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National
Qualifications
2019

Mark

X844/75/01

**Applications of Mathematics
Paper 1 (Non-calculator)**

THURSDAY, 2 MAY
09:00 AM – 10:05 AM



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.

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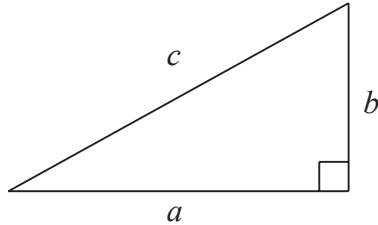


FORMULAE LIST

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 $V = \pi r^2 h$

Volume of a prism $V = Ah$

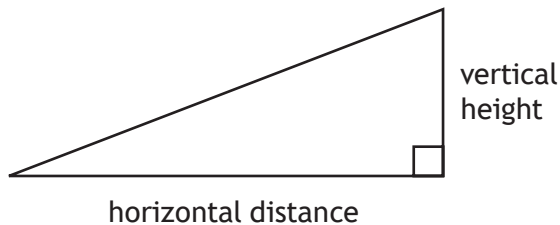
Volume of a cone $V = \frac{1}{3} \pi r^2 h$

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

Standard deviation $s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$

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

Gradient



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



Total marks — 45
Attempt ALL questions

1. Helen makes and sells candles.

These candles should be 22.5 cm tall.

She rejects any candle that is outwith the range of ± 2 mm of this height.

Below are the heights, in centimetres, of 10 candles chosen at random.

22.2, 22.6, 22.5, 22.9, 22.3, 21.6, 22.6, 22.4, 22.7, 22.8

Calculate the percentage of candles that she rejects.

3



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

MARKS

DO NOT
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2. Paul usually works 30 hours each week.
He is paid time and a half for any **additional** hours that he works.
His basic rate of pay is £12.50.
Last week, he worked a total of 37 hours.
- (a) Calculate his gross pay for last week.

3



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

2. (continued)

Paul is buying a new TV.

It is advertised at a price of £825.

He decides to use a payment plan to buy the TV.

The total cost of the TV using the payment plan is £845.80.

The payments are calculated as follows

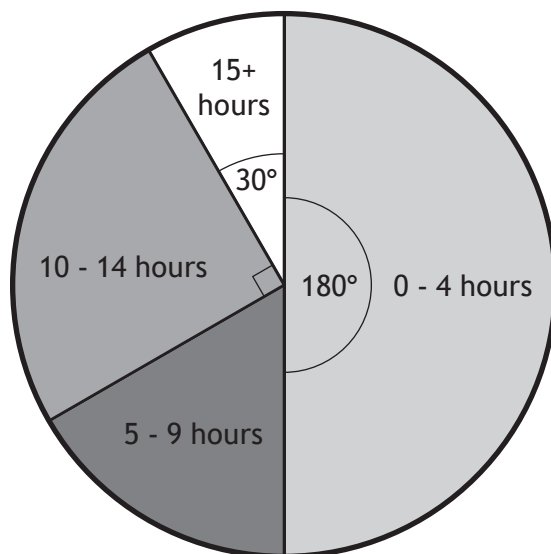
- deposit of $\frac{1}{5}$ of **advertised** price
- 8 equal monthly instalments
- final payment of £100.

(b) Calculate the monthly instalment.

3



3. The pie chart shows the number of hours overtime that 72 employees of a supermarket worked during one month.



- (a) Calculate how many employees worked 15+ hours overtime.

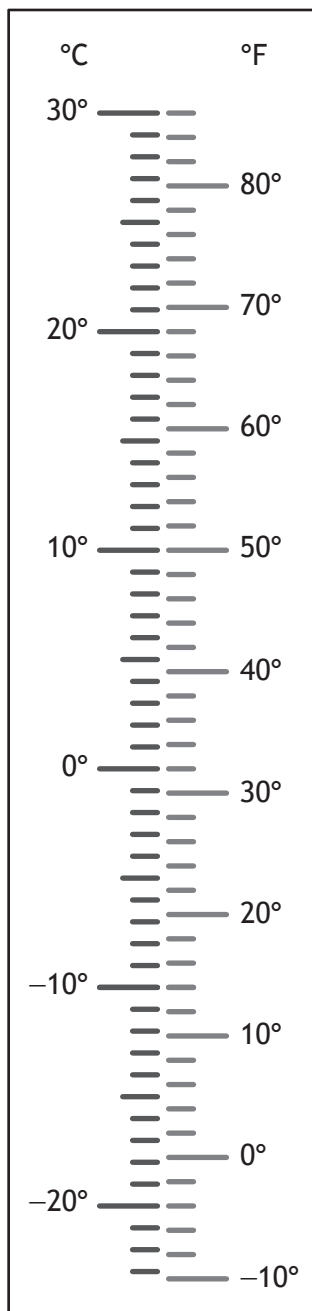
1

- (b) Calculate the probability that an employee chosen at random worked 9 or less hours overtime.

