G.1	The student will construct and judge the validity of a logical argument consisting of a set of premises and a conclusion. This will include
	
	    a) identifying the converse, inverse, and contrapositive of a conditional statement;
	    b) translating a short verbal argument into symbolic form;
	    c) using Venn diagrams to represent set relationships; and
	    d) using deductive reasoning.

G.1a	Which of the following symbolic forms is the contrapositive of, a → ~b?
	
	  A. ~a → b
	  B. ~b → a
	  C. ~b → ~a
	  D. b → ~a

G.1a	If two angles are supplementary, then the sum of their measures is 180, is a conditional, then if two angles are not supplementary, then the sum of their measures is not 180 is the
	
	  A. converse
	  B. inverse
	  C. contrapositive
	  D. biconditional

G.1a	State the converse of the following conditional: If the calculator is not working, then the batteries must be dead.
G.1b	Directions: Write the selected symbolic representation in the correct box. p: ΔABC is a right triangle q: ΔRST is an obtuse triangle Select one of the following to represent the symbolic representation for each argument. | p → q	q → p	p ∧ q	p ∨ q	p ↔ q	∴p → q	∴p ∨ q | ΔABC is a right triangle, if and only if ΔRST is an obtuse triangle. ☐ Therefore ΔABC is a right triangle or ΔRST is an obtuse triangle. ☐ If ΔRST is an obtuse triangle, then ΔABC is a right triangle. ☐ ΔABC is a right triangle and ΔRST is an obtuse triangle. ☐

G.1c	Directions: Shade the appropriate region on the Venn diagram.
	A group of students were polled on the type of gaming systems they most like to play. The Venn diagram shows the results of this poll. Shade the region that represents students that like to play Xbox 360 and PlayStation, but not Wii.
G.1d	Which of the following is a valid argument using laws of deductive reasoning? A. If the road conditions are icy, then they are hazardous. The road conditions are hazardous. Therefore, the road is icy. B. If two angles are vertical angles, then they are congruent. If two angles are congruent, then they have the same measure. If two angles are vertical angles, then they have the same measure. C. If today is Friday, then tomorrow is Saturday. If tomorrow is Saturday, then I don't have to go to school. If tomorrow is Saturday, then I will go to the park. D. All athletes must have a physical. Ralph had a physical. Ralph is an athlete.
G.2	The student will use the relationships between angles formed by two lines cut by a transversal to a) determine whether two lines are parallel; b) verify the parallelism, using algebraic and coordinate methods as well as deductive proofs; and c) solve real-world problems involving angles formed when parallel lines are cut by a transversal.
G.2a	What measure of ∠ABC will prove that $\overleftrightarrow{BC}$ is parallel to $\overleftrightarrow{DE}$? A. 8° B. 33° C. 69° D. 111°

G.2b	Directions: Write the reasons for the proof in the appropriate box.

Given: Lines *r* and *s* with transversal *t*
∠3 ≅ ∠1
Prove: *r* ∥ *s*
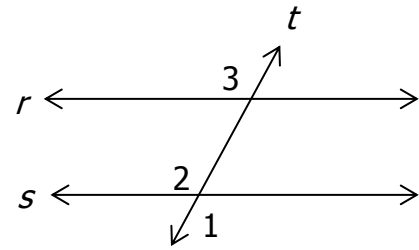
Statements	Reasons
1. Lines *r* and *s* with transversal t ∠3 ≅ ∠1	1. Given
2. ∠1 ≅ ∠2	2.
3. ∠3 ≅ ∠2	3.
4. *r* ∥ *s*	4.

Fill in the reasons for the proof using the following theorems, definitions, postulates or properties of algebra.

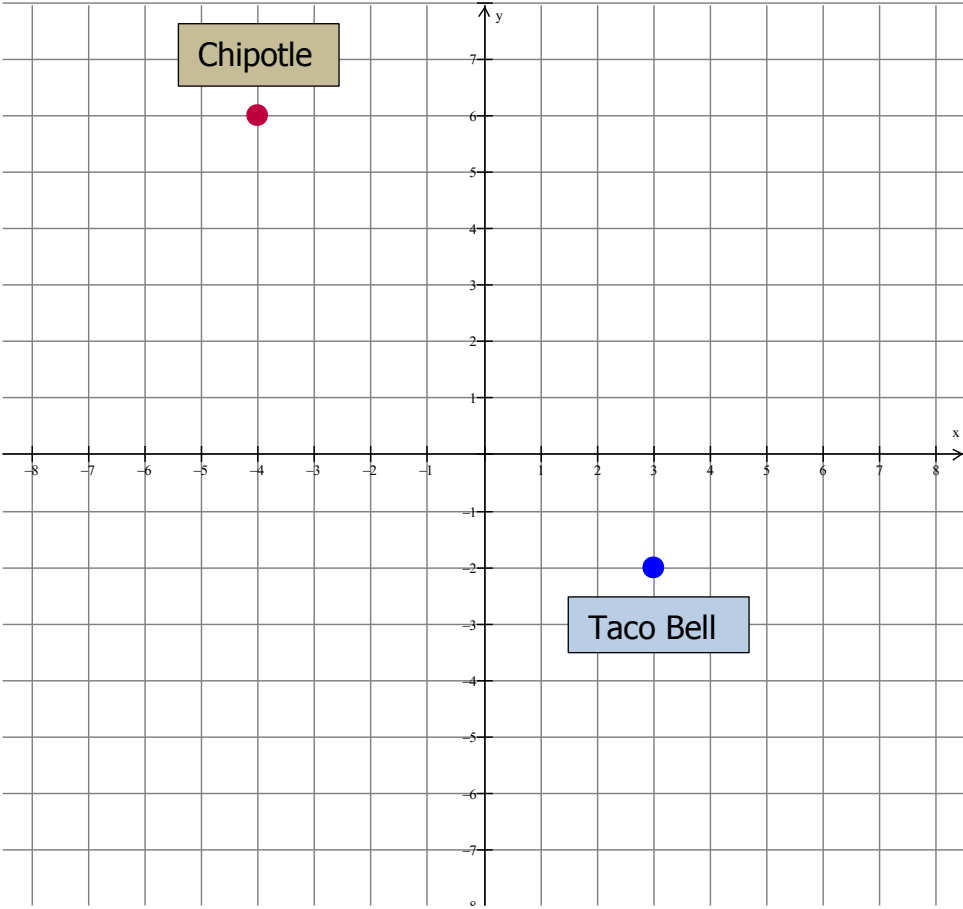| |
|---|
| If two lines are intersected by a transversal so that each pair of alternate interior angles is congruent, then the lines are parallel. |
| Transitive Property |
| Definition of congruent angles |
| Vertical angles are congruent |
| Reflexive Property |
| If two lines are intersected by a transversal so that each pair of corresponding angles is congruent, then the lines are parallel. |

