



- 1 A histogram shows the heights of 71 trees. The table gives the frequency density for each class.

Height (h m)	Frequency density
$0 < h \leq 10$	1.2
$10 < h \leq 20$	2.5
$20 < h \leq 40$	1.5
$40 < h \leq 50$	0.4

Work out the frequency for each class and check that the total is 71.

(2 marks)

$$\text{frequency} = \text{fd} \times \text{width}$$

$$0-10: 1.2 \times 10 = 12$$

$$10-20: 2.5 \times 10 = 25$$

$$20-40: 1.5 \times 20 = 30$$

$$40-50: 0.4 \times 10 = 4$$

$$12 + 25 + 30 + 4 = 71$$

$$\boxed{12, 25, 30, 4}$$

2

A histogram shows the waiting times, w minutes, of 50 callers. The table gives the frequency density for each class.

Waiting time (w minutes)	Frequency density
$0 < w \leq 5$	2
$5 < w \leq 10$	4
$10 < w \leq 15$	3
$15 < w \leq 20$	1

Work out an estimate for the mean waiting time.

(3 marks)

frequencies: $2 \times 5, 4 \times 5, 3 \times 5, 1 \times 5 = 10, 20, 15, 5$

midpoints: 2.5, 7.5, 12.5, 17.5

$$2.5 \times 10 = 25$$

$$7.5 \times 20 = 150$$

$$12.5 \times 15 = 187.5$$

$$17.5 \times 5 = 87.5$$

$$\text{total} = 450$$

$$\text{mean} = \{450\} / \{50\}$$

9 minutes

3

A histogram shows the times, t minutes, taken by 60 pupils to travel to school. The table gives the frequency density for each class.

Time (t minutes)	Frequency density
$0 < t \leq 10$	1.8
$10 < t \leq 15$	3.2
$15 < t \leq 25$	1.4
$25 < t \leq 45$	0.6

Work out an estimate for the mean time.

(4 marks)

$$0-10: 1.8 \times 10 = 18$$

$$10-15: 3.2 \times 5 = 16$$

$$15-25: 1.4 \times 10 = 14$$

$$25-45: 0.6 \times 20 = 12$$

midpoints 5, 12.5, 20, 35

$$5 \times 18 = 90$$

$$12.5 \times 16 = 200$$

$$20 \times 14 = 280$$

$$35 \times 12 = 420$$

$$\text{total} = 990$$

$$\text{mean} = \{990\} / \{60\}$$

$$16.5 \text{ minutes}$$

4

A histogram shows the masses, m kg, of parcels in a depot. There is no scale on the vertical axis, so the table gives the height of each bar in cm.

Mass (m kg)	Bar height (cm)
$0 < m \leq 2$	1.5
$2 < m \leq 4$	3
$4 < m \leq 8$	2.5
$8 < m \leq 10$	0.5

The bar for $2 < m \leq 4$ represents 18 parcels.

- Work out the frequency density that a bar of height 1 cm stands for.
- Work out an estimate for the mean mass of a parcel.

(4 marks)

a)

$$fd = \{18\} / \{2\} = 9$$

$$9 \div 3 \text{ cm} = 3$$

$$\text{frequency density} = 3 \times \text{height}$$

b)

$$0-2: 1.5 \times 3 = 4.5, \times 2 = 9$$

$$2-4: 18$$

$$4-8: 2.5 \times 3 = 7.5, \times 4 = 30$$

$$8-10: 0.5 \times 3 = 1.5, \times 2 = 3$$

$$\text{total} = 9 + 18 + 30 + 3 = 60$$

$$\text{midpoints } 1, 3, 6, 9$$

$$9 + 54 + 180 + 27 = 270$$

$$\text{mean} = \{270\} / \{60\}$$

$$\boxed{\text{a) } fd = 3 \times \text{height} \text{ b) } 4.5 \text{ kg}}$$

5

A histogram shows the journey times, d minutes, of 50 delivery drivers. The table gives the frequency density for each class.

Time (d minutes)	Frequency density
$0 < d \leq 4$	2.5
$4 < d \leq 8$	5
$8 < d \leq 12$	3.75
$12 < d \leq 16$	1.25

- a. Work out an estimate for the mean journey time.
 b. The company then looked at the 50 original times and found the exact mean was 7.4 minutes.
 Explain why this is different from your estimate.

