

FREE SAMPLE: THE FIRST 3 QUESTIONS

Question 1 (10 marks)

Suggested maximum time: 5 minutes.

A game consists of spinning a fair spinner and rolling a fair 4-sided die. The spinner has 4 equal coloured sectors: black (K), white (W), grey (Y) and pink (P).

(a) Complete the table below to show all 16 possible outcomes of the game. Two have already been done for you. For example, K1 means black on the spinner and 1 on the die.

Spinner \ Die	1	2	3	4
K	K1			
W		W2		
Y				
P				

[4 marks]

(b) Each outcome in the table is equally likely. The game is played once. Find the probability that the outcome is grey on the spinner.

[3 marks]

(c) Find the probability that the outcome is grey on the spinner and an even number on the die.

[3 marks]

Question 2 (25 marks)

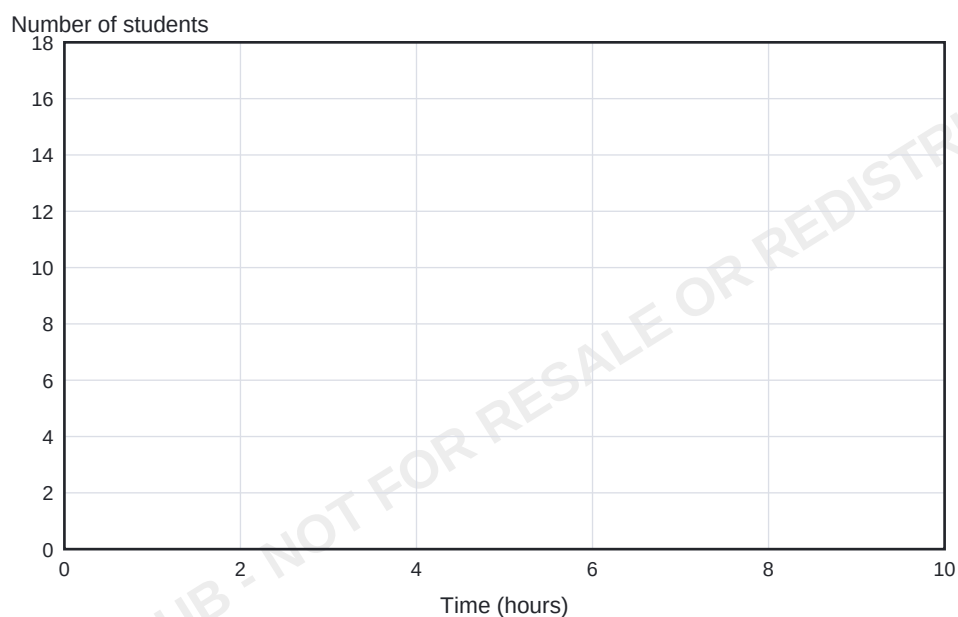
Suggested maximum time: 10 minutes.

45 students were asked how much time they spent on their phone on a particular day. The results are shown in the frequency table below. [Note: 2 – 4 means 2 hours or more but less than 4 hours, and so on.]

(a) Draw a histogram to show the information in the table. Use the axes below.

Time (hours)	0 – 2	2 – 4	4 – 6	6 – 8	8 – 10
Number of students	14	14	8	5	4

[6 marks]



(b) Find the minimum number of students who could have given an answer of less than 7 hours.

[4 marks]

[6 marks]

[9 marks]

Most common use of their phone	Social media	Video streaming	Gaming	Messaging
Number of students	2	32	4	7

[3 marks]

(b) Martina pays a customs charge of €2430. Write this charge as a percentage of €18 000.

[3 marks]

(c) Martina has a gross annual income of €59 000. Martina pays income tax on this income at the rates given in the table. Work out Martina's annual income tax at each of these two rates (20% and 40%).

Annual income	Tax rate
First €44 000	20%
Balance	40%

[5 marks]

(d) Martina has annual tax credits of €3500. Work out Martina's net annual income.

[6 marks]

(e) Martina gets a pay rise and Martina's net annual income increases by €1500. Work out Martina's new gross annual income.

[8 marks]

THE WORKED ANSWERS TO THOSE 3 QUESTIONS

Question 1 (10 marks) [Probability and outcomes]

Suggested maximum time: 5 minutes. A game consists of spinning a fair spinner and rolling a fair 4-sided die. The spinner has 4 equal coloured sectors: black (K), white (W), grey (Y) and pink (P).

(a) Complete the table below to show all 16 possible outcomes of the game. Two have already been done for you. For example, K1 means black on the spinner and 1 on the die.

