



H18-30min Percentiles and Interpercentile Range: 30-minute Pack

EDEXCEL 1ST0 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** The distances, in km, cycled by 15 members of a cycling club during a training session are listed below, in order from shortest to longest.

4.2, 4.5, 4.8, 5.0, 5.3, 5.6, 5.8, 6.0, 6.2, 6.5, 6.7, 7.0, 7.3, 7.6, 8.0

- (a) Write down the formula used to find the position of the k th percentile within an ordered list of n data values. (1)

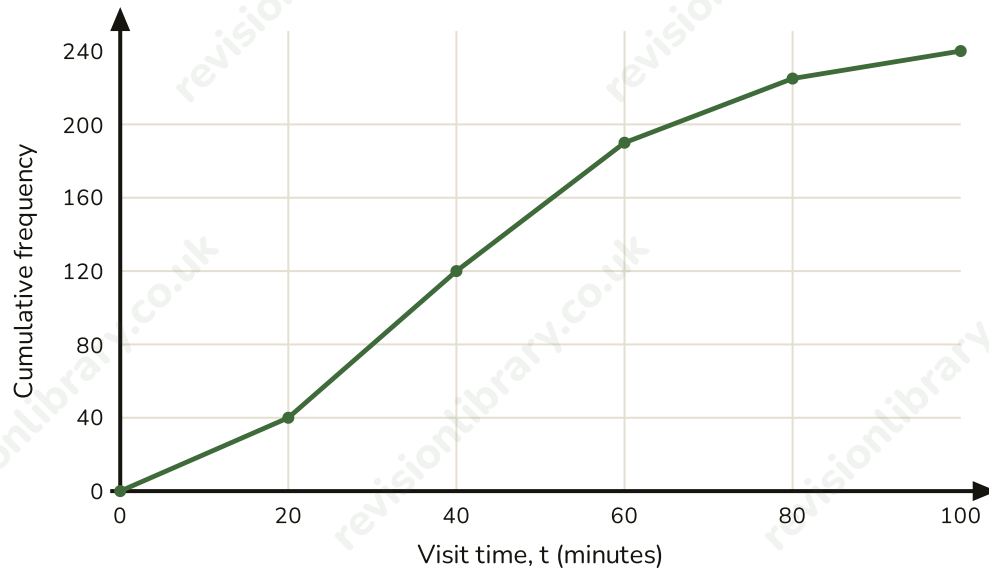
- (b) Find the 10th percentile of the training distances. (2)

- (c) Find the 90th percentile of the training distances. (2)

- (d) Hence find the 10-90 interpercentile range (the interdecile range) of the training distances. (2)

(Total for Question 1 is 7 marks)

- 2 The cumulative frequency graph shows the time, t minutes, spent by 240 visitors at a museum exhibition.



- (a) Use the graph to estimate the lower quartile (Q_1 , the 25th percentile) of the visit times. (2)
- (b) Use the graph to estimate the upper quartile (Q_3 , the 75th percentile) of the visit times. (2)
- (c) Hence write down an estimate for the interquartile range of the visit times. (1)
- (d) Use the graph to estimate the 10th and 90th percentiles of the visit times, and hence the 10-90 interpercentile range (the interdecile range). (3)
- (e) The interquartile range uses only the middle 50% of the data, while the 10-90 interpercentile range uses the middle 80%. Explain why the interdecile range is larger than the interquartile range for this data. (1)

(Total for Question 2 is 9 marks)

- 3** The annual salaries of the 11 employees at a small company are listed below, in order from lowest to highest.

£18,000, £19,000, £20,000, £21,000, £22,000, £23,000, £24,000, £25,000, £26,000, £28,000, £95,000

The highest salary, £95,000, is paid to the company's founder and chief executive.

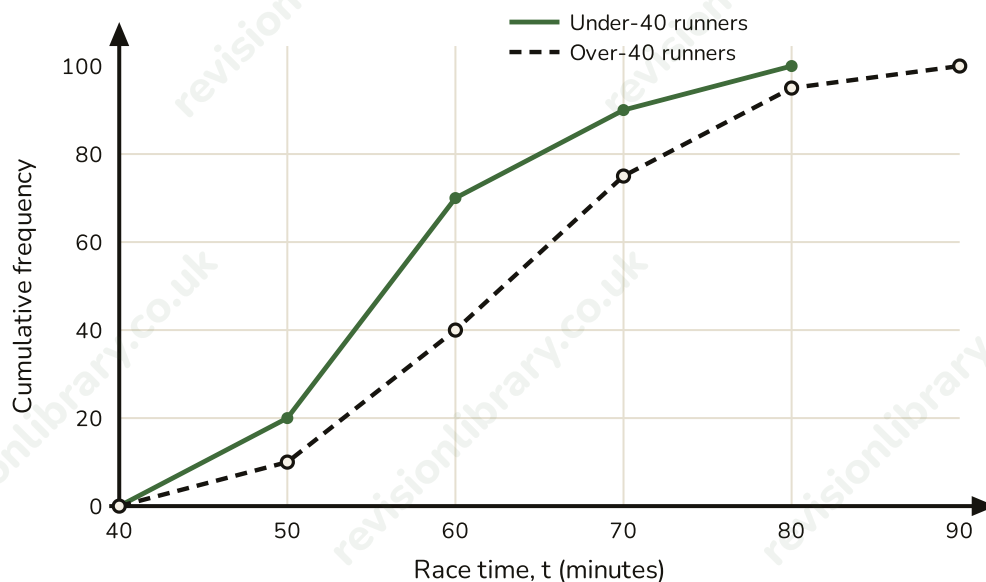
- (a)** Find the range of the salaries. (1)

- (b)** Find the 10th and 90th percentiles of the salaries, and hence find the 10-90 interpercentile range (the interdecile range). (3)

- (c)** Explain why the interdecile range gives a more reliable description of the spread of most employees' salaries than the range. (1)

(Total for Question 3 is 5 marks)

- 4 100 Under-40 runners and 100 Over-40 runners entered a charity 10 km road race. The cumulative frequency graph shows their finishing times, t minutes.



