Circle Geometry

9 μnit 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:

Which of the following is true about angles subtended by the same arc at the circumference of a circle?

A. They are supplementary. **B.** They are equal. **C.** Their sum is $180°$. **D.** They are complementary.

◯ **A** ◯ **B** ◯ **C** ◯ **D**

Space for question 1…

Question 2:

The angle at the centre of a circle subtended by an arc is 120° . What is the angle at the circumference subtended by the same arc?

A. 30° **B.** 60° **C.** 90° **D.** 120°

◯ **A** ◯ **B** ◯ **C** ◯ **D**

Space for question 2...

Part 2: Short Answer (4 marks)

Question 3:

Explain the theorem that states "the angle in a semicircle is a right angle" .

Question 4:

If two tangents are drawn from an external point to a circle, what can be said about the lengths of these tangents?

Part 3: Problem Solving (4 marks)

Question 5:

In a circle, a chord AB is 8 cm long and is 3 cm from the centre O. Calculate the radius of the circle.

Question 6:

Given a circle with centre O, and points A, B, and C on the circumference where AOC is a straight line. If $\angle BOC = 70°$, what is $\angle BAC$?

Solutions

1. (1 mark)

B. They are equal.

Angles subtended by the same arc at the circumference are equal in measure.

2. (1 mark)

B. $60°$.

The angle at the circumference is half the angle at the centre subtended by the same arc.

3. (2 marks)

This theorem states that if an angle is subtended by the diameter of a circle at the circumference, then that angle is always a right angle ($90°$). This is because any line through the centre of the circle will create two right triangles with the diameter as the hypotenuse when extended to the circle's edge.

4. (2 marks)

The lengths of the two tangents drawn from the same external point to a circle are equal. This is known as the Tangent-Segment Theorem.

5. (2 marks)

Using the Pythagorean theorem in the right triangle formed by the radius, the perpendicular from the centre to the chord, and half of the chord:

Half of $AB = 4cm$

$$r^2 = 4^2 + 3^2$$
$$r^2 = 16 + 9$$
$$r^2 = 25$$
$$r = 5\,cm\,.$$

6. (2 marks)

$\angle BOC$ is at the centre, and since AOC is a straight line, $\angle AOC = 180°$.

Therefore, $\angle BAC$ (which is at the circumference subtended by arc BC) is half of $\angle BOC$:

$$\angle BAC = \frac{70°}{2}$$
$$= 35°\,.$$

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Statistics 9 μnit Test

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

Part 1: Multiple Choice (2 marks)

Question 1:

Which of the following describes the standard deviation of a dataset?

A. The average of the data points.
B. The middle value when data is ordered.
C. A measure of how spread out the numbers are.
D. The difference between the highest and lowest values.

◯ **A** ◯ **B** ◯ **C** ◯ **D**

Space for question 1…

Question 2:

If a dataset has a very low standard deviation, what does this suggest about the data?

A. The data points are spread out widely.
B. Most data points are close to the mean.
C. There are many outliers.
D. The mean is not a good measure of central tendency.

◯ **A** ◯ **B** ◯ **C** ◯ **D**

Space for question 2…

Part 2: Short Answer (4 marks)

Question 3:

Describe the steps to calculate the standard deviation for a *sample* dataset.

Question 4:

Why might standard deviation be a more useful measure of spread than the range in some datasets?

Part 3: Problem Solving (4 marks)

Question 5:

Given the dataset: $\{ 10, 12, 13, 15, 17 \}$ **, calculate the sample standard deviation (** σ **).**

Question 6:

A class took a test, and the scores were: $\{ 75, 82, 90, 88, 70, 95 \}$ **. Analyse the distribution of scores using measures of central tendency and dispersion.**

Solutions

1. (1 mark)

C. A measure of how spread out the numbers are.

Standard deviation quantifies the dispersion of data points around the mean.

2. (1 mark)

B. Most data points are close to the mean.

A low standard deviation indicates that data points are closely clustered around the mean.

3. (2 marks)

1. Calculate the Mean: Add all the values and divide by the number of data points.
2. Find the Deviations: Subtract the mean from each data point to find how much each point deviates from the mean.
3. Square the Deviations: Square each deviation to make them positive and emphasise larger differences.
4. Sum the Squared Deviations: Add up all the squared deviations.
5. Calculate Variance: Divide this sum by $n - 1$ (for sample data [divide by n for population data]) to get the sample variance.
6. Standard Deviation: Take the square root of the variance to get the standard deviation.

4. (2 marks)

Standard deviation takes into account every data point in the dataset, providing a measure of how data is spread around the mean. The range only considers the two most extreme values, which might not reflect the variability of all data points, especially if there are outliers. Standard deviation gives insight into the consistency of the data.

