HIGHER

6.12 Box Plots: 1-hour Pack

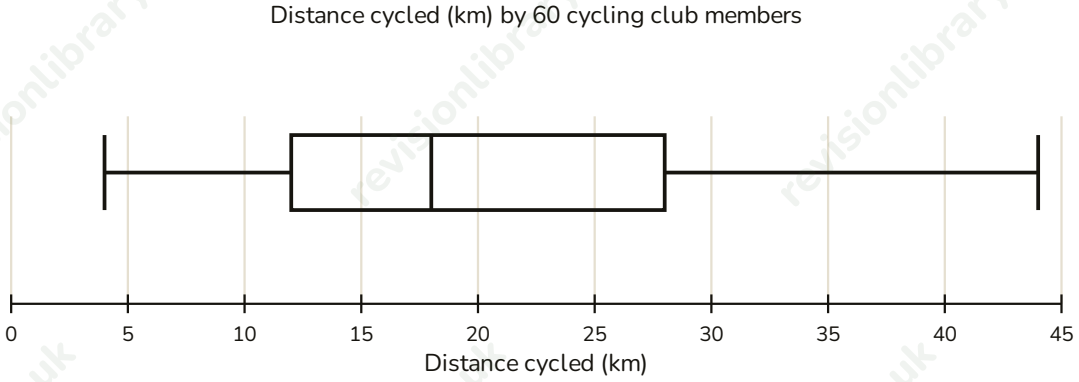
EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 The box plot shows the distance, in km, cycled by 60 members of a cycling club last Saturday.



(a) Write down the median distance cycled. **(1)**

.....

(b) Write down the interquartile range of the distances. **(1)**

.....

(c) Write down the range of the distances. **(1)**

.....

(d) Work out the number of members who cycled more than 28 km. **(1)**

.....

(Total for Question 1 is 4 marks)

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2 Here are 11 values of heights (cm): 71, 14, 39, 66, 47, 36, 54, 46, 59, 36, 45. Work out the values needed to draw a box plot: the minimum, lower quartile, median, upper quartile and maximum.

(Total for Question 2 is 4 marks)

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3 Two box plots show the daily rainfall (mm) for A and B. For A: median 66, interquartile range 27. For B: median 41, interquartile range 8. Compare the distributions.

(Total for Question 3 is 4 marks)

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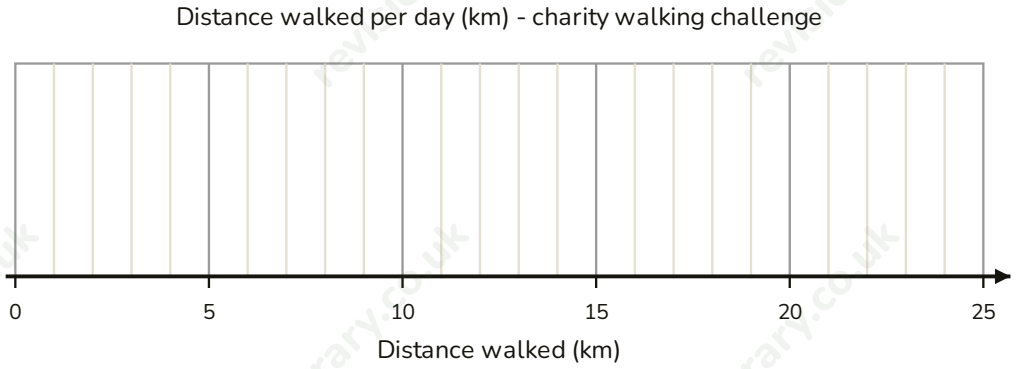
4 A box plot for the daily rainfall (mm) of 40 items has lower quartile 35, median 49 and upper quartile 64. Estimate how many items have a value more than 49.

(Total for Question 4 is 2 marks)

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5 During a charity walking challenge, one participant's five-number summary for the distances, in km, walked on each day of the challenge is:

Minimum = 4 km, Lower quartile = 9 km, Median = 14 km, Upper quartile = 19 km, Maximum = 23 km Draw a box plot for these distances.

