Frequency Polygons & Estimated Mean

Practice Worksheet (Problem Solving)

I Do

The table shows some information about the ages of 70 teachers.

Age (a years)	**Frequency**
$20 < a \leq 30$	8
$30 < a \leq 40$	18
$40 < a \leq 50$	24
$50 < a \leq 60$	14
$60 < a \leq 70$	6

(a) Write down the modal class interval.

..... *(1 mark)*

(b) Draw a frequency polygon for the information in the table.



(2 marks)

(Total for Question is 3 marks)

We Do

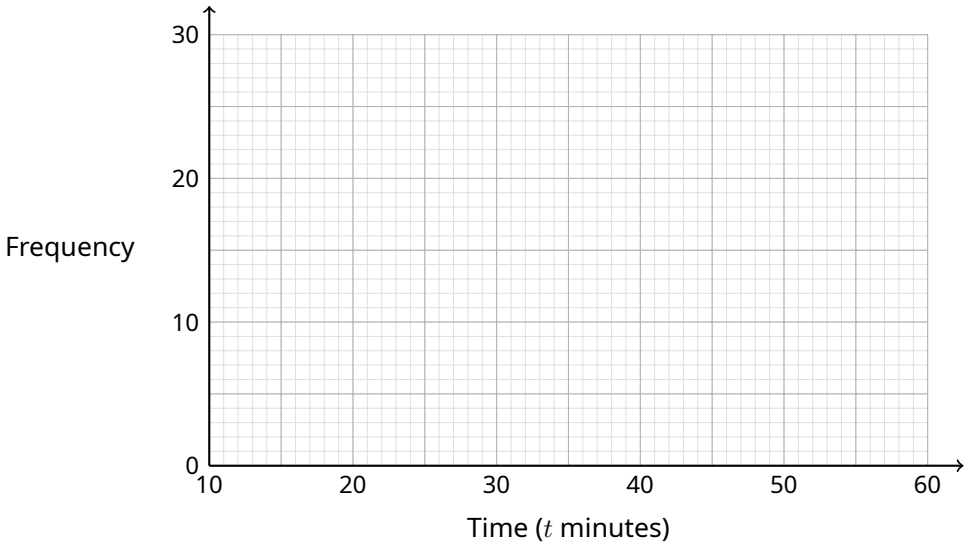
The table shows some information about the times taken, in minutes, by 60 runners to complete a race.

Time (t minutes)	Frequency
$10 < t \leq 20$	6
$20 < t \leq 30$	14
$30 < t \leq 40$	22
$40 < t \leq 50$	12
$50 < t \leq 60$	6

(a) Write down the modal class interval.

..... *(1 mark)*

(b) Draw a frequency polygon for the information in the table.



(2 marks)

(Total for Question is 3 marks)

You Do 1

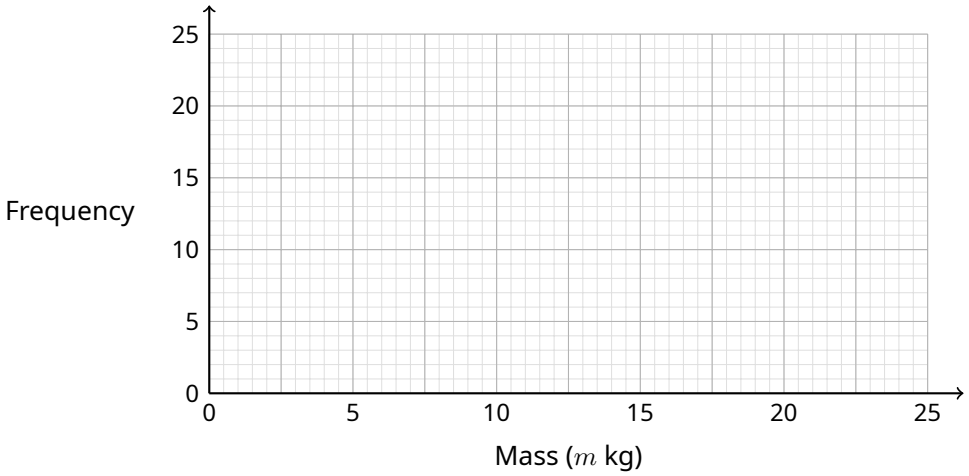
The table shows some information about the masses, in kg, of 50 parcels.