2



4. Gillian thinks that 24°F is colder than -3°C .
A thermometer is shown.



Determine if she is correct.
Justify your answer.

2



MARKS

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MARGIN

5. Allana takes out a loan of £4500.
The interest plus the administration fee is 7.5% of the loan amount.
The total amount will be paid back in 9 equal monthly payments.
Calculate the monthly payment.

3

6. Write the following values in order from greatest to least.

$$0.388, \frac{3}{8}, 38.38\%, 0.39$$

Justify your answer.

2



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

7. An airline records the number of passengers who fail to turn up for their flights each month.

The numbers for 2017 are

25, 14, 32, 29, 20, 43, 17, 20, 38, 27, 49, 23.

- (a) For this data, calculate

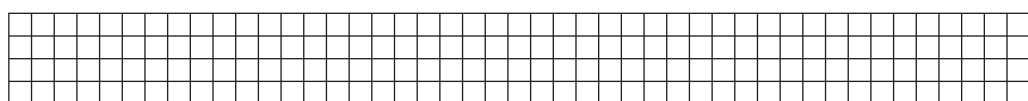
- the median
- the lower quartile
- the upper quartile.

2

- (b) Construct a boxplot for this set of data.

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

2



10 15 20 25 30 35 40 45 50 55

number of passengers

- (c) Calculate the interquartile range for this set of data.

1

In 2016, the interquartile range for the number of passengers who failed to turn up for their flights was 17.

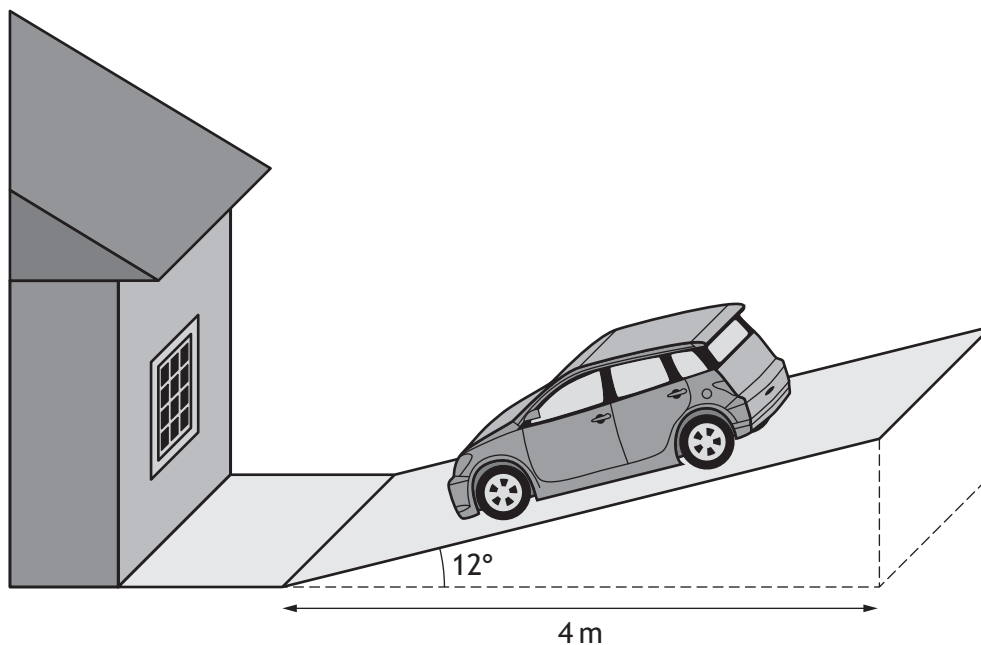
- (d) Make one valid comment comparing the number of passengers who failed to turn up for their flights in these two years.

1



* X 8 4 4 7 5 0 1 0 9 *

8. Sarah's driveway is sloped as shown in the diagram below.
- The cross-section of the driveway is in the shape of a right-angled triangle.
- The base is 4 metres long and makes an angle of 12° with the driveway as shown in the diagram below.



- (a) Construct a scale drawing of the cross-section of the driveway.
Use a scale of 1 cm : 0.5 m.

2



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

MARKS

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8. (continued)

(b) Use your scale drawing to calculate the gradient of the driveway.

2



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

9. After a meeting in Beijing, Jennifer flies home to London via Amsterdam.
 The plane leaves Beijing on 3 February at 12:15 local time.
 The plane lands in Amsterdam on 3 February at 18:00 local time.
 Beijing is 7 hours ahead of Amsterdam.