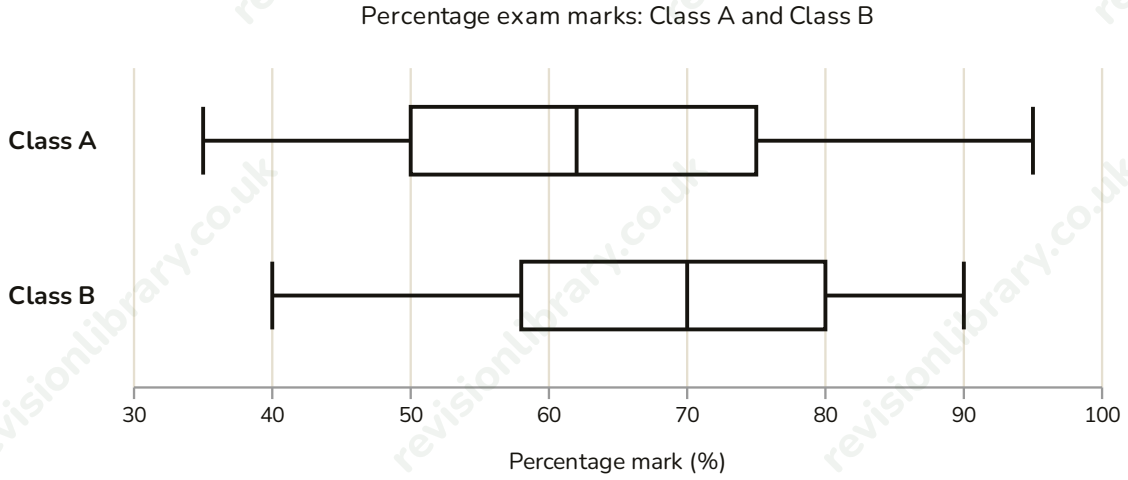


(Total for Question 5 is 3 marks)

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6 Box plots for the percentage exam marks of two classes are summarised below.

Class A: minimum = 35, lower quartile = 50, median = 62, upper quartile = 75, maximum = 95
Class B: minimum = 40, lower quartile = 58, median = 70, upper quartile = 80, maximum = 90



(a) Work out the interquartile range for Class A and for Class B. **(2)**

(b) Make one comparison about the average mark, and one comparison about the consistency of marks, between the two classes. You must refer to the context in both comparisons. **(2)**

(Total for Question 6 is 4 marks)

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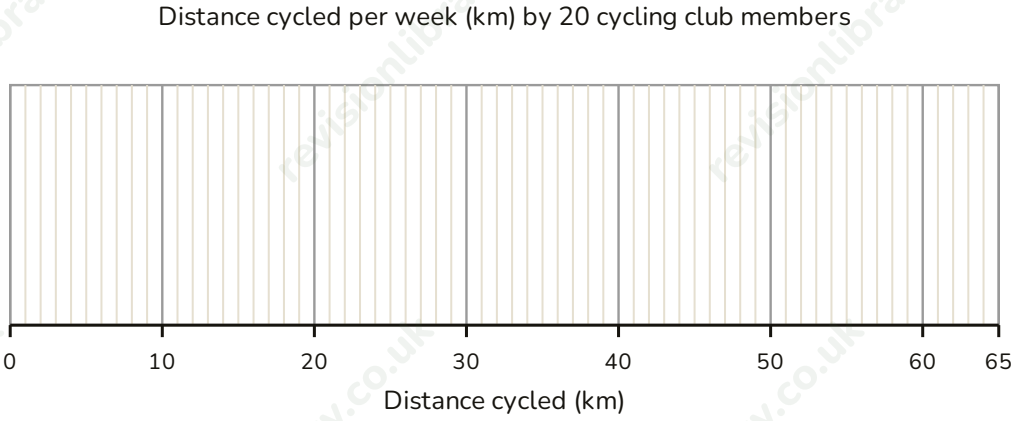
7 A box plot has been drawn for a set of data. Explain why the mean cannot be worked out from the box plot alone.

(Total for Question 7 is 1 mark)

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8 As part of a fitness survey, the distances, in km, cycled in one week by 20 members of a cycling club were recorded, and are shown below in ascending order.

12, 15, 18, 20, 22, 24, 26, 28, 29, 31, 33, 35, 37, 39, 41, 43, 47, 50, 54, 60



(a) Find the median, the lower quartile, the upper quartile and the interquartile range of these distances. **(4)**

(b) Draw a box plot to represent this data on the grid provided. **(3)**

(c) Describe the skewness of the distribution of distances cycled, giving a reason for your answer. **(2)**

(Total for Question 8 is 9 marks)

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9 A company's weekly sales figures, in GBP, for a product across all of its shops are shown on a box plot. The upper quartile is £1200 and the maximum is £2000. It is known that 18 shops had weekly sales between the upper quartile and the maximum.

(a) Work out the total number of shops in the sample. **(2)**

.....