Mass (m kg)	**Frequency**
$0 < m \leq 5$	5
$5 < m \leq 10$	12
$10 < m \leq 15$	19
$15 < m \leq 20$	10
$20 < m \leq 25$	4

(a) Write down the modal class interval.

..... *(1 mark)*

(b) Draw a frequency polygon for the information in the table.



(2 marks)

(Total for Question is 3 marks)

You Do 2

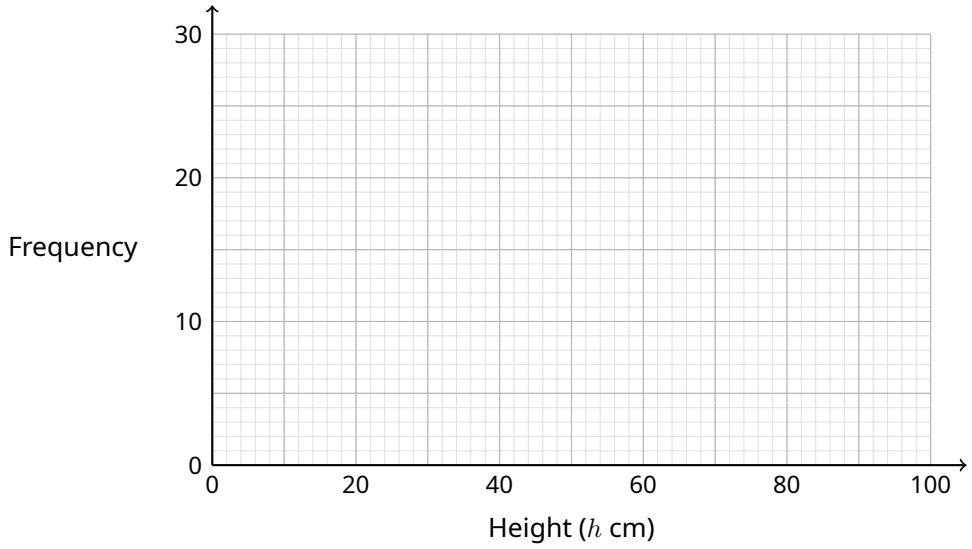
The table shows some information about the heights, in cm, of 80 plants.

Height (h cm)	**Frequency**
$0 < h \leq 20$	10
$20 < h \leq 40$	26
$40 < h \leq 60$	22
$60 < h \leq 80$	14
$80 < h \leq 100$	8

(a) Find the class interval that contains the median height.

..... *(1 mark)*

(b) Draw a frequency polygon for the information in the table.



(2 marks)

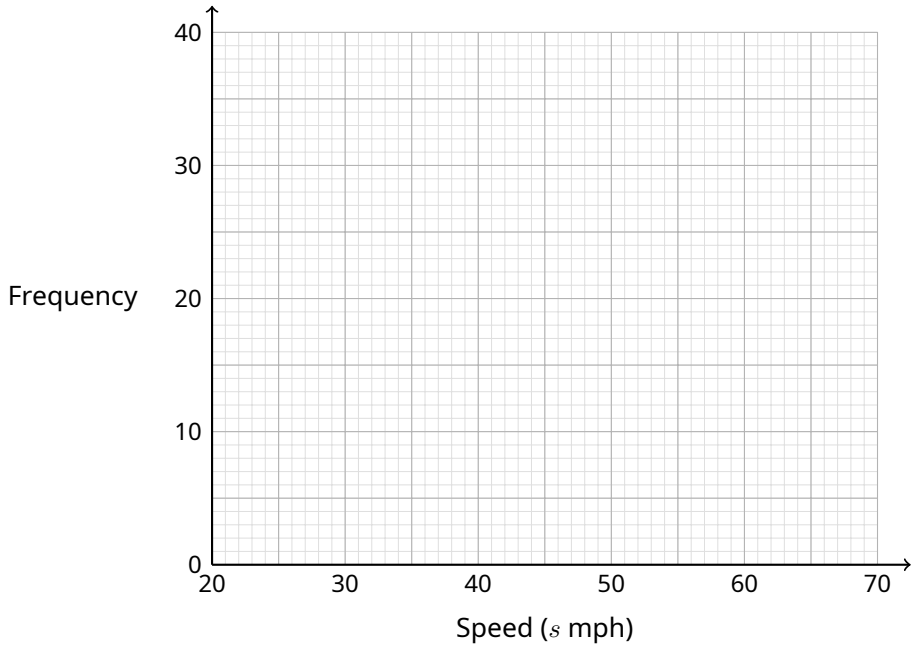
(Total for Question is 3 marks)

