

10th Grade Estimation and Computation

Estimation: The student solves problems (including real-world situations) using estimation by:

[10] E&C-1 (L) Explaining why one strategy is more appropriate than another and determining why the estimation result is greater or less than the exact answer (M3.4.1)

1. Brianna was asked to find the distance traveled by an airplane that was flying with a speed of 89 miles per hour for 2.4 hours. She estimated using the multiplication $90 \times 2 = 180$ miles. Her answer is less than the actual answer because _____.
 - a. she rounded both the speed and time down.
 - b. she rounded both the speed and time up.
 - c. she rounded the speed up a small amount and the time down a large amount.
 - d. she rounded the speed down a small amount and the time up a large amount.

2. Mary and Fred are asked to pack $6,000 \text{ cm}^3$ of salmon in a box. The box measures 7.8 cm by 19.5 cm by 36.5 cm. Mary and Fred each use different methods to estimate the volume of a box.

Mary thinks: 7.8 rounds up to 8 while 19.5 rounds up to 20 and 36.5 rounds up to 37. $8 \times 20 \times 37 = 5,920$. The volume is about $5,920 \text{ cm}^3$.

Fred thinks: 7.8 rounds up to 10 while 19.5 rounds down to 19 and 36.5 rounds up to 40. $10 \times 19 \times 40 = 7,600$. The volume is about $7,600 \text{ cm}^3$.

Explain which estimate is more appropriate for the situation and why. Is the box large enough for the job?

Computation: The student accurately solves problems (including real-world situations) involving:

[10] E&C-2 Applying basic operations with real numbers using powers [and scientific notation L] (M3.4.2 & M3.4.3)

1. Evaluate: $2.58 \times 10^5 + 3.8 \times 10^4$
 - a. 2.96×10^5
 - b. 9.804×10^5
 - c. 6.38×10^9
 - d. 2.580038×10^{13}

[10] E&C-3 Solving problems involving percent increase or decrease (M3.4.5)

2. The population of a particular town increased from 12,800 to 14,200 over a 10-year period. What percent increase does this represent over the old population?
 - a. .109%
 - b. 11%
 - c. 14%
 - d. 140%

3. The cost of 200 gallons of fuel oil is \$425.52. This includes an 8% tax. What is the cost of 1 gallon of oil before the tax is added?
 - a. \$1.96
 - b. \$1.97
 - c. \$2.02
 - d. \$2.12

10th Grade Estimation and Computation Answer Key

Estimation: The student solves problems (including real-world situations) using estimation by:

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 - b. she rounded both the speed and time up.
 - c. *she rounded the speed up a small amount and the time down a large amount.**
 - d. she rounded the speed down a small amount and the time up a large amount.
2. Mary and Fred are asked to pack 6,000 cm³ of salmon in a box. The box measures 7.8 cm by 19.5 cm by 36.5 cm. Mary and Fred each use different methods to estimate the volume of a box.

Mary thinks: 7.8 rounds up to 8 while 19.5 rounds up to 20 and 36.5 rounds up to 37. $8 \times 20 \times 37 = 5,920$. The volume is about 5,920 cm³.

Fred thinks: 7.8 rounds up to 10 while 19.5 rounds down to 19 and 36.5 rounds up to 40. $10 \times 19 \times 40 = 7,600$. The volume is about 7,600 cm³.

Explain which estimate is more appropriate for the situation and why. Is the box large enough for the job?

Mary's estimate is more appropriate because it is more exact by rounding to the nearest whole number, while Fred rounds some up to the next ten and others down to the nearest whole number. The box is not big enough, because Mary rounds all the dimensions up and still can't fit 6,000 cubic inches of salmon in the box.

Computation: The student accurately solves problems (including real-world situations) involving:

[10] E&C-2 Applying basic operations with real numbers using powers [and scientific notation L] (M3.4.2 & M3.4.3)

1. Evaluate: $2.58 \times 10^5 + 3.8 \times 10^4$
- a. **2.96×10^5 ***
 - b. 9.804×10^5
 - c. 6.38×10^9
 - d. 2.580038×10^{13}

[10] E&C-3 Solving problems involving percent increase or decrease (M3.4.5)

1. The population of a particular town increased from 12,800 to 14,200 over a 10-year period. What percent increase does this represent over the old population?
- a. .109%
 - b. **11%***
 - c. 14%
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- a. \$1.96
 - b. **\$1.97***
 - c. \$2.02
 - d. \$2.12

10th Grade Functions and Relationships

Describing Patterns and Functions: The student demonstrates conceptual understanding of functions, patterns, or sequences including those represented in real-world situations by:

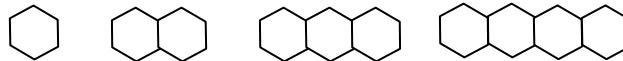
[10] F&R-1 Describing or extending patterns (families of functions: linear, quadratic, absolute value), up to the n th term, represented in tables, sequences, graphs, or in problem situations (M4.4.1)

- Which is the next term in the pattern: 5.5, 9, 12.5, 16, ... ?
 - 17.5
 - 19.5
 - 28.5
 - None of the above

- Complete the table.

1	2	3	4	5		10	n
-4	-3	0	5	12	32		

- Dan is using hexagonal tiles as a border around his kitchen floor. The table below shows the relationship between the number of tiles and the perimeter of the figure.



Tiles	1	2	3	4	5
Perimeter	6	10	14	18	22

Write a sentence that gives the perimeter if there are n tiles.

[10] F&R-2 Generalizing equations and inequalities (linear, quadratic, absolute value) using a table of ordered pairs or a graph (M4.4.4)

1. Torvald uses an equation to produce the following table of ordered pairs:

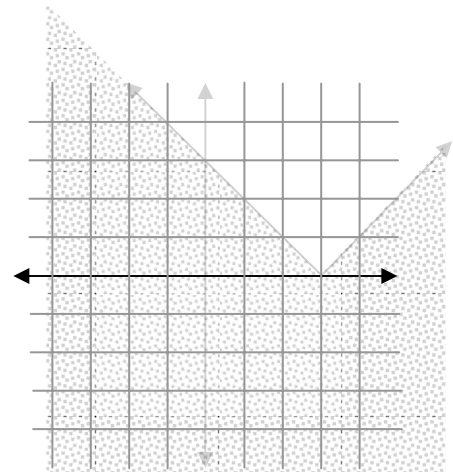
x	y
-2	-7
0	-3
2	1
4	5

Which equation describes this list?

- a. $y = -3x$
- b. $y = x + 4$
- c. $y = 2x - 3$
- d. $y = 2x^2$

2. Which equation gives the graph at the right?

- a. $y \leq |x - 3|$
- b. $y > |x + 3|$
- c. $y < |x - 3|$
- d. $y \geq |x - 3|$



[10] F&R-3 Describing in words how a change in one variable or constant in an equation affects the outcome of the equation (M4.3.2)

1. The equation $A = \frac{1}{2}h(b_1 + b_2)$ is used to find the area of a trapezoid. If all the other dimensions are held constant and b_2 decreases, the area of the trapezoid _____.
- a. increases
 - b. decreases
 - c. remains the same

2. Charmain tests two spring scales and finds that as more mass is added to the scales they stretch longer. But the scales are not the same; Scale A stretches according to the equation $l = 2.5m$, while Scale B follows the equation $l = 6m$. (l is the length of the spring, m is the mass of the object hung on the spring.)

When a mass of 3 kilograms is hung from the two scales, which one stretches farther?

- a. Scale A
- b. Scale B

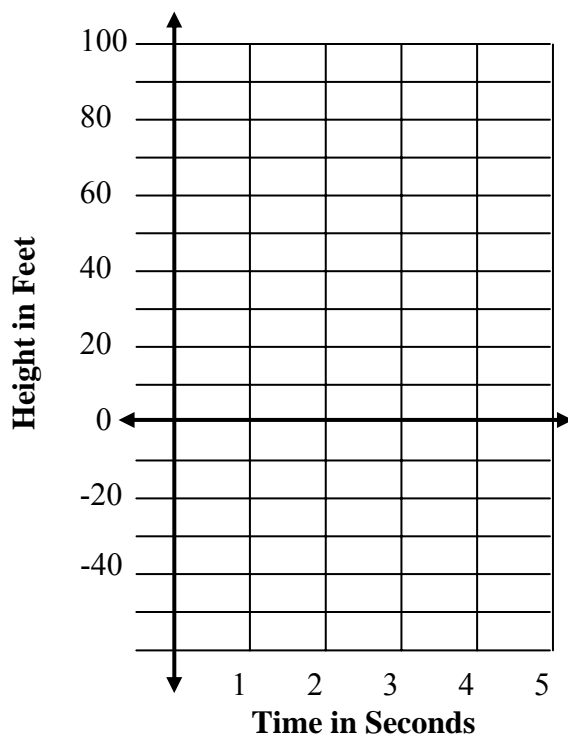
[10] F&R-4 (L) Using a calculator as a tool when describing, extending, representing, or graphing patterns, linear or quadratic equations (M4.4.2)

1. The height of a ball thrown into the air follows the curve described by the equation:

$$h = -16t^2 + 65t + 20.$$

Use a calculator to complete the table. Graph the coordinates on the graph at the below.

Time (t)	0	1	2	3		5
Height (h)	20	69			24	



Modeling and Solving Equations and Inequalities: The student demonstrates algebraic thinking by:

[10] F&R-5 Modeling (graphically or algebraically) or solving situations using systems of linear equations or inequalities (including real-world applications) (M4.4.3)

1. Dylan gets his pictures developed at Photo-Phast. Photo-Phast uses the equation $C = \$0.15 \cdot p$ to calculate the cost, C , of p photographs. Anne gets her pictures developed at Quick-Pix. Quick-Pix uses the equation $C = \$0.10 \cdot p + \1.20 to calculate their charges. Dylan and Anne paid the amount of money for their pictures. How many pictures did they get developed?
 - a. 5 photos
 - b. 24 photos
 - c. 36 photos
 - d. 120 photos

[10] F&R-6 Selecting and using the quadratic formula to solve problems (M4.4.2)

1. Use the quadratic formula to find x : $0 = -(1/2)x^2 + 3x + 8$
 - a. $x = 22$ or 28
 - b. $x = 0$ or -8
 - c. $x = -2$ or 8
 - d. No Solution

[10] F&R-7 Solving or identifying solutions to literal equations or formulas for a variable involving multi-steps (e.g., solve for h when $A = \frac{1}{2}h(b_1 + b_2)$) (M4.4.2)

1. Given the equation $A = 3Pr - 8$, solve for r .
 - a. $r = 3PA - 8$
 - b. $r = \frac{1}{3}A - 8(P)$
 - c. $r = 3A - P + 8$
 - d. $r = (A + 8)/3P$

10th Grade Functions and Relationships Answer Key

Describing Patterns and Functions: The student demonstrates conceptual understanding of functions, patterns, or sequences including those represented in real-world situations by:

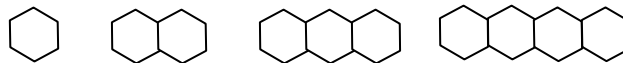
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1. Which is the next term in the pattern: 5.5, 9, 12.5, 16, ... ?
- a. 17.5
 - b. 19.5*
 - c. 28.5
 - d. None of the above

2. Complete the table.

1	2	3	4	5	7	10	n
-4	-3	0	5	12	32	77	$n^2 - 2n - 3$

3. Dan is using hexagonal tiles as a border around his kitchen floor. The table below shows the relationship between the number of tiles and the perimeter of the figure.