- (a) Calculate the time taken for Jennifer’s flight from Beijing to Amsterdam.
 Give your answer in hours and minutes.

1

On landing in Amsterdam, Jennifer’s phone tells her the time and date in the following cities.

Amsterdam, Netherlands	18:00	3 Feb
London, United Kingdom	17:00	3 Feb
Miami, United States of America	12:00	3 Feb

- Jennifer plans to telephone her brother as soon as she gets home.
- She will arrive at her home, in London, at 23:15 local time.
- Her brother lives in Miami, and arrives home from work at 17:00 local time.

- (b) Determine whether her brother will be home from work when Jennifer makes the phone call.

Use your working to justify your answer.

2



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

MARKS

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10. A basic cookie dough mix requires butter, sugar, flour and chocolate chips.

- $\frac{1}{6}$ of the mix is butter
- $\frac{1}{3}$ of the mix is sugar
- $\frac{1}{4}$ of the mix is chocolate chips
- The rest of the mix is flour

Calculate the fraction of the mix that is flour.

3



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

11. Mary gave some money to four of her nieces.
It was shared **in proportion** to their ages.

Name	Age
Jane	4
Heather	11
Laura	9
Kate	6

Kate's share is £1950.

Calculate the total amount Mary gifted her nieces.

3



12. Kieran and Gemma have each set themselves a monthly electricity allowance.

Kieran has set himself an allowance of £42.

Gemma has set herself an allowance of £49.

At the end of July, their smart meters recorded that

- Kieran had used £15 of his allowance
- Gemma had used £21 of her allowance.

Determine who had used a greater proportion of their allowance.

Use your working to justify your answer.

3



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

13. Joe had a business meeting in London.

He travelled from home to his meeting by car.

- He arrived at his meeting at 11:45
- He travelled 220 miles to his meeting at an average speed of 50 mph
- During his journey he stopped for half an hour for breakfast

Calculate the time he left home.

4

[END OF QUESTION PAPER]



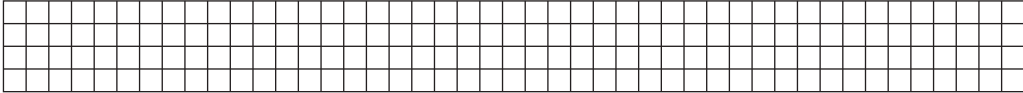
* X 8 4 4 7 5 0 1 1 6 *

MARKS

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ADDITIONAL SPACE FOR ANSWERS

Additional grid for use in question 7 (b)



10 15 20 25 30 35 40 45 50 55
number of passengers



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

MARKS

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ADDITIONAL SPACE FOR ANSWERS



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2019

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X844/75/02

Applications of Mathematics Paper 2

THURSDAY, 2 MAY
10:35 AM – 12:35 PM



* X 8 4 4 7 5 0 2 *

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Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth

Day

Month

Year

Scottish candidate number

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

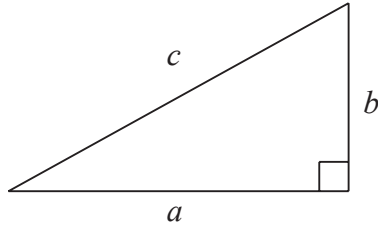


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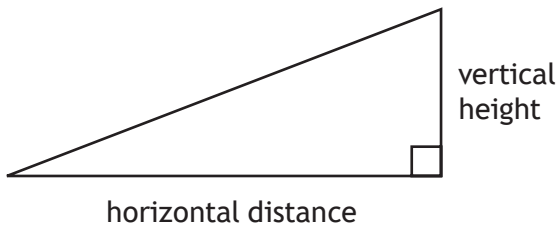
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Gradient



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Total marks — 65
 Attempt ALL questions

1. Sam buys a rare stamp for his stamp collection at an auction. He buys the stamp for £920.

The stamp

- increased in value by 7% in each of the first 2 years
- decreased in value by 4% in the third year.

Calculate the value of the stamp after these 3 years.

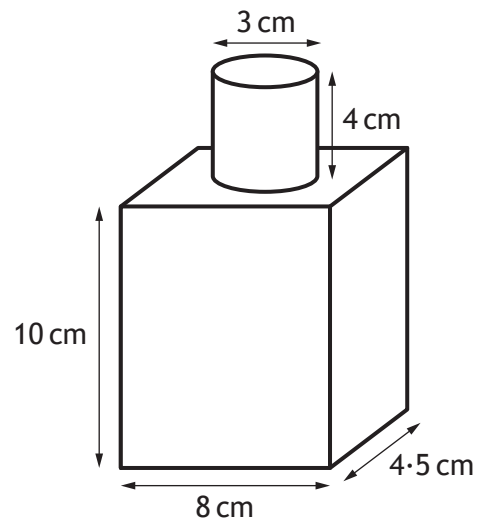
Give your answer to 3 significant figures.