5. (2 marks)

$$\begin{aligned}\text{Mean} &= \frac{\text{Sum of scores}}{\text{Number of scores}} \\ &= \frac{10+12+13+15+17}{5} \\ &= \frac{67}{5} \\ &= 13.4\,.\end{aligned}$$

Deviations from the mean:

$$\begin{aligned}10-13.4 &= -3.4 \\ 12-13.4 &= -1.4 \\ 13-13.4 &= -0.4 \\ 15-13.4 &= 1.6 \\ 17-13.4 &= 3.6\end{aligned}$$

Squared deviations:

$$\begin{aligned}(-3.4)^2 &= 11.56 \\ (-1.4)^2 &= 1.96 \\ (-0.4)^2 &= 0.16 \\ 1.6^2 &= 2.56 \\ 3.6^2 &= 12.96\end{aligned}$$

$$\begin{aligned}\text{Sum of squared deviations} &= 11.56+1.96+0.16+2.56+12.96 \\ &= 29.2\,.\end{aligned}$$

$$\begin{aligned}\text{Variance (for sample)} &= \frac{\text{Sum of squared deviations}}{n-1} \\ &= \frac{29.2}{4} \\ &= 7.3 \text{ (since we're using sample standard deviation).}\end{aligned}$$

$$\begin{aligned}\text{Standard Deviation} = \sigma &= \sqrt{\text{Variance}} \\ &= \sqrt{7.3} \\ &\approx 2.7\,.\end{aligned}$$

6. (2 marks)

Mean:

$$\rightarrow \frac{75+82+90+88+70+95}{6}$$

$$= \frac{500}{6}$$

$$\approx 83.33 .$$

Median:

Arranged in order : $\cancel{70}, \cancel{75}, 82, 88, \cancel{90}, \cancel{95}$;

Median is the average of the $3rd$ and $4th$ number,

$$= \frac{82+88}{2}$$

$$= 85 .$$

Mode:

There is no mode since all scores are unique.

Range:

$$= \text{Maximum} - \text{Minimum}$$

$$= 95 - 70$$

$$= 25 .$$

Standard Deviation:

Deviations: $-8.33, -1.33, 6.67, 4.67, -13.33, 11.67$

Squared Deviations: $69.39, 1.77, 44.49, 21.81, 177.69, 136.19$

Sum: 451.34

Variance (for sample): $\frac{451.34}{5} = 90.27$

Standard Deviation: $\sqrt{90.27}$

$$\approx 9.5 .$$

Analysis:

The mean and median are close, suggesting a somewhat symmetrical distribution but with a slight skew towards higher scores (median higher than mean). The relatively high standard deviation for this small sample indicates a fair amount of variability in test performance, with scores spread out from the mean.

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

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Probability of Combined Events

9 μnit Test

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

Part 1: Multiple Choice (2 marks)

Question 1:

If A and B are independent events, which of the following is true about their probabilities?

A. $P(A \cap B) = P(A) + P(B)$

B. $P(A \cap B) = P(A) \times P(B)$

C. $P(A \cap B) = P(A) - P(B)$

D. $P(A \cap B) = \dfrac{P(A)}{P(B)}$

◯ **A** ◯ **B** ◯ **C** ◯ **D**

Space for question 1…

Question 2:

What does conditional probability represent?

A. The probability of an event occurring when another event has already occurred.
B. The probability of two events occurring at the same time.
C. The probability that one event will not occur given that another event has occurred.
D. The probability of an event occurring in isolation.

◯ **A** ◯ **B** ◯ **C** ◯ **D**

Space for question 2…

Part 2: Short Answer (4 marks)

Question 3:

Explain the difference between independent and dependent events with an example.

Question 4:

Describe how a tree diagram can help in calculating conditional probabilities.

Part 3: Problem Solving (4 marks)

Question 5:

A bag contains 5 red balls and 3 blue balls. If you draw two balls without replacement: What is the probability that the first ball is red? What is the conditional probability that the second ball is blue, given the first was red?

Question 6:

In a school, $40\,\%$ of students play football, $30\,\%$ play basketball, and $15\,\%$ play both. Draw a Venn diagram to represent this data. Calculate the probability that a student chosen at random plays football but not basketball.

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

Solutions

1a. (1 mark)

B. $P(A \cap B) = P(A) \times P(B)$.

For independent events, the probability of both occurring is the product of their individual probabilities.

2. (1 mark)

A. The probability of an event occurring when another event has already occurred.

Conditional probability is written as P(AIB), the probability of A given B has happened.

3. (2 marks)

Independent events: The occurrence of one does not affect the probability of the other. Example: Flipping a coin twice; the result of the first flip does not change the probability of the second flip.

Dependent events: The outcome of the first event influences the probability of the second. Example: Drawing two cards without replacement from a deck; if you draw an ace first, the probability of drawing another ace changes because the deck has one less ace.

4. (2 marks)

A tree diagram branches out to show all possible outcomes of sequential events. For conditional probabilities, each branch represents how the occurrence of one event affects the probability of subsequent events. By following the path where the condition has occurred, you can see how to calculate the probability of another event given that condition.

5. (2 marks)

First ball red:

$$P(\text{Red first}) = \frac{5}{8}$$

Second ball blue given first is red:

After drawing one red, there are 7 balls left, 3 of which are blue:

$$P(\text{Blue second} \mid \text{Red first}) = \frac{3}{7}.$$

6. (2 marks)

Venn Diagram:

Football circle: $40\,\%$

Basketball circle: $30\,\%$

Overlap (both): $15\,\%$

Probability Calculation:

Students playing football but not basketball:

$$\begin{aligned} P(\text{Football only}) &= P(\text{Football}) - P(\text{Both}) \\ &= 0.40 - 0.15 \\ &= 0.25 \end{aligned}$$

Therefore, the probability is $25\,\%$.

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 9 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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