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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

* S 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 — 45**

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.

SQA ©

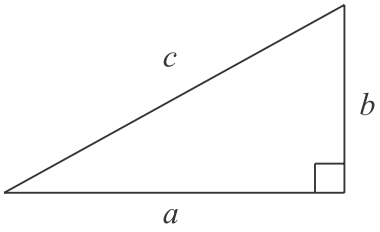
* S 8 4 4 7 5 0 1 0 1 *

**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: $V = \pi r^2 h$

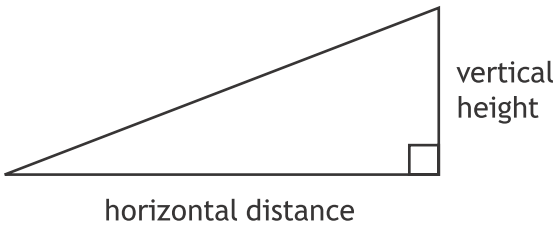
Volume of a prism: $V = Ah$

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: $s = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}} = \sqrt{\frac{\Sigma x^2 - (\Sigma x)^2/n}{n-1}}$, 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.** S6 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 $2{\cdot}4 \pm 0{\cdot}05$ 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 $CO_2$ 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 $CO_2$ 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**

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

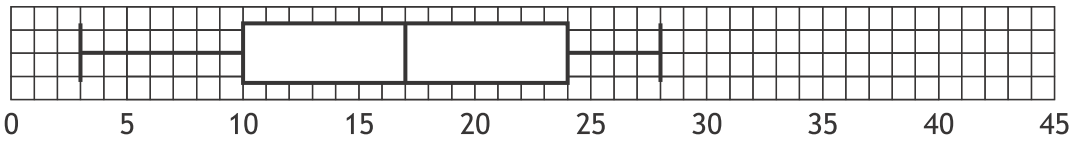
| Girls | | Boys |
|---|---|---|
| | 0 | 3 6 8 9 |
| 8 4 3 0 | 1 | 1 2 4 7 7 8 9 |
| 9 8 7 6 2 2 1 | 2 | 2 6 7 8 8 |
| 7 2 0 | 3 | |
| 2 | 4 | |
| n = 15 | | n = 16 |

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

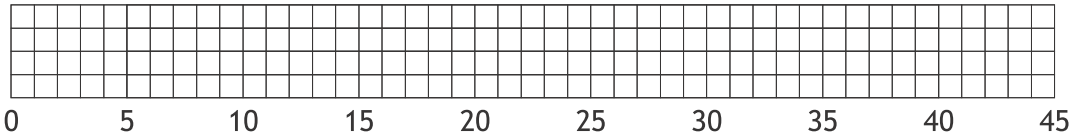
the lower quartile

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**

**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.

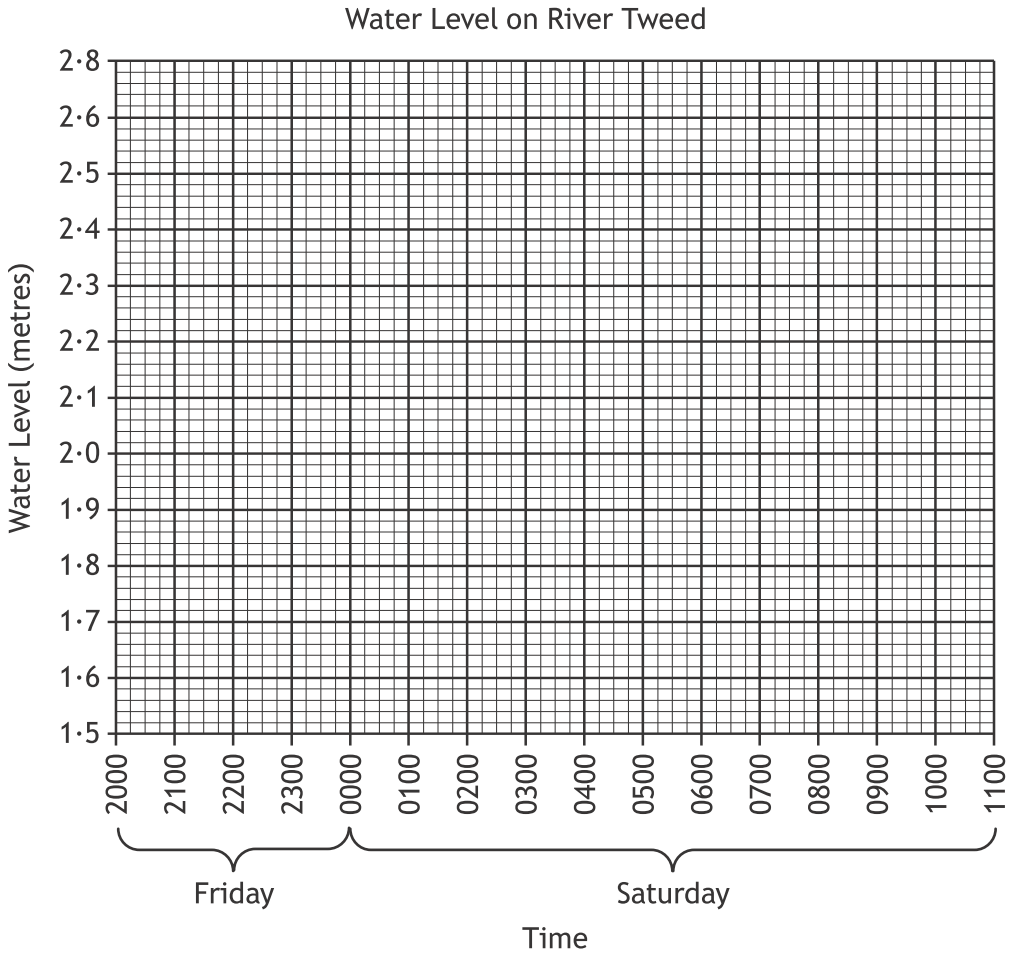
Give your answer in **hours and minutes**. **3**