4



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

2. A bottle consists of a cuboid and a cylinder.
The dimensions are shown in the diagram.

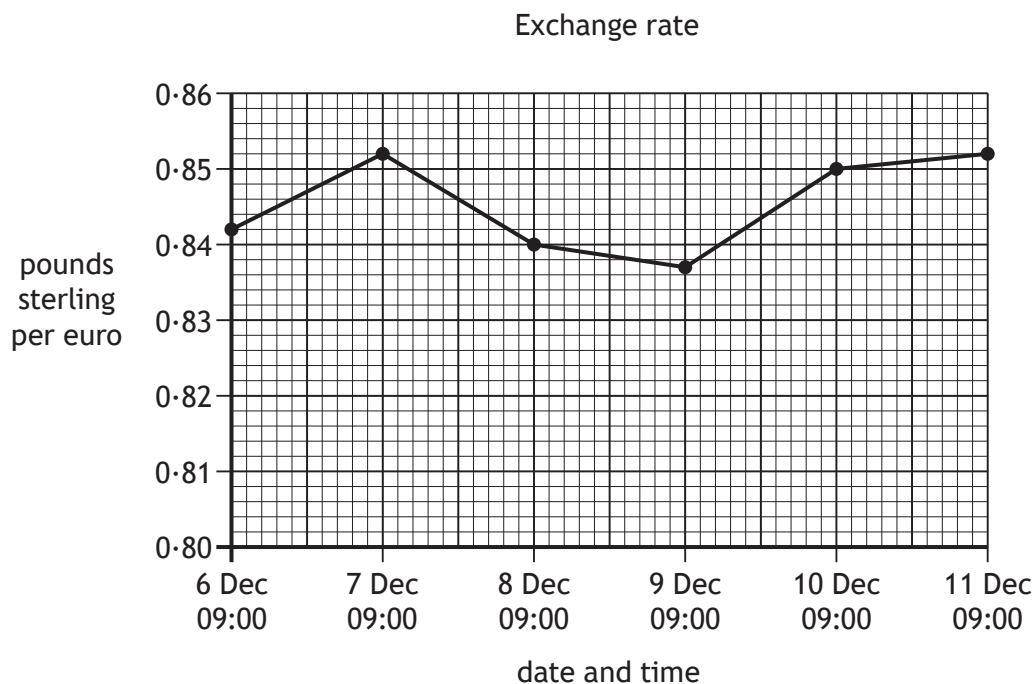


Calculate the volume of the bottle.

4



3. The graph shows how many pounds sterling could be bought for 1 euro during December 2017.



Daniel changed 250 euros to pounds sterling at 09:00 on 7 December.

- (a) Calculate how many pounds he received. 2

Daniel was working in France.
 He bought a laptop costing 400 euros.
 He calculated this was equivalent to £334.80.

- (b) Use the graph to find the date that Daniel bought the laptop.
 Use your working to justify your answer. 2



4. Karen buys and sells silver, gold and platinum.

The table shows the price per ounce of each of these metals, on the first trading day of each month, over the last year.

Month	Price of silver	Price of gold	Price of platinum
Jan	15.60	1170	1275
Feb	17.40	1140	1050
Mar	16.50	1210	1100
Apr	17.00	1200	1150
May	16.70	1190	1100
Jun	16.70	1275	1075
Jul	15.60	1175	1100
Aug	14.50	1190	850
Sep	14.60	1140	975
Oct	14.50	1125	1000
Nov	15.60	1195	1125
Dec	16.50	1200	1200
All prices in US dollars			

Karen bought 1 ounce of gold on the first trading day in March and sold it on the first trading day in September.

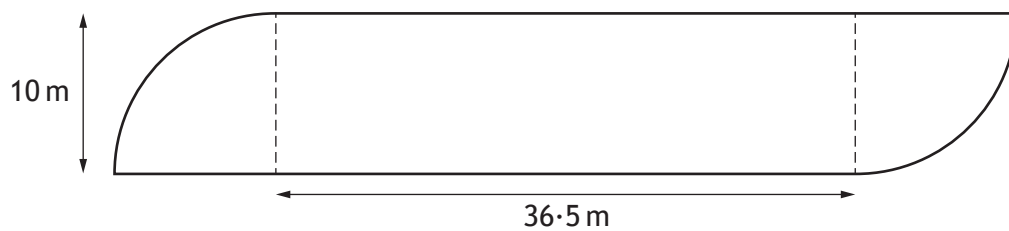
Calculate the percentage loss she made.

