

FOR OFFICIAL USE



National  
Qualifications  
2023 MODIFIED

Mark

X844/75/01

# Applications of Mathematics Paper 1 (Non-calculator)

THURSDAY, 4 MAY

9:00 AM – 9:50 AM



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

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 — 35

Attempt ALL questions.

You must 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.



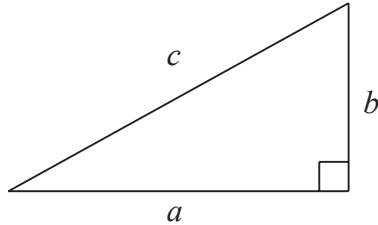
\* X 8 4 4 7 5 0 1 0 1 \*

## 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  $V = Ah$

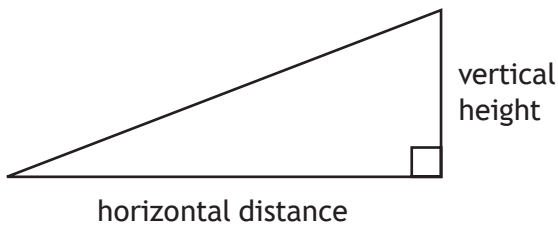
Volume of a cone  $V = \frac{1}{3} \pi r^2 h$

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

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

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

Gradient



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



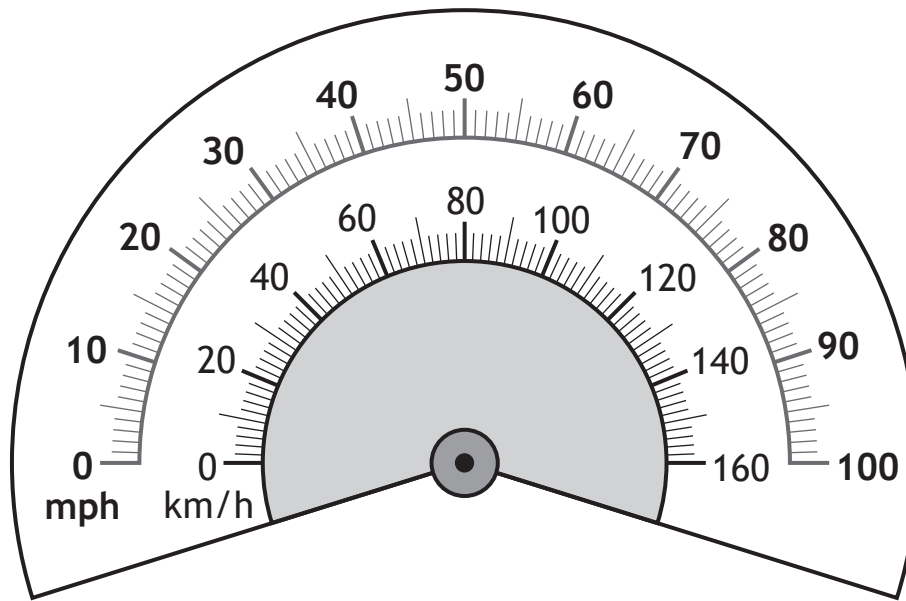
**Total marks — 35**  
**Attempt ALL questions**

1. Josh earns £9 per hour and works 30 hours a week.  
His weekly outgoings are £220 a week.  
Josh saves all his remaining money.  
He books a holiday costing £566.  
He will take £800 spending money with him.  
Calculate the minimum number of weeks it will take him to save the total amount. **2**

[Turn over



2. A lorry's speedometer is shown.



The lorry's speed is restricted to a maximum of 56 mph.  
 Use the speedometer to determine this speed in km/h.  
 (An additional diagram, if required, can be found on *page 17*.)

2

3. The crowd at a rugby match was made up of home supporters, away supporters and people who were neutral.

- $\frac{3}{7}$  were home supporters.
- $\frac{2}{5}$  were away supporters.
- The remaining people were neutral.

Calculate the fraction of the crowd that were neutral.

