# Unit 13 · Statistics

**HARDER WORKSHEET · ANSWER KEY**

Full marks 20

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

## 1 Two missing frequencies

**ANSWER** HA · 3

$N = 20 + p + q = 40$, so $p + q = 20$.

$\Sigma fm = 20 + 15p + 250 + 35q + 270 = 540 + 15p + 35q = 26 \times 40 = 1040$, so $3p + 7q = 100$.

With $p = 20 - q$: $60 + 4q = 100$, $q = \mathbf{10}$, $p = \mathbf{10}$.

**MARKING SCHEME**

- ✓ $p + q = 20$.
- ✓ $3p + 7q = 100$.
- ✓ $p = 10$, $q = 10$.

## 2 Two classes together

**ANSWER** A · 2

Totals $30 \times 42 = 1260$ and $20 \times 52 = 1040$: $\dfrac{2300}{50} = \mathbf{46}$.

It isn't $\dfrac{42 + 52}{2} = 47$ because Class A has more students, so its mean counts for more.

**MARKING SCHEME**

- ✓ 46 from the totals.
- ✓ The larger class counts more.

## 3 A value misread

**ANSWER** A · 2

Wrong total $20 \times 35 = 700$; correct total $700 - 84 + 48 = 664$. Mean $\dfrac{664}{20} = \mathbf{33.2}$.

**MARKING SCHEME**

- ✓ The total corrected to 664.
- ✓ 33.2.

## 4 Work backwards from the mode

**ANSWER** HA · 3

34 is in 30–40, so that is the modal class: $f_1 = 12, f_0 = x, f_2 = 6$.

$34 = 30 + \dfrac{12 - x}{24 - x - 6} \times 10$, so $4(18 - x) = 10(12 - x)$, $72 - 4x = 120 - 10x$, $x = \mathbf{8}$.

Check: 12 is still the largest frequency ✓.

**MARKING SCHEME**

- ✓ The modal class 30–40 with $f_0 = x$.
- ✓ The equation $4(18 - x) = 10(12 - x)$.
- ✓ $x = 8$, checked.

## 5 Is the report possible?

**a.** **ANSWER** HA · 2

**No.** 20 students above 80 make a total of more than $20 \times 80 = 1600$, but a mean of 42 means the total of all 25 is only $25 \times 42 = 1050$.

**MARKING SCHEME**

- ✓ Total at least 1,600 against 1,050.
- ✓ So it can't be true.



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**b.** ANSWER HA · 1

**No:** a quarter of the values are below $Q_1$ and half below the median, so $Q_1$ can never be more than the median.

MARKING SCHEME

✓ $Q_1$ can't be more than the median.

## 6 Change every value

MARKING SCHEME U · 2

✓ Median 39 (the middle value changes the same way).

✓ Mean 43 (the total doubles and gains $3N$).

## 7 Spread of the middle half

ANSWER A · 3

*cf*: 2, 8, 28, 36, 40. $Q_1$, the 10th item, is in 30–40: $30 + \frac{10 - 8}{20} \times 10 = 31$. $Q_3$, the 30th, is in 40–50: $40 + \frac{30 - 28}{8} \times 10 = 42.5$.

10A's middle half spans $42.5 - 31 = 11.5$ marks, 10B's $45 - 32 = 13$. **10A's middle half is closer together.**

MARKING SCHEME

✓ $Q_1 = 31$ and $Q_3 = 42.5$.

✓ The spreads 11.5 and 13.

✓ 10A, with the reason.

## 8 Make your own

ANSWER HA · 2

The median is the 10th item. It comes out exactly 30 when exactly 10 values are below 30 and at least one is in 20–30: then 20–30 is the median class (its *cf* is the first to reach 10) and the 10th item is its last value, so the formula gives its upper limit. For example 2, 3, 5, 6, 4: *cf* 2, 5, 10, 16, 20, so $M_d = 20 + \frac{10 - 5}{5} \times 10 = 30$.

MARKING SCHEME

✓ A table of 20 with exactly 10 values below 30, some of them in 20–30.

✓ The check by the formula.

| Marks by level | Knowledge | Understanding | Application | Higher ability | Total |
|---|---|---|---|---|---|
| **Marks** | 0 | 2 | 7 | 11 | **20** |



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