Answers - Statistics: scatter graphs and averages

Year: Year 8

Answer to Question 1

a. **3, 4, 6, 7, 9, 10, 10, 11**
b. **10** appears twice
c. Middle two values are 7 and 9: $(7 + 9) \div 2 =$ **8**
d. Sum $= 60$, $60 \div 8 =$ **7.5**
e. $11 - 3 =$ **8**

With eight values the median is halfway between the 4th and 5th values once the data are in order.

Answer to Question 2

a. Total = mean × number: $5 \times 12 = 60$. The four known values add to 47, so the fifth is $60 - 47 =$**13**.
b. Old total $6 \times 72 = 432$. New total $432 + 86 = 518$ for 7 scores: $518 \div 7 =$**74.0**.
c. Totals $4 \times 9 = 36$ and $6 \times 14 = 84$. All ten: $120 \div 10 =$**12**.
d. Total $3 \times 20 = 60$. The numbers are 15, 20 and $60 - 15 - 20 =$**25**; the range $25 - 15 = 10$ confirms it.

Answer to Question 3

a. $8 + 14 + 10 + 5 + 3 =$ **40**
b. **1 pet** has the highest frequency (14).
c. Cumulative: 8, 22. The 20th and 21st values are both 1. Median **1**.
d. Total pets $= 0 + 14 + 20 + 15 + 12 = 61$. $61 \div 40 =$ **1.525**
e. $4 - 0 =$ **4**

The mean from a frequency table uses the total of value × frequency divided by the total frequency, not the sum of the frequencies alone.

Answer to Question 4

a. 10 (frequency 11)
b. The 15th and 16th values: cumulative 4, 15, 25. The 15th is in the second class and the 16th in the third: median class is 10 (or the boundary).
c. Midpoints 5, 15, 25, 35.
$4 \times 5 + 11 \times 15 + 10 \times 25 + 5 \times 35 = 20 + 165 + 250 + 175 = 610$. $610 \div 30 =$

20.3 cm

d. We used the midpoint of each class, but we do not know the exact heights within each class.

Answer to Question 5

a. $30 + 24 + 21 + 15 =$**90** pupils.
b. Each pupil is $360 \div 90 = 4^\circ$. Maths $30 \times 4 =$**120°**, English **96°**, Science **84°**, Art **60°**.
c. $120 + 96 + 84 + 60 =$**360°**, a full circle.
d. $\frac{21}{90} = 0.2333\ldots$, which is **23.3%**.

Finding the angle for one pupil first makes every sector a simple multiplication.

Answer to Question 6

a. **Positive correlation**: taller pupils usually have bigger feet. A line of best fit is useful.
b. **Negative correlation**: as it gets warmer fewer people buy hot chocolate. A line is useful.
c. **No correlation**: there is no connection. A line of best fit is not useful.
d. **Negative correlation**: older cars are usually worth less. A line is useful.

Answer to Question 7

a. Frequencies: 2, 3, 4, 1, 1, 1 (total 12).
b. Mean $= \frac{23}{12} = 1.92$ (total goals 23). Median: ordered 0,0,1,1,1,2,2,2,2,3,4,5; middle values 2 and 2: **2**. Mode: **2**.
c. The **median or mode (2)** is typical. The mean is pulled up a little by the 5.
d. New total 32, 13 matches: mean $= 2.46$. New median is the 7th value $= 2$.

Answer to Question 8

a. Sum $= 437$, mean $=$ **£21.85**. Median $= (15 + 15) \div 2 =$ **£15**. Mode **£15**.
b. **£100** is far from the others.
c. Without £100: sum $= 337$, 19 values, mean $=$ **£17.74**.
d. The **median** (£15) is best, since the outlier makes the mean (£21.85) too high.

Answer to Question 9

a. Class 8A has the higher mean (62) and median (65), so **8A** did better on average.
b. **8B**: its range (18) is smaller, so the scores are closer together.
c. $25 \times 62 =$ **1550 marks**
d. The mean goes **up** because 78 is more than the current mean of 60.

Answer to Question 10

a. 15
b. Midpoints 12.5, 17.5, 22.5, 27.5.
$6 \times 12.5 + 12 \times 17.5 + 9 \times 22.5 + 3 \times 27.5 = 75 + 210 + 202.5 + 82.5 = 570$.
$570 \div 30 =$ **19 minutes**
c. Each journey is $12°$: $72°$, $144°$, $108°$, $36°$. (Total $360°$.)
d. $\frac{9+3}{30} = \frac{2}{5}$

The mean is an estimate because each journey is assumed to take the midpoint time of its class.

