

# **Math II**

## **Student/Parent Guide**

**Math II is the second math course in a sequence of courses designed to provide students with a rigorous program of study. The course includes topics from Geometry, Algebra II, and Statistics. This guide contains excerpts from the Georgia Department of Education's material for Math II. If you have any questions about your child's progress, please contact his/her teacher.**

## How does Math II Look in Your Child's Classroom?

- **Students will be doing more than arithmetic:**  
Students will be seeing that math is much more than arithmetic (knowing the facts and number operations): it involves estimation, algebra, geometry, probability, statistics, and more.
- **Students will be striving to achieve high goals:**  
Students will be achieving high standards of understanding, complexity, and accuracy set for them by their parents, teachers, schools, and the state of Georgia.
- **Students will be actively involved in the study of mathematics:** Students will be doing tasks that involve investigations. They will be talking and writing explanations for their thinking.
- **Students will be working with one another:**  
Students will be collaborating to make discoveries, draw conclusions, and discuss math.
- **Students will be evaluated in a variety of ways:**  
Teachers will use many different ways to determine if children know and understand math concepts. Some of these will include writing samples, projects, or written tests. Not all evaluation will be the same for every classroom or every child.
- **Students will be using calculators to solve problems:** They will be using calculators not as crutches but as tools to solve more complex problems with bigger numbers than they could do otherwise.

## Helping Your Child Achieve in Math II

- **Positive attitudes about math will reinforce encouragement.** Your feeling will have an impact on how your children think about math and themselves as mathematicians. Positive attitudes about math are important in encouraging your child to think mathematically.
- **The unit outline will help your child preview upcoming material.** Even if all of the material is new to you, discuss with your child what they will be learning and tell them that you are looking forward to learning with them. The vocabulary is from the Georgia Teacher Text for Math II.
- **The terminology will help familiarize your child with the language of mathematics.** These words can be thought of as a spelling list for the students, where knowing the definition is important.
- **The sample test items are a great review and help alleviate test anxiety.** These test items are from the test bulletin for the Georgia End of Course Test (EOCT) in Math II. Before the end of unit assessment, make sure that your child has worked through the practice assessments and encourage him/her to ask the teacher questions about any problems that seem difficult or confusing.

# Unit 1 Outline

- I. Students will represent and operate with complex numbers.
  - A. Square Roots of Negative Numbers
  - B. Real and Imaginary Number Form
  - C. Operations
  
- II. Students will analyze quadratic functions in the forms  $f(x) = ax^2 + bx + c$  (general form) and  $f(x) = a(x - h)^2 + k$  (vertex form).
  - A. Conversion between Forms
  - B. Transformation of  $f(x) = x^2$
  - C. Domain
  - D. Range
  - E. Vertex
  - F. Axis of Symmetry
  - G. Zeros
  - H. Extrema
  - I. Intervals of Increase/Decrease
  - J. Rates of Change
  - H. Arithmetic Sequences and Quadratics
  
- III. Students will solve quadratic equations and inequalities in one variable.
  - A. Solutions to Equations/Inequalities
    - 1. Graphical
    - 2. Factorization
    - 3. Square Roots
    - 4. Quadratic Formulas
  
  - B. Description/Meanings of Solutions

## Vocabulary List

Horizontal shift: A rigid transformation of a graph in a horizontal direction, either left or right.

Complete factorization over the integers: Writing a polynomial as a product of polynomials so that none of the factors is the number 1, there is at most one factor of degree zero, each polynomial factor has degree less than or equal to the degree of the product polynomial, each polynomial factor has all integer coefficients, and none of the factor polynomial can be written as such a product.

Vertex form of a quadratic function: A formula for a quadratic equation of the form

$f(x) = a(x - h)^2 + k$ , where  $a$  is a nonzero constant and the vertex of the graph is the point  $(h, k)$ .

Discriminant of a quadratic equation: The discriminant of a quadratic equation of the form  $ax^2 + bx + c = 0$ ,  $a \neq 0$ , is the number  $b^2 - 4ac$ .

## Unit 1 Sample Items

1.

The quadratic function  $f(x)$  has these characteristics:

- The vertex is located at  $(8, -2)$ .
- The range is  $-2 \leq f(x) < \infty$ .

Which function could be  $f(x)$ ?

A.  $f(x) = \frac{1}{2}x^2 - 8x + 30$

B.  $f(x) = \frac{1}{2}x^2 - 8x + 31$

C.  $f(x) = -\frac{1}{2}x^2 + 8x - 34$

D.  $f(x) = -\frac{1}{2}x^2 - 2x + 6$

[Key: A]

2

The vertex of the quadratic function  $g(x)$  is located at  $(4, 2)$ . An  $x$ -intercept of  $g(x)$  is located at  $(5, 0)$ . What is the  $y$ -intercept of  $g(x)$ ?