G.2c	Directions: Write your answer in the box.
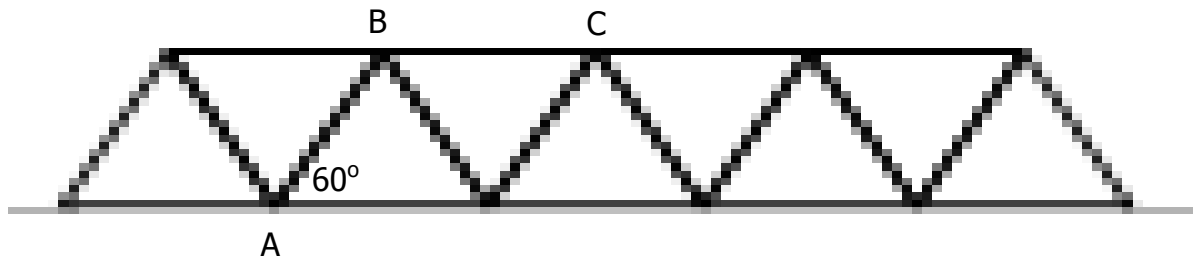
The illustration above pictures a bridge. What must be m∠ABC to insure the top of the bridge is parallel to the bottom of the bridge?

G.3	The student will use pictorial representations, including computer software, constructions and coordinate methods, to solve problems involving symmetry and transformation. This will include
	a) investigating and using formulas for finding distance, midpoint, and slope;
	b) applying slope to verify and determine whether lines are parallel or perpendicular;
	c) investigating symmetry and determining whether a figure is symmetric with respect to a line or a point; and
	d) determining whether a figure has been translated, reflected, rotated, or dilated, using coordinate methods.

G.3a	Chipotle and Taco Bell have been given the coordinates below in the graph. How far is Chipotle from Taco Bell?

A. $\sqrt{15}$ B. $\sqrt{113}$ C. 15   D. 113

G.3a	Directions: Write your answer in the box.
	The coordinate of the endpoint of one diagonal of a square is (-4, 9) and the coordinate of the midpoint of the diagonal is (2, -5). What is the coordinate of the other endpoint of the diagonal?
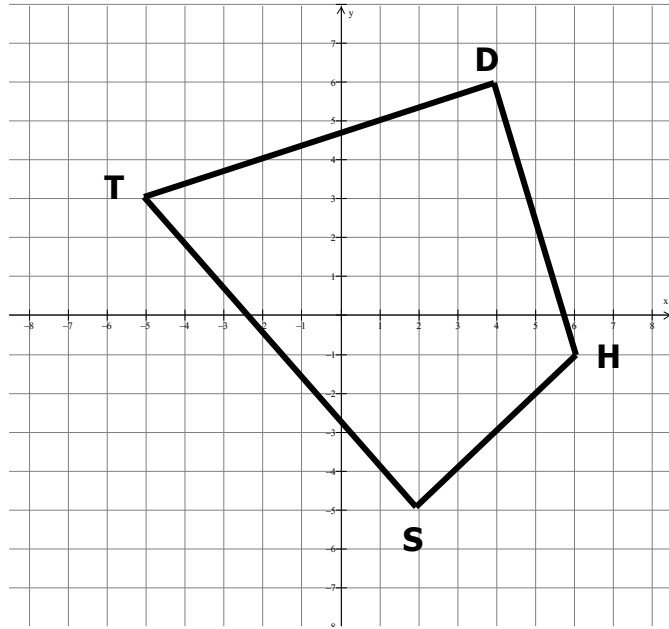
G.3a
Quadrilateral TDHS is shown on the graph. What is the slope of diagonal SD?
A. $\frac{2}{11}$ B. $-\frac{11}{2}$ C. $-\frac{2}{11}$ D. $\frac{11}{2}$
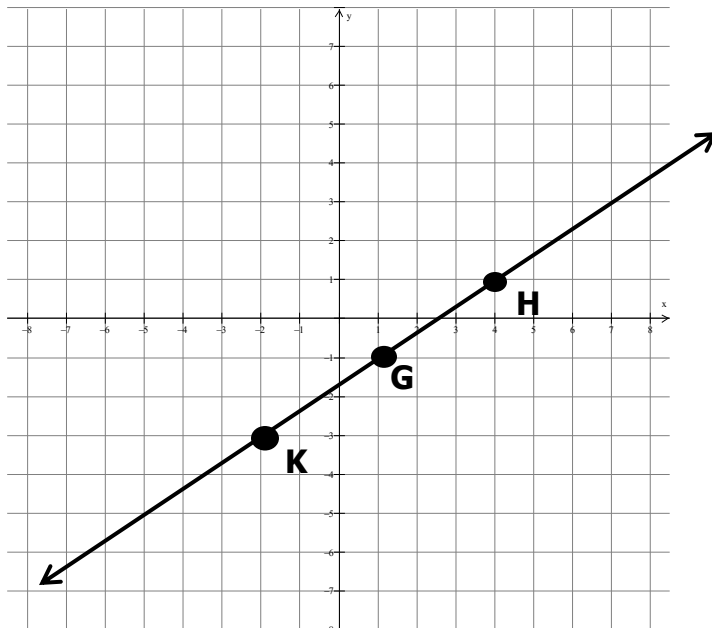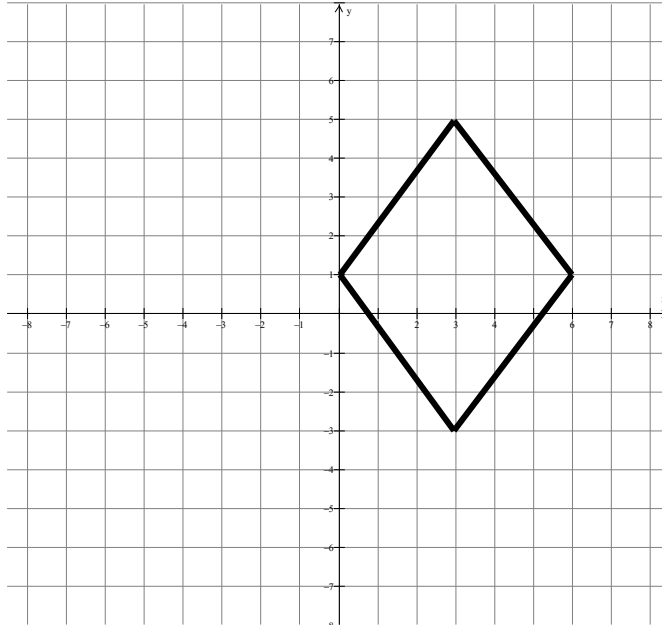| G.3b	Directions: Write your answer in the box.
	Line a has the equation $y = 7x - 12$. Line b has the equation $2x + 14y = 28$. Determine whether lines a and b are parallel, perpendicular or neither.
G.3b	Directions: Place a point on the grid to plot the point you want to select.
Plot a point T such that $\overleftrightarrow{GT}$ is perpendicular to $\overleftrightarrow{KH}$. |