Give your answer to 2 decimal places.

3



5. A hotel is having a swimming pool built.
It is in the shape of a rectangle and two quarter circles as shown below.



The swimming pool will have a safety rail fitted around its edge.

- There will be two 125 cm wide gaps to allow access to the pool
- Safety rail is sold in 3 metre lengths
- Each 3 metre length costs £11.49

Calculate the minimum cost of the safety rail for the pool.

5



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

MARKS

DO NOT
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6. Denisa bought 375 shares for £4.50 per share.
She later sold them all for £5.20 per share.
She had to pay commission of 2.7% of the total selling price.
Calculate her total profit.

3



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

7. The birth weight of babies in a hospital in 2017 was recorded. A sample of the weights, in kilograms, is shown.

2.5 4.5 3.7 3.1 3.8 3.4

(a) For these weights, calculate

(i) the mean

1

(ii) the standard deviation.

3

The birth weight of babies born in hospital in 1987 was also recorded. The mean weight in 1987 was 3.4 kg and the standard deviation was 0.95 kg.

(b) Make two valid comparisons about the weight of babies in 1987 and 2017.

2



7. (continued)

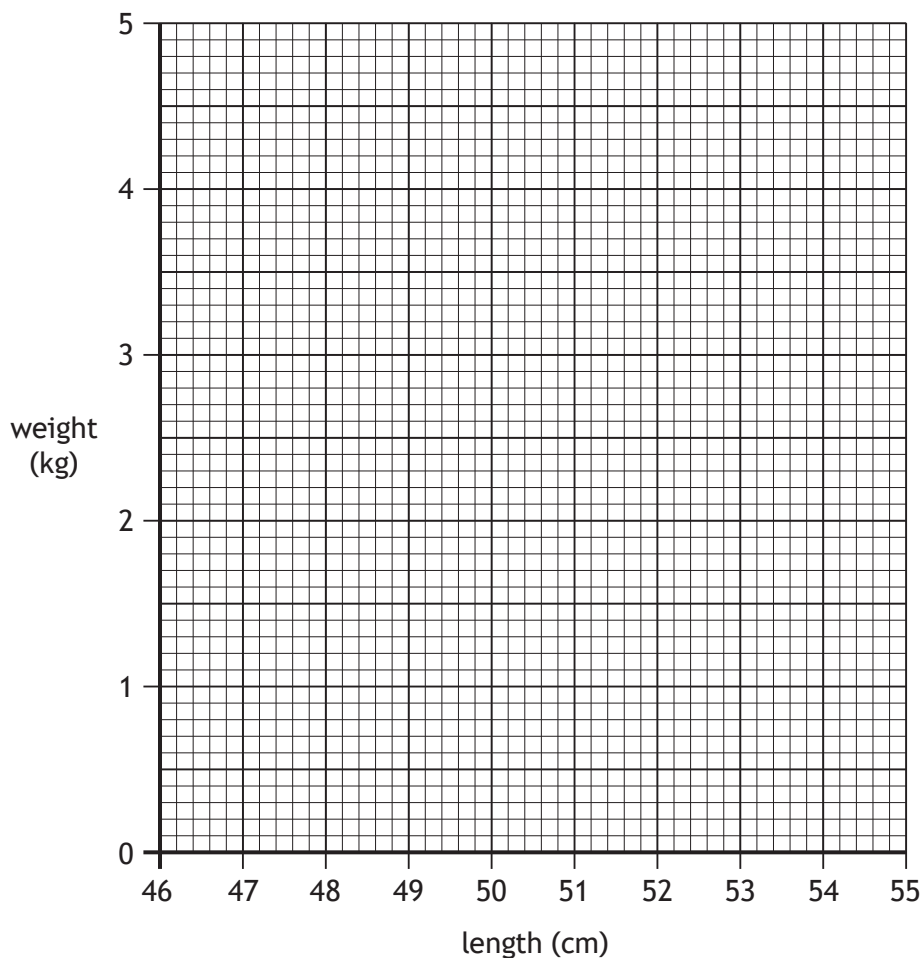
MARKS DO NOT WRITE IN THIS MARGIN

The lengths and weights of 8 new-born babies are recorded in the table as shown.

Length (cm)	46	47	49	51	52	52	54	55
Weight (kg)	2.7	2.8	3.5	3.7	3.4	3.7	4.0	4.4

- (c) (i) On the grid draw a scatter graph to show this data. 2
 (An additional grid, if required, can be found on page 20.)