Tiles	1	2	3	4	5
Perimeter	6	10	14	18	22

Write a sentence that gives the perimeter if there are n tiles.

Sample response: If n is the number of tiles, then $4n + 2$ is the perimeter of the figure.

[10] F&R-2 Generalizing equations and inequalities (linear, quadratic, absolute value) using a table of ordered pairs or a graph (M4.4.4)

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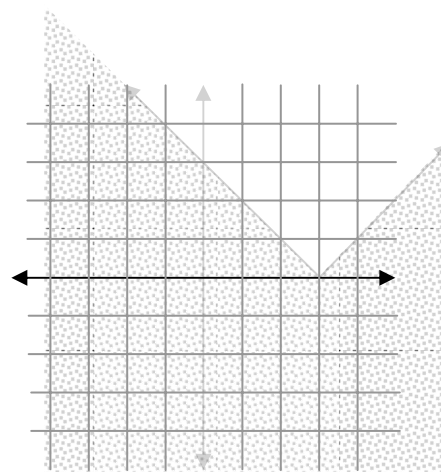
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1. The equation $A = \frac{1}{2}h(b_1 + b_2)$ is used to find the area of a trapezoid. If all the other dimensions are held constant and b_2 decreases, the area of the trapezoid _____.
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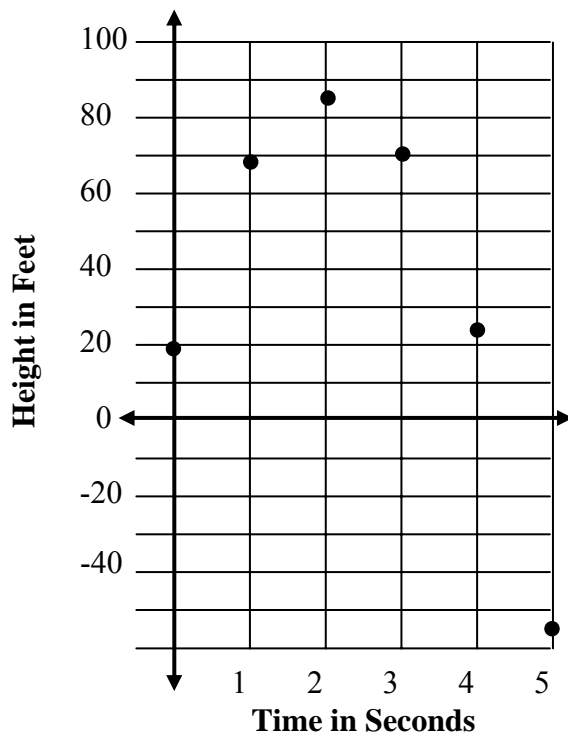
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Use a calculator to complete the table. Graph the coordinates on the graph at the below.

Time (t)	0	1	2	3	4	5
Height (h)	20	69	86	71	24	-55



Modeling and Solving Equations and Inequalities: The student demonstrates algebraic thinking by:

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10th Grade Geometry

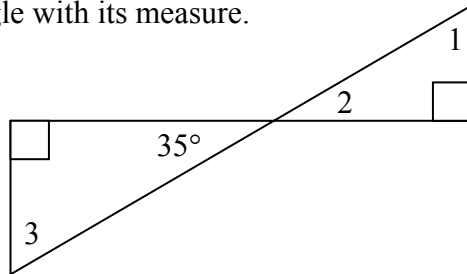
Geometric Relationships: The student demonstrates an understanding of geometric relationships by:

[10] G-1 Identifying, analyzing, comparing, or using properties of plane figures:

- supplementary, complementary or vertical angles
- angles created by parallel lines with a transversal
- sum of interior or exterior angles of a polygon
- central angles, chords, inscribed angles or arcs of a circle (M5.4.1)

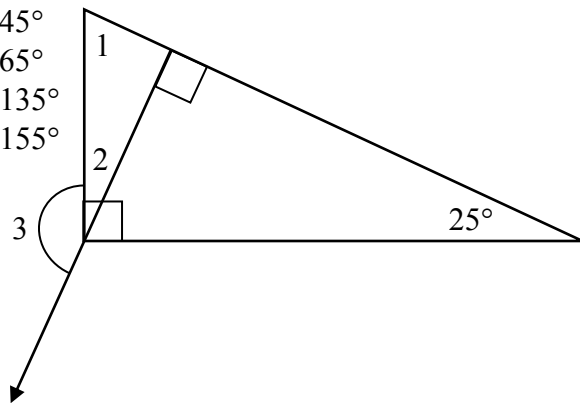
1. Using the diagram at the right, match the angle with its measure.

- | | |
|--|--|
| <p>_____ a. $m\angle 1$</p> <p>_____ b. $m\angle 2$</p> <p>_____ c. $m\angle 3$</p> | <p>I. 35°</p> <p>II. 45°</p> <p>III. 55°</p> <p>IV. 145°</p> |
|--|--|



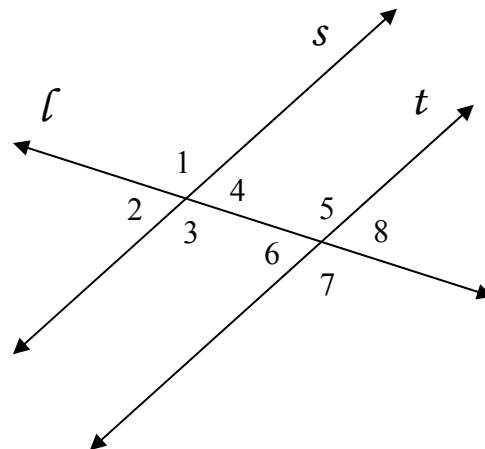
2. Using the diagram at the right, match the angle with its measure.

- | | |
|--|---|
| <p>_____ a. $m\angle 1$</p> <p>_____ b. $m\angle 2$</p> <p>_____ c. $m\angle 3$</p> | <p>I. 25°</p> <p>II. 45°</p> <p>III. 65°</p> <p>IV. 135°</p> <p>V. 155°</p> |
|--|---|

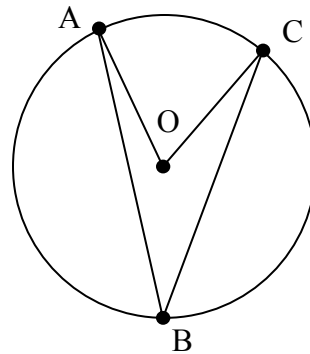


3. In the diagram at the right, lines s and t are parallel and $m\angle 2 = 65^\circ$. Which angles in the diagram have a measure of 115° ?

- a. $\angle 1, \angle 2, \angle 3$ & $\angle 4$
- b. $\angle 1, \angle 3, \angle 5$ & $\angle 7$
- c. $\angle 5, \angle 6, \angle 7$ & $\angle 8$
- d. $\angle 1, \angle 4, \angle 5$ & $\angle 8$

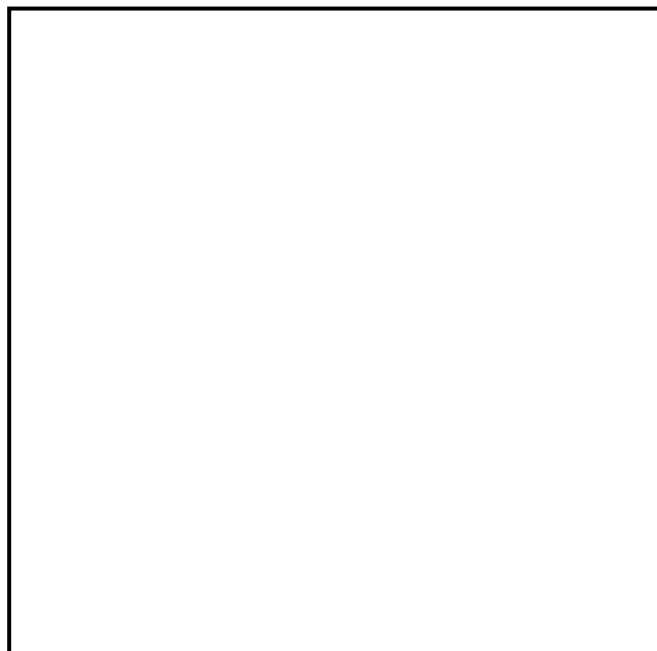
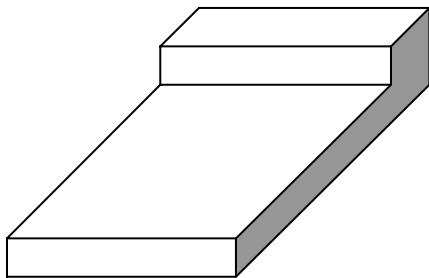


4. The five **interior** angles of a pentagon have a sum of ____.
- 180°
 - 360°
 - 540°
 - 720°
5. Which figures listed below have **exterior** angles which sum to be 360° ?
- Triangles
 - Quadrilaterals
 - Quadrilateral and Hexagons
 - Triangles, Quadrilaterals and Hexagons
6. In circle O, if the measure of arc AC is 82° , which statement must be true?
- $m\angle AOC = 164^\circ$
 - $m\angle ABC = 82^\circ$
 - $m\angle ABC = 41^\circ$
 - $m\angle AOC = 41^\circ$



[10]G-2 [Using isometric drawings to create two-dimensional drawings of three-dimensional objects (shapes that are composites of rectangular right prisms) L] (M5.4.2)

- Draw a net for the 3-dimensional figure shown below in the space provided.

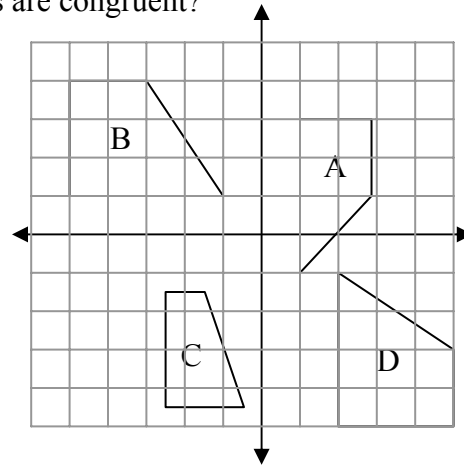


Transformation of Shapes: The student demonstrates conceptual understanding of similarity, congruence, symmetry, or transformations of shapes by:

[10] G-3 Identifying congruent and similar figures using Euclidean geometry (e.g., [constructions L], coordinate geometry) (M5.4.3)

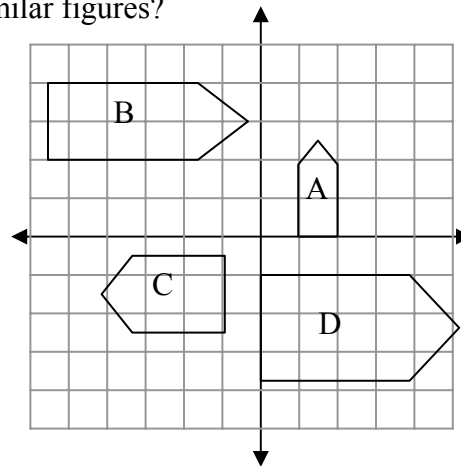
1. Using the graph to the right, which figures are congruent?