3

[Turn over



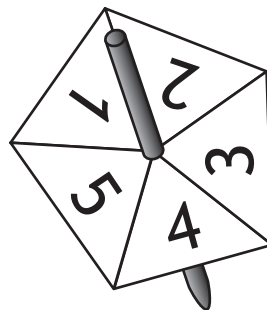
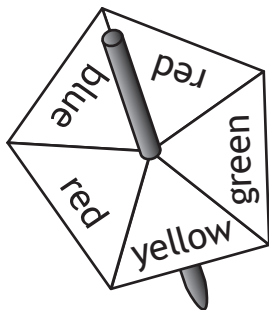
4. Geoffrey shared his savings between his three children, Sophie, Ed and Lucy. The money was shared in the ratio 7 : 2 : 6. Sophie received £3304. Calculate how much money Geoffrey gave his three children in total.

3



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

5. Eddie runs a stall at the school fundraiser.  
 His game requires two spinners to be spun and allowed to come to rest.  
 The spinners are shown.



A prize is won if one spinner lands on blue or green **and** the other spinner lands on an even number.

Calculate the probability of NOT winning a prize.

3

[Turn over



6. Kenny buys a new fridge.

The original price of the fridge was £650.

A shop is having a sale with 20% off the price of all fridges.

When Kenny goes to the shop, he finds there is an additional 2.5% off the sale price.

Calculate the price Kenny pays for the fridge.

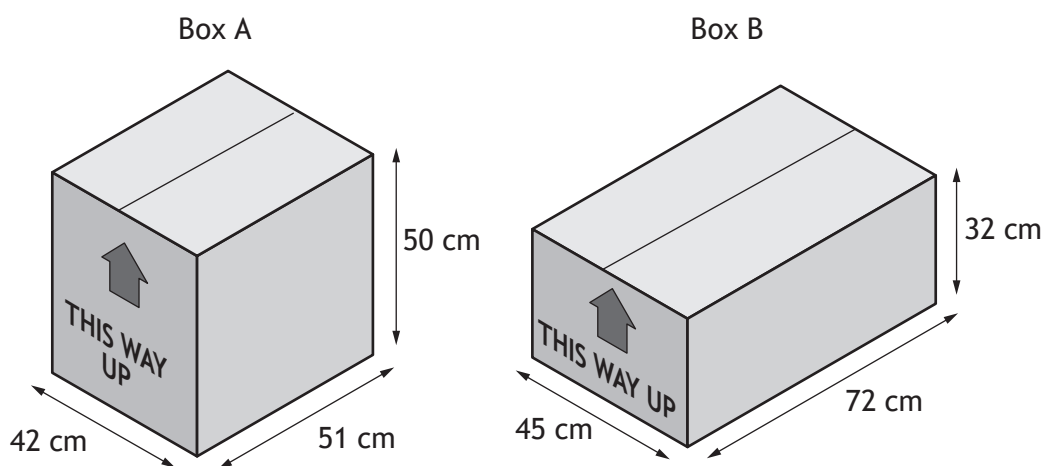
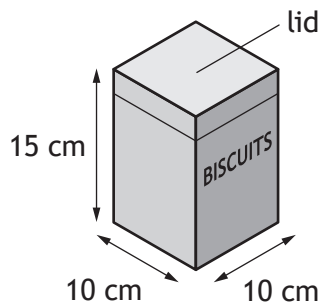
3



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



7. Biscuits are sold in tins in the shape of a cuboid as shown.  
The tins need to be packed into boxes with the lid facing upwards.  
There are two types of box available with internal measurements as shown.



Determine the maximum number of tins which can be packed.  
Use your working to justify your answer.

2

[Turn over



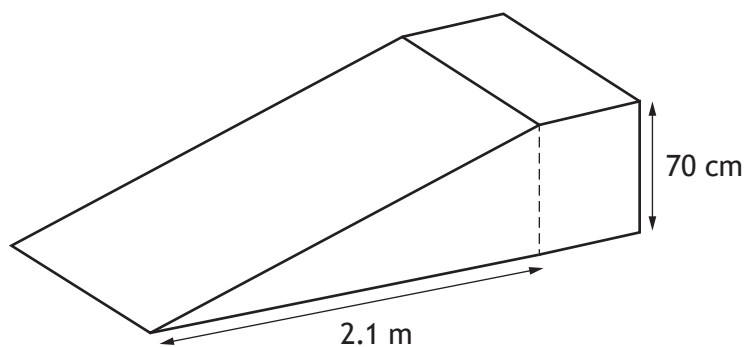
8. Janet travelled by car from her home to a meeting.  
She arrived at the meeting at 10:15 am.  
She travelled 136 miles at an average speed of 40 mph.  
During the journey she stopped for 50 minutes for breakfast.  
Determine the time Janet left home.