- A.  $(0, -30)$
- B.  $(0, -14)$
- C.  $(0, -4)$
- D.  $(0, 3)$

[Key: A]

3

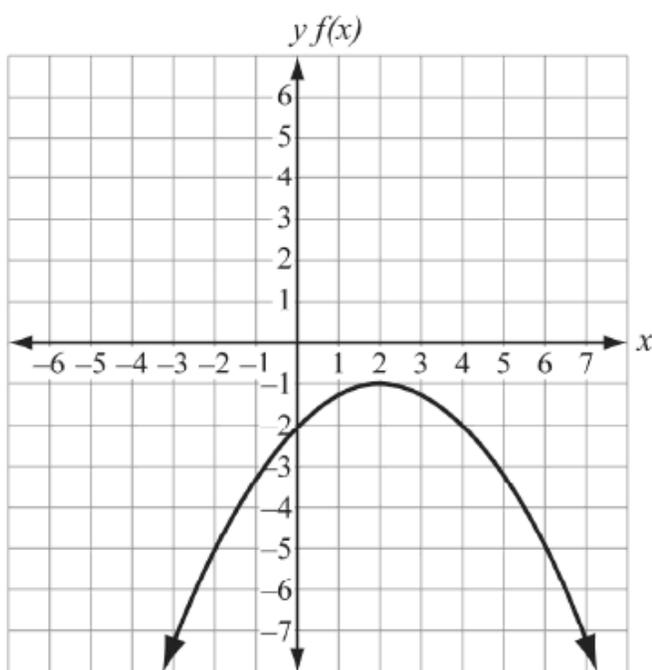
What are the solutions to the equation  $289 = \left(\frac{1}{3}x - 8\right)^2$ ?

- A.  $x = -27$  only
- B.  $x = 75$  only
- C.  $x = -27$  and  $x = 75$
- D.  $x = -75$  and  $x = 75$

[Key: C]

4

Use this graph of the function  $g(x)$  to answer the question.



Which statement about the real solutions of  $g(x)$  is true?

- A.  $g(x)$  has no real solutions.
- B.  $g(x)$  has exactly one real solution.
- C.  $g(x)$  has two real solutions that are rational.
- D.  $g(x)$  has two real solutions that are irrational.

[Key: A]

5

Which expression represents the sum of the first  $n$  multiples of 8?

- A.  $8n$
- B.  $8n^2$
- C.  $4n^2 + 4n$
- D.  $8n^2 + 8n$

[Key: C]

6

Alex started a business making bracelets. She sold 30 bracelets the first month. Her goal is to sell 6 more bracelets each month than she sold the previous month.

If Alex meets her goal, what is the total number of bracelets she will sell in the first 12 months?

- A. 378
- B. 426
- C. 498
- D. 756

[Key: D]

## Unit 2 Outline

- I. Students will identify and use special right triangles.
  - A. 30 – 60 - 90 degree triangles
  - B. 45 – 45 – 90 degree triangles
  
- II. Students will define and apply sine, cosine, and tangent ratios to right triangles.
  - A. Similar Triangles
  - B. Complementary Angles
  - C. Application Problems

## Vocabulary List

**Opposite side:** In a right triangle, the side of the triangle opposite the vertex of an acute angle is called the opposite side relative to that acute angle.

**Adjacent side:** In a right triangle, for each acute angle in the interior of the triangle, one ray forming the acute angle contains one of the legs of the triangle and the other ray contains the hypotenuse. This leg on one ray forming the angle is called the adjacent side of the acute angle.

For any acute angle in a right triangle, we denote the measure of the angle by  $\theta$  and define three numbers related to  $\theta$  as follows:

$$\text{sine of } \theta = \sin \theta = \frac{\text{length of opposite side}}{\text{length of hypotenuse}}$$

$$\text{cosine of } \theta = \cos \theta = \frac{\text{length of adjacent side}}{\text{length of hypotenuse}}$$

$$\text{tangent of } \theta = \tan \theta = \frac{\text{length of opposite side}}{\text{length of adjacent side}}$$

## Unit 2 Sample Items

- 1) The length of one diagonal of a rhombus is 12 cm. The measure of the angle opposite that diagonal is  $60^\circ$ .

What is the perimeter of the rhombus?

- A. 24 cm
- B. 48 cm
- C.  $12\sqrt{3}$  cm
- D.  $24\sqrt{3}$  cm

[Key: B]

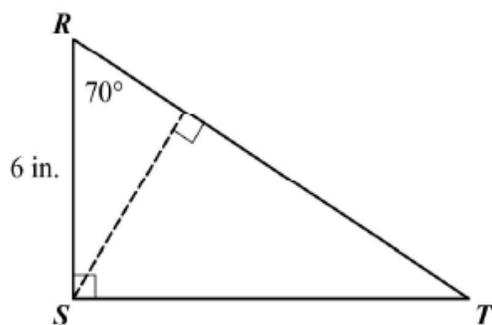
- 2) Angle  $J$  and angle  $K$  are complementary angles in a right triangle. The value of  $\tan J$  is  $\frac{15}{8}$ .