G.3c	**Directions:** Circle all lines of symmetry. You must choose all correct answers.

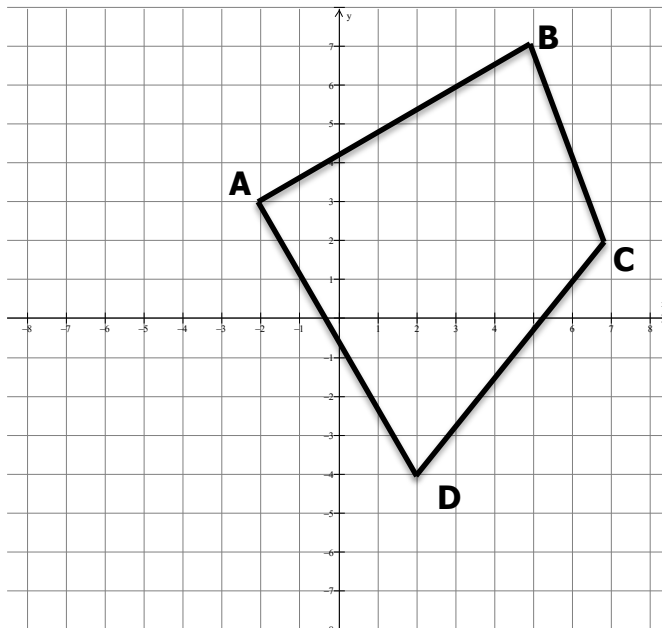Circle all equations that could be a line of symmetry for the above figure.

y = x   y = 1   y = 3   x = 1   y = -x   x = 3

Directions: Write your answer in the box.

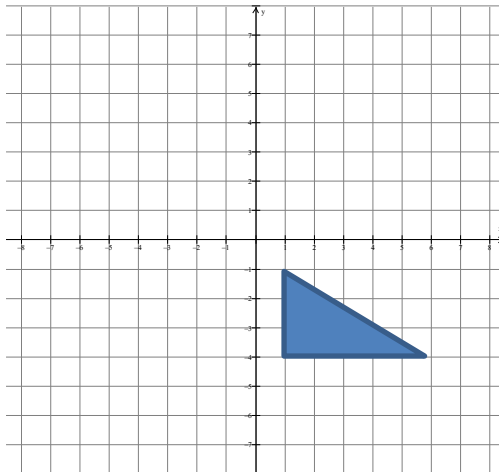Does the following letter have point symmetry, line symmetry, point and line symmetry or no symmetry?

W

G.3d	

If quadrilateral ABCD is reflected across the Y axis, what will be the coordinate of A' ?
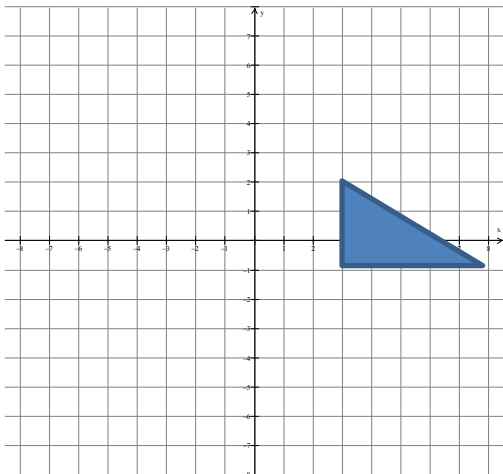
A. (-2, -4)   B. (-7, 2)   C. (2, 3)   D. (-5, 7)

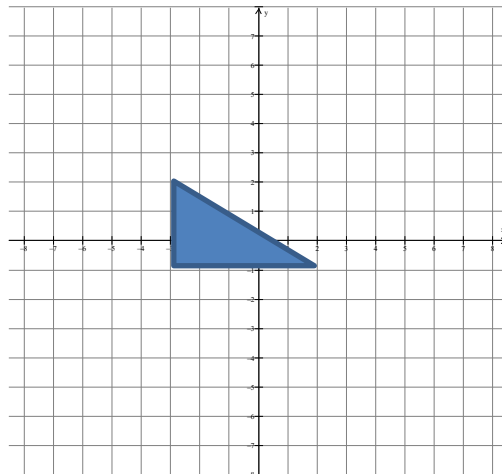|	
G.3d	Which of the following shows the Δ translated 3 units up and 4 units left?

