HSC Mathematics Standard 2 Practice Exam (Sample)

Study Guide

Questions

1. **What is the key attribute of Kruskal's Algorithm?**

    A. It randomly selects edges until all vertices are connected

    B. It keeps adding smallest edges that do not form a cycle

    C. It stops when all edges have been added

    D. It selects edges based only on the highest weight

2. **In a right triangle, what is the relationship between the lengths of the sides?**

    A. The sum of the lengths of the two shorter sides equals the longest side

    B. The longest side is always equal to the sum of the other two sides

    C. The lengths are in the ratio of 3:4:5

    D. The square of the longest side equals the sum of the squares of the other two sides

3. **Which of the following represents the slope of a line in the equation $y = mx + b$?**

    A. m

    B. b

    C. x

    D. y

4. **What is a linear equation?**

    A. An equation that graphs a curved line

    B. An equation that graphs a straight line

    C. An equation with no solutions

    D. An equation that involves variables only

5. **Which components are included in a box-and-whisker plot?**

    A. Mean, median, mode, lower and upper extremes.

    B. Median, lower extreme, lower quartile, upper quartile, and higher extreme.

    C. Lower quartile, upper quartile, range, and all data points.

    D. Minimum, lower quartile, median, mode, and maximum.

6. **What is meant by the "limit of reading" on a measuring instrument?**

   A. The maximum reading possible on the instrument.

   B. The smallest unit that can be accurately measured.

   C. The total measurement range of the instrument.

   D. The difference between maximum and minimum values.

7. **What does a radial survey involve?**

   A. Measuring distances only

   B. Calculating areas

   C. Measuring angles and sides from a central point

   D. Drawing straight lines between points

8. **What is the value of the expression $9^2 - 3^2$?**

   A. 72

   B. 36

   C. 54

   D. 81

9. **What defines a parallelogram?**

   A. All sides are equal

   B. Opposite sides are parallel and equal in length

   C. All angles are 90 degrees

   D. It has exactly two pairs of equal sides

10. **What does the equation y = ax represent?**

   A. Linear growth

   B. Quadratic growth

   C. Exponential growth

   D. Cubic growth

Answers

1. **B**
2. **D**
3. **A**
4. **B**
5. **B**
6. **B**
7. **C**
8. **A**
9. **B**
10. **C**

Explanations

1. What is the key attribute of Kruskal's Algorithm?

A. It randomly selects edges until all vertices are connected

B. It keeps adding smallest edges that do not form a cycle

C. It stops when all edges have been added

D. It selects edges based only on the highest weight

Kruskal's Algorithm is designed to find the minimum spanning tree (MST) for a connected, undirected graph. The key attribute of the algorithm is that it focuses on adding edges in increasing order of their weights while ensuring that no cycles are formed. This process guarantees that the resulting tree is of minimal weight. When Kruskal's Algorithm operates, it sorts all the edges in the graph by their weight. Then, it systematically adds the smallest edge to the growing spanning tree, assuming the edge does not create a cycle with the edges already included. This prevents the formation of loops and ensures that all vertices remain connected as the tree grows, eventually leading to the inclusion of all vertices with the minimum total edge weight. In contrast, other choices illustrate incorrect principles or misunderstandings of how the algorithm functions. For example, the idea of randomly selecting edges or selecting edges based on the highest weight does not align with the systematic, ordered approach of Kruskal's Algorithm. The algorithm does not simply stop adding edges once all edges are included; it specifically needs to stop when there are exactly $(n - 1)$ edges in a tree with (n) vertices, ensuring connectivity without redundancy.