What is the value of  $\sin J$ ?

- A.  $\frac{8}{17}$
- B.  $\frac{8}{15}$
- C.  $\frac{15}{17}$
- D.  $\frac{17}{15}$

[Key: C]

3) Triangle  $RST$  is a right triangle with right angle  $S$ , as shown.



What is the area of triangle  $RST$ ?

- A. 6.15 sq. in.
- B. 6.54 sq. in.
- C. 46.47 sq. in.
- D. 49.45 sq. in.

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[Key: D]

## Unit 3 Outline

I. Students will understand the properties of circles.

A. Triangle Similarity

1. Chords
2. Tangents
3. Secants

B. Angles

1. Central
2. Inscribed
3. Related

C. Problem Solving

1. Arcs
2. Sectors

D. Measurements

1. Geometric Properties
2. Algebraic Properties

II. Students will find and compare the measures of spheres.

A. Surface Areas

B. Volumes

## Vocabulary List

An **arc** is a connected section of the circumference of a circle. An arc has a linear measurement, which is the portion of the circumference, and an arc has a degree measurement, which is a portion of the 360 degree circle.

If a circle is divided into two unequal arcs, the shorter arc is called the **minor arc** and the longer arc is called the **major arc**.

If a circle is divided into two equal arcs, each arc is called a **semicircle**.

A **secant line** is a line that intersects a circle at two points on the circle.

A **tangent line** is a line that intersects the circle at exactly one point.

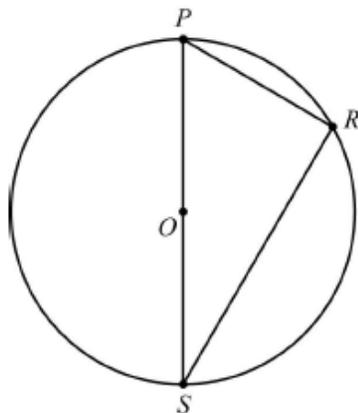
A **central angle** of a circle is an angle whose vertex is the center of the circle.

An **inscribed angle** is an angle in a circle, whose vertex is on the circle and whose sides contain chords of the circle.

A **sector** of a circle is a region in the interior of the circle bounded by two radii and an arc of the circle.

## Unit 3 Sample Items

- 1) In circle  $O$ ,  $\overline{PS}$  is a diameter. The measure of  $\widehat{PR}$  is  $72^\circ$ .



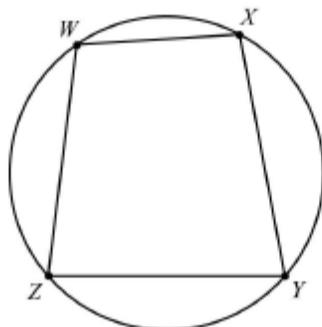
not drawn to scale

What is the measure of  $\angle SPR$ ?

- A.  $36^\circ$
- B.  $54^\circ$
- C.  $72^\circ$
- D.  $108^\circ$

[Key: B]

2) Quadrilateral  $WXYZ$  is inscribed in this circle.

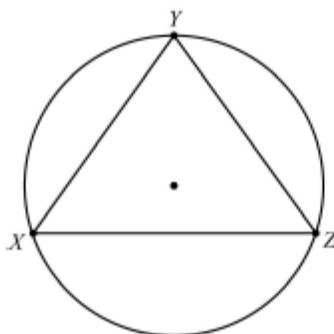


Which statement must be true?

- A.  $\angle W$  and  $\angle Y$  are complementary.
- B.  $\angle W$  and  $\angle Y$  are supplementary.
- C.  $\angle Z$  and  $\angle Y$  are complementary.
- D.  $\angle Z$  and  $\angle Y$  are supplementary.

[Key: B]

3) Isosceles triangle  $XYZ$  is inscribed in this circle.



- $\overline{XY} \cong \overline{ZY}$
- $m\widehat{YZ} = 108^\circ$

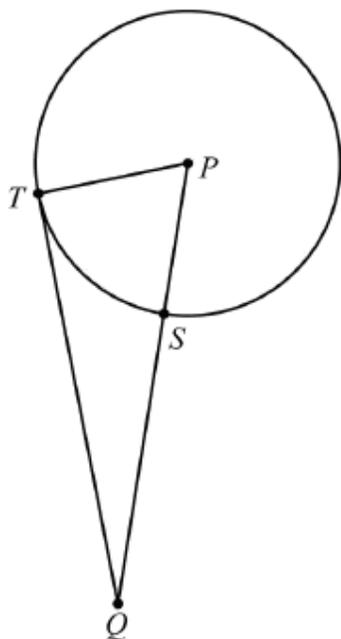
What is the measure of  $\angle XYZ$  ?

