UNIT TEST #015 | Australian Curriculum Mathematics | UTM8T4U7

Data Representation and Interpretation

8 Unit Test

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Instructions: Read all questions carefully to ensure you understand what is being asked. When completing your official tests / exams, your grade will be based upon your: **understanding, fluency, reasoning, and problem solving,** so ensure you show all lines of working and draw accurate, labelled diagrams where necessary. (ACiQ|9.0 Mathematics standard elaborations found on final page (general assessment marking standards)). [Practise tests are marked out of a score of 10]. For multiple choice questions, tick or fill in the circle next to the corresponding letter under the question.

Check your work if you have time. *Remember:* you don't have to start at question one, it's always best to firstly look through the test, highlight the easy looking questions and complete them first, then secondly, go back through and work on the harder questions. Good luck! And remember to breathe!

$$\sum = \frac{\quad}{10} = \quad \%$$

Part 1: Multiple Choice (2 marks)

Question 1:

a) Which measure of central tendency is most affected by extreme values in a dataset?

A. Mean **B.** Median **C.** Mode **D.** Range

◯ **A** ◯ **B** ◯ **C** ◯ **D**

b) What is the mean of the following dataset $\{ 75, 82, 88, 75, 90, 92, 85 \}$ **?**

A. 17 **B.** 75 **C.** 83.36 **D.** No range

◯ **A** ◯ **B** ◯ **C** ◯ **D**

Question 2:

a) What does a large standard deviation indicate about a dataset?

A. Data points are closely clustered around the mean.
B. The data is spread out over a wide range.
C. There are no extreme values.
D. The median is a better measure of central tendency.

◯ **A** ◯ **B** ◯ **C** ◯ **D**

b) Determine the range from question 1b.

A. 17 **B.** 18 **C.** 19 **D.** 20

◯ **A** ◯ **B** ◯ **C** ◯ **D**

Part 2: Short Answer (4 marks)

Question 3:

a) Calculate the mean, median, and mode for the following dataset: $\{ 5, 7, 7, 9, 10, 12, 12, 15 \}$ **.**

b) Create a frequency table for the data in question 3a.

Question 4:

a) Explain what the range tells us about a dataset.

b) Calculate the interquartile range for this dataset: $\{ 2, 5, 7, 9, 12, 15 \}$.

Part 3: Problem Solving (4 marks)

Question 5:

a) Given the scores of 10 **students in a test:** $\{ 80, 85, 90, 75, 88, 92, 70, 82, 86, 84 \}$ **:**
Calculate the mean score. Find the median score. Determine the range of the scores.

b) A dataset has the following values: $\{ 1, 2, 3, 3, 4, 4, 5, 5, 5 \}$ **. Manually calculate the standard deviation of this dataset. (Note: You can use the formula for variance and population standard deviation for simplicity. Population Standard Deviation** $= \sigma = \sqrt{\text{Variance}}$ **) .**

Question 6:

a) A teacher recorded the heights of students in a year 8 class in $centimetres$ **:**
$\{ 150, 155, 160, 160, 165, 170, 175 \}$ **. Calculate and interpret the mean height and the range.**

b) How does this compare to the Australian Bureau of Statistics (A.B.S.) data collected on the average measured height of males and females aged 12-15 years (see table below) ?

Australian Bureau of Statistics

Table 17.1 Children's Body Mass Index, waist circumference, height and weight(a)(b), by age and sex(c) — Children aged 2–17 years, Estimate