(4 marks)

a)

frequencies: 10, 20, 15, 5

midpoints: 2, 6, 10, 14

$$2 \times 10 = 20$$

$$6 \times 20 = 120$$

$$10 \times 15 = 150$$

$$14 \times 5 = 70$$

$$\text{total} = 360$$

$$\text{mean} = \{360\} / \{50\}$$

$$\text{mean} = 7.2 \text{ minutes}$$

b)

estimate assumes all values are at the midpoints

real values are spread out in each class

a) 7.2 minutes b) midpoints are only an assumption

6

The table shows the frequency densities from a histogram of the waiting times, w minutes, of 40 callers to a helpline.

Waiting time (w minutes)	Frequency density
$0 < w \leq 4$	2
$4 < w \leq 10$	3
$10 < w \leq 12$	5
$12 < w \leq 20$	0.5

- a. Show that the histogram represents 40 callers.
b. Calculate an estimate for the mean waiting time.

(4 marks)

Frequencies

$$2 \times 4 = 8, 3 \times 6 = 18, 5 \times 2 = 10, 0.5 \times 8 = 4. \text{ Total} = 40$$

The exact waiting times within each group are unknown. Use the midpoint to represent each caller in that group, so the resulting mean is an estimate

Midpoints: 2, 7, 11, 16

$$(2 \times 8) + (7 \times 18) + (11 \times 10) + (16 \times 4) = 16 + 126 + 110 + 64 = 316$$

$$\text{Estimated mean} = 316 \div 40 = 7.9 \text{ minutes}$$

7

A histogram shows the ages, x years, of 80 members of a club. Some of the frequency densities are in the table.

Age (x years)	Frequency density
$0 < x \leq 10$	2.4
$10 < x \leq 30$	1.4
$30 < x \leq 40$	k
$40 < x \leq 60$	0.4

- a. Work out the value of k .
b. Work out an estimate for the mean age.

(5 marks)

a)

$$0-10: 2.4 \times 10 = 24$$

$$10-30: 1.4 \times 20 = 28$$

$$40-60: 0.4 \times 20 = 8$$

$$24 + 28 + 8 = 60$$

$$30-40 \text{ frequency} = 80 - 60 = 20$$

$$10k = 20$$

 $\div 10$

$$k = 2$$

 $\div 10$

b)

midpoints 5, 20, 35, 50

$$5 \times 24 = 120$$

$$20 \times 28 = 560$$

$$35 \times 20 = 700$$

$$50 \times 8 = 400$$

$$\text{total} = 1780$$

$$\text{mean} = \{1780\} / \{80\}$$

$$\boxed{\text{a) } k = 2 \text{ b) } 22.25 \text{ years}}$$

A histogram shows the times, t minutes, that 80 shoppers spent in a shop. The table gives the height of each bar in cm.

Time (t minutes)	Bar height (cm)
$0 < t \leq 2$	1.5
$2 < t \leq 4$	1
$4 < t \leq 8$	2
$8 < t \leq 10$	3.5

The bar for $4 < t \leq 8$ represents 32 shoppers.

- Work out the frequency of each class.
- Work out an estimate for the mean time.
- Work out an estimate for the number of shoppers who spent more than 6 minutes in the shop.

(5 marks)

a)

$$fd = \{32\} / \{4\} = 8$$

$$8 \div 2 \text{ cm} = 4$$

$$fd = 4 \times \text{height}$$

$$0-2: 1.5 \times 4 \times 2 = 12$$

$$2-4: 1 \times 4 \times 2 = 8$$

$$4-8: 32$$

$$8-10: 3.5 \times 4 \times 2 = 28$$

b)

$$1 \times 12 = 12$$

$$3 \times 8 = 24$$

$$6 \times 32 = 192$$

$$9 \times 28 = 252$$

$$\text{total} = 480$$

$$\text{mean} = \{480\} / \{80\}$$

$$\text{mean} = 6 \text{ minutes}$$

c)

6 to 8 is half of the 4-8 class

$$16 + 28 = 44$$

$$\boxed{a) 12, 8, 32, 28 \quad b) 6 \text{ min} \quad c) 44}$$