- A.  $48^\circ$
- B.  $54^\circ$
- C.  $72^\circ$
- D.  $108^\circ$

[Key: C]

4

In this diagram, segment  $\overline{QT}$  is tangent to circle  $P$  at point  $T$ .



The measure of minor arc  $\widehat{ST}$  is  $70^\circ$ . What is  $m\angle TQP$ ?

- A.  $20^\circ$
- B.  $25^\circ$
- C.  $35^\circ$
- D.  $40^\circ$

[Key: A]

5.

A map company makes a globe in the shape of a sphere. The company plans to make a new model globe with a diameter that is 20% larger than the diameter of the original model.

By what percent will the surface area of the new model globe increase compared to the surface area of the original model?

- A. 4%
- B. 20%
- C. 40%
- D. 44%

[Key: D]

6.

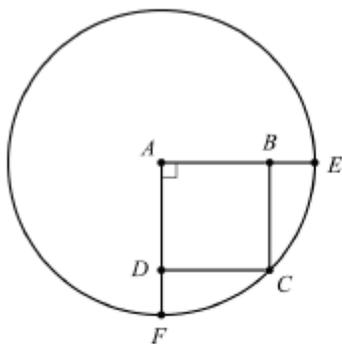
A sphere has a volume of  $39\pi$  cubic centimeters. What is the surface area of the sphere?

- A.  $3.0\pi$  sq. cm.
- B.  $9.5\pi$  sq. cm.
- C.  $38.0\pi$  sq. cm.
- D.  $81.5\pi$  sq. cm.

[Key: C]

7.

Quadrilateral  $ABCD$  is a square in circle  $A$ .



If  $\overline{AE} = 3$  cm, what is the length of  $\overline{DF}$ ?

- A.  $\sqrt{2}$
- B.  $3\sqrt{2} - 3$
- C.  $\frac{3\sqrt{2}}{2}$
- D.  $\frac{3\sqrt{2} - 3}{2}$

[Key: D]

8.

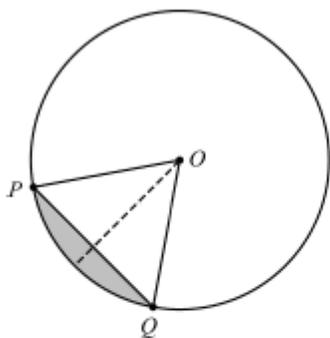
A circular pizza with a diameter of 15 inches is cut into 8 equal slices. What is the area of one slice?

- A. 5.9 sq. in.
- B. 22.1 sq in.
- C. 88.4 sq. in.
- D. 120 sq. in.

[Key: B]

9.

In this diagram, triangle  $OPQ$  is equilateral, with vertex  $O$  at the center of a circle and vertices  $P$  and  $Q$  on the circle.



The radius of circle  $O$  is 12 cm. What is the area, in square units, of the shaded region?

- A.  $24\pi - 18$
- B.  $24\pi - 36\sqrt{3}$
- C.  $48\pi - 18$
- D.  $48\pi - 36\sqrt{3}$

[Key: B]

## Unit 4 Outline

Using sample data, students will make informal inferences about population means and standard deviations.

- I. Sample Data
  - A. Means
  - B. Standard Deviations
  - C. Comparisons
  
- II. Normal Distributions
  - A. Population Parameters
  - B. Sample Means
  - C. Variability

## Vocabulary List

- **Census:** A census occurs when everyone in the population is contacted.
- **Empirical Rule** is as follows:

If a distribution is normal, then approximately

68% of the data will be located within one standard deviation symmetric to the mean

95% of the data will be located within two standard deviations symmetric to the mean

99.7% of the data will be located within three standard deviations symmetric to the mean

- **Frequency Distribution:** Instead of listing every data point, a frequency distribution will list the value with its associated frequency (number of times it is listed). For example, if the data are 2,2,2,2,2,3,3,3,3,3,5,6,6,6 a frequency distribution for the data would be

x	2	3	4	5	6
frequency	5	6	0	1	3

The mean of a frequency distribution,  $\mu_x$ , can be found by calculating  $\frac{\sum_{i=1}^n (X_i F_i)}{n}$  where  $F_i$  is the frequency of the value  $X_i$  and “n” is the sample size. Note: The sample size “n” is the sum of the frequency column.

The standard deviation of a frequency distribution can be found by calculating

$$\sigma_x = \sqrt{\frac{\sum_{i=1}^n (F_i (X_i - \bar{X})^2)}{n}}$$

- **Golden Ratio:**  $\phi = \frac{1 + \sqrt{5}}{2}$  which is approximately = 1.6180339887.

- **Measures of Center**

➤ **Mean:** The average =  $\frac{\sum_{i=1}^n X_i}{N}$ . The symbol for the sample mean is  $\bar{X}$ . The symbol for the population mean is  $\mu_x$ .