National Health Survey, 2022 — Australia

	Age group (years)								
	2–4	5–7	8–11	12–15	16–17	2–14	15–17	Total 2–17 years	Total 5–17 years
	ESTIMATE ('000)								
	MALES AGED 2–17 YEARS								
Males									
Measured Body Mass Index									
Underweight	55.1	40.8	*33.9	63.0	*35.2	170.2	57.1	234.6	171.1
Normal	341.0	322.5	438.5	407.0	158.0	1,393.6	273.8	1,659.8	1,322.0
Overweight	59.1	79.3	137.8	132.6	63.4	381.9	89.0	471.9	413.2
Obese	**13.2	53.6	56.5	68.3	*36.6	167.8	*48.5	222.5	210.6
Overweight / Obese	*63.5*	*126.9*	*195.7*	*198.7*	*98.4*	*558.9*	*133.6*	*693.1*	*619.6*
Total males aged 2–17 years	*468.1*	*490.9*	*663.5*	*671.4*	*310.0*	*2,118.1*	*471.3*	*2,585.7*	*2,125.1*
Average measured Body Mass Index	16.5	16.8	18.7	21.2	23.3	18.3	22.6	19.1	19.7
Median measured Body Mass Index	16.2	16.1	17.7	20.0	21.8	17.2	21.5	17.8	18.6
Average measured height (cm)	99.7	120.0	142.8	166.3	177.0	133.1	175.7	140.9	149.9
Median measured height (cm)	100.0	120.0	142.0	167.0	177.0	133.0	176.0	142.6	152.0
Average measured weight (kg)	16.6	24.4	38.7	59.1	73.2	34.9	70.1	41.4	46.8
Median measured weight (kg)	16.0	23.2	36.0	56.1	68.8	31.0	67.0	36.5	43.3
Average measured waist circumference (cm)	52.9	58.9	69.0	78.3	83.5	65.3	81.9	68.3	71.7
Median measured waist circumference (cm)	52.0	58.0	67.0	76.0	81.0	62.0	79.0	66.0	70.0
Total males, 2–17 years	**468.1**	**490.9**	**663.5**	**671.4**	**310.0**	**2,118.1**	**471.3**	**2,585.7**	**2,125.1**
	FEMALES AGED 2–17 YEARS								
Females									
Measured Body Mass Index									
Underweight	70.0	40.6	*22.9	*38.9	*30.9	172.3	36.2	205.7	143.2
Normal	273.7	290.7	419.8	426.9	184.0	1,299.8	302.3	1,600.8	1,328.5
Overweight	65.5	92.8	138.5	109.4	53.0	370.9	78.3	455.3	388.0
Obese	51.3	*22.3	*46.4	*40.6	*19.6	145.7	*32.1	181.0	127.8
Overweight / Obese	*107.5*	*108.5*	*182.0*	*149.2*	*78.2*	*518.0*	*105.7*	*629.0*	*518.3*
Total females aged 2–17 years	*446.3*	*445.9*	*632.5*	*614.7*	*295.8*	*1,993.4*	*444.7*	*2,438.0*	*1,987.2*
Average measured Body Mass Index	16.4	16.3	18.7	21.4	22.7	18.2	22.6	19.0	19.6
Median measured Body Mass Index	15.9	15.7	18.1	20.0	21.9	17.4	21.7	18.2	18.8
Average measured height (cm)	99.3	119.9	143.5	159.3	163.1	131.7	163.2	137.5	146.1
Median measured height (cm)	99.9	119.6	144.0	159.0	163.0	135.0	164.0	144.0	150.0
Average measured weight (kg)	16.2	23.7	39.0	54.4	60.7	33.7	60.3	38.6	43.7
Median measured weight (kg)	16.0	22.8	36.6	52.9	59.0	30.9	58.0	37.5	43.6
Average measured waist circumference (cm)	53.5	58.4	66.8	72.5	75.8	63.2	75.2	65.4	68.1
Median measured waist circumference (cm)	52.0	57.0	65.6	70.0	72.0	61.0	72.0	63.0	67.0
Total females, 2–17 years	**446.3**	**445.9**	**632.5**	**614.7**	**295.8**	**1,993.4**	**444.7**	**2,438.0**	**1,987.2**

Solutions

1a. (0.5 marks)

A. Mean.

- The mean can be significantly altered by outliers because it takes into account every value in the dataset.

b. (0.5 marks)

C. 83.86 .

$$\begin{aligned}\textbf{Mean: Sum of scores} &= 75+82+88+75+90+92+85\\ &= 587,\\ \textbf{divided by 7 (number of scores)} &= \frac{587}{7}\\ &\approx 83.86.\end{aligned}$$

2a. (0.5 marks)

B. The data is spread out over a wide range.

- A large standard deviation implies greater variability among the data points.

b. (0.5 marks)