New-born babies: weight versus length



- (ii) Draw a line of best fit on your scatter graph. 1
- (iii) Use your line of best fit to estimate the weight of a baby who was 50 cm when born. 1



7. (continued)

MARKS DO NOT WRITE IN THIS MARGIN

Baby milk powder is sold in 900 g packs.

The feeding guide from one of these packs is shown.

Approximate baby weight (kg)	Number of feeds per 24 hours	Number of level scoops per feed	Quantity of water per feed	
			ml	fl oz
less than 3.5	6	3	60	2
3.5 up to 4.0	6	4	90	3
4.0 up to 5.0	5	6	120	4
5.0 up to 6.5	5	7	150	5
6.5 up to 7.5	4	8	180	6
7.5 or more	3	7	150	5

Each level scoop contains 4.5 g of milk powder.

Baby Andrew weighs 7.1 kg.

(d) Determine whether a 900 g pack of milk powder will last Andrew 1 week.

Use your working to justify your answer.

3

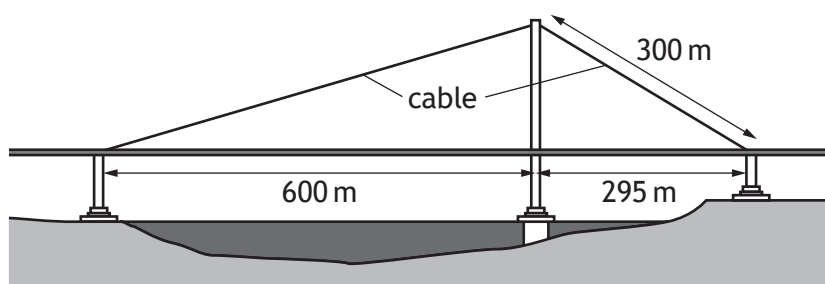


8. A new road bridge has been built.
A worker paints 367 lines along the centre of the road.
- Each line is four metres long
 - There is a gap of two metres between each line
 - The first line starts at the beginning of the bridge
 - The last line finishes at the end of the bridge

(a) Calculate the length of the bridge.

2

Two cables support a section of the bridge.
This section forms two right-angled triangles, as shown in the diagram.



(b) Calculate the total length of cable needed for this section of bridge.
Do not use a scale drawing.

4



9. David is writing his new book.

He spends

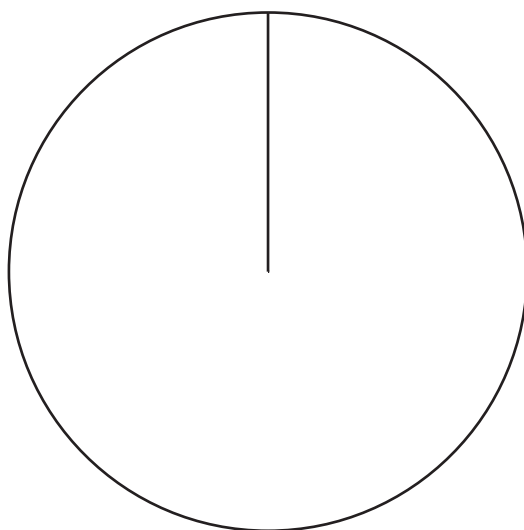
- 210 hours on research
- 96 hours in meetings
- 234 hours writing the book.

(a) Construct a pie chart to illustrate this information.

3

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

Time spent on each task



* X 8 4 4 7 5 0 2 1 3 *

9. (continued)

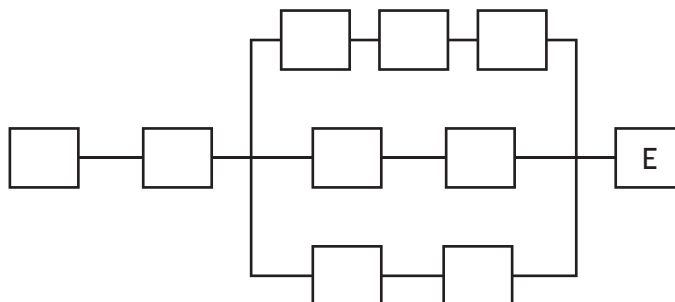
The publishing company produced the following table to show all the tasks involved in publishing the book.

Activity	Description	Preceding task
A	Illustrate cover	H
B	Write 1st draft	C
C	Research ideas	None
D	Edit book	B
E	Publish book	A,J,G
F	Re-work	D
G	Proof read	F
H	Choose title	B
I	Copyright	B
J	ISBN	I

(b) Complete the diagram below to show the tasks.