You Do 3

The table shows some information about the speeds, in mph, of 100 cars passing a speed camera.

Speed (s mph)	**Frequency**
$20 < s \leq 30$	12
$30 < s \leq 40$	34
$40 < s \leq 50$	28
$50 < s \leq 60$	18
$60 < s \leq 70$	8

(a) Draw a frequency polygon for the information in the table.



(2 marks)

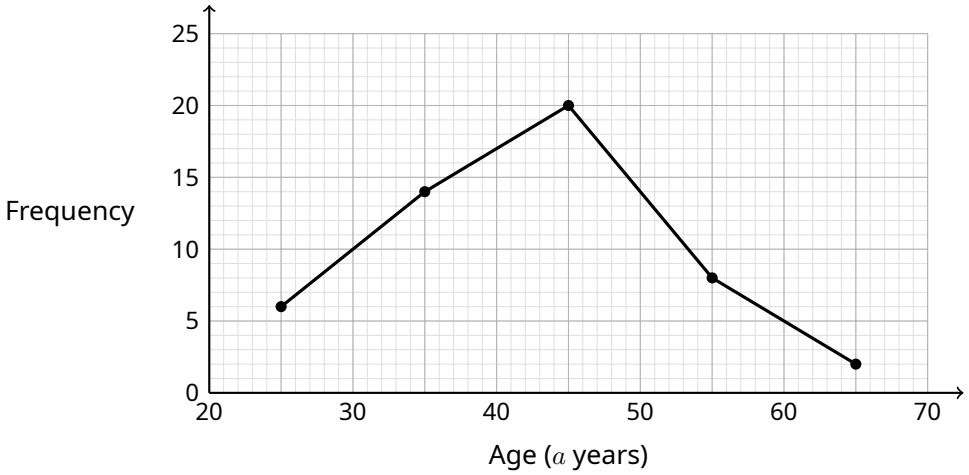
(b) Work out the percentage of these cars travelling at more than 50 mph.

.....% *(2 marks)*

(Total for Question is 4 marks)

Challenge 1

The frequency polygon shows information about the ages of a group of workers at a company.



(a) Write down the total number of workers in the group.