A.

B.

C.

D.
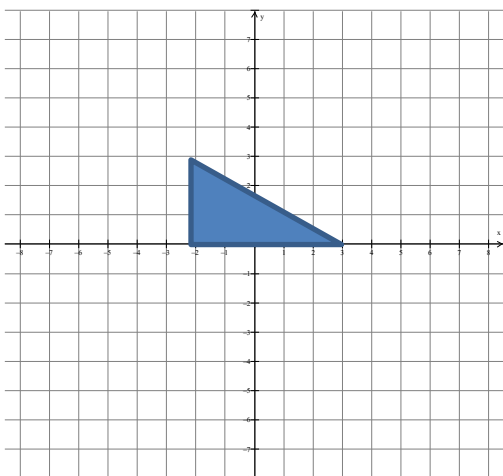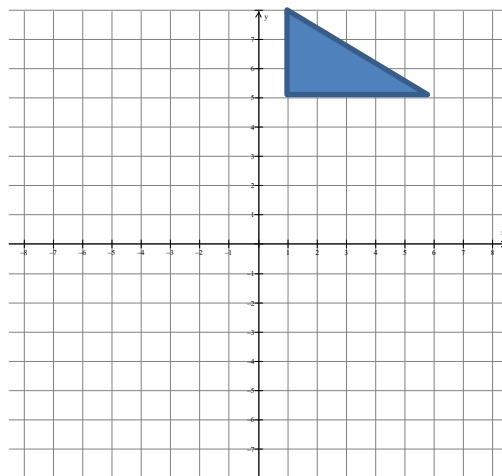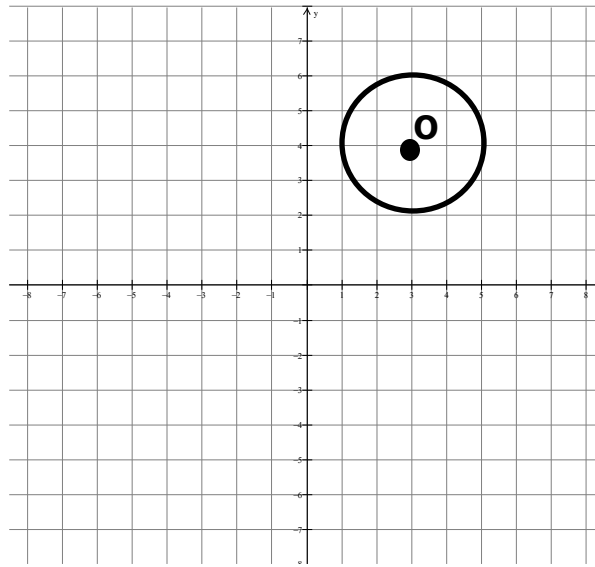
G.3d	What will be the coordinate of the center of circle O if it is rotated 270° counterclockwise about the origin?
	A. (-4, 3) B. (-3, -4) C. (4, -3) D. (3, 4)
G.3d	The dilation pictured is a(n)
	A. Reduction, scale factor = 2 B. Reduction, scale factor = $\frac{1}{2}$ C. Enlargement, scale factor = 2 D. Enlargement, scale factor = $\frac{1}{2}$
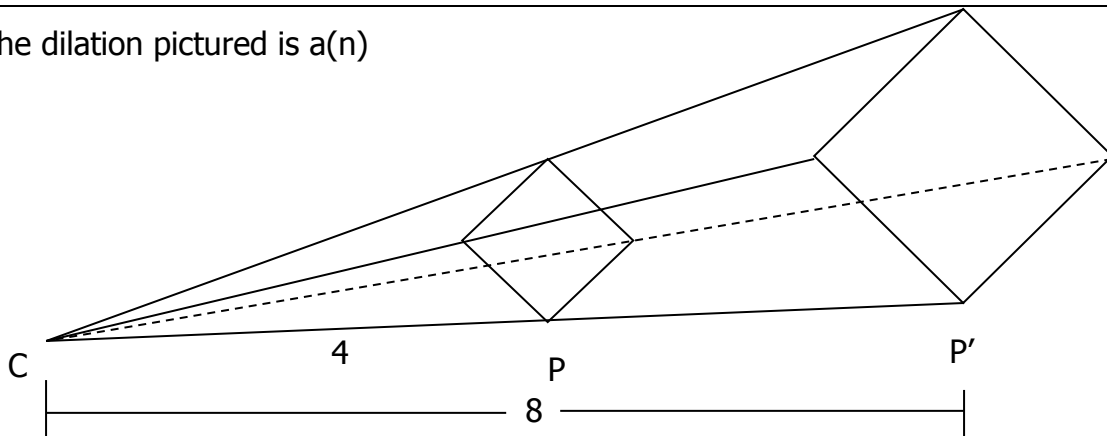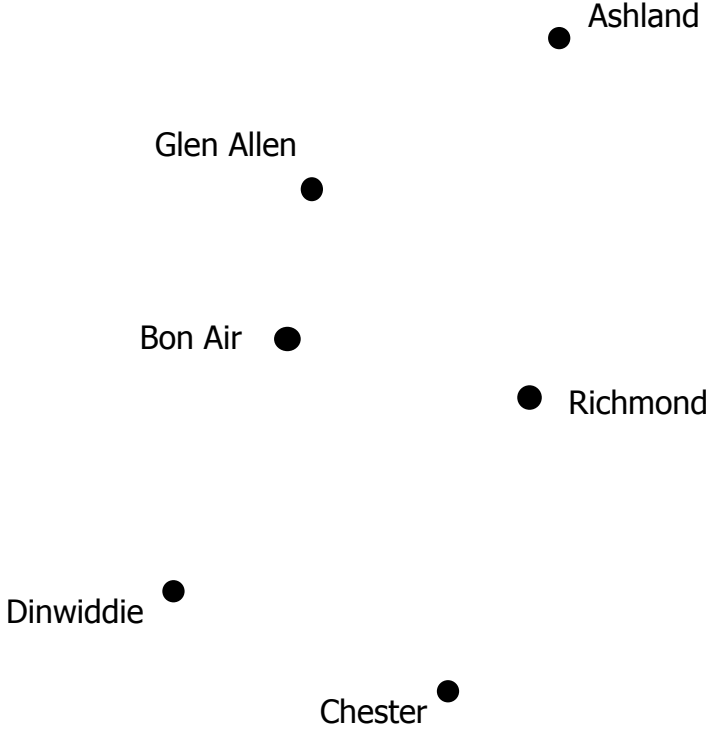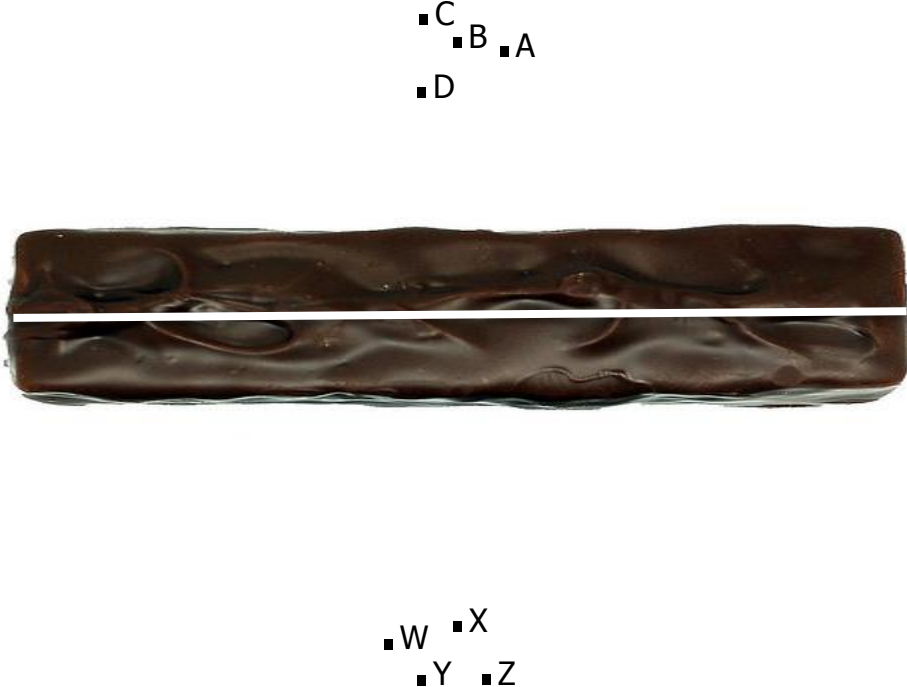
G.4	The student will construct and justify the constructions of
	     a) a line segment congruent to a given line segment;
	     b) the perpendicular bisector of a line segment;
	     c) a perpendicular to a given line from a point not on the line;
	     d) a perpendicular to a given line at a given point on the line;
	     e) the bisector of a given angle,
	     f) an angle congruent to a given angle; and
	     g) a line parallel to a given line through a point not on the given line.