- a. Figures A & B
- b. Figures B & C
- c. Figures C & D
- d. Figures B & D



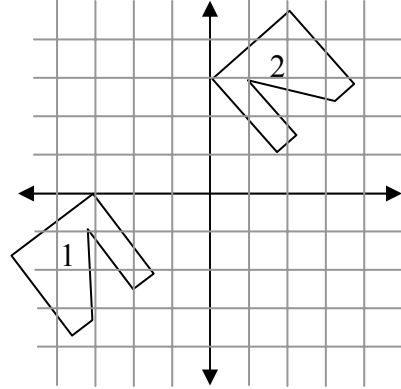
2. Using the graph at the right, which are similar figures?

- a. Figures A & B
- b. Figures B & C
- c. Figures A & C
- d. Figures B & D

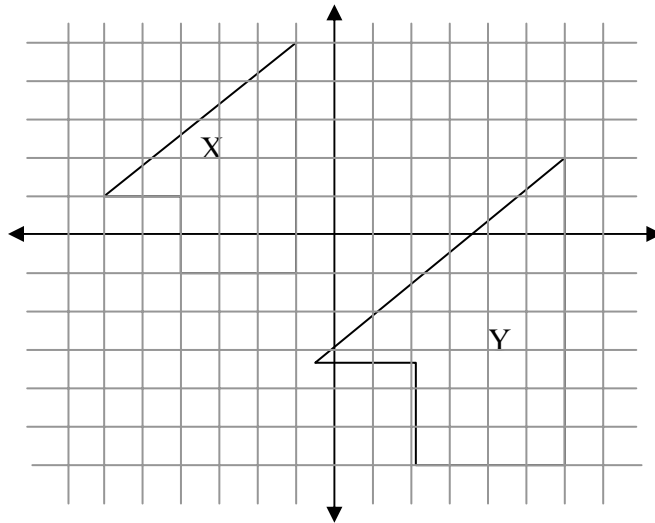


[10] G-4 Using transformations to show congruence or similarity of figures on a coordinate plane (M5.4.4)

1. Which statement best describes why Figure 2 is congruent to Figure 1.
 - a. Figure 2 is a reflection of Figure 1.
 - b. Figure 2 is a translation of Figure 1.
 - c. Figure 2 is a rotation of Figure 1.
 - d. Figure 2 is equidistant from the X-axis as Figure 1.



2. In order for Figure Y to be similar to Figure X, the scale factor would be _____.
 - a. $1/2$
 - b. $2/3$
 - c. 1
 - d. $4/3$

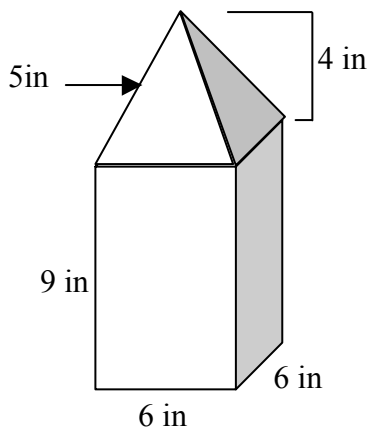


Perimeter, Area, and Volume: The student solves problems (including real-world situations) by:

[10] G-5 Determining the volume or surface area of spheres or compound solids (M5.3.4)

1. Which is the volume of a sphere with diameter 50 cm?
 - a. 15625π cu. cm.
 - b. 125000π cu. cm.
 - c. 20833.3π cu. cm
 - d. 166666.6π cu. cm

2. A right regular pyramid is placed on a rectangular prism with a square base as pictured on the left. What is the surface area of the figure?



- a. 300 sq. cm
- b. 312 sq. cm
- c. 348 sq. cm
- d. 384 sq. cm

Position and Direction: The student demonstrates understanding of position and direction when solving problems (including real-world situations) by:

[10] G-6 Graphing a line segment on a coordinate grid and/or identifying its length or midpoint by using formulas (M5.4.5)

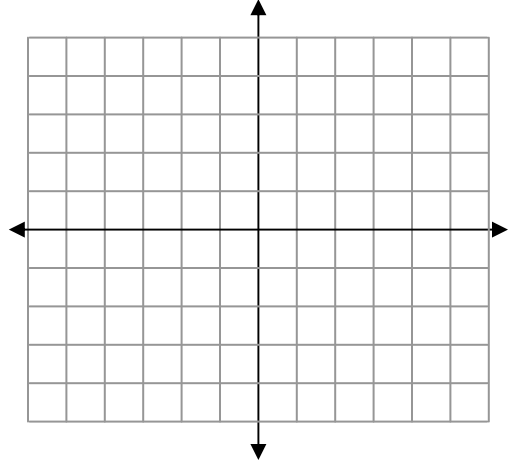
1. The point (12, -5) is _____ units away from the origin.
 - a. 13 units
 - b. 25 units
 - c. 144 units
 - d. 169 units

2. Calculate the distance between (-4, -7) and (8, 9).
 - a. 12 units
 - b. 16 units
 - c. 20 units
 - d. 28 units

3. A segment has endpoints at (-2, 8.4) and (2.8, 12). Find the coordinates of the segment's midpoint.
 - a. (0.4, 10.2)
 - b. (2.4, 10.2)
 - c. (0.4, 9.7)
 - d. None of the above.

[10] G-7 Graphing a system of equations on a coordinate grid, identifying a solution, or determining their relationship (intersecting, parallel, perpendicular) (M5.4.5)

- Graph the system of equations $y = 3x + 2$ and $3x + 3y = 18$. Then determine whether they are intersecting, perpendicular or parallel.
 - Intersecting but not perpendicular
 - Intersecting and perpendicular
 - Parallel



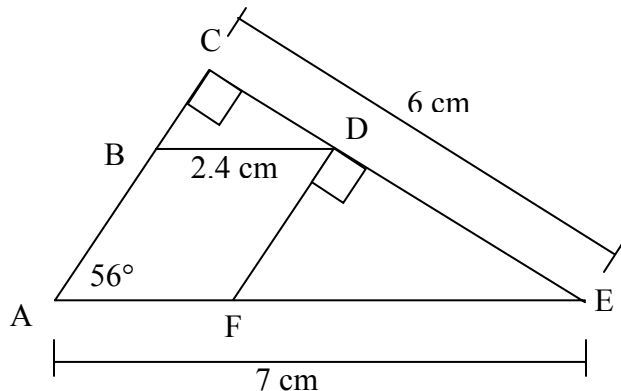
- In order for the system of equations: $x + y = 7$ and $y = mx - 4$ to show two parallel lines, then _____.
 - $m = 3$
 - $m = 1$
 - $m = 0$
 - $m = -1$

Construction: The student demonstrates a conceptual understanding of geometric drawings or constructions by:

[10] G-8 (L) Drawing, measuring, or constructing geometric models of plane figures (containing parallel and/or perpendicular lines, angles, perpendicular bisectors, congruent angles, regular polygons) (M5.4.6)

- Find the value of the missing measures. You may use a ruler or protractor with this scale drawing. Be sure to include the units in your answer.

- $AF =$ _____
 $BC =$ _____
 $DF =$ _____
 $m\angle AFD =$ _____
 $m\angle DFE =$ _____
 $m\angle E =$ _____



10th Grade Geometry Answer Key

Geometric Relationships: The student demonstrates an understanding of geometric relationships by:

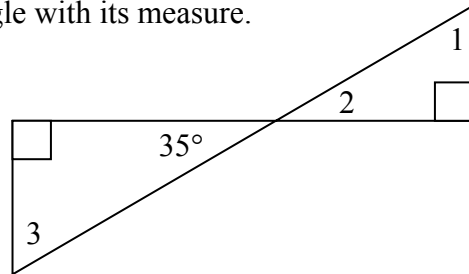
[10] G-1 Identifying, analyzing, comparing, or using properties of plane figures:

- supplementary, complementary or vertical angles
- angles created by parallel lines with a transversal
- sum of interior or exterior angles of a polygon
- central angles, chords, inscribed angles or arcs of a circle (M5.4.1)

1. Using the diagram at the right, match the angle with its measure.

- III a. $m\angle 1$
I b. $m\angle 2$
III c. $m\angle 3$

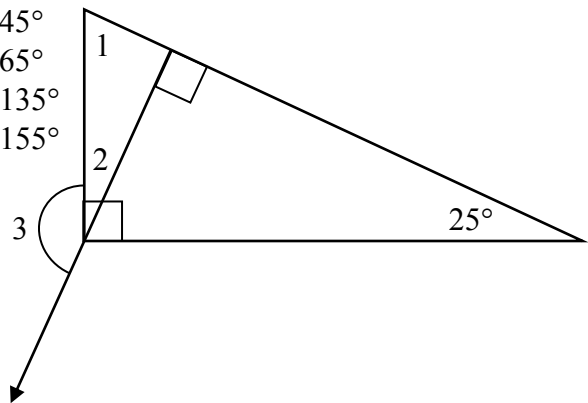
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2. Using the diagram at the right, match the angle with its measure.

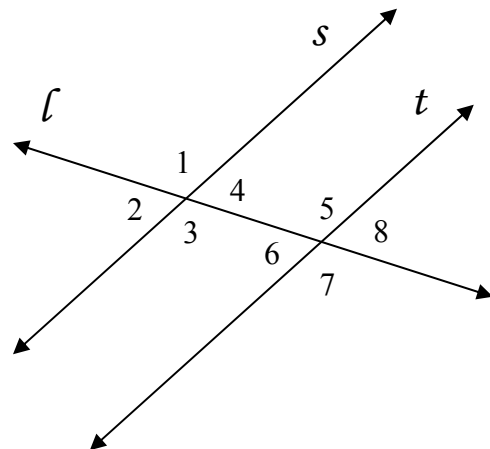
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 IV. 135°
 V. 155°



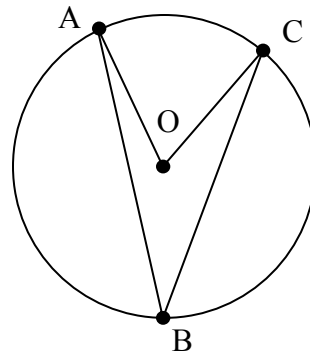
3. In the diagram at the right, lines s and t are parallel and $m\angle 2 = 65^\circ$. Which angles in the diagram have a measure of 115° ?