(a) Answer: All 16 outcomes: K1 K2 K3 K4; W1 W2 W3 W4; Y1 Y2 Y3 Y4; P1 P2 P3 P4

- Every colour on the spinner can be paired with every number on the die, so there are $4 \times 4 = 16$ outcomes.
- Write one row for each colour: the colour letter followed by each die number from 1 to 4.
- Rows: K: K1 K2 K3 K4; W: W1 W2 W3 W4; Y: Y1 Y2 Y3 Y4; P: P1 P2 P3 P4.
- Check the count: 4 rows of 4 outcomes = 16.

KEY TAKEAWAY

A two-stage game: list the outcomes in a table, one row for each result of the first stage and one column for each result of the second. Total outcomes = first $\times$ second.

(b) Each outcome in the table is equally likely. The game is played once. Find the probability that the outcome is grey on the spinner.

(b) Answer: $\frac{1}{4}$

- There are 16 outcomes in total, and each is equally likely.
- The outcomes with grey on the spinner are the whole Y row: 4 outcomes.
- Probability = favourable outcomes $\div$ total outcomes = $\frac{4}{16} = \frac{1}{4}$.

KEY TAKEAWAY

Probability = number of favourable outcomes $\div$ total number of outcomes. Always simplify the fraction.

(c) Find the probability that the outcome is grey on the spinner and an even number on the die.

(c) Answer: $\frac{1}{8}$

- Look at the Y row and pick out only the outcomes where the die shows an even number.
- The numbers on the die that fit are 2, 4, so there are 2 favourable outcomes.
- Probability = $\frac{2}{16} = \frac{1}{8}$.

KEY TAKEAWAY

For 'A and B' in a two-stage game, count the cells of the table that satisfy both conditions and divide by the total.

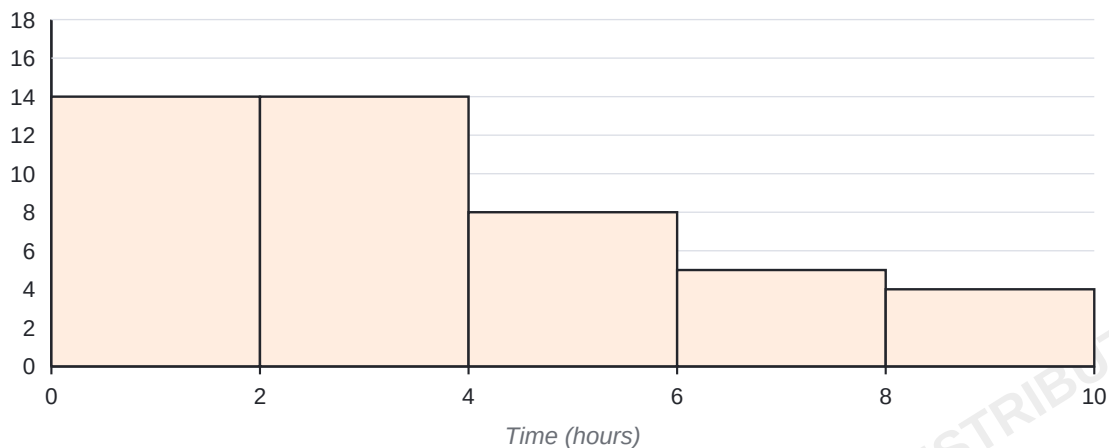
LOS: Probability and outcomes (Junior Cycle Mathematics, Higher Level, Statistics and Probability)

Question 2 (25 marks) [Statistics: tables, histograms, means and pie charts]

Suggested maximum time: 10 minutes. 45 students were asked how much time they spent on their phone on a particular day. The results are shown in the frequency table below. [Note: 2 – 4 means 2 hours or more but less than 4 hours, and so on.]

(a) Draw a histogram to show the information in the table. Use the axes below.

Number of students



(a) Answer: A histogram with bars of equal width and heights (0–2: 14, 2–4: 14, 4–6: 8, 6–8: 5, 8–10: 4).

- The class intervals all have the same width (2 hours), so the height of each bar is simply the frequency.
- Draw one bar for each class, with no gaps, from the lower to the upper class boundary on the horizontal axis.
- Bar heights: 0–2: 14, 2–4: 14, 4–6: 8, 6–8: 5, 8–10: 4.
- Label both axes and check that the total of the heights is 45.

KEY TAKEAWAY

A histogram has touching bars; with equal class widths the height of each bar is the frequency of its class.

(b) Find the minimum number of students who could have given an answer of less than 7 hours.

(b) Answer: 36

- The value 7 hours lies inside the class 6 – 8, so we do not know exactly how many in that class are below it.
- Everyone in the classes below that one is definitely under 7 hours: $14 + 14 + 8 = 36$.
- Minimum: none of the 5 in the class 6 – 8 need be below it, so the answer is 36.