2. In a right triangle, what is the relationship between the lengths of the sides?

A. The sum of the lengths of the two shorter sides equals the longest side

B. The longest side is always equal to the sum of the other two sides

C. The lengths are in the ratio of 3:4:5

D. The square of the longest side equals the sum of the squares of the other two sides

In a right triangle, the relationship between the side lengths is defined by the Pythagorean theorem. This theorem states that for any right triangle, the square of the length of the longest side (the hypotenuse) is equal to the sum of the squares of the lengths of the other two sides. Mathematically, if we denote the lengths of the two shorter sides as (a) and (b), and the hypotenuse as (c), the theorem is expressed as: $[c^2 = a^2 + b^2]$ This fundamental relationship holds true for all right triangles, regardless of their size. It's an essential concept in geometry that illustrates how side lengths interact in a right triangle configuration. In contrast, the other options misrepresent the relationships in a right triangle. For example, while the statement about the ratio of 3:4:5 does describe specific integer values that form a right triangle (known as a Pythagorean triple), it does not apply to all right triangles. Similarly, the claim that the longest side is equal to the sum of the other two sides describes a property of triangles in general, not specifically of right triangles. The notion that the sum of the

3. Which of the following represents the slope of a line in the equation y = mx + b?

A. m

B. b

C. x

D. y

In the equation of a line given by the slope-intercept form, $y = mx + b$, the variable m specifically represents the slope of the line. The slope indicates how steep the line is, and it describes the rate of change of y with respect to x. A positive slope means that as x increases, y also increases, while a negative slope indicates that as x increases, y decreases. The term b in this equation represents the y-intercept, the point where the line crosses the y-axis. The variables x and y are the coordinates of points on the line and do not indicate the slope directly. Therefore, the correct identification of the slope in the equation is indeed the value m. Understanding this relationship is crucial for graphing lines and analyzing their behavior in coordinate geometry.

4. What is a linear equation?

A. An equation that graphs a curved line

B. An equation that graphs a straight line

C. An equation with no solutions

D. An equation that involves variables only

A linear equation is characterized by its ability to graph as a straight line on a coordinate plane. This type of equation typically takes the form $y = mx + b$, where m represents the slope and b the y-intercept. The defining feature of a linear equation is that it does not include any exponents greater than one, nor does it involve products of variables, which ensures the graph remains a straight line. The choice indicating that a linear equation graphs a curved line is incorrect because that would pertain to non-linear equations, such as quadratic or exponential equations. Similarly, the assertion that a linear equation has no solutions does not apply universally; many linear equations do, in fact, have solutions. Finally, stating that a linear equation involves variables only doesn't encapsulate the essential quality that defines linear equations, which specifically relates to their graphical representation as straight lines.

5. Which components are included in a box-and-whisker plot?

A. Mean, median, mode, lower and upper extremes.

B. Median, lower extreme, lower quartile, upper quartile, and higher extreme.

C. Lower quartile, upper quartile, range, and all data points.

D. Minimum, lower quartile, median, mode, and maximum.

A box-and-whisker plot, also known as a box plot, is a standardized way of displaying the distribution of data based on a five-number summary. The correct choice includes the key components that define this plot, which are the median, lower extreme, lower quartile, upper quartile, and higher extreme. Specifically, the median divides the dataset into two equal halves, indicating the middle value. The lower and upper quartiles represent the 25th and 75th percentiles, respectively, showing the spread of the middle 50% of the data. The lower extreme is the minimum value, while the higher extreme is the maximum value in the dataset. Collectively, these components give a clear visual representation of the data's distribution, including its central tendency and variability. The other choices mention components that do not accurately represent a box-and-whisker plot. For instance, including the mean is not relevant since a box plot focuses on medians and quartiles. Additionally, the range, while a concept related to spread, is not explicitly represented in the format of a box plot.