- a. $\angle 1, \angle 2, \angle 3$ & $\angle 4$
 b. $\angle 1, \angle 3, \angle 5$ & $\angle 7$ *
 c. $\angle 5, \angle 6, \angle 7$ & $\angle 8$
 d. $\angle 1, \angle 4, \angle 5$ & $\angle 8$



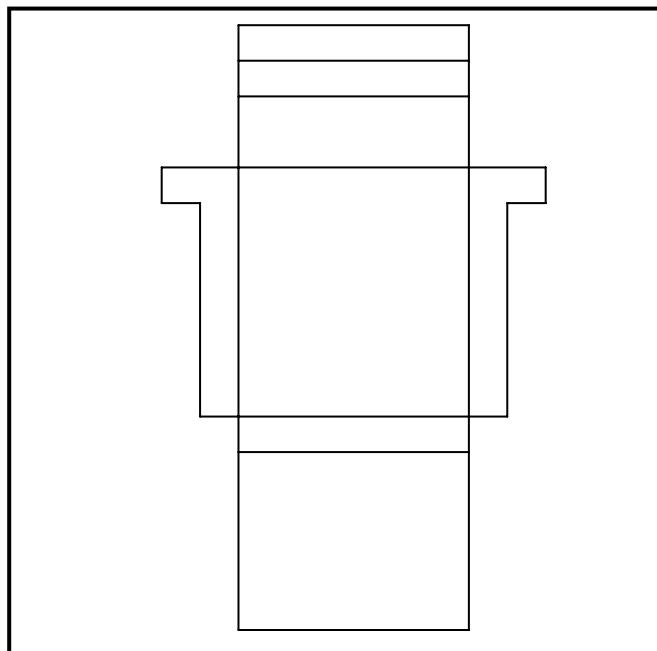
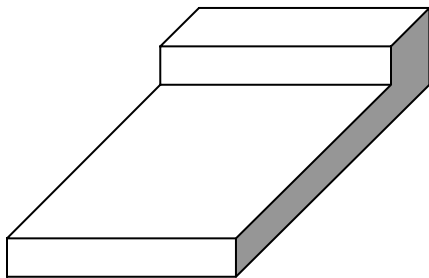
4. The five **interior** angles of a pentagon have a sum of ____.
- 180°
 - 360°
 - 540° ***
 - 720°
5. Which figures listed below have **exterior** angles which sum to be 360° ?
- Triangles
 - Quadrilaterals
 - Quadrilateral and Hexagons
 - Triangles, Quadrilaterals and Hexagons****

6. In circle O, if the measure of arc AC is 82° , which statement must be true?
- $m\angle AOC = 164^\circ$
 - $m\angle ABC = 82^\circ$
 - $m\angle ABC = 41^\circ$ ***
 - $m\angle AOC = 41^\circ$



[10] G-2 [Using isometric drawings to create two-dimensional drawings of three-dimensional objects (shapes that are composites of rectangular right prisms) L] (M5.4.2)

1. Draw a net for the 3-dimensional figure shown below in the space provided.

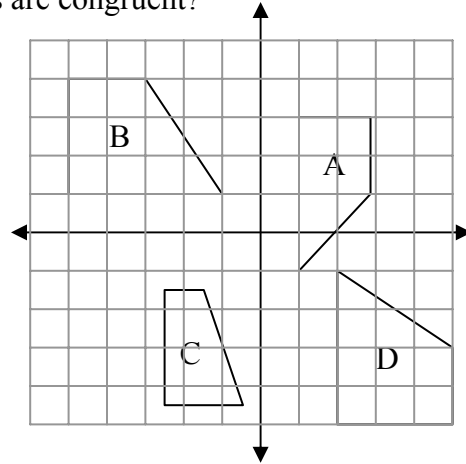


Transformation of Shapes: The student demonstrates conceptual understanding of similarity, congruence, symmetry, or transformations of shapes by:

[10] G-3 Identifying congruent and similar figures using Euclidean geometry (e.g., [constructions L], coordinate geometry) (M5.4.3)

1. Using the graph to the right, which figures are congruent?

- a. Figures A & B
- b. Figures B & C
- c. Figures C & D
- d. **Figures B & D***



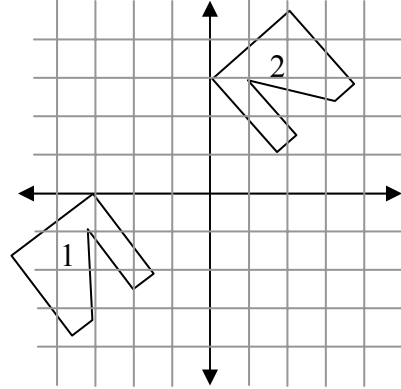
2. Using the graph at the right, which are similar figures?

- a. **Figures A & B***
- b. Figures B & C
- c. Figures A & C
- d. Figures B & D

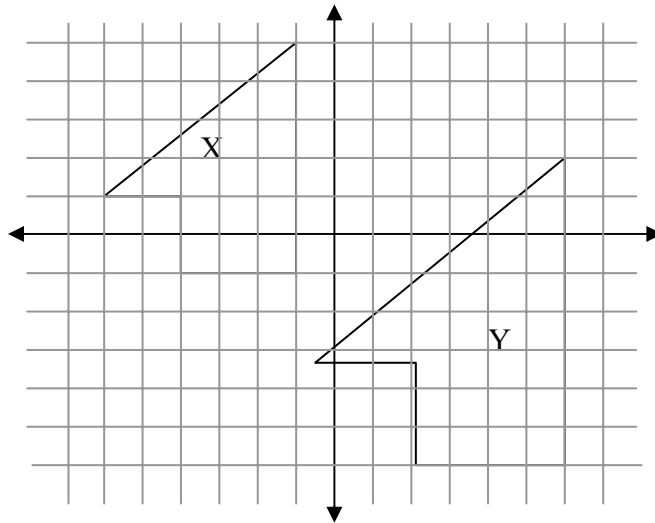


[10] G-4 Using transformations to show congruence or similarity of figures on a coordinate plane (M5.4.4)

1. Which statement best describes why Figure 2 is congruent to Figure 1.
 - a. **Figure 2 is a reflection of Figure 1.***
 - b. Figure 2 is a translation of Figure 1.
 - c. Figure 2 is a rotation of Figure 1.
 - d. Figure 2 is equidistant from the X-axis as Figure 1.



2. In order for Figure Y to be similar to Figure X, the scale factor would be _____.
 - a. $1/2$
 - b. $2/3$
 - c. 1
 - d. $4/3$ *

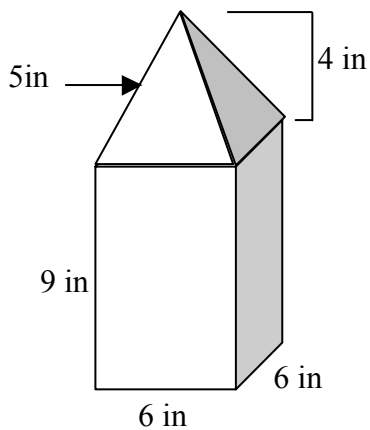


Perimeter, Area, and Volume: The student solves problems (including real-world situations) by:

[10] G-5 Determining the volume or surface area of spheres or compound solids (M5.3.4)

1. Which is the volume of a sphere with diameter 50 cm?
 - a. 15625π cu. cm.
 - b. 125000π cu. cm.
 - c. ***20833.3\pi*** cu. cm*
 - d. 166666.6π cu. cm

2. A right regular pyramid is placed on a rectangular prism with a square base as pictured on the left. What is the surface area of the figure?



- a. 300 sq. cm
- b. *312 sq. cm****
- c. 348 sq. cm
- d. 384 sq. cm

Position and Direction: The student demonstrates understanding of position and direction when solving problems (including real-world situations) by:

[10] G-6 Graphing a line segment on a coordinate grid and/or identifying its length or midpoint by using formulas (M5.4.5)

1. The point (12, -5) is _____ units away from the origin.
 - a. **13 units***
 - b. 25 units
 - c. 144 units
 - d. 169 units

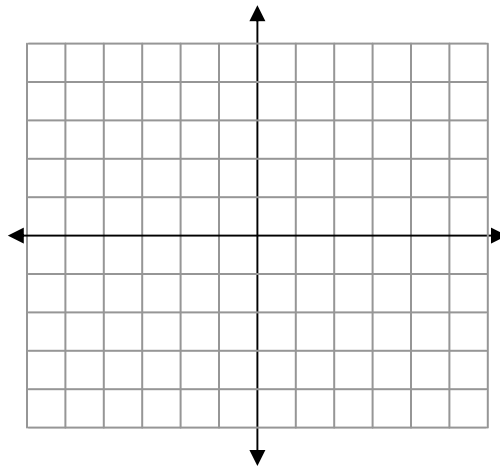
2. Calculate the distance between (-4, -7) and (8, 9).
 - a. 12 units
 - b. 16 units
 - c. **20 units***
 - d. 28 units

3. A segment has endpoints at (-2, 8.4) and (2.8, 12). Find the coordinates of the segment's midpoint.
 - a. **(0.4, 10.2)***
 - b. (2.4, 10.2)
 - c. (0.4, 9.7)
 - d. None of the above.

[10] G-7 Graphing a system of equations on a coordinate grid, identifying a solution, or determining their relationship (intersecting, parallel, perpendicular) (M5.4.5)

1. Graph the system of equations $y = 3x + 2$ and $3x + 3y = 18$. Then determine whether they are intersecting, perpendicular or parallel.

- a. ***Intersecting but not perpendicular****
 b. Intersecting and perpendicular
 c. Parallel



2. In order for the system of equations: $x + y = 7$ and $y = mx - 4$ to show two parallel lines, then _____.
- a. $m = 3$
 b. $m = 1$
 c. $m = 0$
 d. ***$m = -1$ ****

Construction: The student demonstrates a conceptual understanding of geometric drawings or constructions by:

[10] G-8 (L) Drawing, measuring, or constructing geometric models of plane figures (containing parallel and/or perpendicular lines, angles, perpendicular bisectors, congruent angles, regular polygons) (M5.4.6)

1. Find the value of the missing measures. You may use a ruler or protractor with this scale drawing. Be sure to include the units in your answer.

$AF = \underline{2.4 \text{ cm}}$

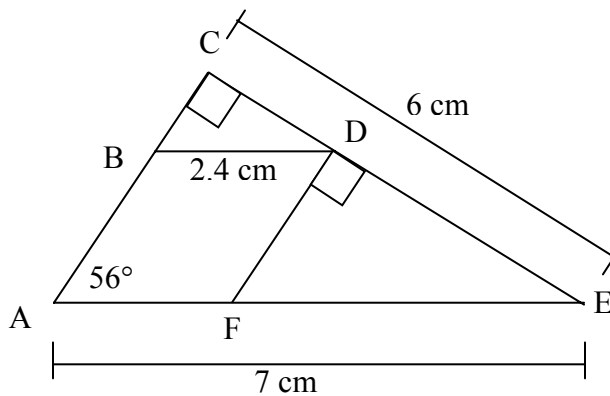
$BC = \underline{1.2 \text{ cm}}$

$DF = \underline{2.4 \text{ cm}}$

$m\angle AFD = \underline{124^\circ}$

$m\angle DFE = \underline{56^\circ}$

$m\angle E = \underline{34^\circ}$



10th Grade Measurement

Measurable Attributes: The student demonstrates understanding of measurable attributes by:

[10] MEA-1 Converting square and cubic units within the same system, English or metric, in real-world applications (M2.4.2)

1. Ramona is replacing the carpet in her living room. She calculates the room has an area of 10 square yards. What is the area of the room in square feet?
 - a. 3.33 square feet
 - b. 30 square feet
 - c. 90 square feet
 - d. 120 square feet

2. The volume of a cylindrical canister is 7,853,982 cubic millimeters. Find the volume of the canister in cubic centimeters.
 - a. 785,398.2 cubic centimeters
 - b. 19,949,114.28 cubic centimeters
 - c. 19,949.11428 cubic centimeters
 - d. 7,853.982 cubic centimeters

Measurement Techniques: The student uses measurement techniques by:

[10] MEA-2 (L) Applying right triangle trigonometry (sine, cosine, and tangent) to find missing dimensions in real-world applications (M2.4.4)