G.4a	Which city is the same distance from Richmond as is Glen Allen from Richmond?
	● Ashland
	Glen Allen ●
	Bon Air ●
	● Richmond
	Dinwiddie ●
	Chester ●
	A. Ashland B. Bon Air C. Chester D. Dinwiddie
G.4b	Pictured below is a Snickers bar that you must divide evenly with your best friend. Through which segment will you make your cut with the knife?
	▪C ▪B ▪A ▪D
	▪W ▪X ▪Y ▪Z
	A. $\overline{AW}$ B. $\overline{BX}$ C. $\overline{CY}$ D. $\overline{DZ}$

G.4c	The baseball coach is laying out the infield and must locate third base using second base and the third base line as references. Knowing that second base and third base are on a perpendicular line, which point locates third base correctly?

2nd base

Home plate

.Q .S .R .P
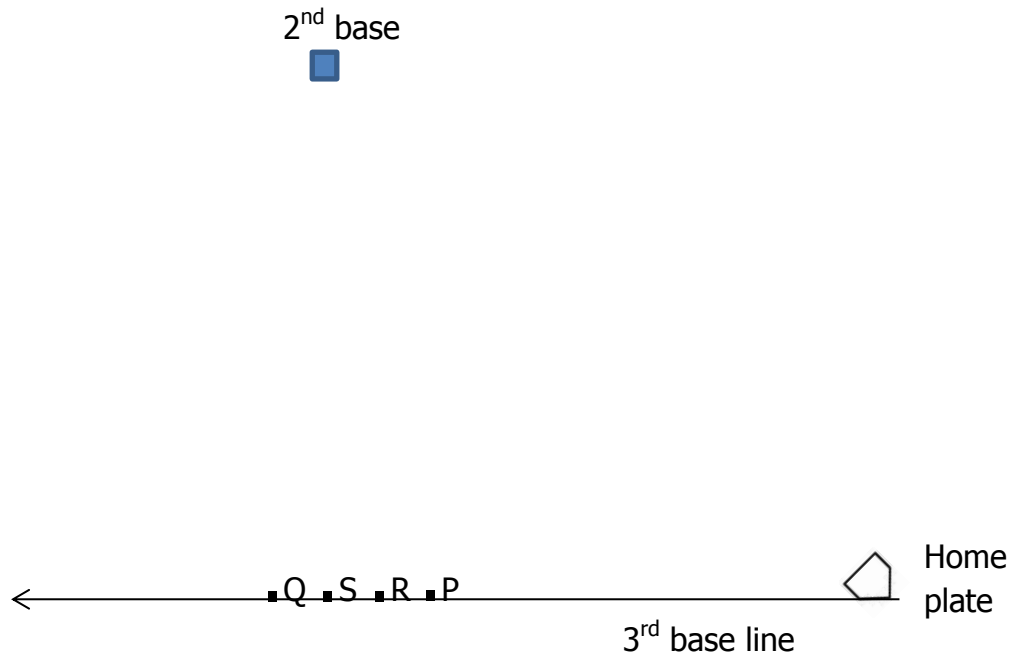
3rd base line |
| G.4d | Shamal has decided to cut the board into two pieces. To insure a straight cut Shamal wants to construct a perpendicular line to follow as he cuts. Which mark(s) would be the first step in Shamal's construction?