➤ **Median:** When the data points are organized from least to greatest, the median is the middle number. If there is an even number of data points, the median is the average of the two middle numbers.

➤ **Mode:** The most frequent value in the data set.

- **Measures of Spread (or variability)**

➤ **Interquartile Range:**  $Q_3 - Q_1$  where  $Q_3$  is the 75<sup>th</sup> percentile (or the median of the second half of the data set) and  $Q_1$  is the 25<sup>th</sup> percentile (or the median of the first half of the data set).

➤ **Mean Deviation:**  $\frac{\sum |X_i - \bar{X}|}{N}$  where  $X_i$  is each individual data point,  $\bar{X}$  is the sample mean, and  $N$  is the sample size.

➤ **Variance:** In this unit, I decided to use the population variance throughout. The students have an intuitive understanding of the population variance as opposed to the sample variance. The

sample variance should be explored in the future. The formula for the population variance is as follows:

$$\text{variance : } \frac{\sum_{i=1}^n (X_i - \bar{X})^2}{n}$$

- **Standard Deviation:** The standard deviation is the square root of the variance. The formula for the population standard deviation is as follows:

$$\text{standard deviation : } \sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{n}}$$

- **Normal Distribution:** The standard deviation is a good measure of spread when describing a normal distribution. Many things in life vary normally. Many measurements vary normally such as heights of men. Most men are around the average height, but some are shorter and some are taller. The shape of the distribution of men's heights will be a bell shape curve. All normal distributions are bell shaped; however, all bell shaped curves are not normal. If a distribution is a normal distribution, then the Empirical Rule should apply (see Empirical Rule above).
- **Parameters:** These are numerical values that describe the population. The population mean is symbolically represented by the parameter  $\mu_x$ . The population standard deviation is symbolically represented by the parameter  $\sigma_x$ .
- **Random:** Events are random when individual outcomes are uncertain. However, there is a regular distribution of outcomes in a large number of repetitions.
- **Sample:** A subset, or portion, of the population.
- **Sampling Distribution of a Sample Mean:** The sampling distribution of a sample mean refers to the distribution of the mean of random samples of a given size drawn from the population. For example, if the sample size is 5, then the averages of 5 randomly selected values (per sample) from the population are recorded. This process is repeated enough times to see the shape of the sampling distribution emerge. If the sample size is small, the shape of the sampling distribution of the sample mean will be similar to that of the population. If the sample size is large, the shape of the sampling distribution will become more normal-like. The mean of the sampling distribution (the mean of the averages) will theoretically be the same as the mean of the population regardless of sample size. The standard deviation of the averages will be smaller than the population standard deviation.
- **Statistics:** These are numerical values that describe the sample. The sample mean is symbolically represented by the statistic  $\bar{X}$ . The sample standard deviation is symbolically represented by the statistic  $s_x$ .

## Unit 4 Sample Items

- 1) This table shows the scores of the first six games played in a professional basketball league.

<b>Winning Score</b>	110	98	91	108	109	116
<b>Losing Score</b>	101	88	84	96	77	114

The winning margin for each game is the difference between the winning score and the losing score. What is the standard deviation of the winning margins for these data?

- A. 3.8 points
  - B. 8.3 points
  - C. 9.5 points
  - D. 12.0 points
- 2) This frequency table shows the heights for Mrs. Quinn's students.

<b>Height (in inches)</b>	<b>Frequency</b>
42	1
43	2
44	4
45	5
46	4
47	2
48	1

What is the approximate standard deviation of these data?

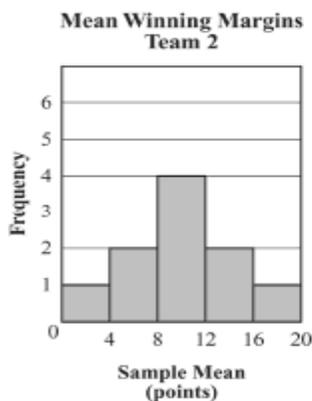
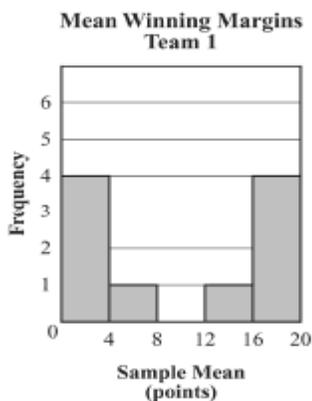
- A. 1.0 inches
- B. 1.5 inches
- C. 2.5 inches
- D. 3.5 inches

[Key: C]

[Key: B]

3.

- ) Kara took 10 random samples of the winning margins for each of two professional basketball teams. The sample size was 4. The distributions of the sample means are shown in these histograms.