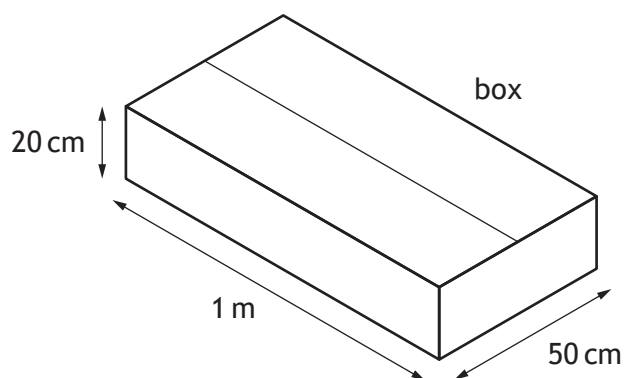
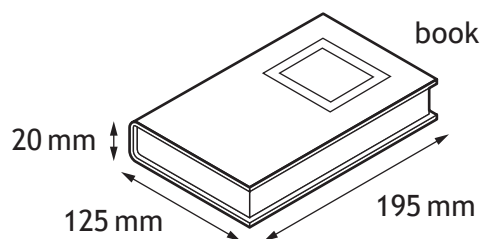
2

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



9. (continued)

The books are to be packed in boxes for transporting to the bookshops.
The dimensions of the book and the internal dimensions of the box are shown in the diagrams.



The books need to be laid with the front cover facing upwards in the boxes.
They must all be aligned in the same direction.

- (c) Calculate the maximum number of books that can be packed into each box.

3



9. (continued)

This is the fourth book that David has written in this series of books.
The cost of each book is shown in the table.

Book	Cost	Year published
1	£5.50	2013
2	£8.50	2015
3	£4.00	2016
4	£12.00	2019

The following special offers are available to buy all four books.



Buy all 4
save 20%



Buy all 4
for £22.99



Buy all 4
get the 2 most
recently published
half price

- (d) Determine which shop offers the best deal for buying all four books.
Use your working to justify your answer.

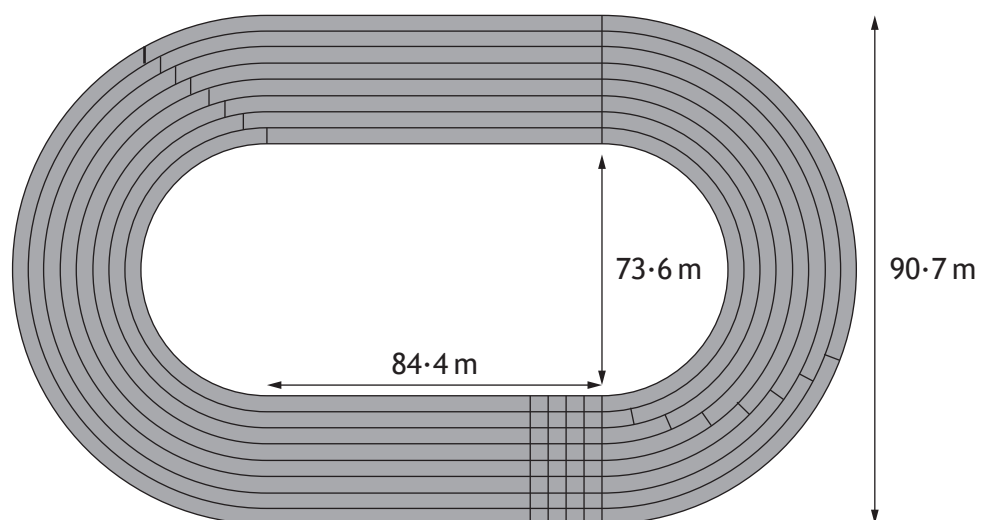
3



MARKS

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10. A sports ground is in the shape of a rectangle and two semi-circles as shown.



The running track is shaded in the diagram.

- (a) Calculate the area of the running track.

5



10. (continued)

The running track is to be resurfaced.

A resurfacing company has a team of 5 workers who can resurface a track of this size in 42 hours.

The resurfacing company are now able to provide 2 more workers to resurface this track.

All the workers work at the same rate.

(b) Calculate the time it will now take to resurface the track.

3



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

10. (continued)

John works for the resurfacing company.

His annual salary is £17 108.

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

National Insurance rates	
Up to £8424	0%
From £8424 to £46 384	12%
Over £46 384	2%

- (c) (i) Calculate John's annual National Insurance payment. 2

John pays 7% of his annual salary into his pension.

John's annual income tax is £1051.60.