E

D   C

A

B
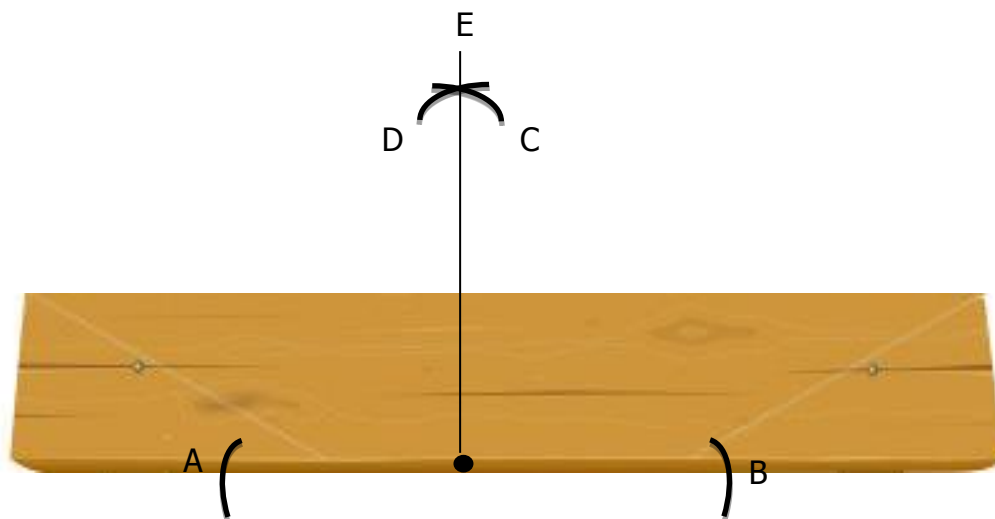
A.   D   B. A and B   C. E   D. C and D |

G.4e	One slice of pumpkin pie remains for you and your friend. What construction would you use to insure that each of you gets an equal slice of the pie?
	A. Construct an angle congruent to a given angle B. Construct a segment congruent to a given segment. C. Construct the perpendicular bisector of a segment D. Construct the bisector of an angle.
G.4f	The figure illustrates diagonal parking lines being painted in front of a store. Which segment will make the next line painted parallel to the two painted lines? A. AB B. AC C. AD D. AE
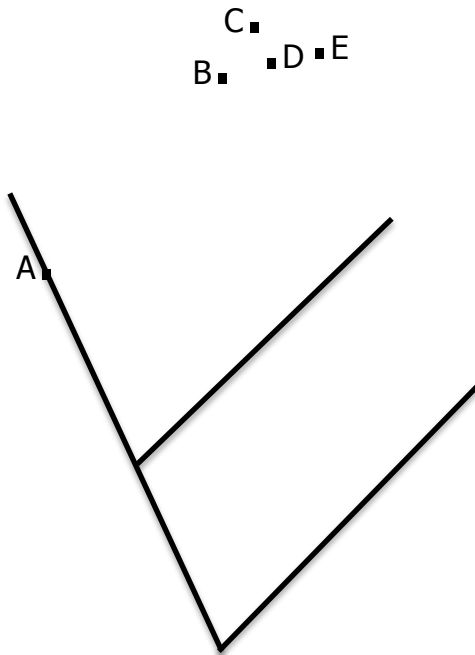
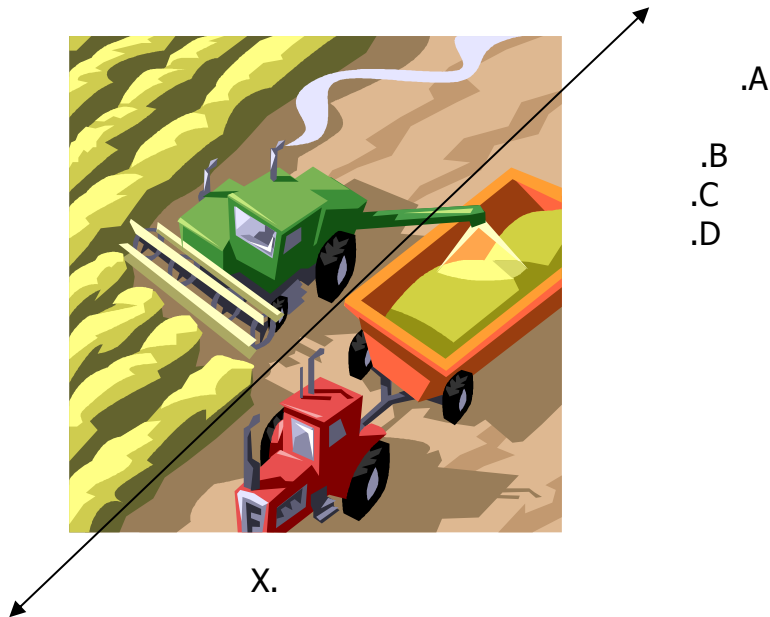|	
G.4g	In order to keep the tractor on a parallel line to the combine, which point must lie on the line with X? .A .B .C .D X.