- (a) Using the graph, estimate the 10th and 90th percentiles of the Under-40 runners' finishing times, and hence their 10-90 interpercentile range. (3)
- (b) Using the graph, estimate the 10th and 90th percentiles of the Over-40 runners' finishing times, and hence their 10-90 interpercentile range. (3)
- (c) Compare the finishing times of the two groups, using your answers to (a) and (b). (3)

(Total for Question 4 is 9 marks)

Mark scheme · H18-30min Percentiles and Interpercentile Range: 30-minute Pack

Question 1

- (a) **B1** position = $(k / 100) \times n$, oe
- (a) **Answer: position = $(k / 100) \times n$**
- (b) **M1** position = $0.1 \times 15 = 1.5$ (not a whole number, so round up to the 2nd value)
- (b) **A1** 4.5 cao
- (b) **Answer: 4.5 km**
- (c) **M1** position = $0.9 \times 15 = 13.5$ (not a whole number, so round up to the 14th value)
- (c) **A1** 7.6 cao
- (c) **Answer: 7.6 km**
- (d) **M1** 7.6 - 4.5, oe (ft from (b) and (c))
- (d) **A1** 3.1 cao
- (d) **Answer: 3.1 km**

Question 2

- (a) **M1** reads across from a cumulative frequency of 60 to the curve, then down to the time axis
- (a) **A1** 25 (accept 24 - 26) minutes
- (a) **Answer: 25 minutes**
- (b) **M1** reads across from a cumulative frequency of 180 to the curve, then down to the time axis
- (b) **A1** 57 (accept 55 - 59) minutes
- (b) **Answer: 57 minutes**
- (c) **B1** 32 minutes, ft from (a) and (b) (accept 29 - 35)
- (c) **Answer: 32 minutes**
- (d) **M1** $P_{10} = 12$ (accept 11 - 13) minutes
- (d) **M1** $P_{90} = 75$ (accept 73 - 77) minutes
- (d) **A1** interdecile range = 63 minutes, ft (accept 60 - 66)
- (d) **Answer: $P_{10} = 12$ min, $P_{90} = 75$ min, interdecile range = 63 min**
- (e) **B1** the interdecile range spans a wider proportion (80%) of the data than the IQR (50%), so its lower and upper bounds must be at least as far apart as the IQR's (oe)
- (e) **Answer: Because it covers a wider proportion (80%) of the data than the IQR (50%), the interdecile range must span from a value at least as low up to a value at least as high, making it at least as large.**

Question 3

- (a) **B1** 77000 cao
- (a) **Answer: £77,000**
- (b) **M1** positions $0.1 \times 11 = 1.1$ (round up to the 2nd value) and $0.9 \times 11 = 9.9$ (round up to the 10th value)
- (b) **A1** $P_{10} = 19000$ and $P_{90} = 28000$
- (b) **A1** interdecile range = 9000 cao
- (b) **Answer: $P_{10} = £19,000$, $P_{90} = £28,000$, interdecile range = £9,000**
- (c) **B1** the range is almost entirely determined by the one outlier salary (£95,000), whereas the interdecile range ignores the most extreme 10% of salaries at each end, so it reflects the spread of the typical employees' salaries instead (oe)
- (c) **Answer: The range (£77,000) is dominated by the founder's unusually high salary. The interdecile range (£9,000) ignores the most extreme 10% at each end, so it better reflects how spread out most employees' salaries actually are.**

Question 4

- (a) **M1** P10 = 45 (accept 44 - 46) minutes
- (a) **M1** P90 = 70 minutes (read directly from the curve)
- (a) **A1** interdecile range = 25 minutes, ft
- **(a) Answer: P10 = 45 min, P90 = 70 min, interdecile range = 25 min**
- (b) **M1** P10 = 50 minutes (read directly from the curve)
- (b) **M1** P90 = 77.5 (accept 76 - 79) minutes
- (b) **A1** interdecile range = 27.5 minutes, ft (accept 26 - 29)
- **(b) Answer: P10 = 50 min, P90 = 77.5 min, interdecile range = 27.5 min**
- (c) **B1** the Over-40 group has both a higher P10 (50 vs 45) and a higher P90 (77.5 vs 70), so Over-40 runners generally took longer to finish than Under-40 runners (oe)
- (c) **B1** the Over-40 group has a slightly larger interdecile range (27.5 min) than the Under-40 group (25 min)
- (c) **B1** so finishing times were slightly more variable/spread out among the Over-40 group than the Under-40 group (oe)
- **(c) Answer: Over-40 runners typically took longer to finish (higher P10 and P90) and had slightly more variable times (larger interdecile range: 27.5 min vs 25 min) than Under-40 runners.**