

Stats 29.05 [67 marks]

1. A data set consisting of 16 test scores has mean 14.5. One test score of 9 requires a second marking and is removed from the data set.

Find the mean of the remaining 15 test scores.

Markscheme

* This sample question was produced by experienced DP mathematics senior examiners to aid teachers in preparing for external assessment in the new MAA course. There may be minor differences in formatting compared to formal exam papers.

$$\frac{\sum_{i=1}^{16} x_i}{16} = 14.5 \text{ (M1)}$$

Note: Award **M1** for use of $\bar{x} = \frac{\sum_{i=1}^n x_i}{n}$.

$$\Rightarrow \sum_{i=1}^{16} x_i = 232 \text{ (A1)}$$

$$\text{new } \bar{x} = \frac{232-9}{15} \text{ (A1)}$$

$$= 14.9 (= 14.8\bar{6}, = \frac{223}{15}) \text{ A1}$$

Note: Do not accept 15.

[4 marks]

The number of hours spent exercising each week by a group of students is shown in the following table.

Exercising time (in hours)	Number of students
2	5
3	1
4	4
5	3
6	x

The median is 4.5 hours.

2a. Find the value of x .

[2 marks]

Markscheme

EITHER

recognising that half the total frequency is 10 (may be seen in an ordered list or indicated on the frequency table) **(A1)**

OR

$$5 + 1 + 4 = 3 + x \quad \mathbf{(A1)}$$

OR

$$\sum f = 20 \quad \mathbf{(A1)}$$

THEN

$$x = 7 \quad \mathbf{A1}$$

[2 marks]

2b. Find the standard deviation.

[2 marks]

Markscheme

METHOD 1

1.58429...

1.58 **A2**

METHOD 2

EITHER

$$\sigma^2 = \frac{5 \times (2-4.3)^2 + 1 \times (3-4.3)^2 + 4 \times (4-4.3)^2 + 3 \times (5-4.3)^2 + 7 \times (6-4.3)^2}{20} \quad (= 2.51)$$

(A1)

OR

$$\sigma^2 = \frac{5 \times 2^2 + 1 \times 3^2 + 4 \times 4^2 + 3 \times 5^2 + 7 \times 6^2}{20} - 4.3^2 \quad (= 2.51) \quad \textbf{(A1)}$$

THEN

$$\sigma = \sqrt{2.51} = 1.58429 \dots$$

= 1.58 **A1**

[2 marks]

The fastest recorded speeds of eight animals are shown in the following table.

Animal	Speed (km h ⁻¹)
Golden eagle	300
Swordfish	97
Hare	80
Lion	80
Horse	71
Zebra	64
Komodo dragon	21
Tiger beetle	6

3a. State whether **speed** is a continuous or discrete variable.

[1 mark]

Markscheme

* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.

continuous **(A1) (C1)**

[1 mark]

3b. Write down the median speed for these animals.

[1 mark]

Markscheme

75.5 (km h⁻¹) **(A1) (C1)**

Note: Answer must be exact.

[1 mark]

3c. Write down the range of the animal speeds.

[1 mark]

Markscheme

294 (km h⁻¹) **(A1) (C1)**

[1 mark]

3d. For these eight animals find the mean speed.

[2 marks]

Markscheme

$$\frac{300+97+80+80+71+64+21+6}{8} \quad \text{OR} \quad \frac{719}{8} \quad \text{(M1)}$$

Note: Award **(M1)** for correct sum divided by 8.

89.9 (89.875)(km h⁻¹) **(A1) (C2)**

[2 marks]

3e. For these eight animals write down the standard deviation.

[1 mark]

Markscheme

84.6 (84.5597...)(km h⁻¹) **(A1) (C1)**

Note: If the response to part (d)(i) is awarded zero marks, a correct response to part (d)(ii) is awarded **(C2)**.

[1 mark]

A florist sells bouquets of roses. The florist recorded, in **Table 1**, the number of roses in each bouquet sold to customers.

Table 1

Number of roses in a bouquet (n)	2	3	4	5	6	7	8	9	10	11	12
Number of customers (f)	9	2	4	5	7	3	10	2	3	1	4

The roses can be arranged into bouquets of size small, medium or large. The data from **Table 1** has been organized into a cumulative frequency table, **Table 2**.