1. A 20 meter long cable is used to support a telephone pole, holding it perpendicular to the ground. If the cable forms a 60° angle with the ground, how high up the pole should the cable be attached?
 - a. 10 meters
 - b. $10\sqrt{3}$ meters
 - c. $20\sqrt{2}$ meters
 - d. $20\sqrt{3}$ meters

2. The short leg of a right triangle is 10 meters and the acute angles measure 25° and 65° . Use trigonometry and a calculator to find the measures of the longer leg of the right triangle.
- a. 10 meters
 - b. 11.03 meters
 - c. 18.66 meters
 - d. 21.45 meters

10th Grade Measurement Answer Key

Measurable Attributes: The student demonstrates understanding of measurable attributes by:

[10] MEA-1 Converting square and cubic units within the same system, English or metric, in real-world applications (M2.4.2)

1. Ramona is replacing the carpet in her living room. She calculates the room has an area of 10 square yards. What is the area of the room in square feet?
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 - a. 785,398.2 cubic centimeters
 - b. 19,949,114.28 cubic centimeters
 - c. 19,949.11428 cubic centimeters
 - d. ***7, 853.982 cubic centimeters****

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1. A 20 meter long cable is used to support a telephone pole, holding it perpendicular to the ground. If the cable forms a 60° angle with the ground, how high up the pole should the cable be attached?
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 - b. ***$10\sqrt{3}$ meters****
 - c. $20\sqrt{2}$ meters
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- a. 10 meters
 - b. 11.03 meters
 - c. 18.66 meters
 - d. 21.45 meters***

10th Grade Numeration

Understanding Numbers: The student demonstrates understanding of real numbers by:

[10] N-1 Identifying their subsets (natural, whole, integers, rational, irrational) (M1.4.1)

1. Which list contains only integers?

- a. .8, 1.4, 7.2, 19.3, 27.8
- b. -3, -2, 0, 8, 17
- c. -2, -1.8, 8, 15, 101
- d. $\frac{1}{2}$, $\frac{4}{5}$, $\frac{8}{9}$, $\frac{11}{15}$, $\frac{23}{40}$

2. Which set best describes the following list? 3.4, -9, 0, $5\frac{1}{2}$, -0.4

- a. Whole Numbers
- b. Integers
- c. Rational Numbers
- d. Irrational Numbers

[10] N-2 Simplifying expressions with positive and negative exponents (M1.4.4 & M3.4.4)

1. $3^2 + 5^3 =$ _____.

2. $2^{-5} =$ _____.

3. Which value is equal to $2^3 \times 4^{-2}$?

- a. 0
- b. $\frac{1}{2}$
- c. 1
- d. None of the above

[10] N-3 Expressing square roots in simplest radical form (M1.4.4 & M3.4.4)

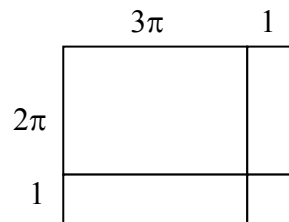
1. Which is equal to $\sqrt{1800}$ in simplest radical form?
- a. $2\sqrt{900}$
 - b. $10\sqrt{18}$
 - c. $30\sqrt{2}$
 - d. 60

Understanding Meaning of Operations: The student demonstrates conceptual understanding of mathematical operations by:

[10] N-4 Describing or illustrating the effects of arithmetic operations on real numbers (M1.4.3)

1. Which equation is illustrated by the diagram at the right?

- a. $3\pi + 1 + 2\pi + 1 = 5\pi + 2$
- b. $2(3\pi + 1) + 2(2\pi + 1) = 10\pi + 4$
- c. $(3\pi \times 1)(2\pi \times 1) = 6\pi^2$
- d. $(3\pi + 1)(2\pi + 1) = 6\pi^2 + 5\pi + 1$



[10] N-5 Describing or illustrating the use of inverse operations (cubing/cube root) (M1.4.3 & 1.4.5)

1. Tom wants to solve the equation $324 = (r+4)^3$ to find the value of r. Which operation will Tom need to use first to solve for r?
- a. Addition
 - b. Multiplication
 - c. Squaring
 - d. Cube root

**[10] N-6 Describing or illustrating [counting and adding in different bases L]
(M1.4.2)**

1. Add in Base 2: $10110_2 + 10101_2$
 - a. 111010_2
 - b. 101100_2
 - c. 101011_2
 - d. 102011_2

2. When counting in Base 2, which number follows 101_2 ?
 - a. 1101_2
 - b. 1011_2
 - c. 1010_2
 - d. 110_2

Number Theory: The student demonstrates conceptual understanding of number theory by:

[10] N-7 identifying or applying commutative, identity, associative, inverse, or distributive properties to real numbers and variables (M1.4.5)

1. Simplify the expression $2x(5 + y)$.
 - a. $7x + y$
 - b. $7x + 2xy$
 - c. $10x + y$
 - d. $10x + 2xy$

2. $13y + 4x - 8y = 13y - 8y + 4x$ shows how the _____ property is applied.
 - a. commutative
 - b. associative
 - c. distributive
 - d. identity

3. $(24m - 3m^2h) + 7m^2h = 24m + (-3m^2h + 7m^2h)$ shows how the _____ property is applied.
- commutative
 - associative
 - distributive
 - identity

[10] N-8 identifying or writing the prime factorization of a variable expression using exponents (M1.4.4)

1. Write the prime factorization for $45x^2y^2 \cdot 35xy^3$.
- $3^2 \cdot 5^2 \cdot 7 \cdot x^3 \cdot y^5$
 - $2 \cdot 3 \cdot 5 \cdot 7 \cdot x^3 \cdot y^5$
 - $3^2 \cdot 5^2 \cdot 7 \cdot x^2 \cdot y^6$
 - $2 \cdot 3 \cdot 5 \cdot 7 \cdot x^2 \cdot y^6$

10th Grade Numeration Answer Key

Understanding Numbers: The student demonstrates understanding of real numbers by:

[10] N-1 Identifying their subsets (natural, whole, integers, rational, irrational) (M1.4.1)

1. Which list contains only integers?

- a. .8, 1.4, 7.2, 19.3, 27.8
- b. -3, -2, 0, 8, 17***
- c. -2, -1.8, 8, 15, 101
- d. $\frac{1}{2}$, $\frac{4}{5}$, $\frac{8}{9}$, $\frac{11}{15}$, $\frac{23}{40}$

2. Which set best describes the following list? 3.4, -9, 0, $5\frac{1}{2}$, -0.4

- a. Whole Numbers
- b. Integers
- c. *Rational Numbers****
- d. Irrational Numbers

[10] N-2 Simplifying expressions with positive and negative exponents (M1.4.4 & M3.4.4)

1. $3^2 + 5^3 = \underline{134}$

2. $2^{-5} = \frac{1}{\underline{32}}$ ***or 0.03125***

3. Which value is equal to $2^3 \times 4^{-2}$?

- a. 0
- b. $\frac{1}{2}$ ***
- c. 1
- d. None of the above

[10] N-3 Expressing square roots in simplest radical form (M1.4.4 & M3.4.4)

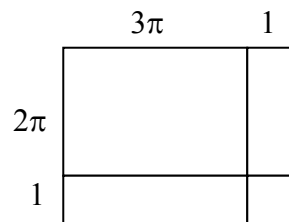
1. Which is equal to $\sqrt{1800}$ in simplest radical form?
- a. $2\sqrt{900}$
 - b. $10\sqrt{18}$
 - c. $30\sqrt{2}$ *
 - d. 60

Understanding Meaning of Operations: The student demonstrates conceptual understanding of mathematical operations by:

[10] N-4 Describing or illustrating the effects of arithmetic operations on real numbers (M1.4.3)

1. Which equation is illustrated by the diagram at the right?

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- b. $2(3\pi + 1) + 2(2\pi + 1) = 10\pi + 4$
- c. $(3\pi \times 1)(2\pi \times 1) = 6\pi^2$
- d. $(3\pi + 1)(2\pi + 1) = 6\pi^2 + 5\pi + 1$ *



[10] N-5 Describing or illustrating the use of inverse operations (cubing/cube root) (M1.4.3 & 1.4.5)

1. Tom wants to solve the equation $324 = (r+4)^3$ to find the value of r. Which operation will Tom need to use first to solve for r?
- a. Addition
 - b. Multiplication
 - c. Squaring
 - d. **Cube root** *

**[10] N-6 Describing or illustrating [counting and adding in different bases L]
(M1.4.2)**

1. Add in Base 2: $10110_2 + 10101_2$
 - a. 111010_2
 - b. 101100_2
 - c. **101011_2 ***
 - d. 102011_2

2. When counting in Base 2, which number follows 101_2 ?
 - a. 1101_2
 - b. 1011_2
 - c. 1010_2
 - d. **110_2 ***

Number Theory: The student demonstrates conceptual understanding of number theory by:
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[10] N-7 identifying or applying commutative, identity, associative, inverse, or distributive properties to real numbers and variables (M1.4.5)

1. Simplify the expression $2x(5 + y)$.
 - a. $7x + y$
 - b. $7x + 2xy$
 - c. $10x + y$
 - d. **$10x + 2xy$ ***

2. $13y + 4x - 8y = 13y - 8y + 4x$ shows how the _____ property is applied.
 - a. ***commutative****
 - b. associative
 - c. distributive
 - d. identity

3. $(24m - 3m^2h) + 7m^2h = 24m + (-3m^2h + 7m^2h)$ shows how the _____ property is applied.
- commutative
 - associative****
 - distributive
 - identity

[10] N-8 identifying or writing the prime factorization of a variable expression using exponents (M1.4.4)

1. Write the prime factorization for $45x^2y^2 \cdot 35xy^3$.
- $3^2 \cdot 5^2 \cdot 7 \cdot x^3 \cdot y^5$ *
 - $2 \cdot 3 \cdot 5 \cdot 7 \cdot x^3 \cdot y^5$
 - $3^2 \cdot 5^2 \cdot 7 \cdot x^2 \cdot y^6$
 - $2 \cdot 3 \cdot 5 \cdot 7 \cdot x^2 \cdot y^6$

10th Grade Process Skills

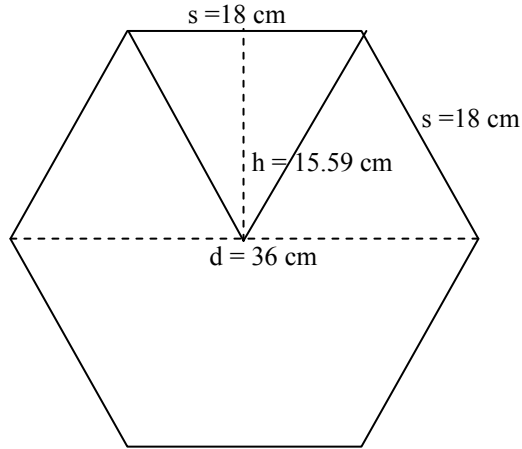
Process Skills: Understand and be able to select and use a variety of problem-solving strategies by:

[10] PS-1 Applying multi-step, integrated, mathematical problem-solving strategies (M7.4.2)

1. Greta used 100 pounds of fertilizer on her garden last year. But this year she is going to increase her garden from 40 feet by 60 feet to 60 feet by 100 feet. If each 30-pound bag of fertilizer costs \$12.95, how much will she spend on fertilizer this year? Assume she will use the same rate of fertilization as she did last year. Show details of your work in the space provided. You may use as many pages as needed.

