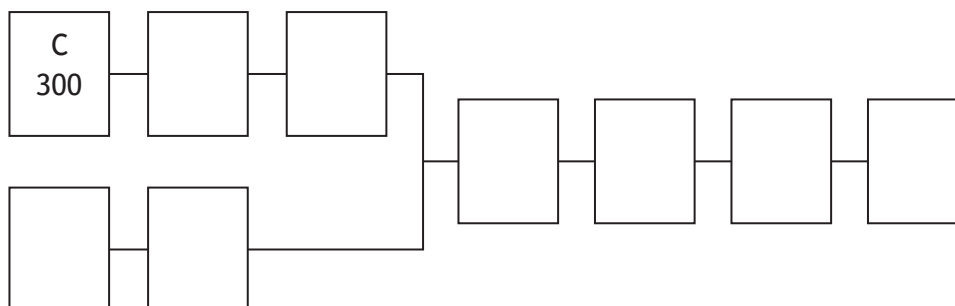


\* X 8 4 4 7 5 0 2 1 2 \*

9. A factory produces cans of tinned beans.  
The table shows the list of tasks and the time taken to complete them.

Task	Detail	Preceding task	Time (seconds)
A	Boil beans to cook them	C	500
B	Put on lid	H,E	3
C	Blanch dried beans in water	None	300
D	Attach label	I	5
E	Put sauce in tin	F	2
F	Make the sauce	None	900
G	Put in box	D	5
H	Put beans in tin	A	2
I	Cook beans in sauce in tin	B	300

- (a) Complete the diagram below to show the tasks and times in the boxes. 1  
(An additional diagram, if required, can be found on *page 21*.)



The factory manager thinks that the whole process can be completed in less than 25 minutes.

- (b) Based on the times given, is the factory manager correct?  
Use your working to justify your answer. 2

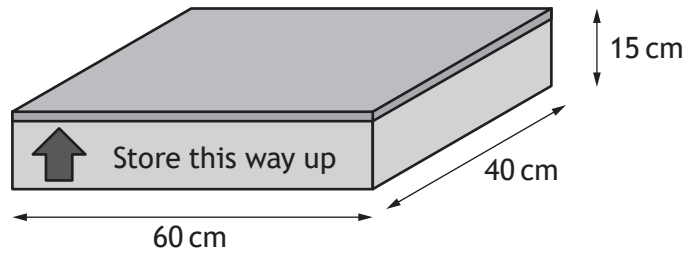


9. (continued)

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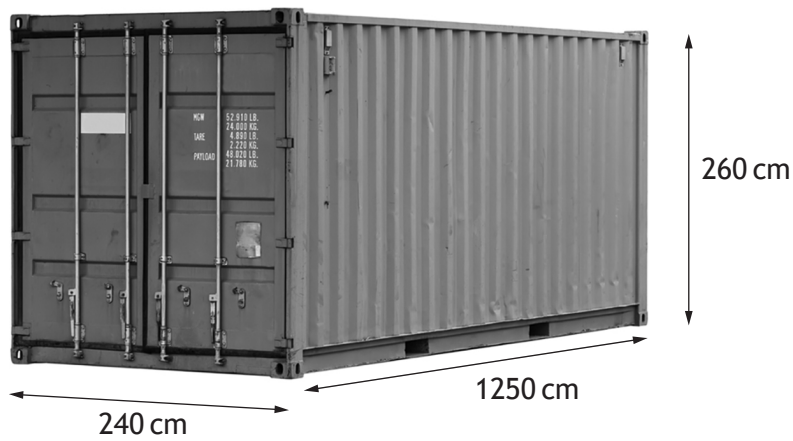
The tins are packed in boxes.

Each box has dimensions  $60\text{ cm} \times 40\text{ cm} \times 15\text{ cm}$  as shown below.



The boxes must be packed into containers for shipping to Canada.

The container has the internal dimensions shown below.



All the boxes must be aligned in the same direction.

(c) Calculate the maximum number of boxes that will fit in the container.

3



9. (continued)

MARKS  
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It takes 277 hours to sail from the UK to Canada.

The local time in Canada is 5 hours behind the local time in the UK.

The ship leaves the UK at 2200 on 3rd June.

(d) Calculate the date and local time that the ship will arrive in Canada.

3



10. Fiona is a vet.

She has started a new job.

Her new salary is £42 000.

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

National Insurance rates	
Up to £8164	0%
From £8164 to £45 032	12%
Over £45 032	2%

(a) (i) Calculate Fiona's annual National Insurance payment.

2

Fiona's annual income tax payment is £5427.96.

She pays an annual contribution of £3360 into her pension.

Fiona is paid in 12 equal monthly payments.

(ii) Calculate Fiona's monthly net pay.

2



10. (continued)

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Fiona plans to rent accommodation.

She needs to work out how much she can afford to spend on rent, electricity and council tax.

The table shows her monthly outgoings.

	Outgoings
Car payment	395
Car insurance	28
Road tax	12
Food	380
Clothes	130
Mobile phone	64
Internet	55
Socialising	250
Loan	200
Savings	200
<b>Total</b>	

- (b) Calculate how much she will have available per month for rent, electricity and council tax.

1



10. (continued)

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Fiona is considering these 3 properties.