KEY TAKEAWAY

When a value falls inside a class you only know a range: the minimum counts the classes fully below it, the maximum adds the whole class it falls in.

(c) Use mid-interval values to estimate the mean for the 45 students. Give your answer in hours, correct to 1 decimal place.

(c) Answer: 3.7 hours

- Write the mid-interval value of each class: 1, 3, 5, 7, 9.
- Multiply each mid-interval value by its frequency and add: $(1 \times 14) + (3 \times 14) + (5 \times 8) + (7 \times 5) + (9 \times 4)$.
- Sum = 167.
- Mean = $167 \div 45 = 3.7$ hours (1 d.p.).

KEY TAKEAWAY

Estimated mean from a grouped table = $\Sigma(\text{mid-interval value} \times \text{frequency}) \div \text{total frequency}$.

(d) The 45 students were also asked about their most common use of their phone. The results are shown in the table. Complete a pie chart to show this information. Label each sector and the size of each angle clearly. Show any workings out.

(d) Answer: Angles: Social media 16°, Video streaming 256°, Gaming 32°, Messaging 56° (total 360°).

- The whole circle is 360° and it represents all 45 students, so one student is worth $360 \div 45 = 8^\circ$.
- Angle of each sector = frequency $\times 8^\circ$: Social media $2 \times 8 = 16^\circ$, Video streaming $32 \times 8 = 256^\circ$, Gaming $4 \times 8 = 32^\circ$, Messaging $7 \times 8 = 56^\circ$.
- Check: $16 + 256 + 32 + 56 = 360^\circ$.
- Measure the angles with a protractor, draw the sectors in order and label each one with its name and angle.

KEY TAKEAWAY

Pie chart: sector angle = $(\text{frequency} \div \text{total}) \times 360^\circ$. The angles must add to 360° .

LOS: Statistics: tables, histograms, means and pie charts (Junior Cycle Mathematics, Higher Level, Statistics and Probability)

Question 3 (25 marks) [Money, currency and income tax]

Suggested maximum time: 10 minutes.

(a) Martina buys a car from abroad. The cost of the car is \$22 500 US. The exchange rate is €1 = \$1.25 US. Show that the cost of the car in euro is €18 000.

(a) Answer: $22\,500 \div 1.25 = \text{€}18\,000$

- €1 is worth \$1.25, so to change to euro we divide by the exchange rate.
- Cost in euro = $22\,500 \div 1.25$.
- $22\,500 \div 1.25 = 18\,000$, so the cost is €18 000, as required.

KEY TAKEAWAY

Foreign currency → euro: divide by the exchange rate (units of foreign currency for €1).

(b) Martina pays a customs charge of €2430. Write this charge as a percentage of €18 000.

(b) Answer: 13.5%

- Percentage = (part ÷ whole) × 100.
- Charge as a percentage of the cost = $(2430 \div 18\,000) \times 100$.
- = 13.5%.

KEY TAKEAWAY

To write one amount as a percentage of another: $\text{part} \div \text{whole} \times 100$.

(c) Martina has a gross annual income of €59 000. Martina pays income tax on this income at the rates given in the table. Work out Martina's annual income tax at each of these two rates (20% and 40%).

(c) Answer: Tax at 20% = €8800; tax at 40% = €6000

- Income taxed at 20% = the first €44 000, so tax = $0.20 \times 44\,000 = €8800$.
- Income taxed at 40% = the balance = $59\,000 - 44\,000 = 15\,000$.
- Tax at 40% = $0.40 \times 15\,000 = €6000$.

KEY TAKEAWAY

Income tax with two rates: apply each rate only to the part of the income in its band, then add.

(d) Martina has annual tax credits of €3500. Work out Martina's net annual income.

(d) Answer: €47 700

- Total tax before credits = $8800 + 6000 = 14\,800$.
- Tax payable = total tax – credits = $14\,800 - 3500 = 11\,300$.
- Net income = gross income – tax payable = $59\,000 - 11\,300 = €47\,700$.

KEY TAKEAWAY

Net income = gross income – (income tax – tax credits). Credits reduce the tax you pay.

(e) Martina gets a pay rise and Martina's net annual income increases by €1500. Work out Martina's new gross annual income.

(e) Answer: €61 500

- The tax credits do not change, and the extra income is all taxed at the 40% rate, so for every extra €1 of gross income Martina keeps €0.60.
- Increase in gross income = increase in net income ÷ 0.60 = $1500 \div 0.6 = 2500$.
- New gross income = $59\,000 + 2500 = €61\,500$.

KEY TAKEAWAY

Extra income above the standard rate band is taxed at the higher rate, so net increase = gross increase × (1 – 0.40).

LOS: Money, currency and income tax (Junior Cycle Mathematics, Higher Level, Number)