3



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

9. A design for a skatepark ramp is shown.  
The height of the ramp is 70 cm.



To be suitable the ramp must have a gradient of  $0.35 \pm 0.01$ .  
Determine whether the ramp is suitable.  
Use your working to justify your answer.

3

[Turn over

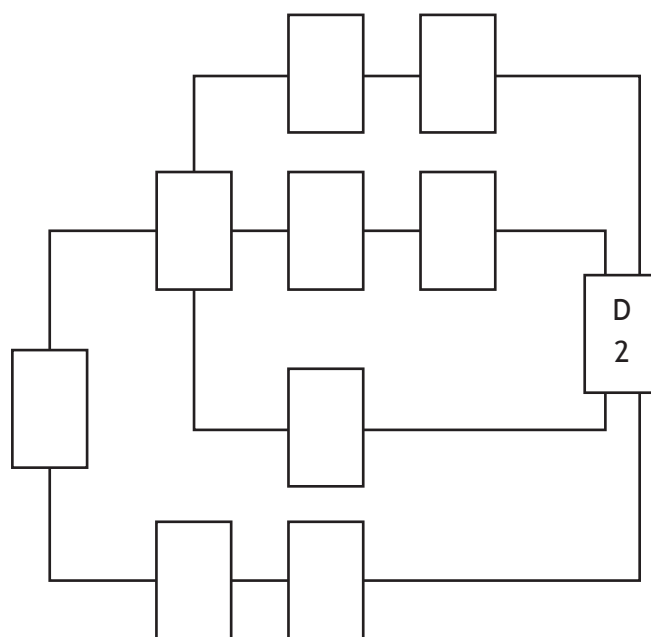


10. John owns a bike shop and has a team of mechanics who build each new bicycle. The table lists the tasks that need to be completed and the time required for each task.

Task	Detail	Preceding task	Time (minutes)
A	attach bicycle to bicycle clamp stand	F	1
B	grease pedals	A	1
C	attach wheels	A	7
D	put bike on display	G, H, I, J	2
E	grease saddle post	F	1
F	remove bicycle frame and parts from box	none	2
G	insert saddle post into frame and tighten	E	1
H	install headset	A	5
I	inflate the tyres	C	4
J	attach pedals	B	3

- (a) Complete the diagram below by writing these tasks and times in the boxes. (An additional diagram, if required, can be found on page 17.)

2



10. (continued)

John thinks that the team of mechanics will have the bike ready within 15 minutes.

(b) Determine if John is correct.

Use your working to justify your answer.

2

[Turn over



11. A survey was conducted into favourite pie fillings.

The results were:

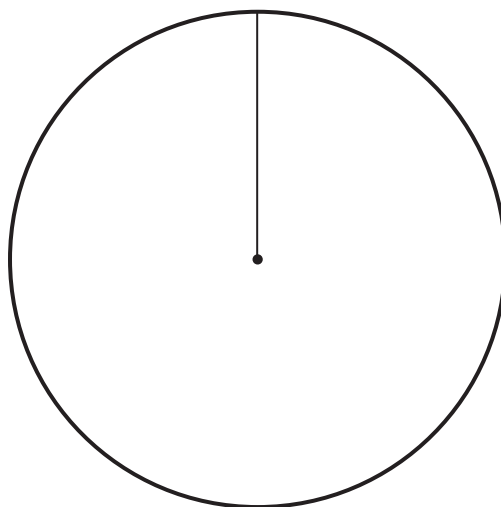
- 80 people for apple
- 40 people for cherry
- 60 people for lemon.

Construct a pie chart to illustrate this information.

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

3

Favourite pie fillings



12. Laura makes and sells fruit smoothies.

She intends to buy kiwi fruit in bulk.