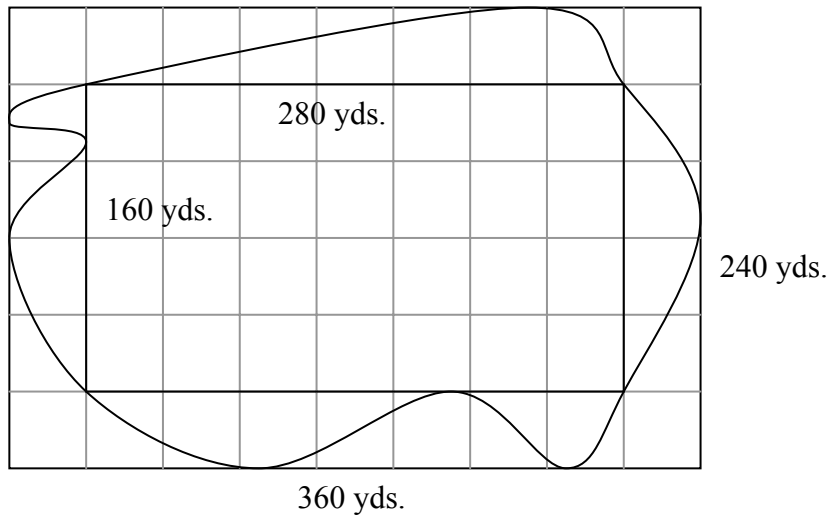
[10] PS-2 Verifying the answer by using an alternative strategy (M7.4.3)

1. Ben finds the area of the regular hexagon below by dividing the figure into congruent triangles, finding the area of each and adding. He found the area to be 842 square cm. Apply a second strategy for finding the area to verify Ben's answer. Show details of your work in the space provided. You may use as many pages as needed.



2. Drew and Jason are estimating the area of the lake behind the school. Drew places the lake inside a large rectangle with dimensions 360 yards by 240 yards. He then sketches a second rectangle inside the lake with dimensions 280 yds x 160 yds. Drew reasons the area of the lake must be between 86,400 square yards and 44,800 square yards. ($360 \times 240 = 86,400$ and $280 \times 160 = 44,800$)

By averaging, he determines the area to be 65,600 square yards. Develop and carry out a plan for Jason, who has been asked to see if Drew's estimate is reasonable. Show details of your work in the space provided. You may use as many pages as needed.



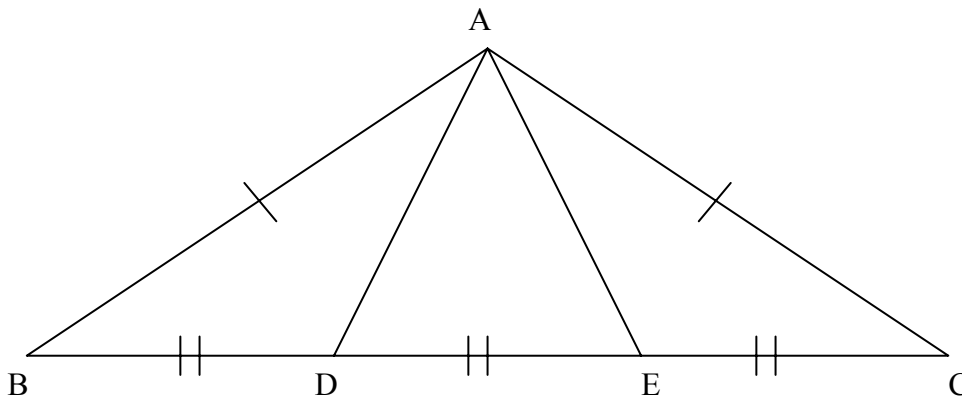
Communication: The student communicates his or her mathematical thinking by:

[10] PS-3 Representing mathematical problems numerically, graphically, and/or symbolically communicating math ideas in writing; or using appropriate vocabulary, symbols, or technology to explain, justify, and defend strategies and solutions (M8.4.1, M8.4.2, & M8.4.3)*

**Note: This problem lends itself well to exploration using an electronic drawing tool such as Cabri or Geometer's Sketchpad. Use of such software is encouraged on this problem, though it is not required. Students may use many techniques to explore the diagram, including deductive proof, indirect proof, construction, and/or other problem solving methods.*

1. In the figure below, $AB = AC$, and $BD = DE = EC$. **Explore** the diagram to determine if $m\angle BAD = m\angle CAE = m\angle EAD$.
 - a. Will these three angles be equal when $\angle BAC$ is acute?
 - b. How does the relationship between $\angle BAD$, $\angle CAE$, and $\angle EAD$ change when $\angle BAC$ is obtuse?
 - c. Are there any unique associations between these three angles when $m\angle BAC$ is a right angle?

Be sure to show your explorations. State whatever conclusions you can draw. Justify your conclusions with diagrams and a brief explanation of your work. You may use as many pages as needed.



Reasoning: The student demonstrates an ability to use logic and reason by:

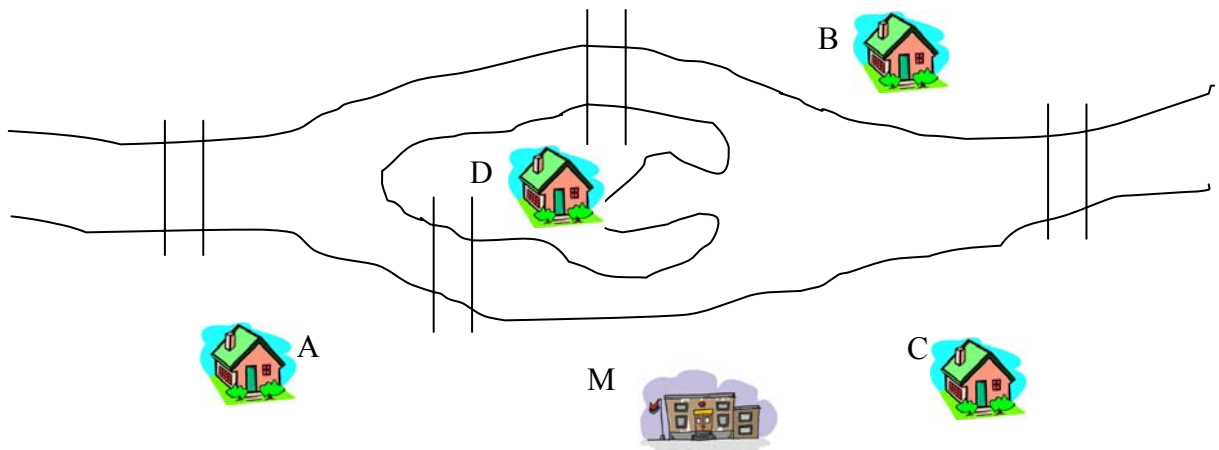
[10] PS-4 Using methods of proof including direct, indirect, and counter examples to validate conjectures (M9.4.3)

1. Trisha says a rectangle with area 4,800 square meters is longer than a rectangle with area 4,200 square meters. Defend or reject this hypothesis, using examples, calculations, and supporting reasons. Show your detailed work in the space provided. You may use as many pages as needed.

Connections: The student understands and applies mathematical skills and processes across the content strands by:

[10] PS-5 Using real-world contexts such as global issues and careers (M10.4.1 & M10.4.2)

1. Amber, Ben, Carl, and Denika live in Kwitna River. The river runs right through town with four bridges connecting the two shores and an island as illustrated in the map below. Amber and Carl live on the side where the school, post office, movie theater, and church are located. Ben lives on the other side of the river, near the store and cannery. Denika lives on the island next to the harbor. The four are planning a night at the movies. Is there a way for Amber to pick up the other three and go to the movies without crossing either of the four bridges twice? If there is, describe your solution. If not, give a convincing argument why there isn't.



10th Grade Process Skills Answer Key

Process Skills: Understand and be able to select and use a variety of problem-solving strategies by:

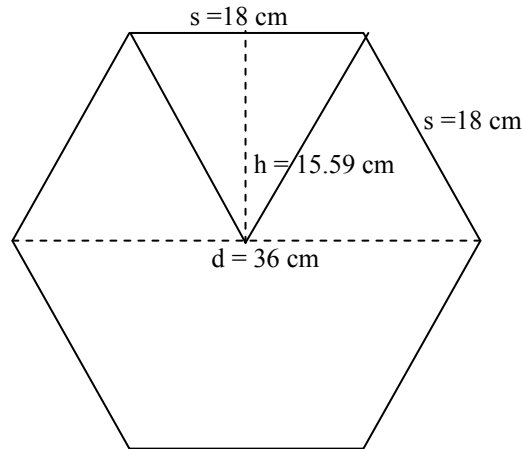
[10] PS-1 Applying multi-step, integrated, mathematical problem-solving strategies (M7.4.2)

1. Greta used 100 pounds of fertilizer on her garden last year. But this year she is going to increase her garden from 40 feet by 60 feet to 60 feet by 100 feet. If each 30-pound bag of fertilizer costs \$12.95, how much will she spend on fertilizer this year? Assume she will use the same rate of fertilization as she did last year. Show details of your work in the space provided. You may use as many pages as needed.

A 40 x 60 foot garden has 2,400 square feet of area; a 60 x 100 foot garden has 6,000 square feet. Using proportions, $100/2400 = x / 6000$. She will need 250 pounds of fertilizer. If each bag has 30 pounds of fertilizer, $250/30 = 8.3333$ bags of fertilizer. She'll need to buy 9 bags: $12.95 \times 9 = 116.55$. The fertilizer will cost \$116.55.

[10] PS-2 Verifying the answer by using an alternative strategy (M7.4.3)

1. Ben finds the area of the regular hexagon below by dividing the figure into congruent triangles, finding the area of each and adding. He found the area to be 842 square cm. Apply a second strategy for finding the area to verify Ben's answer. Show details of your work in the space provided. You may use as many pages as needed.



Use trapezoids to find the area: $A = \frac{1}{2} \times h \times (b_1 + b_2)$

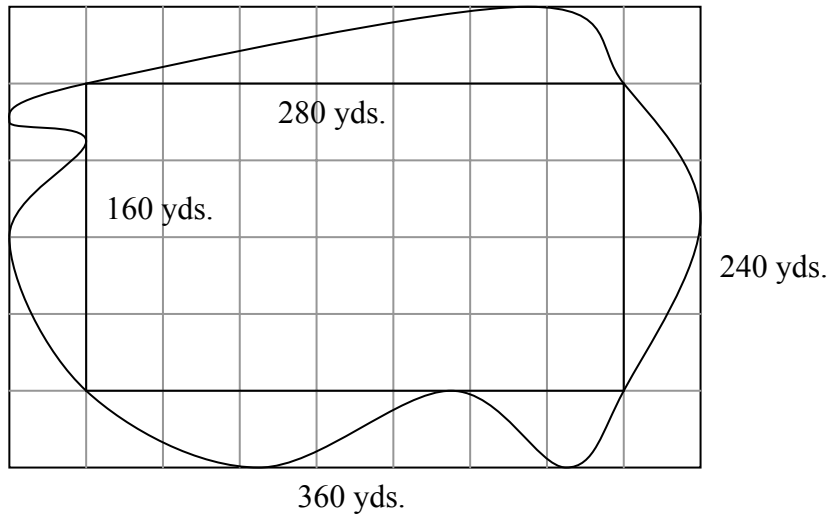
$$A = \frac{1}{2} \times 15.59 \times (18 + 36) = 420.93$$

But, there are two trapezoids, so the total area of the hexagon is 841.86 square centimeters.