Table 2

Bouquet size	Number of roses (n)	Frequency (f)	Cumulative frequency
small	$2 \leq n \leq 4$	15	
medium	$5 \leq n \leq 8$	25	
large	$9 \leq n \leq 12$		

4a. Complete the cumulative frequency table.

[2 marks]

Markscheme

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Bouquet size	Number of roses (n)	Frequency (f)	Cumulative frequency
small	$2 \leq n \leq 4$	15	15
medium	$5 \leq n \leq 8$	25	40
large	$9 \leq n \leq 12$	10	50

(A1)

(A1)(ft) (C2)

Note: Award **(A1)** for 10; **(A1)(ft)** for the last column all correct. Follow through from *their* 10 for *their* 50 in the last column.

[2 marks]

- 4b. Write down the probability that a bouquet of roses sold is **not** small. [2 marks]

Markscheme

$$\frac{35}{50} \left(0.7, \frac{7}{10}, 70\% \right) \quad (\mathbf{A1})(\mathbf{ft})(\mathbf{A1})(\mathbf{ft}) \quad (\mathbf{C2})$$

Note: Award **(A1)(ft)** for their numerator being 25 + *their* 10, and **(A1)(ft)** for their denominator being *their* 50. Follow through from part (a).

[2 marks]

- 4c. A customer buys a large bouquet. [2 marks]
Find the probability that there are 12 roses in this bouquet.

Markscheme

$$\frac{4}{10} \left(0.4, \frac{2}{5}, 40\% \right) \quad (\mathbf{A1})(\mathbf{A1})(\mathbf{ft}) \quad (\mathbf{C2})$$

Note: Award **(A1)** for a numerator of 4 and **(A1)(ft)** for *their* 10 as denominator. Follow through from part (a).

[2 marks]

A group of 10 girls recorded the number of hours they spent watching television during a particular week. Their results are summarized in the box-and-whisker plot below.



- 5a. The range of the data is 16. Find the value of a . [2 marks]

Markscheme

* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.

valid approach **(M1)**

eg $16 + 8$, $a - 8$

24 (hours) **A1 N2**

[2 marks]

5b. Find the value of the interquartile range.

[2 marks]

Markscheme

valid approach **(M1)**

eg $20 - 15$, $Q_3 - Q_1$, $15 - 20$

IQR = 5 **A1 N2**

[2 marks]

The group of girls watched a total of 180 hours of television.

5c. Find the mean number of hours that the girls in this group spent watching television that week.

[2 marks]

Markscheme

correct working **(A1)**

eg $\frac{180}{10}$, $\frac{180}{n}$, $\frac{\sum x}{10}$

mean = 18 (hours) **A1 N2**

[2 marks]

A group of 20 boys also recorded the number of hours they spent watching television that same week. Their results are summarized in the table below.

$\bar{x} = 21$	$\sigma = 3$
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- 5d. Find the total number of hours the group of boys spent watching television that week. [2 marks]

Markscheme

attempt to find total hours for group B **(M1)**

eg $\bar{x} \times n$

group B total hours = 420 (seen anywhere) **A1 N2**

[2 marks]

- 5e. Find the mean number of hours that **all 30** girls and boys spent watching television that week. [3 marks]

Markscheme

attempt to find sum for combined group (may be seen in working) **(M1)**

eg $180 + 420, 600$

correct working **(A1)**

eg $\frac{180+420}{30}, \frac{600}{30}$

mean = 20 (hours) **A1 N2**

[3 marks]

The following week, the group of boys had exams. During this exam week, the boys spent half as much time watching television compared to the previous week.

For this exam week, find

- 5f. the mean number of hours that the group of boys spent watching television. [2 marks]

Markscheme

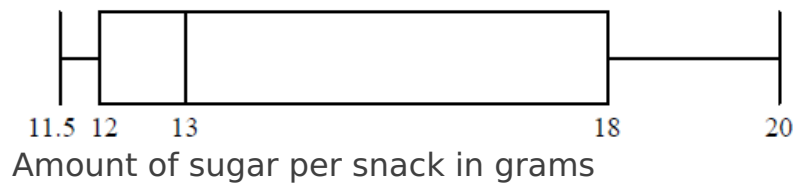
valid approach to find the new mean **(M1)**

eg $\frac{1}{2}\mu, \frac{1}{2} \times 21$

mean = $\frac{21}{2}$ (= 10.5) hours **A1 N2**

[2 marks]

A health inspector analysed the amount of sugar in 500 different **snacks** prepared in various school cafeterias. The collected data are shown in the following box-and-whisker diagram.