She considers the following two options:

- Option 1: 35 kiwi fruit for £5.95
- Option 2: 45 kiwi fruit for £8.10

Determine which option offers the best value for money.

Use your working to justify your answer.

2

[Turn over



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

13. Senior students are preparing to sell scented candles at the school fair.

Before ordering the candles, they carried out a survey to find out which scent people preferred.

The results of the survey are shown below.

Preferred scent of candle	Linen	Vanilla	Rose	Cinnamon
Percentage of people	50%	35%	10%	5%

The students sell 180 candles in total.

They sold 65 vanilla scented candles.

Determine if this is more or less than expected.

2

[END OF QUESTION PAPER]



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



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**X844/75/02**

# Applications of Mathematics Paper 2

THURSDAY, 4 MAY  
10:20 AM – 12:00 NOON



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 — 55**

Attempt ALL questions.

**You may use a calculator.**

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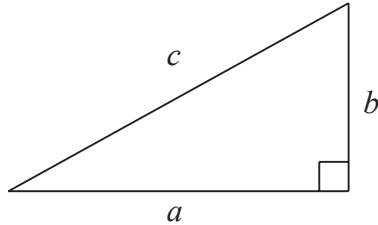


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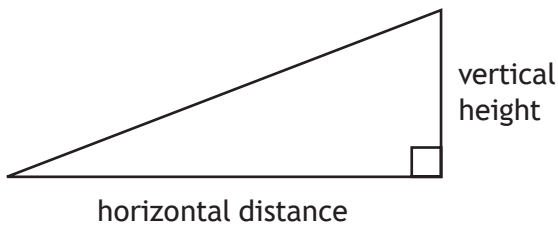
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Gradient



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Total marks — 55  
Attempt ALL questions

1. A lake had a volume of 14 730 000 litres.

Due to decreasing rainfall the volume of the lake is expected to decrease by 2.8% annually.

Calculate the expected volume of the lake after 3 years.

Give your answer to **3 significant figures**.

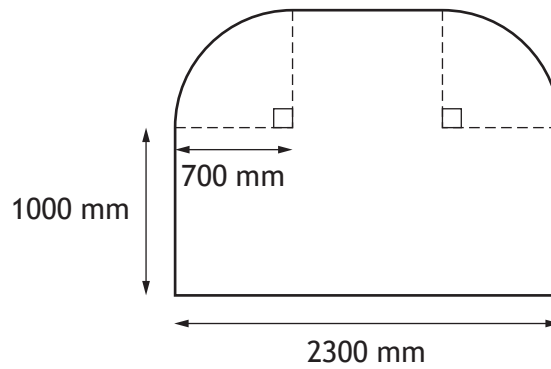
4

[Turn over



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

2. A glazier is edging the perimeter of a window.  
The window is in the shape of two rectangles and two identical quarter circles.

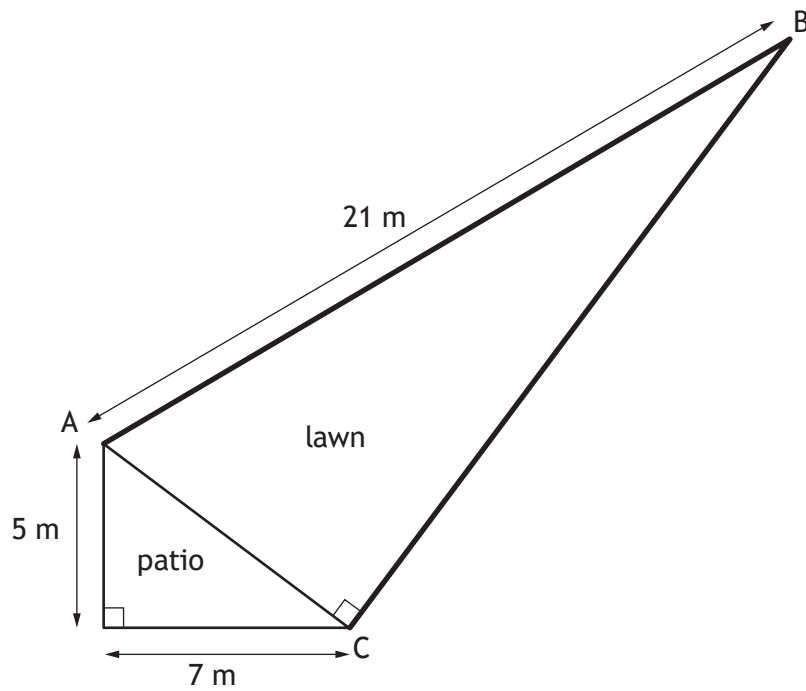


Calculate the length of edging required for the perimeter of the window.