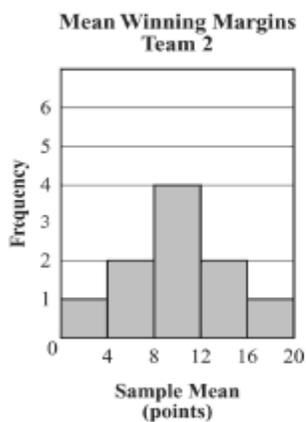
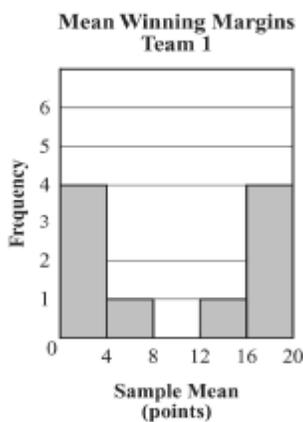
Which is the best estimate of the standard deviation for both samples?

- A. Team 1: 3.75 points; Team 2: 2.2 points
- B. Team 1: 7.4 points; Team 2: 4.4 points
- C. Team 1: 15 points; Team 2: 8.8 points
- D. Team 1: 10 points; Team 2: 10 points

[Key: B]

4.

John took 10 random samples of the winning margins for each of two professional basketball teams. The distributions of the sample means are shown in these histograms.



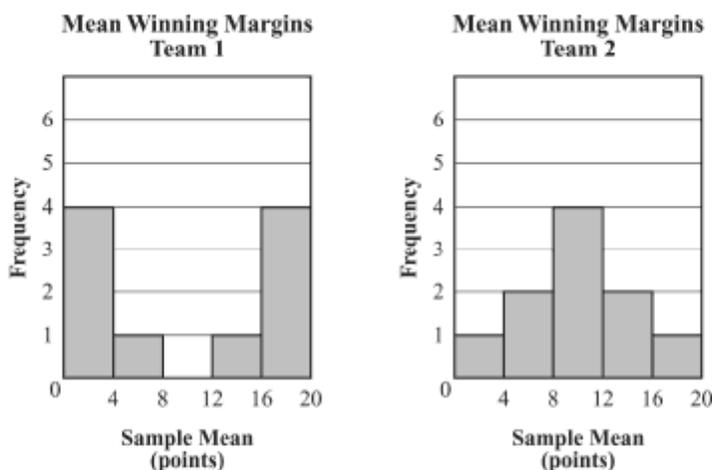
Based on John's data, which statement is MOST likely true?

- A. Both the sample mean and the sample standard deviation are greater for Team 1 than for Team 2.
- B. The sample means for both teams are equal, but the sample standard deviation for Team 1 is greater.
- C. The sample means for both teams are equal, but the sample standard deviation for Team 2 is greater.
- D. Both the sample mean and the sample standard deviation are greater for Team 2 than for Team 1.

[Key: B]

5.

Mary took 10 random samples of the winning margins for each of two professional basketball teams. The samples were taken from all 82 games in one season. The distributions of the sample means are shown in these histograms.



Which question can be answered based on Mary's data?

- A. Which team had the greater number of all-star players?
- B. Which team won more games?
- C. Which team won by a more consistent margin?
- D. Which team lost more games by a narrow margin?

[Key: C]

6.

In a set of 10 random samples of winning scores for games played in a professional basketball league, the sample size is 6, the sample mean is 97.5 points, and the sample standard deviation is 5.2 points. Which expression represents the estimated standard deviation of all the winning scores?

- A.  $\frac{5.2}{\sqrt{10}}$
- B.  $5.2\sqrt{10}$
- C.  $\frac{5.2}{\sqrt{6}}$
- D.  $5.2\sqrt{6}$

[Key: D]

## Unit 5 Outline

- I. Students will investigate step and piecewise functions, including greatest integer and absolute value functions.
  - A. Domain
  - B. Range
  - C. Vertex
  - D. Axis of Symmetry
  - E. Zeros
  - F. Intercepts
  - G. Extrema
  - H. Points of Discontinuity
  - I. Constant/Decreasing/Increasing Intervals
  - J. Rates of Change
- II. Students will explore exponential functions.
  - A. Properties of exponents
  - B. Characteristics
    - 1. Domain
    - 2. Range
    - 3. Asymptotes
    - 4. Zeros
    - 5. Intercepts
    - 6. Increasing/Decreasing Intervals
    - 7. Rates of Change
    - 8. End Behavior
  - C. Transformations of  $f(x) = a^x$
  - D. Simple Equations
  - E. Real Phenomena Models
- III. Students will explore inverses of functions.
  - A. Characteristics
    - 1. One-to-oneness
    - 2. Domain
    - 3. Range
  - B. Types
    - 1. Linear
    - 2. Quadratic
    - 3. Power Functions
    - 4.  $f(x) = a/x$
  - C. Graphs
  - D. Compositions

## Vocabulary List

Greatest integer function (floor function) – The greatest integer function is determined by locating the *greatest integer less than or equal to* the x-value in question. Common notations:  $f(x) = \lfloor x \rfloor$ ,  $f(x) = [x]$ , or  $f(x) = \square x \square$ .