A. 17 .

$$\begin{aligned}\text{Range} &= \text{Maximum} - \text{Minimum}\\ &= 92-75\\ &= 17\,.\end{aligned}$$

3a. (1 mark)

$$\text{Mean: } \frac{5+7+7+9+10+12+12+15}{8} = \frac{77}{8} = 9.625\,,$$

Median: Arranging in order: $\cancel{5},\cancel{7},\cancel{7},\boxed{9,\,10,}\cancel{12},\cancel{12},\cancel{15}$,

The median is the average of the $4th$ and $5th$ number:

$$\frac{9+10}{2} = 9.5\,,$$

Mode: The most frequent number is 7 and 12, so there are two modes:

$$= 7 \text{ and } 12\,.$$

b. (1 mark)

Number	Frequency
5	1
7	2
9	1
10	1
12	2
15	1

4a. (1 mark)

The range provides a measure of how spread out the data is by showing the difference between the highest and lowest values in the dataset. It gives an idea of the variability but doesn't account for how the data is distributed between those extremes.

b. (1 mark)

To find quartiles, firstly, break the dataset into two even parts.
$\{ 2, 5, 7, \} \{ 9, 12, 15 \}$, then:

Q1 (First Quartile), is given by the median of the lower half:
$\{ 2, 5, 7 \} = 5$,

Q3 (Third Quartile), is given by the median of the upper half:
$\{ 9, 12, 15 \} = 12$,

$$\begin{aligned} IQR &= Q3 - Q1 \\ &= 12 - 5 \\ &= 7. \end{aligned}$$

5a. (1 mark)

Mean:

$$\mu = \frac{\sum_{i=1}^{n} x_i}{n} = \text{Mean} = \frac{\text{Sum of all scores}}{\text{Number of Scores}}$$
$$= \frac{80 + 85 + 90 + 75 + 88 + 92 + 70 + 82 + 86 + 84}{10}$$
$$= \frac{832}{10}$$
$$= 83.2 ,$$

Median:

Arranging in order:

$$70, 75, 80, 82, 84, 85, 86, 88, 90, 92.$$
$$= 4 ,$$

Range:

$$92 - 70 = 22 .$$

b. (1 mark)

Mean:

$$mu = \frac{\sum_{i=1}^{n} x_i}{n} = \text{Mean} = \frac{\text{Sum of all scores}}{\text{Number of Scores}}$$
$$= \frac{1+2+3+3+4+4+5+5+5}{9}$$
$$= \frac{32}{9}$$
$$\approx 3.56\,.$$

Variance:

$$\text{Deviations from mean} = (1-3.56)^2, (2-3.56)^2, \ldots, (5-3.56)^2$$
$$= (-2.56)^2, (-1.56)^2, \ldots, (1.44)^2$$
$$\text{Sum of squared deviations} = (-2.56)^2 + (-1.56)^2 + (-0.56)^2 \times 2 + (0.44)^2 \times 2 + (1.44)^2 \times 3$$
$$= 6.5792 + 2.4336 + 0.6272 \times 2 + 0.1936 \times 2 + 2.0736 \times 3$$
$$= 16.016\,.$$
$$\text{Variance} = \sigma^2 = \frac{\sum_{i=1}^{n} (x_i - \mu)^2}{n}$$
$$\text{Variance} = \frac{\text{Sum of squared deviations}}{\text{Number of Scores}}$$
$$= \frac{16.016}{9}$$
$$\approx 1.778\,.$$

Standard Deviation:

$$\text{Variance} = (\text{Standard Deviation})^2$$
$$\text{Variance} = \sigma^2$$
$$\sigma^2 = \text{Variance}$$
$$\sqrt{\sigma^2} = \sqrt{\text{Variance}}$$
$$\text{Standard Deviation} = \sigma = \sqrt{\text{Variance}}$$
$$\sigma = \sqrt{\text{Variance}}$$
$$\approx \sqrt{1.778}$$
$$\approx 1.32\,.$$