G.5	The student, given information concerning the lengths of sides and/or measures of angles in triangles, will
	     a) order the sides by length, given the angle measures;
	     b) order the angles by degree measure, given the side lengths;
	     c) determine whether a triangle exists; and
	     d) determine the range in which the length of the third side must lie.
	 These concepts will be considered in the context of real-world situations.

G.5a	3 cows are standing in a field. Which answer choice states the distance between each cow from least to greatest? O C $42°$ $82°$ W A. OW, CO, CW B. OW, CW, CO C. CO, CW, OW D. CW, CO, OW
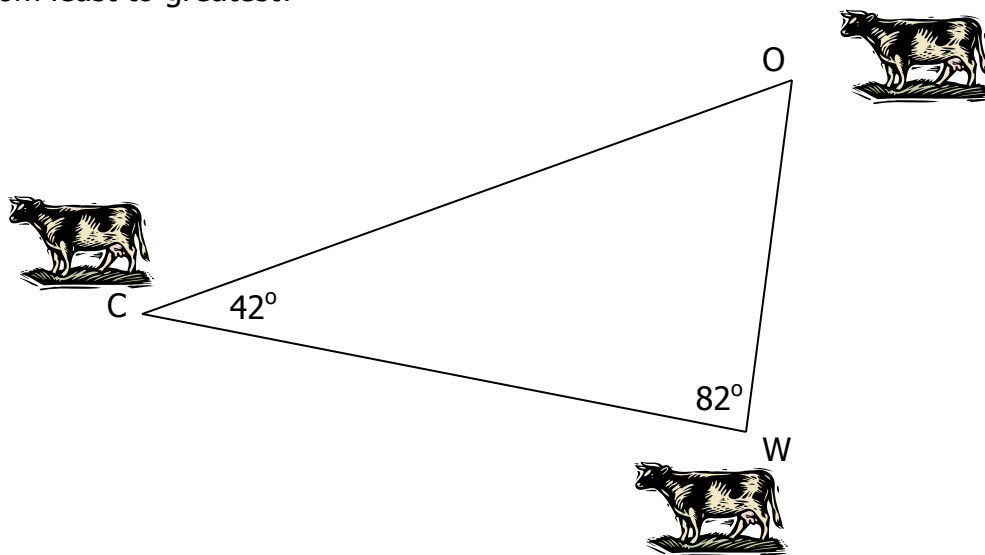
G.5b	Pocahontas State Park, Ironbridge Park and Point of Rocks Park form a triangle. Given the information in the diagram, which of the following statements is true?

Point of Rocks

12 miles

9 miles

Ironbridge

4 miles

Pocahontas

A. The smallest angle is at Ironbridge Park
B. The largest angle is at Pocahontas State Park
C. The smallest angle is at Pocahontas State Park
D. The largest angle is at Point of Rocks Park

G.5c	Directions: Circle all possible lengths that form a triangle. You must choose all answers.

Circle all possible side lengths that could form a triangle.

8, 15, 6	9, 21, 29	24, 15, 33
15, 17, 35	19, 9, 13	3, 7, 10

G.5d	Directions: Circle all possible distances. You must choose all correct answers.

Bus C is 8 miles from bus B. Bus C is 23 miles from bus A. Circle all possible distances from bus B to bus A.

A

B

C

14 miles	23 miles	9 miles	30 miles
27 miles	18 miles	8 miles	25 miles

G.6	The student, given information in the form of a figure or statement, will prove two triangles are congruent, using algebraic and coordinate methods as well as deductive proofs.
G.6	Directions: Write the reasons and/or statements for the proof in the appropriate box.

Given: $\overline{AC} \perp \overline{BD}$, $\overline{AD} \perp \overline{CE}$, $\overline{CE} \cong \overline{DB}$

Prove: $\overline{AB} \cong \overline{AE}$

A

B

E

C

D
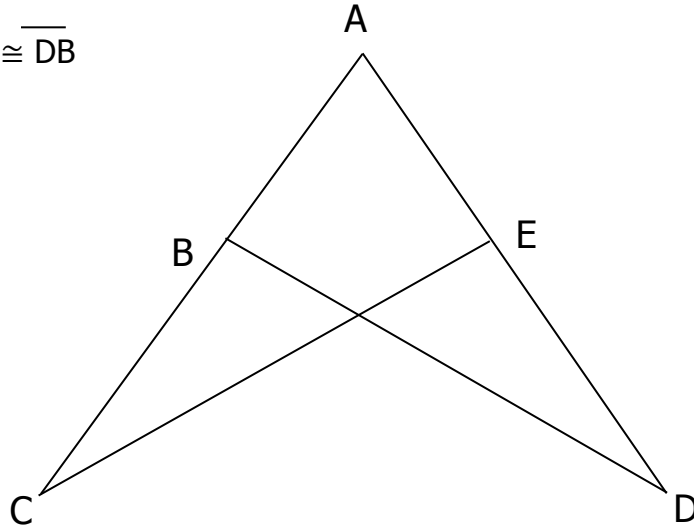
Statements	Reasons
1. AC ⊥ BD, AD ⊥ CD, $\overline{CE} \cong \overline{DB}$	1. Given
2. ∠ABD and ∠AEC are right angles	2.
3.	3. All right angles are ≅
4. ∠A ≅ ∠A	4.
5. ΔACE ≅ ΔADB	5.
6. $\overline{AB} \cong \overline{AE}$	6.

Angle-Angle-Side (AAS)	Def. of perpendicular lines.	∠ABD ≅ ∠AEC
Side-Side-Side (SSS)	Vertical angles are congruent.	Reflexive Property
Side-Angle-Side (SAS)	Def. of ≅ triangles.	Def. of a right triangle.
Angle-Side-Angle (ASA)	Corresponding parts of congruent triangles are congruent.	
Hypotenuse-Leg (HL)	or Definition of congruent triangles	

G.6	Directions: Write the reasons for the proof in the appropriate box.