**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**

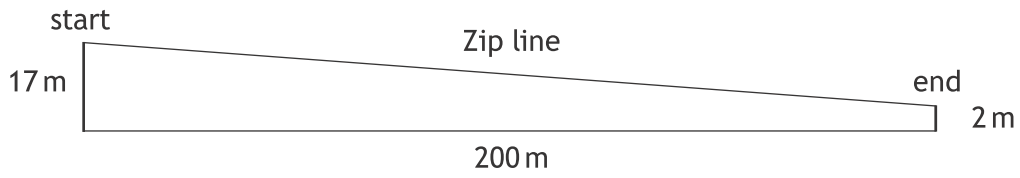
| River Tweed | |
|---|---|
| Water level: | |
| Huge | > 3·5 |
| Very High | 2·5 - 3·5 |
| High | 2·0 - 2·5 |
| Medium | 1·7 - 2·0 |
| Low | 1·2 - 1·7 |
| Scrapeable | 0·0 - 1·2 |
| Empty | never |

Will the Tweed be "Very High" at 0830?

Justify your answer. **2**

**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 2½% of her selling price when she sells her shares.
Calculate the loss that she has made. **4**

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

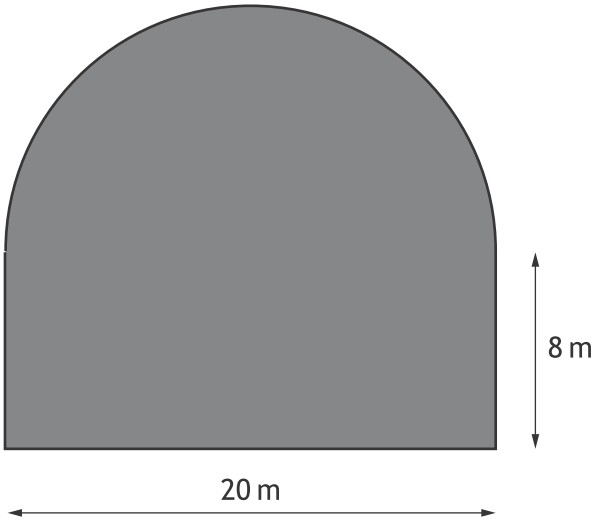



It is recommended that the average gradient of the zip line should be between 0·06 and 0·08 to be safe.

Does the planned zip line meet these safety recommendations?

Use your working to justify your answer. **3**

**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. **3**

Take $\pi = 3{\cdot}14$.

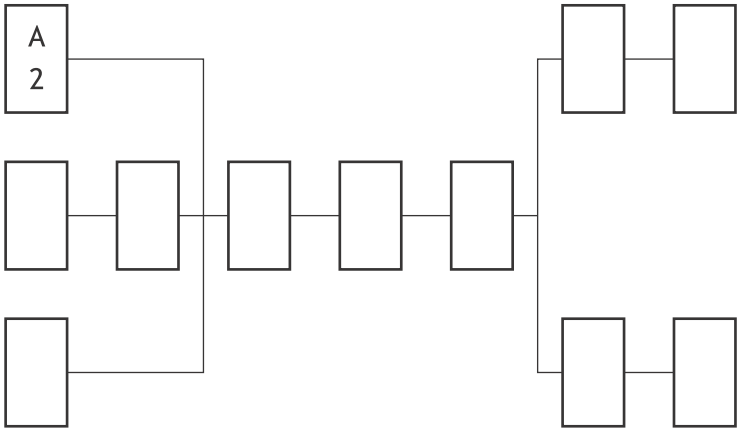
MARKS DO NOT WRITE IN THIS MARGIN

(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.