Least integer function (ceiling function) – The least integer function is determined by locating the *least integer greater than or equal to* the x-value in question. Notation:  $f(x) = \lceil x \rceil$ .

Piecewise function – a function formed by taking the union of two or more functions with restricted domains where the separate functions have the same output at each value that belongs to more than one domain.

Step function – a piecewise function whose graph consists of horizontal line segments that form steps.

# Unit 5 Sample Items

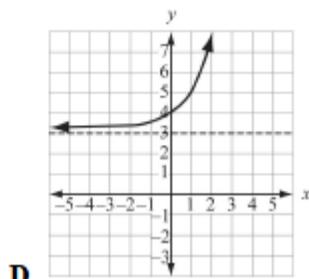
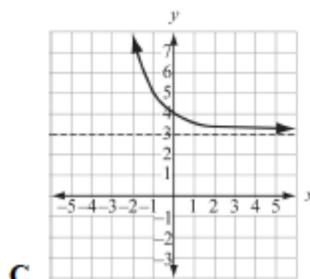
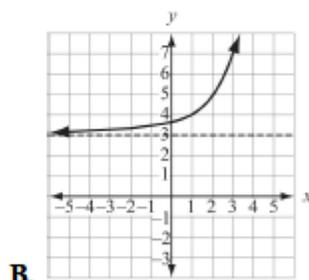
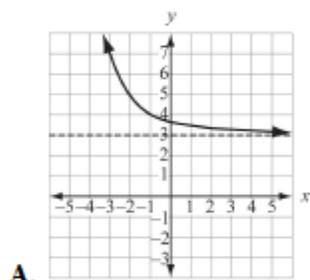
- 1) The function  $f(x)$  has these properties.
- As  $x$  increases,  $f(x)$  approaches 3.
  - As  $x$  decreases,  $f(x)$  increases.
  - The domain of  $f(x)$  is all real numbers.

Which of the following could be the function?

- A.  $f(x) = -2^{x-3}$
- B.  $f(x) = \left(\frac{1}{2}\right)^{x-3}$
- C.  $f(x) = -2^x + 3$
- D.  $f(x) = \left(\frac{1}{2}\right)^x + 3$

[Key: D]

- 2) Which graph represents  $f(x) = \left(\frac{1}{2}\right)^{x+1} + 3$ ?



[Key: A]

3.

Use this function to answer the question.

$$f(x) = \frac{2}{x} + 3$$

What value is NOT included in the domain of the inverse of this function?

- A. 0
- B. 1
- C. 2
- D. 3

[Key: D]

4.

Use these functions to answer the question.

$$f(x) = 4x - 2$$

$$g(x) = \frac{x+2}{4}$$

$$f(g(x)) = x$$

Which statement about the functions  $f(x)$  and  $g(x)$  is true?

- A. They are inverse functions because  $f(g(x))$  is not equal to 0.
- B. They are inverse functions because  $f(g(x))$  is equal to  $x$ .
- C. They are not inverse functions because  $f(g(x))$  is not equal to 0.
- D. They are not inverse functions because  $f(g(x))$  is equal to  $x$ .

[Key: B]

## Unit 6 Outline

- I. Students will investigate step and piecewise functions, including greatest integer and absolute value functions.
  - A. Absolute Values as Piecewise Functions
  - B. Solving Using Algebra and Graphs
  
- II. Students will determine an algebraic model to quantify the association between two quantitative variables.
  - A. Linear/Quadratic Models
  - B. Curve Fitting
  - C. Linear/Quadratic Regression
  - D. Correlation versus Causation

## Vocabulary List

Correlation coefficient – The correlation coefficient,  $r$ , measures the direction and strength of a *linear*

relationship between two variables. Formula:  $r = \frac{1}{n-1} \sum \left( \frac{x_i - \bar{x}}{s_x} \right) \left( \frac{y_i - \bar{y}}{s_y} \right)$ .

Extrapolation – the use of a regression curve to make predictions for a value of the independent variable less than the smallest, or greater than the largest, value of the independent variable occurring with the data set that the regression curve models.

Interpolation – the use of a regression curve to make predictions for a value of the independent variable that is between two values of the independent variable occurring with the data set that the regression curve models.

Linear regression line – A straight line that approximates the relationship between two variables represented by a set of data points.

Least squares regression line (LSRL) – the line that minimizes the sum of the squares of the vertical distances between the data points and any possible regression line.