I would agree with Ben's answer even though they are different. It is probably just a rounding difference.

2. Drew and Jason are estimating the area of the lake behind the school. Drew places the lake inside a large rectangle with dimensions 360 yards by 240 yards. He then sketches a second rectangle inside the lake with dimensions 280 yds x 160 yds. Drew reasons the area of the lake must be between 86,400 square yards and 44,800 square yards. ($360 \times 240 = 86,400$ and $280 \times 160 = 44,800$).

By averaging, he determines the area to be 65,600 square yards. Develop and carry out a plan for Jason, who has been asked to see if Drew's estimate is reasonable. Show details of your work in the space provided. You may use as many pages as needed.



Jason could use trapezoids, rectangles and triangles with heights of 40 to estimate the area of the lake.

$$A1 = \frac{1}{2} \times 280 \times 40 = 5600$$

$$A2 = 320 \times 40 = 12800$$

$$A3 = \frac{1}{2} \times (320 + 360) \times 40 = 13600$$

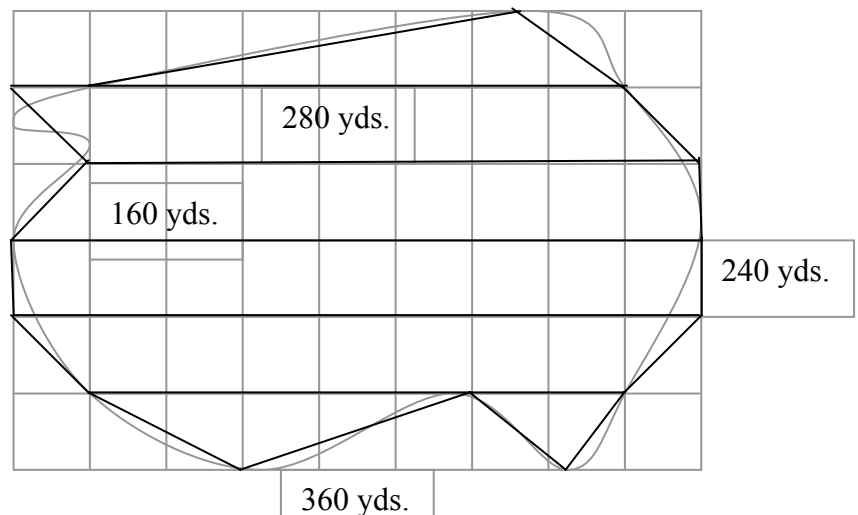
$$A4 = 360 \times 40 = 14400$$

$$A5 = \frac{1}{2} \times (280 + 360) \times 40 = 12800$$

$$A6 = \frac{1}{2} \times 200 \times 40 = 4000$$

$$A7 = \frac{1}{2} \times 80 \times 40 = 1600$$

Total Area: 64, 800 sq. yds.



The difference between Drew's estimate and Jason's is only 800 sq. yd., a very small amount compared to the total: $800/65,600 \approx 1.2\%$.

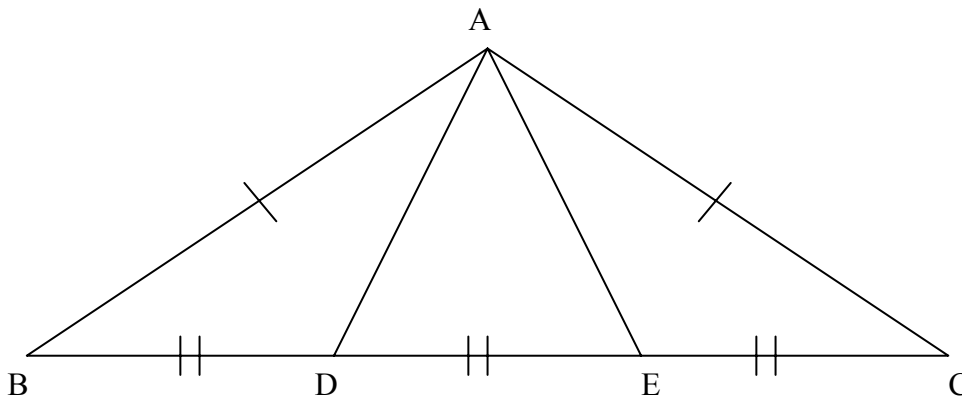
Communication: The student communicates his or her mathematical thinking by:

[10] PS-3 Representing mathematical problems numerically, graphically, and/or symbolically communicating math ideas in writing; or using appropriate vocabulary, symbols, or technology to explain, justify, and defend strategies and solutions (M8.4.1, M8.4.2, & M8.4.3)*

**Note: This problem lends itself well to exploration using an electronic drawing tool such as Cabri or Geometer's Sketchpad. Use of such software is encouraged on this problem, though it is not required. Students may use many techniques to explore the diagram, including deductive proof, indirect proof, construction, and/or other problem solving methods.*

1. In the figure below, $AB = AC$, and $BD = DE = EC$. **Explore** the diagram to determine if $m\angle BAD = m\angle CAE = m\angle EAD$.
 - a. Will these three angles be equal when $\angle BAC$ is acute?
 - b. How does the relationship between $\angle BAD$, $\angle CAE$, and $\angle EAD$ change when $\angle BAC$ is obtuse?
 - c. Are there any unique associations between these three angles when $m\angle BAC$ is a right angle?

Be sure to show your explorations. State whatever conclusions you can draw. Justify your conclusions with diagrams and a brief explanation of your work. You may use as many pages as needed.



Reasoning: The student demonstrates an ability to use logic and reason by:

[10] PS-4 Using methods of proof including direct, indirect, and counter examples to validate conjectures (M9.4.3)

1. Trisha says a rectangle with area 4,800 square meters is longer than a rectangle with area 4,200 square meters. Defend or reject this hypothesis, using examples calculations and supporting reasons. Show your detailed work in the space provided. You may use as many pages as needed.

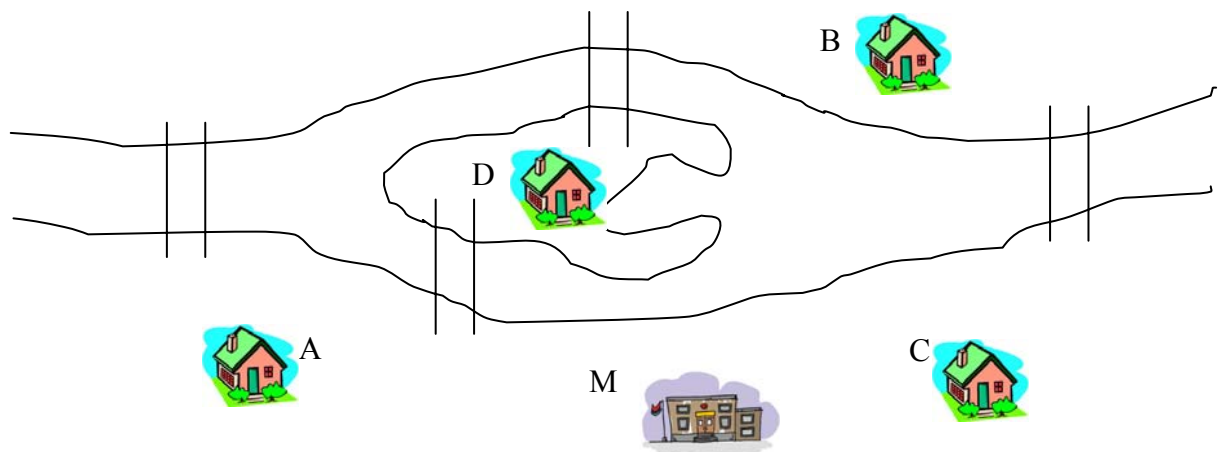
This is not always true. A 4,800 square meter rectangle may have dimensions 60 x 80, 30 x 160, 10 x 480, or 1 x 4,800 (among many other dimensions) while a 4,200 square meter rectangle may have dimensions 60 x 70, 30 x 140, 10 x 420, or 1 x 4,200. So depending on the dimensions of each rectangle, the longest side of the big rectangle may be shorter than the longest side of the small rectangle.

Example: 60 x 80 is shorter than 1 x 4,200, even though it has a greater area.

Connections: The student understands and applies mathematical skills and processes across the content strands by:

[10] PS-5 Using real-world contexts such as global issues and careers (M10.4.1 & M10.4.2)

1. Amber, Ben, Carl, and Denika live in Kwitna River. The river runs right through town with four bridges connecting the two shores and an island as illustrated in the map below. Amber and Carl live on the side where the school, post office, movie theater, and church are located. Ben lives on the other side of the river, near the store and cannery. Denika lives on the island next to the harbor. The four are planning a night at the movies. Is there a way for Amber to pick up the other three and go to the movies without crossing either of the four bridges twice? If there is, describe your solution. If not, give a convincing argument why there isn't.



Amber could pick up Denika first by crossing the bridge to the island. Then she could leave the island and pick up Ben, crossing the second island bridge. Finally, she could cross the bridge spanning the entire river and pick up Carl, heading to the theater for a fun evening out. One bridge has not been crossed but the bridges that are used are only used once.

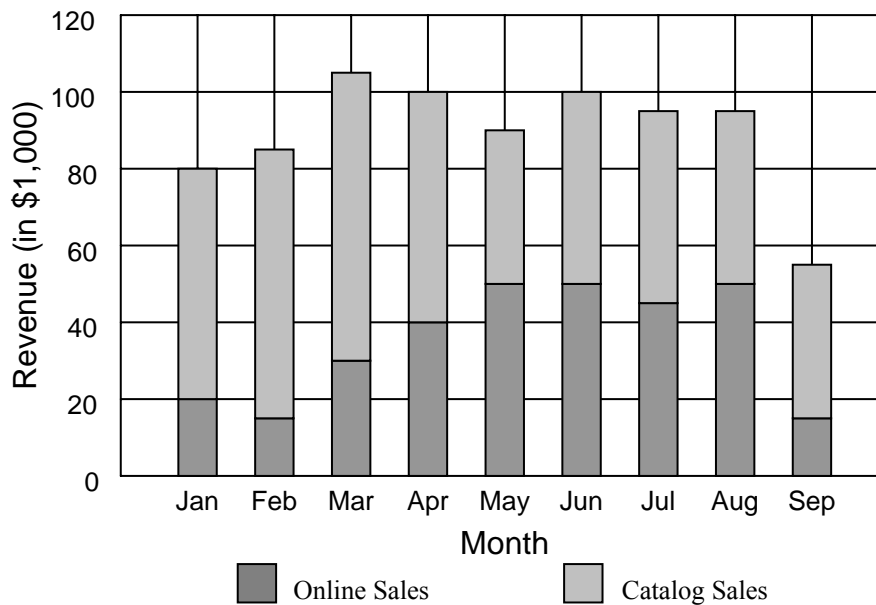
10th Grade Statistics and Probability

Data Display: The student demonstrates an ability to classify and organize data by:

[10] S&P-1 [Designing, collecting L], organizing, displaying, or explaining the classification of data in real-world problems (e.g., science or humanities, peers, community, or careers), using information from tables or graphs that display two or more sets of data [or with technology L] (M6.4.1)

1. Use the information from the stacked bar graph below to complete the table below.

Monthly Revenue Totals for 2003



Monthly Revenue Totals for 2003

(In \$1,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Online	20,000		30,000	40,000	50,000		45,000	50,000	
Catalog	60,000		75,000		40,000	50,000		45,000	40,000
Total	80,000	85,000		100,000	90,000	100,000			

Analysis and Central Tendency: The student demonstrates an ability to analyze data (comparing, explaining, interpreting, evaluating, making predictions, or describing trends; or drawing, formulating, or justifying conclusions) by:

[10] S&P-2 Using information from a display to solve a problem or analyzing the validity of statistical conclusions (M6.4.1 & M6.4.4)

1. While summarizing payroll reports for her company, Ms. Walthers noticed that the mean salary in the firm was \$32,500 while the median salary was only \$28,200. What must be true regarding paychecks at this company?
 - a. There is at least one paycheck that is significantly less than the median payroll amount.
 - b. There is at least one paycheck that is significantly greater than the median payroll amount.
 - c. All paychecks in the company are relatively similar.
 - d. The mode must be between \$28,200 and \$32,500.