6a. State what 13 represents in the given diagram.

[1 mark]

Markscheme

* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.

median **(A1) (C1)**

[1 mark]

6b. Write down the interquartile range for this data.

[2 marks]

Markscheme

18 – 12 **(A1)**

Note: Award **(M1)** for correct quartiles seen.

6 (g) **(A1) (C2)**

[2 marks]

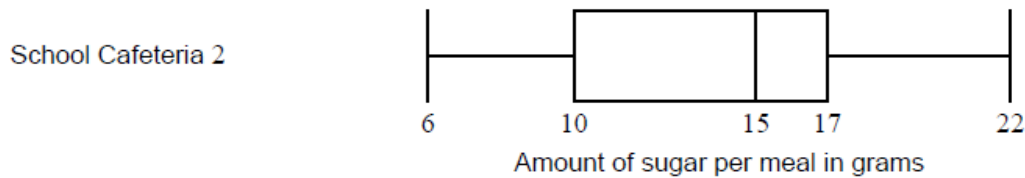
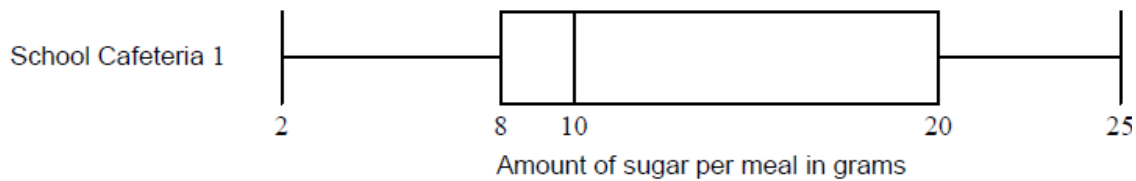
- 6c. Write down the approximate number of snacks whose amount of sugar ranges from 18 to 20 grams. [1 mark]

Markscheme

125 (A1) (C1)

[1 mark]

- 6d. The health inspector visits two school cafeterias. She inspects the same number of **meals** at each cafeteria. The data is shown in the following box-and-whisker diagrams. [2 marks]



Meals prepared in the school cafeterias are required to have less than 10 grams of sugar.

State, giving a reason, which school cafeteria has more meals that **do not** meet the requirement.

Markscheme

Cafeteria 2 (A1) (C1)

75 % > 50 % (do not meet the requirement) (R1) (C1)

OR

25 % < 50 % (meet the requirement) (R1) (C1)

Note: Do not award (A1)(R0). Award the (R1) for a correct comparison of percentages for both cafeterias, which may be in words. The percentage values or fractions must be seen. It is possible to award (A0)(R1).

[2 marks]

Ten students were asked for the distance, in km, from their home to school. Their responses are recorded below.

0.3 0.4 3 3 3.5 5 7 8 8 10

7a. For these data, find the mean distance from a student's home to school. [2 marks]

Markscheme

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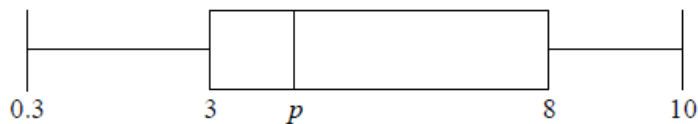
evidence of finding $\frac{\sum x}{n}$ (M1)

eg $\frac{0.3+0.4+3+\dots+10}{10}$, $\frac{48.2}{10}$

$\bar{x} = 4.82$ (exact) **A1 N2**

[2 marks]

The following box-and-whisker plot represents this data.



7b. Find the value of p .

[1 mark]

Markscheme

$p = 4.25$ (exact) **A1 N1**

[1 mark]

7c. Find the interquartile range.

[2 marks]

Markscheme

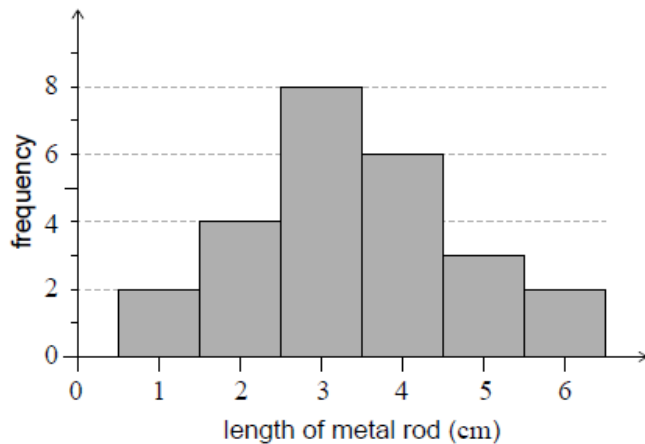
valid approach (M1)

eg $Q_3 - Q_1$ 3 - 8, 3 to 8

IQR = 5 **A1 N2**

[2 marks]

The histogram shows the lengths of 25 metal rods, each measured correct to the nearest cm.