3



3. Fiona is having her back garden redesigned.

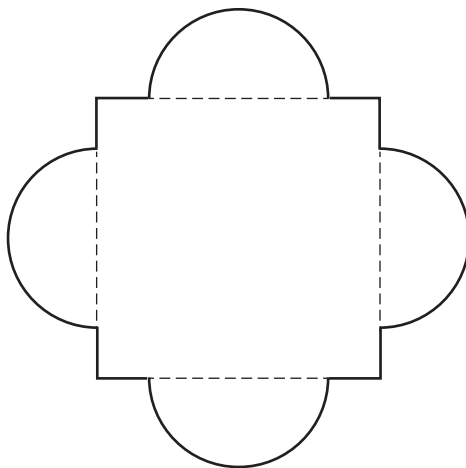


A new fence is to be put from A to B and from B to C.  
 Rolls of fencing are 3 m long and cost £22 per roll.  
 Calculate the cost of the fencing.

6



4. The reception area in a hotel features a large mirror.  
 The mirror is in the shape of a square with identical semi-circles on each side.
- The square has sides of length 1.2 metres.
  - The semi-circles have a **diameter** of 0.7 metres.



(a) Calculate the area of the mirror.

2

## 4. (continued)

The hotel bought a different mirror for the ballroom.

The options for mirrors are shown in the table.

<b>Glass coating</b>	standard: £12 per m <sup>2</sup>		anti-glare: £16 per m <sup>2</sup>			
<b>Fixings</b>	basic: £19 per mirror		standard: £32 per mirror		premium: £42 per mirror	
<b>Backing</b>	no backing: £0 per mirror			foil backing: £20 per mirror		
<b>Glass colour and thickness</b>	<b>Bronze (per m<sup>2</sup>)</b>		<b>Silver (per m<sup>2</sup>)</b>		<b>Gold (per m<sup>2</sup>)</b>	
	4 mm £18	6 mm £36	4 mm £38	6 mm £58	4 mm £66	6 mm £86.50

The hotel bought a mirror with an area of 3 m<sup>2</sup>.

The hotel chose the following options for the mirror:

- 4 mm thick silver glass
- anti-glare glass coating
- standard fixings
- foil backing.

(b) Calculate the total cost of this mirror.

2

[Turn over



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

5. Stuart records the chlorine levels in his hot tub.  
A sample of the levels is shown below.

Mon	Tue	Wed	Thurs	Fri	Sat	Sun
0.8	1.9	1.1	2.6	3.1	2.4	2.1

(a) For these levels, calculate:

(i) the mean

1

(ii) the standard deviation.

3





## 5. (continued)

His friend Colin's hot tub had a mean chlorine level of 2.2 and a standard deviation of 1.4.

- (b) Make two valid comparisons about the chlorine levels in Stuart's and Colin's hot tubs.

2

Colin had a new hot tub installed in his garden.

It normally takes a team of 4 workers 12 hours to complete the task.

The company sent an additional worker to help complete the task.

All workers work at the same rate.

The workers started at 08:00 and they took a 30 minute break for lunch.

- (c) Determine the time they finished installing the hot tub.

3

[Turn over



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

6. Lorna is travelling around Europe.

Rates of exchange	
Pounds sterling (£)	Other currencies
1	1.15 euros
1	4.94 Polish zlotys

- Lorna converted £640 into Polish zlotys.
- She was in Poland for 4 days.
- She spent 340 Polish zlotys each day she was in Poland.
- She converted her remaining Polish zlotys into euros.

(a) Calculate how many euros she received.