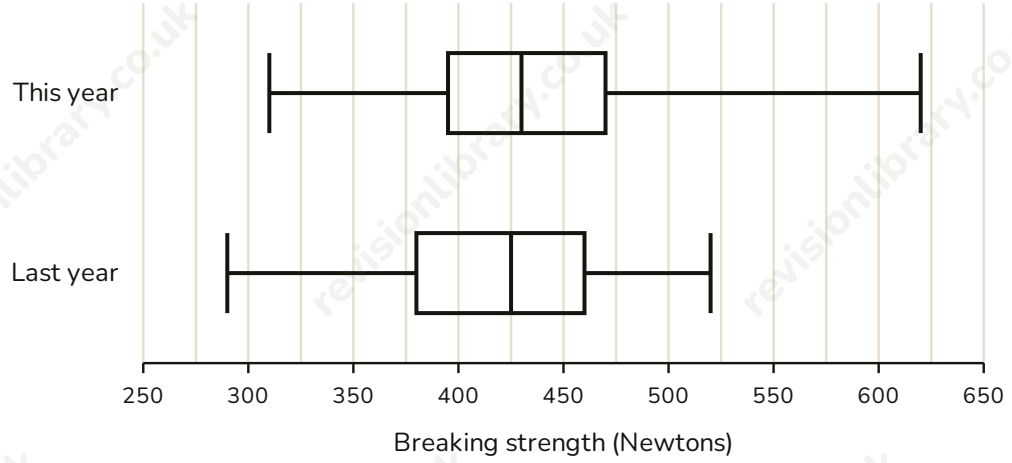
(b) The lower quartile of weekly sales is £700. A sales manager claims that 9 shops had weekly sales below this figure. State, with a reason, whether this claim is consistent with the box plot. **(1)**

(Total for Question 9 is 3 marks)

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10 A factory tests the breaking strength, in Newtons, of 200 rope samples this year and 200 rope samples from last year.

This year: minimum = 310, lower quartile = 395, median = 430, upper quartile = 470, maximum = 620
Last year: minimum = 290, lower quartile = 380, median = 425, upper quartile = 460, maximum = 520



(a) Work out the interquartile range of the breaking strengths for each year. **(2)**

.....

(b) The factory claims: 'Our ropes have become more consistent in strength this year.' Using your answer to part (a), and one other valid comparison from the data, evaluate this claim. **(2)**

.....

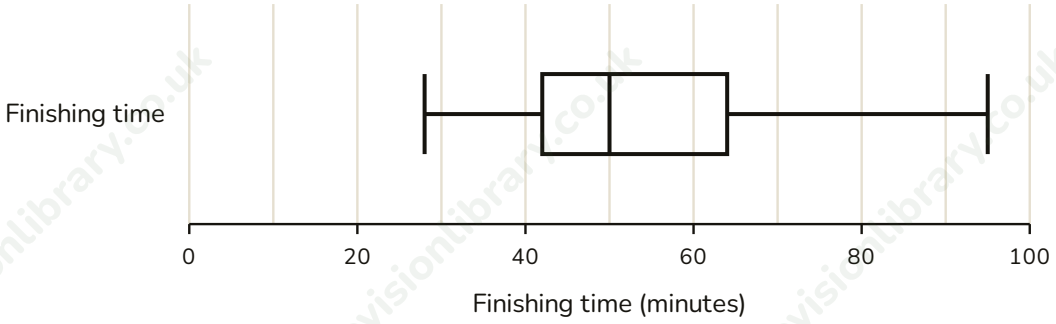
(Total for Question 10 is 4 marks)

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11 The five-number summary for the finishing times, in minutes, of 400 runners in a fun run is:

Minimum = 28, Lower quartile = 42, Median = 50, Upper quartile = 64, Maximum = 95

A runner finishes in 57 minutes. Assuming finishing times are evenly spread within each quarter of the data, estimate the percentage of runners who finished in under 57 minutes.



(Total for Question 11 is 3 marks)

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12 Six positive integers, a, b, c, d, e, f, are written in ascending order. The minimum value is 6, the range is 22, the median is 15, the interquartile range is 10, and the mean of all six numbers is 17.

(a) Find the value of f (the maximum). **(1)**

.....

(b) Find the values of the lower quartile (b) and the upper quartile (e). **(3)**

.....

(Total for Question 12 is 4 marks)

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Mark scheme · 6.12 Box Plots: 1-hour Pack

Question 1

(a) 18 km cao **B1**

(a) Answer: 18 km

(b) 16 km cao **B1**

(b) Answer: 16 km

(c) 40 km cao **B1**

(c) Answer: 40 km

(d) Cannot be determined exactly: some members may have cycled exactly 28 km. **B1**

(d) Answer: Cannot be determined exactly from the box plot.