Median-median line – a linear regression line found by a method based on the calculation of medians. This method of linear regression requires that the data points are ordered from smallest to largest first coordinate and then separates the data into three equal, or nearly equal, groups with at least 1/3 of the data points in each of the first and last groups. The median  $x$ -values and  $y$ -values of each group are calculated. These medians, from smallest  $x$ -values to largest, are named  $(x_1, y_1), (x_2, y_2), (x_3, y_3)$ . Then a line through the first and third medians is found. Finally, a line parallel to this line, 1/3 of the distance between the line and the remaining median is formed. The resulting line is of the following form  $y = ax + b, a = \frac{y_3 - y_1}{x_3 - x_1}, b = \frac{y_1 + y_2 + y_3 - a(x_1 + x_2 + x_3)}{3}$ .

This method of regression is more resistant to outliers than the least squares regression line.

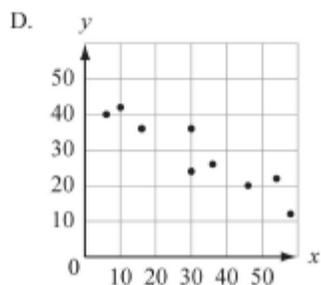
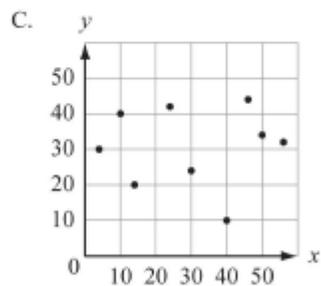
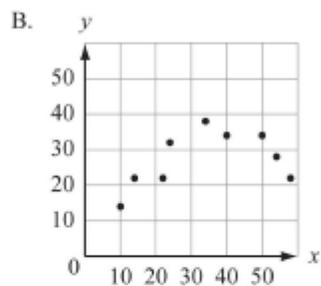
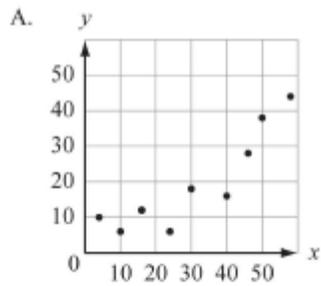
Method of finite differences – a method for determining if data points with equally spaced  $x$ -values exactly fit a linear, quadratic, or higher degree polynomial model.

Quadratic Regression – a quadratic function that minimizes the sum of the squares of the vertical distances between the data points and any possible quadratic function to approximate the data.

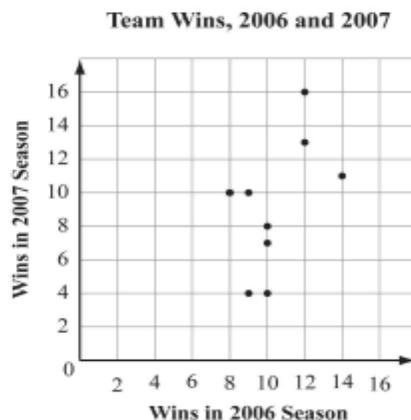
Regression curve – the graph of a function, including possibly a linear function, that approximates the relationship between two variables represented by a set of data points. (Linear and quadratic regression are explored in this unit.)

# Unit 6 Sample Items

1) For which graph of a set of data is a linear function the best model?



- 2) This graph plots the number of wins in the 2006 and 2007 seasons for a sample of professional football teams.



What is the equation of the median-median line for these data?

- A.  $y = 2x - 8$   
 B.  $y = 2x - 9.67$   
 C.  $y = \frac{8}{3}x - 19$   
 D.  $y = \frac{8}{3}x - 19.2$

[Key: B]

- 3) This graph plots the number of wins in the 2006 and 2007 seasons for a sample of professional football teams.



The linear regression model for these data is  $y = 1.10x - 2.29$ . Based on this model, what is the predicted number of 2007 wins for a team that won 5 games in 2006?

- A. 3.2  
 B. 4.5  
 C. 5.5  
 D. 6.6

[Key: A]

- 4) This graph shows the expected income from sales vs. price per issue for a new magazine.



Which equation models these data?

- A.  $y = -5.1x^2 + 34.4x - 3.0$
- B.  $y = 5.1x^2 - 34.4x + 3.0$
- C.  $y = -34.4x^2 + 5.1x - 3.0$
- D.  $y = 34.4x^2 - 5.1x + 3.0$

[Key: A]

- 5) This graph shows the price of a new audio-visual component over time.

**Price of New Audio-Visual  
Component Over Time**

Year	Median Price (in dollars)
0	500
2	425
4	360
6	280
8	200

Which is the best explanation for why a linear model may not be appropriate for these data?

- A. The median price decreases over time.
- B. The value of the median price cannot be negative.
- C. The value of the median price cannot continue to decrease.
- D. A quadratic model would be a better fit because the rate of decrease is decreasing.

[Key: B]

## Resources

Georgia Department of Education

<https://www.georgiastandards.org/Pages/default.aspx>

U. S. Department of Education

<http://www.ed.gov/parents/academic/help/math/index.html>

For information please contact, [melissa.stewart@hallco.org](mailto:melissa.stewart@hallco.org)