Answer to Question 11

a. $144 + 90 + 54 + 72 =$**360°**.
b. Walkers are $\frac{144}{360}$ of the 240 pupils: $0.4 \times 240 =$**96 pupils**.
c. Cyclists: $\frac{72}{360} \times 240 = 48$. Difference $96 - 48 =$**48 pupils**.
d. $\frac{90}{360} = \frac{1}{4} =$**25%** take the bus.

Answer to Question 12

a. **Strong positive correlation**: more revision, higher score.
b. At $x = 6$ the line is at about **7**.
c. A score of 6 is at about **4.5 to 5 hours**; this is interpolation, so it is reasonably safe.
d. 20 hours is far outside the data; the score cannot be more than 10, so the trend cannot continue (extrapolation).

Answer to Question 13

a. Total $= 490$, $490 \div 6 =$ **81.7 mm**

b. Ordered: 60, 65, 70, 80, 95, 120. Median $= (70 + 80) \div 2 =$ **75 mm**. Range $= 120 - 60 =$ **60 mm**.
c. Total 540 over 7 months: **77.1 mm**
d. Six months: mean 81.7 is **not** less than 80. Seven months: 77.1 **is** less than 80.

Answer to Question 14

a. **Size 5** (7 pairs)
b. The 13th of 25 values: cumulative 2, 6, 13, so the median is **size 5**.
c. Total $= 6 + 16 + 35 + 36 + 28 + 16 = 137$. $137 \div 25 =$ **5.5**
d. The **mode (5)**, because the manager wants to know which size sells most; the mean 5.5 is not a real shoe size.

Answer to Question 15

a. Reds: sum 22, mean **2.2**, median **2**, range **4**. Blues: sum 24, mean **2.4**, median **1.5**, range **10**.
b. **Reds** (range 4 against 10).
c. The Blues have the higher mean (2.4); the Reds have the higher median (2).
d. The mean is inflated by one result of 10; the Blues scored 1 or fewer in half their matches. The median 1.5 shows a more typical result.

Answer to Question 16

a. $12 + 25 + 18 + 10 + 4 + 1 =$ **70**
b. $12 + 50 + 54 + 40 + 20 + 6 =$ **182**
c. $182 \div 70 =$ **2.60**
d. Median: 35th and 36th values (cumulative 12, 37): both 2, so **2**. Mode **2**.
e. $(182 + 30) \div 80 =$ **2.65**

Combining groups: add the totals (182 + 30) and the numbers of customers (70 + 10) before dividing.

Answer to Question 17

a. **Strong negative correlation**.
b. About **£4 500**.
c. About **5.5 years**.
d. The line goes below 0 for 12 or more years, which is impossible; extrapolation gives a nonsense value.
e. It is an **outlier**: much lower than the trend (about £6 500).

Answer to Question 18

a. Year 8: $\frac{150}{360} \times 120 = \mathbf{50}$. Year 9: $\frac{100}{360} \times 180 = \mathbf{50}$.
b. Year 8: $\frac{150}{360} = 41.7\%$; Year 9: $\frac{100}{360} = 27.8\%$. **Year 8** is higher.
c. The numbers are **equal (50 each)**, so more did not choose football in Year 8; comparing angles alone is misleading when the totals differ.
d. Remaining angle $= 360 - 100 - 80 = 180^\circ$. Tennis $= 60^\circ$, hockey $= 120^\circ$.

Answer to Question 19

a. 2
b. $10 + 66 + 65 + 40 = 181$. $181 \div 50 =$ **3.62 kg**
c. $13 + 5 = 18$ parcels, $18 \times 2 =$ **£36**
d. The class is wide (4 kg), so the midpoint 8 could be far from the true weights of the parcels in it.

Using midpoints assumes the parcels in each class are spread evenly, which is why the mean is only an estimate.

Answer to Question 20

a. Mean $= 35 \div 5 =$**7**; the middle value is **7**.
b. For a mean of 7 the six numbers must total $6 \times 7 = 42$, so $x = 42 - 35 =$**7**.
c. With six numbers the median is the mean of the 3rd and 4th. If $x = 9$, the list 3, 5, 7, 9, 9, 11 has median $(7 + 9) \div 2 = 8$, so $x = 9$ (any x of at least 9 works).
d. Adding 100 makes the mean $135 \div 6 = 22.5$, a big jump, while the median only becomes 8. The median is much less affected by an extreme value.