- (ii) Calculate John's annual net pay. 2

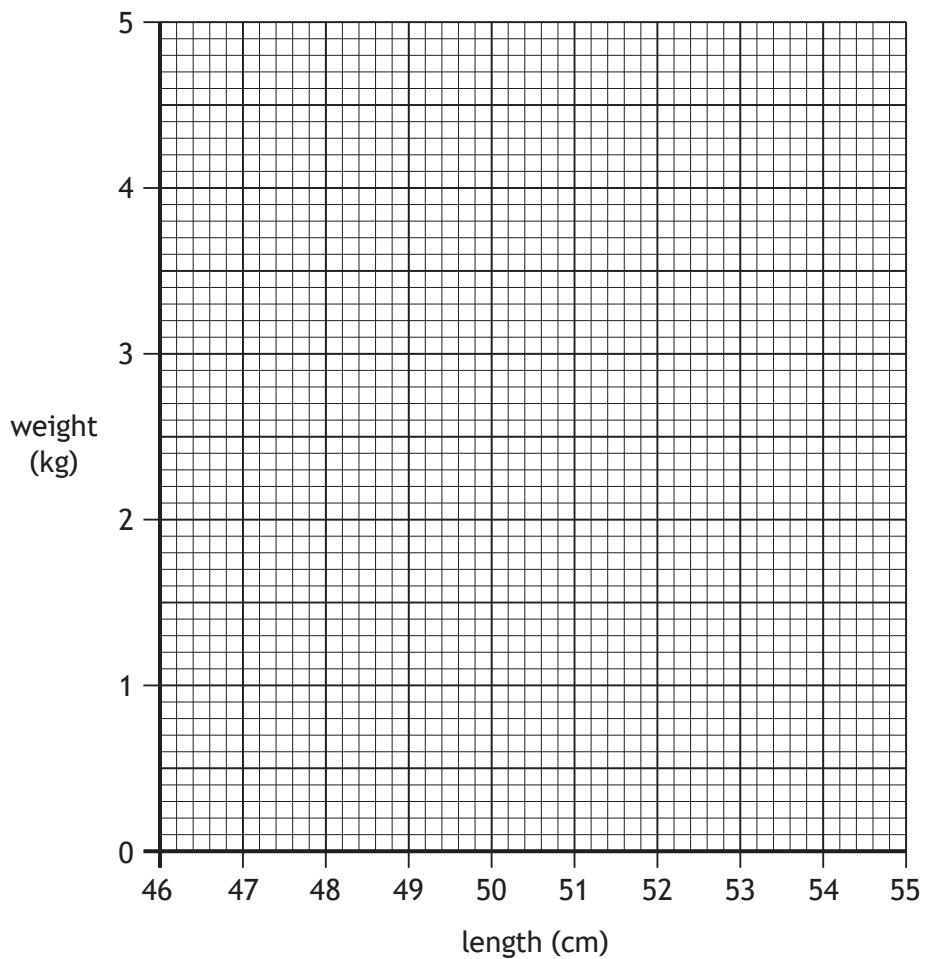
[END OF QUESTION PAPER]



ADDITIONAL SPACE FOR ANSWERS

Additional grid for use in question 7 (c) (i)

New-born babies: weight versus length

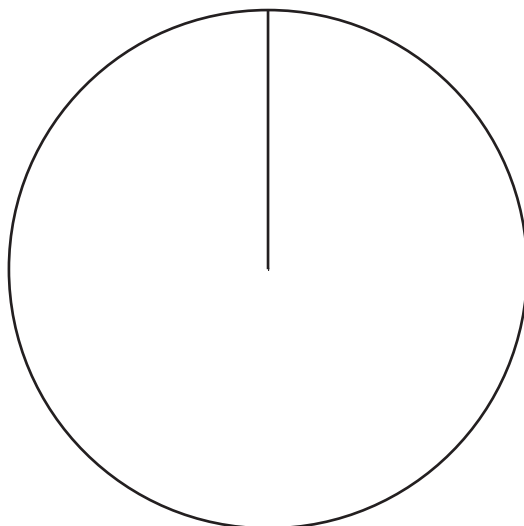


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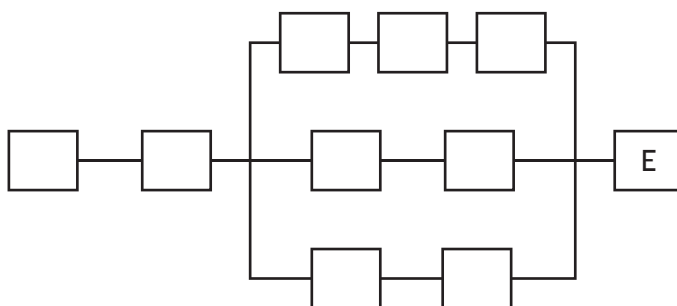
ADDITIONAL SPACE FOR ANSWERS

Additional diagram for use in question 9 (a)

Time spent on each task



Additional diagram for use in question 9 (b)



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