Question 2

puts the values in order **M1**

min = 14 and max = 71 **A1**

median = 46 **A1**

LQ = 36 and UQ = 59 **A1**

Answer: min = 14, LQ = 36, median = 46, UQ = 59, max = 71

Question 3

compares medians: A higher by 25 **B1**

comment in context on typical value **B1**

compares IQRs: B smaller by 19 **B1**

comment in context on consistency **B1**

Answer: A: higher median (66 compared with 41); B: smaller IQR (8 compared with 27), so more consistent

Question 4

uses the correct fraction of the data, e.g. 1/4 or 1/2 or 25% or 50% **M1**

20 cao **A1**

Answer: 20

Question 5

box drawn correctly from the lower quartile (9) to the upper quartile (19), with the median (14) marked inside the box **B1**

whiskers drawn correctly from the box to the minimum (4) and the maximum (23) **B1**

correct linear scale used and axis labelled (distance, km) **B1**

Answer: Box plot with min 4, LQ 9, median 14, UQ 19, max 23 (km)

Question 6

(a) Class A IQR = 25 cao **B1**

(a) Class B IQR = 22 cao **B1**

(a) Answer: Class A: 25; Class B: 22

(b) median comparison in context, e.g. Class B's median (70) is higher than Class A's median (62), so Class B typically scored higher marks oe **B1**

(b) ft: IQR comparison in context, e.g. Class A's IQR (25) is greater than Class B's (22), so Class A's marks were more spread out/less consistent than Class B's oe **B1**

(b) Answer: Class B typically scored higher (higher median); Class A's marks were more varied/less consistent (larger IQR).

Question 7

oe: a box plot only shows the minimum, lower quartile, median, upper quartile and maximum, not the individual data values (or their total), so the exact mean cannot be calculated from it **B1**

Answer: The mean cannot be found because a box plot only shows the five-number summary, not the actual data values or their total.

Question 8

(a) correct method for the median with n = 20, using the mean of the 10th and 11th values **M1**

(a) median = 32 km cao **A1**

(a) correct method for the quartiles, splitting the data into two halves of 10 values and finding the mean of the 5th and 6th value in each half **M1**

(a) LQ = 23 km, UQ = 42 km and IQR = 19 km, all cao **A1**

(a) Answer: Median = 32 km, LQ = 23 km, UQ = 42 km, IQR = 19 km

(b) ft: box drawn correctly from the lower quartile (23) to the upper quartile (42) **B1**

(b) ft: whiskers drawn correctly from the box to the minimum (12) and the maximum (60) **B1**

(b) ft: median (32) correctly marked inside the box, with correct scale and axis labelled **B1**

(b) Answer: Box plot with min 12, LQ 23, median 32, UQ 42, max 60 (km)

(c) ft: correct conclusion, e.g. the distribution is approximately symmetric (only very slight positive skew) oe **B1**

(c) ft: valid reason comparing the two gaps, e.g. median - LQ = 32 - 23 = 9 and UQ - median = 42 - 32 = 10, which are very close in size, so the data are roughly evenly spread either side of the median oe **B1**

(c) Answer: Approximately symmetric (only a very slight positive skew)

Question 9

(a) 0.25 x n = 18 oe, recognising 18 shops represents the top 25% of the sample **M1**

(a) n = 72 cao **A1**

(a) Answer: 72 shops

(b) ft: not consistent, since 25% of 72 shops = 18 shops should lie below the lower quartile, not 9 **B1**

(b) Answer: Not consistent: 18 shops (25% of 72), not 9, should have sales below the lower quartile.

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Question 10

(a) this year's IQR = 75 N cao **B1**

(a) last year's IQR = 80 N cao **B1**

(a) Answer: This year: 75 N; last year: 80 N

(b) oe: this year's IQR (75 N) is slightly smaller than last year's (80 N), so the middle 50% of breaking strengths is slightly more consistent this year, which supports the claim **B1**

(b) oe: however, this year's range (620 - 310 = 310 N) is much larger than last year's (520 - 290 = 230 N), driven by a much higher maximum, so the overall spread has actually increased - the claim is only partly supported **B1**

(b) Answer: Partly supported: the IQR has fallen slightly (80 N to 75 N), suggesting slightly more consistency in the middle 50% of ropes, but the range has increased a lot (230 N to 310 N) because of a much higher maximum this year, so the overall spread of strengths has actually grown.

Question 11

recognising that 57 minutes lies between the median (50) and the upper quartile (64), i.e. in the interval covering the 50th to 75th percentile **M1**

(57 - 50) / (64 - 50) oe, i.e. finding the fraction 1/2 (or 0.5) of the way through that interval **M1**

62.5% cao (accept 62.5 percent, or equivalent awrt 63%) **A1**

Answer: 62.5%

Question 12

(a) f = 28 cao **B1**

(a) Answer: f = 28

(b) using the mean to form total sum = 6 x 17 = 102, and the median to give c + d = 30, to obtain b + e = 102 - 6 - 28 - 30 = 38 **M1**

(b) combining b + e = 38 with e - b = 10 (the interquartile range) to solve simultaneously **dM1**

(b) b = 14 and e = 24, both cao **A1**

(b) Answer: Lower quartile = 14, upper quartile = 24

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