2. Based on the frequency table to the right, what is the median number of riders on Bus 43?

- a. 65
- b. 68
- c. 72
- d. 74

Ridership: Bus 43	
Mon	65
Tues	77
Wed	65
Thur	68
Fri	74
Sat	78
Sun	75

[10] S&P-3 Using and justifying range and measures of central tendency to determine the best representation of the data for a practical situation (M6.4.3)

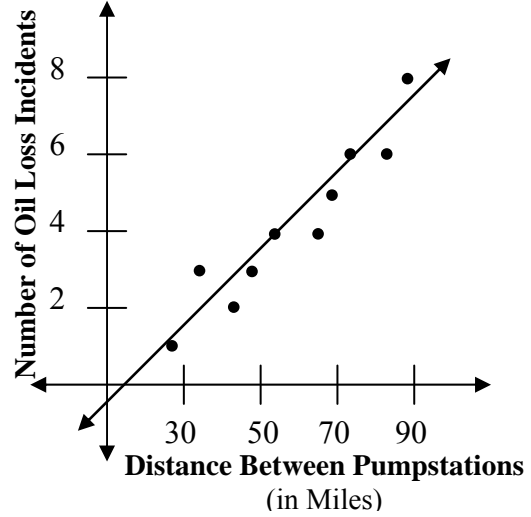
1. Fred has the following test scores at the end of the semester: 71, 74, 81, 88, 92, & 93. Which measure of central tendency should he report to his teacher in order to receive the highest possible grade?
 - a. The mean.
 - b. The median
 - c. The mode
 - d. The range

[10] S&P-4 Using a best fit line to describe trends and make predictions about data (M6.4.2)

1. The trendline at the right shows _____ association between the distance from pumpstations and the number of oil loss incidents recorded for that section of pipeline.

- a. positive
- b. negative
- c. no

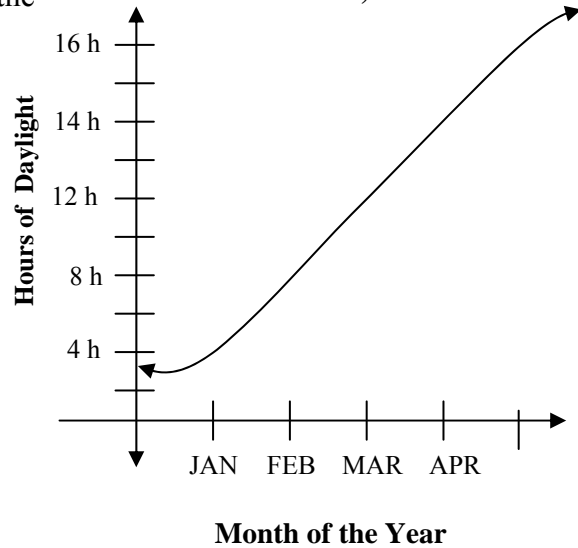
A Comparison of Oil Loss Incidents to Distance between Pumpstations



2. Based on the trendline given at the right, about how many hours of daylight can be expected in Talkeetna, Alaska, during the month of May?

- a. 13 hours
- b. 15 hours
- c. 16 hours
- d. 18 hours

Hours of Daylight Per Month Talkeetna, Alaska



Probability: The student demonstrates a conceptual understanding of probability and counting techniques by:

[10] S&P-5 Explaining in words or identifying the difference between experimental and theoretical probability of independent or dependent events (M6.4.5)

1. Carol and Daphne determined that the probability of rolling a sum of 6 with two dice was $\frac{5}{36}$ but when they actually rolled the pair of dice 100 times, the sum of 6 occurred 18 times. Give a detailed explanation why this difference may occur. List several possibilities with examples.

[10] S&P-6 Analyzing data to make predictions about the probability of independent or dependent events as a basis for solving real-world problems (M6.4.5)

1. Austin recorded the following results of his free throw shooting. Based on this information, what is the probability that Austin will make his second shot if he makes his first shot?

- a. 50%
- b. 65%
- c. 80%
- d. 86.7%

1 st Shot	2 nd Shot
Missed	Missed
Missed	Made
Made	Made
Made	Made
Made	Made
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Made	Missed
Made	Made
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[10] S&P-7 (L) Designing, conducting, analyzing, and communicating the results of a multi-stage probability experiment (M6.4.6)

Fran has been assigned the task of determining the probability of drawing 3 spades from a standard deck of 52 cards. Recall there are 4 suits (diamonds, hearts, spades, and clubs) of 13 cards each, in a deck. Each card is drawn one at a time and held until the remaining cards of the hand are drawn.

1. How many ways are there to draw the first card?
 - a. 1
 - b. 4
 - c. 13
 - d. 52

2. How many ways are there to draw the second card, after the first is drawn?
 - a. 1
 - b. 3
 - c. 12
 - d. 51

3. How many ways are there to draw the third card, after the first and second have been drawn?
 - a. 11
 - b. 12
 - c. 13
 - d. 50

4. Which expression gives the number of 3-card hands *of spades* from a standard deck of 52 cards?
- a. $2 \cdot 12 \cdot 13$
 - b. $13 \cdot 12 \cdot 11$
 - c. $52 \cdot 51 \cdot 50$
 - d. $52 \cdot 52 \cdot 52$
5. Which expression gives the total number of 3-card hands drawn from a standard deck of 52 cards?
- a. $1 \cdot 13 \cdot 13$
 - b. $13 \cdot 12 \cdot 11$
 - c. $52 \cdot 53 \cdot 54$
 - d. $52 \cdot 51 \cdot 50$
6. What is the probability of drawing a 3-card hand of spades from a standard deck of 52 cards?
- a. About 0.01%
 - b. About 0.05%
 - c. About 0.5%
 - d. About 1%

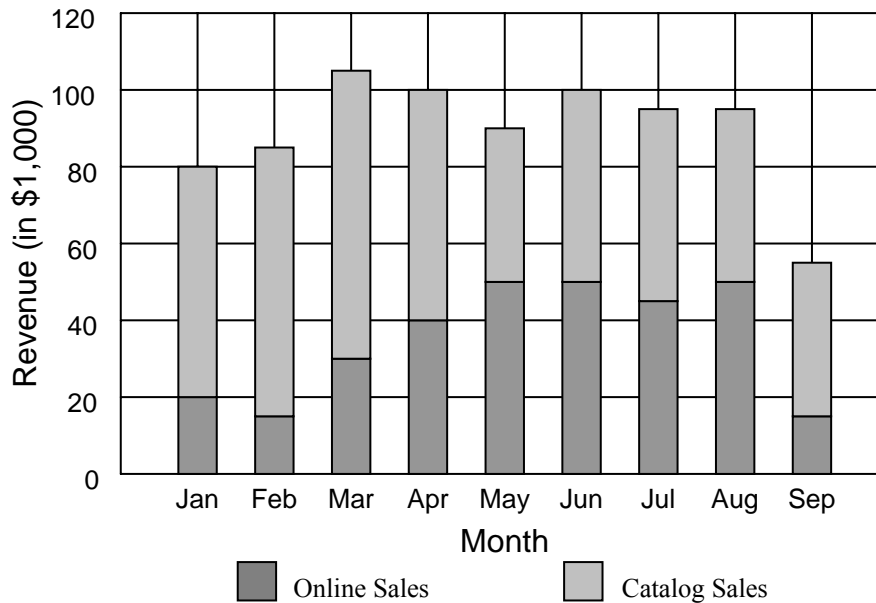
10th Grade Statistics and Probability Answer Key

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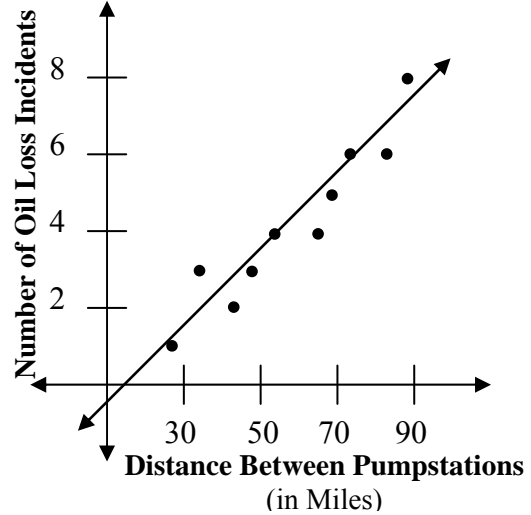
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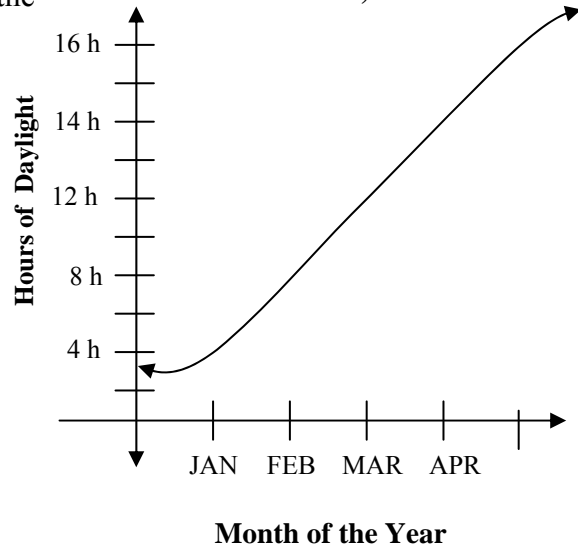
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$\frac{5}{36} = 13.888\%$ $\frac{18}{100} = 18\%$. *There are many reasons why the actual value may be*

different than the expected value. Though $\frac{5}{36} = \frac{13.8}{100}$, you can't roll 13.8 sums of 6!

You can only roll a whole number of times. So you might expect a sum of 6, fourteen or fifteen times. Or it may be that the die the girls used are not "fair," but loaded. So the sum of 6 showed up more often than expected.

[10] S&P-6 Analyzing data to make predictions about the probability of independent or dependent events as a basis for solving real-world problems (M6.4.5)

1. Austin recorded the following results of his free throw shooting. Based on this information, what is the probability that Austin will make his second shot if he makes his first shot?

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- a. About 0.01%
 - b. About 0.05%
 - c. About 0.5%
 - d. About 1% * $(13/52 \cdot 12/51 \cdot 11/50)$**