..... *(1 mark)*

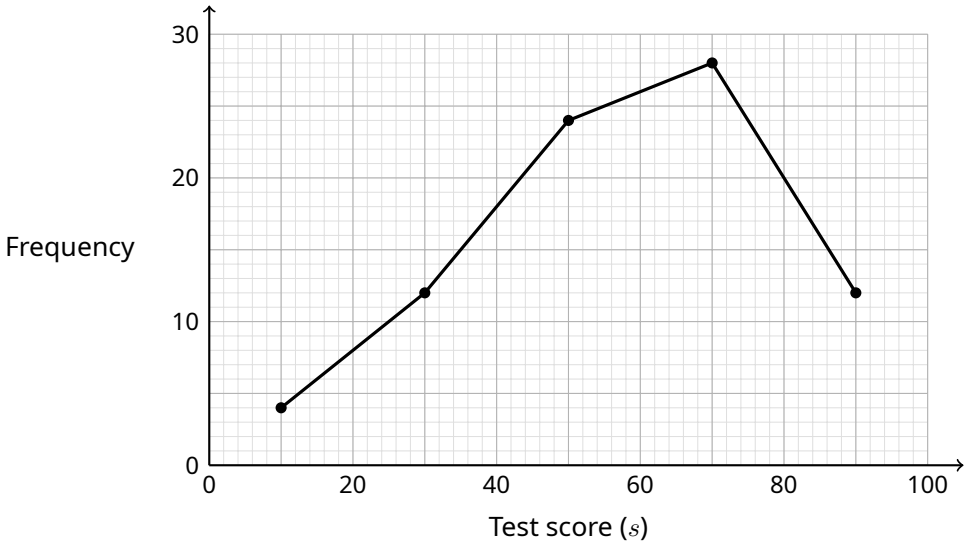
(b) Use the frequency polygon to calculate an estimate for the mean age of the workers.
Show all of your working clearly.

.....years *(4 marks)*

(Total for Question is 5 marks)

Challenge 2

The frequency polygon shows information about the test scores of a group of students in a mathematics exam.



(a) Use the frequency polygon to calculate an estimate for the mean test score.
Show all of your working clearly.

..... *(4 marks)*

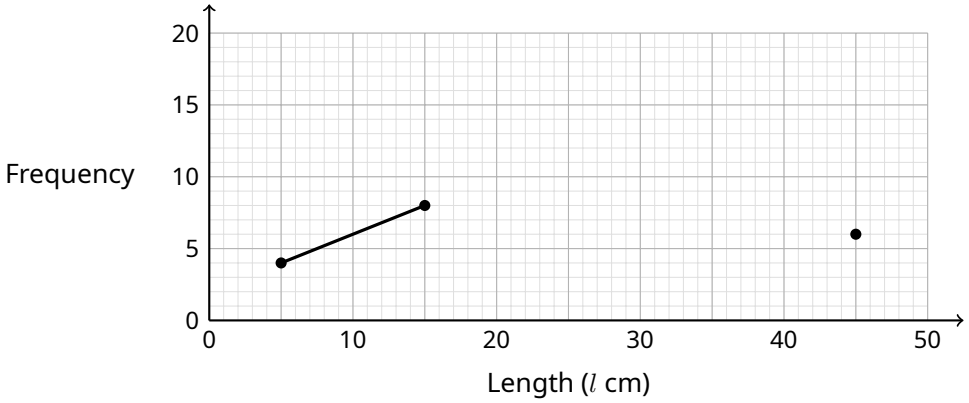
(b) Explain why your answer to part (a) is only an estimate.

(1 mark)

(Total for Question is 5 marks)

Extreme Challenge

The incomplete frequency polygon shows information about the lengths, in cm, of a sample of 40 fish.
The data is grouped into five equal class intervals: $0 < l \leq 10$, $10 < l \leq 20$, $20 < l \leq 30$, $30 < l \leq 40$, and $40 < l \leq 50$.



The points for the intervals $20 < l \leq 30$ and $30 < l \leq 40$ have not been plotted.

Given that the estimated mean length of the 40 fish is 26.5 cm, find the frequency of each of the two missing class intervals and complete the frequency polygon on the grid.
You must show all of your algebraic working clearly.

$20 < l \leq 30$: ..... $30 < l \leq 40$: .....

(Total for Question is 6 marks)

Worked Answers

I Do
(a) The highest frequency is 24, so the modal class interval is **40** $<$ **a** $\leq$ **50**.
(b) Plot the midpoints against the frequencies and join consecutive points with straight line segments:
$(25, 8)$, $(35, 18)$, $(45, 24)$, $(55, 14)$, $(65, 6)$.
(Do not join the first and last points to the horizontal axis.)

We Do
(a) The highest frequency is 22, so the modal class interval is **30** $<$ **t** $\leq$ **40**.
(b) Plot the points $(15, 6)$, $(25, 14)$, $(35, 22)$, $(45, 12)$, $(55, 6)$ and join with straight lines.