6a. (1 mark)

$$\text{Mean} = \frac{\sum_{i=1}^{n} x_i}{n}$$

$$= \frac{\text{Sum of scores}}{\text{Number of Scores}}$$

$$= \frac{150 + 155 + 160 + 160 + 165 + 170 + 175}{7}$$

$$= \frac{1135}{7}$$

$$\approx 162.14\,cm\,.$$

This indicates the average height of the students.

$$\text{Range} = 175 \text{ (highest)} - 150 \text{ (lowest)}$$

$$= 25\,cm\,.$$

This shows the spread from the shortest to the tallest student is quite significant.

b. (1 mark)

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Firstly, calculate the mean height for males and females aged between 12-15 years, using the 'average measured height' of each.

$$\begin{aligned}\text{Mean} &= \frac{\sum_{i=1}^{n} x_i}{n} \\ &= \frac{\text{Sum of scores}}{\text{Number of Scores}} \\ &= \frac{166.3 + 159.3}{2} \\ &= \frac{325.6}{2} \\ &\approx 162.8\,cm\,.\end{aligned}$$

Then compare to calculations in part a).

The A.B.S. data shows a mean height of $162.8\,cm$, the data in par a) shows a mean height of $162.14\,cm$, this shows the year 8 class contains a sample of students that closely matches population data for students aged between 12-15 years.

$$\sum = \frac{}{10} = \quad \%$$

General Assessment Marking Standards

Remember: When your official tests are marked, they won't be a score out of 10, they will be a grade (A,B,C,D,E) based on the following standards:

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Year 8 Mathematics standard elaborations

		A	B	C	D	E
		The folio of student work contains evidence of the following:				
Mathematical proficiencies	Understanding	accurate and consistent identification, representation, description and connection of mathematical concepts and relationships in complex unfamiliar, complex familiar, and simple familiar situations	accurate identification, representation, description and connection of mathematical concepts and relationships in complex familiar and simple familiar situations	identification, representation, description and connection of mathematical concepts and relationships in simple familiar situations	partial identification, representation and description of mathematical concepts and relationships in some simple familiar situations	fragmented identification, representation and description of mathematical concepts and relationships in isolated and obvious situations
	Fluency	choice, use and application of comprehensive facts, definitions, and procedures to find solutions in complex unfamiliar, complex familiar, and simple familiar situations	choice, use and application of effective facts, definitions, and procedures to find solutions in complex familiar and simple familiar situations	choice, use and application of facts, definitions, and procedures to find solutions in simple familiar situations	choice and use of partial facts, definitions, and procedures to find solutions in some simple familiar situations	choice and use of fragmented facts, definitions and procedures to find solutions in isolated and obvious situations
	Reasoning	comprehensive explanation of mathematical thinking, strategies used, and conclusions reached in complex unfamiliar, complex familiar, and simple familiar situations	detailed explanation of mathematical thinking, strategies used, and conclusions reached in complex familiar and simple familiar situations	explanation of mathematical thinking, strategies used, and conclusions reached in simple familiar situations	partial explanation of mathematical thinking, strategies used, and conclusions reached in some simple familiar situations	fragmented explanation of mathematical thinking, strategies used, and conclusions reached in isolated and obvious situations
	Problem-solving	purposeful use of problem-solving approaches to find solutions to problems.	effective use of problem-solving approaches to find solutions to problems.	use of problem-solving approaches to find solutions to problems.	partial use of problem-solving approaches to make progress towards finding solutions to problems.	fragmented use of problem-solving approaches to make progress towards finding solutions to problems.

Key shading emphasises the qualities that discriminate between the A–E descriptors

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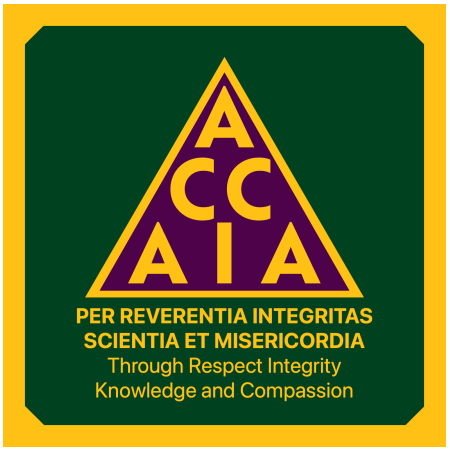

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