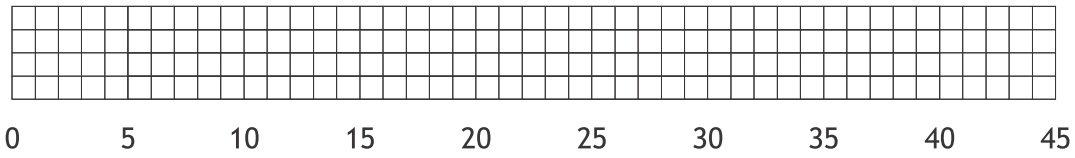
Is this a valid claim?

Use your working to justify your answer. **2**

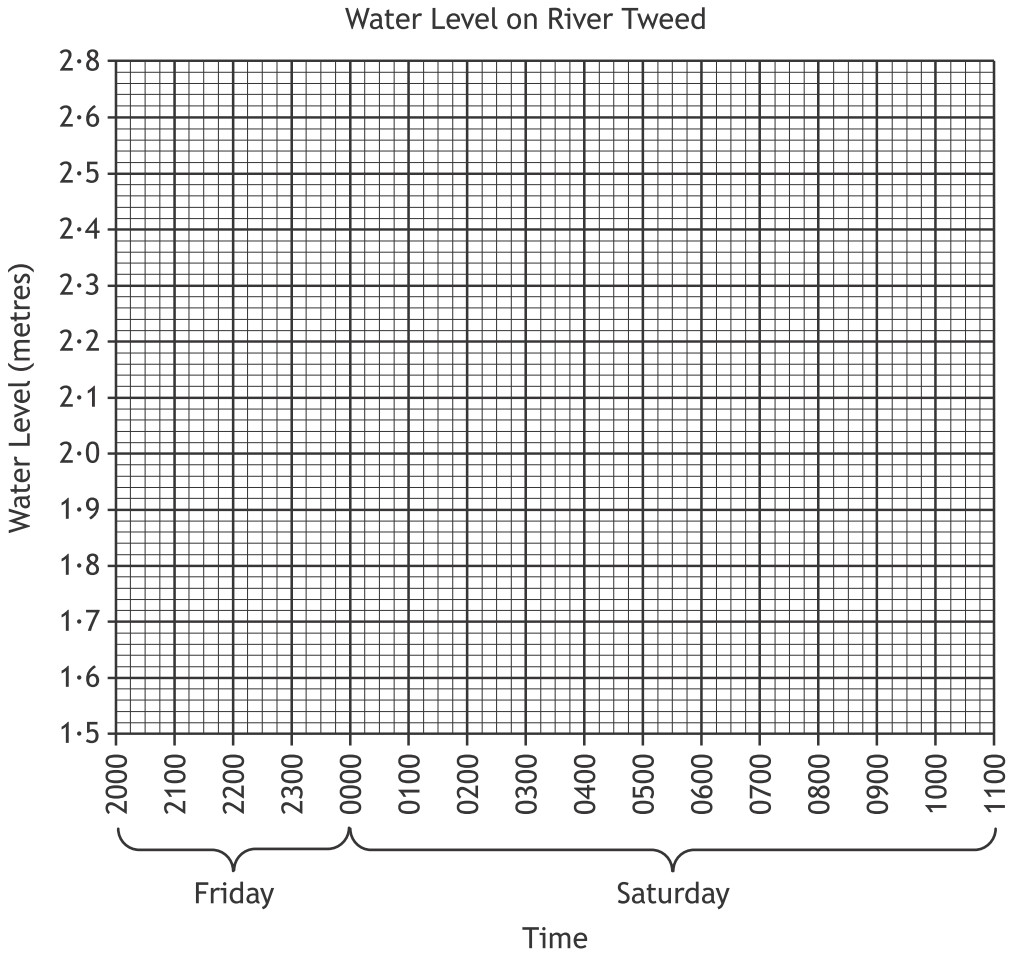
**[END OF SPECIMEN QUESTION PAPER]**

## 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)