You Do 1
(a) The highest frequency is 19, so the modal class interval is **10** $<$ **m** $\leq$ **15**.
(b) Plot the points $(2.5, 5)$, $(7.5, 12)$, $(12.5, 19)$, $(17.5, 10)$, $(22.5, 4)$ and join with straight lines.

You Do 2
(a) Total frequency $= 80$, so the median lies at the 40th / 40.5th value.
Cumulative frequencies: 10, $10 + 26 = 36$, $36 + 22 = 58$.
The 40th value falls in **40** $<$ **h** $\leq$ **60**.
(b) Plot the points $(10, 10)$, $(30, 26)$, $(50, 22)$, $(70, 14)$, $(90, 8)$ and join with straight lines.

You Do 3
(a) Plot the points $(25, 12)$, $(35, 34)$, $(45, 28)$, $(55, 18)$, $(65, 8)$ and join with straight lines.
(b) Cars travelling at more than 50 mph $= 18 + 8 = 26$.
Percentage $= \frac{26}{100} \times 100\%$ = **26%**.

Challenge 1
(a) Read the frequencies from the plotted points: 6, 14, 20, 8, and 2.
Total workers $= 6 + 14 + 20 + 8 + 2 =$ **50**.
(b) Multiply each midpoint (x) by its frequency (f):
$25 \times 6 = 150$
$35 \times 14 = 490$
$45 \times 20 = 900$
$55 \times 8 = 440$
$65 \times 2 = 130$
Total $\sum fx = 150 + 490 + 900 + 440 + 130 = 2110$.
Estimated mean $= \frac{2110}{50} =$ **42.2 years**.

Challenge 2

(a) Read the coordinates (x, f) from the frequency polygon:
$(10, 4)$, $(30, 12)$, $(50, 24)$, $(70, 28)$, $(90, 12)$.
Total students $= 4 + 12 + 24 + 28 + 12 = 80$.
Calculate $\sum fx$:
$10 \times 4 = 40$
$30 \times 12 = 360$
$50 \times 24 = 1200$
$70 \times 28 = 1960$
$90 \times 12 = 1080$
Total $\sum fx = 40 + 360 + 1200 + 1960 + 1080 = 4640$.
Estimated mean $= \frac{4640}{80} =$ **58**.

(b) The data is grouped into class intervals, so we do not know the exact individual test scores (we assume all values in each class lie at the midpoint).

Extreme Challenge

1. Read the three plotted points from the graph:
$(5, 4)$, $(15, 8)$, and $(45, 6)$.
Let the missing frequency for $20 < l \leq 30$ (midpoint 25) be x, and the missing frequency for $30 < l \leq 40$ (midpoint 35) be y.
2. Use the total frequency of 40 to form the first equation:
$4 + 8 + x + y + 6 = 40 \implies 18 + x + y = 40 \implies x + y = 22$.
3. Use the estimated mean of 26.5 cm to find the total $\sum fl$:
$\sum fl = 40 \times 26.5 = 1060$.
4. Form the second equation from $\sum fl$:
$(5 \times 4) + (15 \times 8) + 25x + 35y + (45 \times 6) = 1060$
$20 + 120 + 25x + 35y + 270 = 1060$
$410 + 25x + 35y = 1060 \implies 25x + 35y = 650$.
Divide by 5: $5x + 7y = 130$.
5. Solve the simultaneous equations:
From $x + y = 22$, substitute $x = 22 - y$ into $5x + 7y = 130$:
$5(22 - y) + 7y = 130$
$110 - 5y + 7y = 130 \implies 2y = 20 \implies y = 10$.
Substitute $y = 10$ back into $x = 22 - y$: $x = 12$.
Answer: Frequency for $20 < l \leq 30$ is **12**, and frequency for $30 < l \leq 40$ is **10**.
On the grid, plot the points $(25, 12)$ and $(35, 10)$, and join $(15, 8) \to (25, 12) \to (35, 10) \to (45, 6)$ with straight lines.