**2 Bedroom House**



Total Monthly Cost £730  
including Rent, Council Tax  
and Electricity

**1 Bedroom Apartment**



Weekly Rent £132  
Council Tax Band F  
Weekly Electricity £12

**3 Bedroom Farmhouse**



Monthly Rent £390  
Council Tax Band E  
Monthly Electricity £76

**Annual Council Tax**  
(to be paid in 12 equal  
monthly instalments)

Band A: £1000·92  
Band B: £1167·72  
Band C: £1334·52  
Band D: £1501·32  
Band E: £1834·92  
Band F: £2168·64  
Band G: £2502·24  
Band H: £3002·64

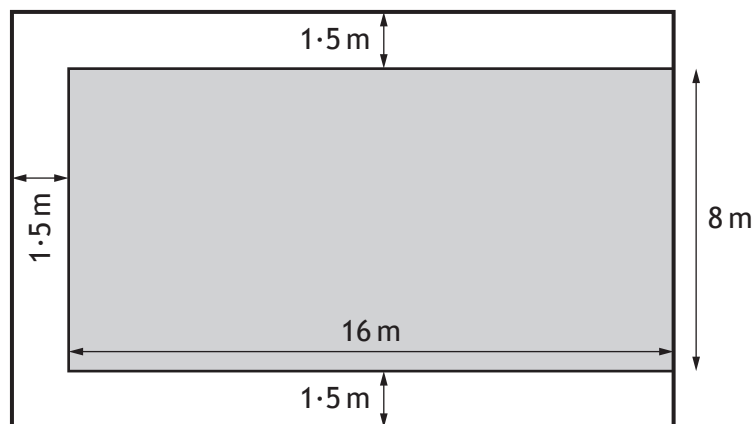
- (c) Which property is the cheapest option?  
Use your working to justify your answer.

3



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

11. A new hotel is being planned in Benidorm.  
 The pool will have a walkway around three sides.  
 The walkway will be 1.5 m wide.  
 This is shown in the diagram.



- (a) Calculate the total area of the walkway. 2

The walkway will be covered in tiles.  
 16 tiles are needed to cover 1 square metre.  
 The tiles are sold in boxes of 50.  
 Each box costs 71.95 euro.

- (b) Calculate the cost of the tiles needed for the walkway. 2

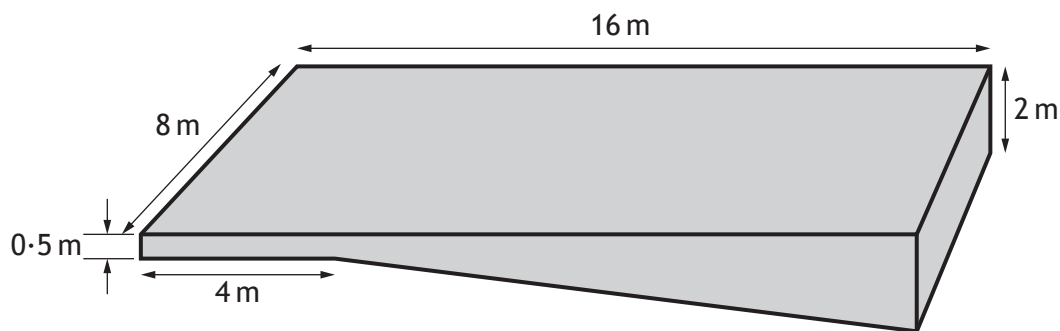


11. (continued)

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The swimming pool is a prism, with dimensions as shown in the diagram below.



(c) Calculate the volume of the swimming pool.

Give your answer in litres.

4

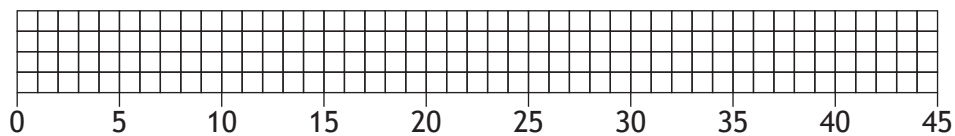
[END OF QUESTION PAPER]



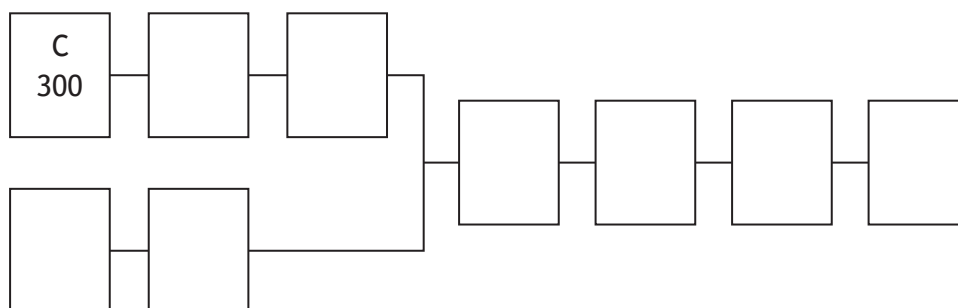
\* X 8 4 4 7 5 0 2 2 0 \*

ADDITIONAL SPACE FOR ANSWERS

Additional diagram for use in question 2 (b)



Additional diagram for use in question 9 (a)



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ADDITIONAL SPACE FOR ANSWERS



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MARKS

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ADDITIONAL SPACE FOR ANSWERS



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

ACKNOWLEDGEMENTS

Question 9(c) – Evannovostro/Shutterstock.com

Question 10(c) – 2 Bedroom House: Ewelina Wachala/Shutterstock.com

1 Bedroom Apartment: Eunika Sopotnicka/Shutterstock.com

3 Bedroom Farmhouse: 1000 Words/Shutterstock.com



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