3



6. (continued)

Lorna visited Switzerland and decided to buy some cheese.  
The cost of five types of cheese is shown in the table.

Type of cheese	Cost per 250 grams in Swiss francs
Emmental	2.50
Gruyere	7.50
Raclette	7.00
Edam	3.00
Mozzarella	2.00

Lorna saw 3 different deals for buying cheese.



Lorna is going to buy 250 grams of each cheese.

- (b) Determine the best deal for buying all 5 cheeses.  
Use your working to justify your answer.

2

[Turn over

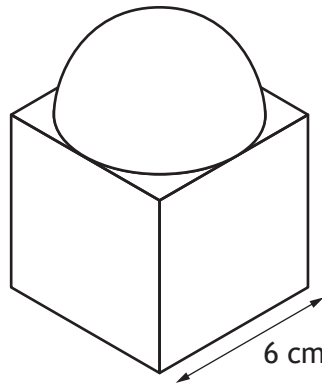


6. (continued)

Lorna also purchased a paperweight as a gift.

The paperweight is made in the shape of a cube with a hemisphere on top.

The hemisphere is half of a sphere with a diameter of 6 cm.



(c) Calculate the volume of the paperweight.

3

7. Dave has a job in an office typing documents.  
He is contracted to work 35 hours per week.  
He earns £11.20 per hour.  
He is paid time and a half for any overtime he works.  
Last week Dave worked 37.5 hours.
- (a) Calculate his gross wage last week.

2

Dave records the number of words per minute that he typed during a 14-minute period.

47 39 51 49 42 44 47 54 48 37 41 46 37 44

- (b) For this data, calculate:
- the median
  - the lower quartile
  - the upper quartile.

2



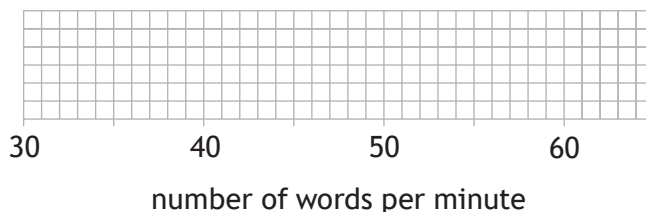
\* X 8 4 4 7 5 0 2 1 3 \*

7. (continued)

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

2

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



- (d) (i) Calculate the interquartile range for the number of words Dave can type per minute.

1

Lynn works in the same office as Dave.

Lynn also records the number of words per minute that she can type.

The interquartile range for the number of words that Lynn can type per minute is 5.

- (ii) Make one valid comment comparing the number of words Dave and Lynn can type per minute.

1



## 7. (continued)

Lynn earns £1052 a week.

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

National Insurance rates (weekly)	
Up to £242	0%
From £242 to £967	13.25%
Over £967	3.25%

- (e) (i) Calculate Lynn's weekly National Insurance payment.

3

Lynn pays 4.5% of her weekly wage into her pension.

Her weekly income tax is £52.08.

- (ii) Calculate Lynn's weekly net pay.

2



8. Jacqueline buys items online and sells them in her shop.  
Jacqueline bought a painting for £320 and sold it for £415.

(a) Calculate the percentage profit that she made.

2

Eileen wants to buy a new dining table from the shop.

It is advertised at a price of £800.

Eileen wishes to use a payment plan to buy the dining table.

The **total price** of the payment plan is **14% more** than the advertised price.

The payments are calculated as follows:

- the deposit is  $\frac{1}{4}$  of the total price
- 10 equal monthly instalments
- followed by a final payment of £100.

(b) Calculate the cost of each monthly instalment.

3



\* X 8 4 4 7 5 0 2 1 6 \*



8. (continued)

Jacqueline owns shops in Edinburgh, New York and Dubai.

Jacqueline wants an item sent from her Dubai shop to her New York shop.

It will be sent from her Dubai shop at 8:45 am local time on 24 November.

The expected delivery time is 90 hours.

New York is 5 hours behind Edinburgh.

Dubai is 4 hours ahead of Edinburgh.

- (c) Determine the local time **and** date the item is expected to arrive at her New York shop.

3

[END OF QUESTION PAPER]