8a. Write down the modal length of the rods.

[1 mark]

Markscheme

* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.

3 **(A1) (C1)**

[1 mark]

8b. Find the median length of the rods.

[3 marks]

Markscheme

median is 13th position **(M1)**

CF: 2, 6, 14, 20, 23, 25 **(M1)**

median = 3 **(A1) (C3)**

[3 marks]

The upper quartile is 4 cm.

8c. Calculate the lower quartile.

[1 mark]

Markscheme

2.5 (A1) (C1)

Note: Award **(A1)(ft)** if the sum of **their** parts (c)(i) and (c)(ii) is 4.

[1 mark]

8d. Calculate the interquartile range.

[1 mark]

Markscheme

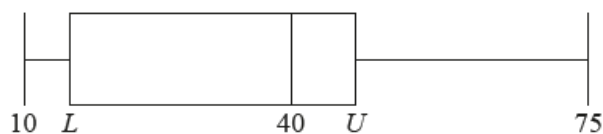
1.5 (A1)(ft) (C1)

Note: Award **(A1)(ft)** if the sum of **their** parts (c)(i) and (c)(ii) is 4.

[1 mark]

A research student weighed lizard eggs in grams and recorded the results. The following box and whisker diagram shows a summary of the results where L and U are the lower and upper quartiles respectively.

diagram not to scale



The interquartile range is 20 grams and there are no outliers in the results.

9a. Find the minimum possible value of U .

[3 marks]

Markscheme

attempt to use definition of outlier

$$1.5 \times 20 + Q_3 \text{ (M1)}$$

$$1.5 \times 20 + U \geq 75 \ (\Rightarrow U \geq 45, \text{ accept } U > 45) \text{ OR } 1.5 \times 20 + Q_3 = 75 \text{ A1}$$

minimum value of $U = 45$ A1

[3 marks]

9b. Hence, find the minimum possible value of L .

[2 marks]

Markscheme

attempt to use interquartile range (M1)

$$U - L = 20 \text{ (may be seen in part (a)) OR } L \geq 25 \text{ (accept } L > 25)$$

minimum value of $L = 25$ A1

[2 marks]

The following box-and-whisker plot shows the number of text messages sent by students in a school on a particular day.



10a. Find the value of the interquartile range.

[2 marks]

Markscheme

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recognizing Q_1 or Q_3 (seen anywhere) (M1)

eg 4,11, indicated on diagram

$$\text{IQR} = 7 \text{ A1 N2}$$

[2 marks]

10b. One student sent k text messages, where $k > 11$. Given that k is an outlier, find the least value of k . [4 marks]

Markscheme

recognizing the need to find 1.5 IQR (M1)

eg $1.5 \times \text{IQR}$, 1.5×7

valid approach to find k (M1)

eg $10.5 + 11$, $1.5 \times \text{IQR} + Q_3$

21.5 (A1)

$k = 22$ A1 N3

Note: If no working shown, award N2 for an answer of 21.5.

[4 marks]

A data set has n items. The sum of the items is 800 and the mean is 20.

11a. Find n . [2 marks]

Markscheme

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correct approach (A1)

eg $\frac{800}{n} = 20$

40 A1 N2

[2 marks]

The standard deviation of this data set is 3. Each value in the set is multiplied by 10.

11b. Write down the value of the new mean. [1 mark]

Markscheme

200 **A1 N1**

[1 mark]

11c. Find the value of the new variance.

[3 marks]

Markscheme

METHOD 1

recognizing variance = σ^2 **(M1)**

eg $3^2 = 9$

correct working to find new variance **(A1)**

eg $\sigma^2 \times 10^2, 9 \times 100$

900 **A1 N3**

METHOD 2

new standard deviation is 30 **(A1)**

recognizing variance = σ^2 **(M1)**

eg $3^2 = 9, 30^2$

900 **A1 N3**

[3 marks]