6. What is meant by the "limit of reading" on a measuring instrument?

A. The maximum reading possible on the instrument.

B. The smallest unit that can be accurately measured.

C. The total measurement range of the instrument.

D. The difference between maximum and minimum values.

The concept of "limit of reading" on a measuring instrument refers to the smallest unit that can be accurately measured. This is critical in understanding the precision of an instrument, as it determines how finely a measurement can be taken. For example, if a ruler has a limit of reading of 1 millimeter, it means that any measurement taken will be rounded to the nearest millimeter, and smaller increments (like half or quarter millimeters) cannot be reliably read from that instrument. The accuracy and reliability of the measurements are directly affected by this limit, making it essential for anyone using measuring instruments to be aware of this parameter. It defines the instrument's capacity for precision, which plays a vital role in various applications, from engineering and science to everyday tasks like cooking or crafting. Understanding this limit allows users to determine how precise their measurements need to be based on the task at hand.

7. What does a radial survey involve?

A. Measuring distances only

B. Calculating areas

C. Measuring angles and sides from a central point

D. Drawing straight lines between points

A radial survey involves measuring angles and sides from a central point to gather information about the surrounding area. This method allows surveyors to obtain precise measurements of distances and angles, facilitating the determination of points relative to a central reference. In a radial survey, the central point serves as the origin from which survey measurements radiate outward. By measuring angles relative to this point, the surveyor can ensure accurate positioning of multiple points surrounding the center. This technique is particularly useful in land surveying and mapping, where establishing a clear geometrical relationship between different locations is essential. The incorrect options do not align fully with the fundamental approach of a radial survey. For example, measuring distances only ignores the essential angular measurements that provide the necessary context and accuracy for positional data. Similarly, while calculating areas could relate to survey work, it is not the primary function of a radial survey, which focuses more on establishing direct relationships between points. Lastly, drawing straight lines between points is a component of visualizing the data collected rather than a defining aspect of conducting a radial survey.

8. What is the value of the expression $9^2 - 3^2$?

A. 72

B. 36

C. 54

D. 81

To find the value of the expression $9^2 - 3^2$, you can apply the concept of the difference of squares, which states that $a^2 - b^2 = (a - b)(a + b)$. Here, $a = 9$ and $b = 3$. First, calculate both squares: - $9^2 = 81$ - $3^2 = 9$ Now, substitute these values into the expression: $$9^2 - 3^2 = 81 - 9$$ Perform the subtraction: $$81 - 9 = 72$$ Thus, the overall value of the expression is 72. The answer is obtained by correctly applying the properties of squares and executing basic arithmetic operations.

9. What defines a parallelogram?

A. All sides are equal

B. Opposite sides are parallel and equal in length

C. All angles are 90 degrees

D. It has exactly two pairs of equal sides

A parallelogram is defined by the property that its opposite sides are parallel and equal in length. This geometric figure is characterized not just by the equal length of its sides, but also by having pairs of sides that run parallel to each other. This fundamental property ensures that opposite angles are also equal, and the sum of adjacent angles equals 180 degrees. While it is true that a rectangle and a square, which are types of parallelograms, have right angles and equal sides respectively, not all parallelograms meet those criteria. Therefore, defining a parallelogram only by equal angles or equal sides doesn't encompass the full range of parallelograms, which can include figures with varying angles and side lengths, as long as the opposite sides remain parallel and equal. These properties make option B the most accurate representation of what defines a parallelogram. Other statements describe specific types of quadrilaterals but do not capture the essence of a parallelogram as a broader category.

10. What does the equation y = ax represent?

A. Linear growth

B. Quadratic growth

C. Exponential growth

D. Cubic growth

The equation $y = ax$ represents a linear relationship between the variables y and x. In this equation, a is a constant that determines the slope of the line. For every unit increase in x, y increases by a constant amount a. This means that the relationship is characterized by a straight line when graphed on a coordinate plane, indicating linear growth. This is fundamentally different from other types of growth. Quadratic growth, for instance, is represented by equations in the form of $y = ax^2$, where the increase in y accelerates as x increases. Exponential growth involves equations like $y = a \cdot b^x$ where the rate of growth itself becomes increasingly faster and is not linear. Cubic growth is represented by $y = ax^3$, resulting in a different curvature. Understanding these distinctions helps clarify that $y = ax$ signifies a consistent, proportional change and can be readily identified as linear growth.