Given: $\overline{BD} \perp \overline{AC}$, $\overline{BD}$ bisects $\overline{AC}$

Prove: Δ ABD ≅ Δ CBD

A

D   B

C
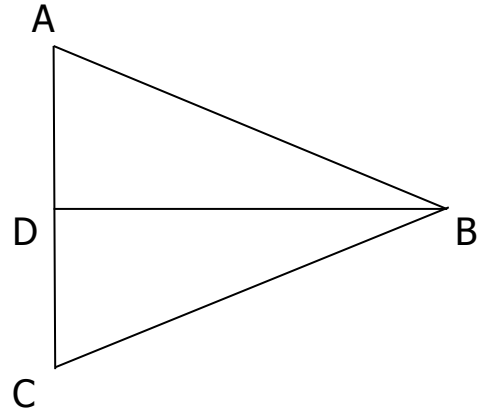
Statements	Reasons
1. $\overline{BD} \perp \overline{AC}$, $\overline{BD}$ bisects $\overline{AC}$	1. Given
2. D is the midpoint of $\overline{AC}$.	2.
3. $\overline{AD} \cong \overline{CD}$	3.
4. ∠ADB & ∠CDB are right angles.	4. Definition of ⊥ lines
5. ∠ADB ≅ ∠CDB	5.
6. $\overline{BD} \cong \overline{BD}$	6. Reflexive Property
7. Δ ABD ≅ ΔCBD	7.

Side-Angle-Side(SAS)	Def. of an angle bisector.	Def. of a congruent triangles.
Angle-Side-Angle(ASA)	Def. of a segment bisector.	Hypotenuse-Leg (HL)
Angle-Angle-Side(AAS)	Def. of a midpoint.	Def. of congruent angles.
Side-Side-Side(SSS)	Vertical angles are congruent.	All right angles are congruent.

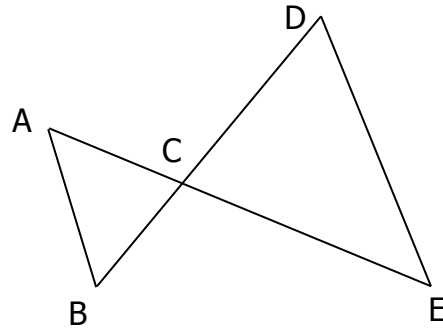| G.7	The student, given information in the form of a figure or statement, will prove two triangles are similar, using algebraic and coordinate methods as well as deductive proofs.

| G.7 | Directions: Write the reasons for the proof in the appropriate box. |

Given: AB ‖ DE

Prove: ΔBCA ∼ ΔDCE

Statements	Reasons
1. $\overline{AB}$ ‖ $\overline{DE}$	1
2. ∠ABC ≅ ∠EDC	2.
3. ∠ACB ≅ ∠ECD	3.
4. ΔBCA ≅ ΔDCE	4.

Side-Side-Side(SSS)	If two parallel lines are intersected by a transversal, then each pair of corresponding angles is congruent.
Given	All right angles are congruent.
Side-Angle-Side(SAS)	If two parallel lines are intersected by a transversal, then each pair of alternate interior angles is congruent.
Angle-Angle(AA)	Vertical angles are congruent.

| G.7 | Directions: Write the similarity statement and justification in the box. |

Are the triangles similar? If so, state the similarity statement and the postulate or theorem used that justifies your answer.
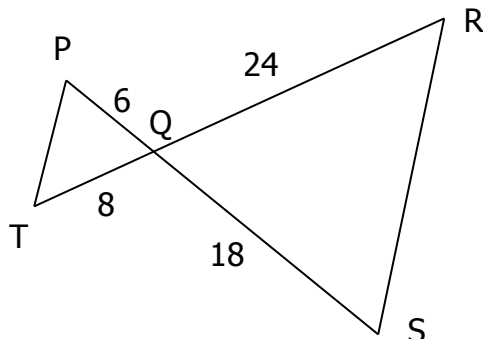
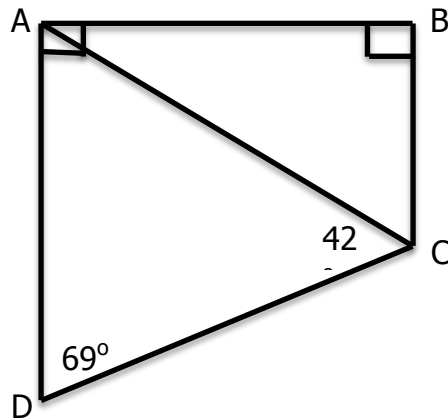| **Similarity Statement** |
|---|
| |

Postulate or Theorem

G.8	The student will solve real-world problems involving right triangles by using the Pythagorean Theorem and its converse, properties of special right triangles, and right triangle trigonometry.
G.8	 sidewalk 15 feet sidewalk 20 feet Joe Bean regularly takes a short-cut across Mr. Wilson's lawn instead of walking on the sidewalk on his way home from school. How much distance is saved by Joe cutting across the lawn? A. 5 feet B. 10 feet C. 15 feet D. 25 feet
G.8	Directions: Write your answer in the box. x 35º 30º 100 ft To the nearest tenth, find the length of the tower on top of the building (x).
G.9	The student will verify characteristics of quadrilaterals and use properties of quadrilaterals to solve real-world problems.

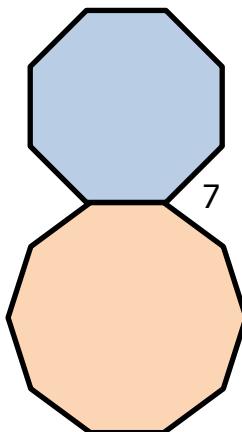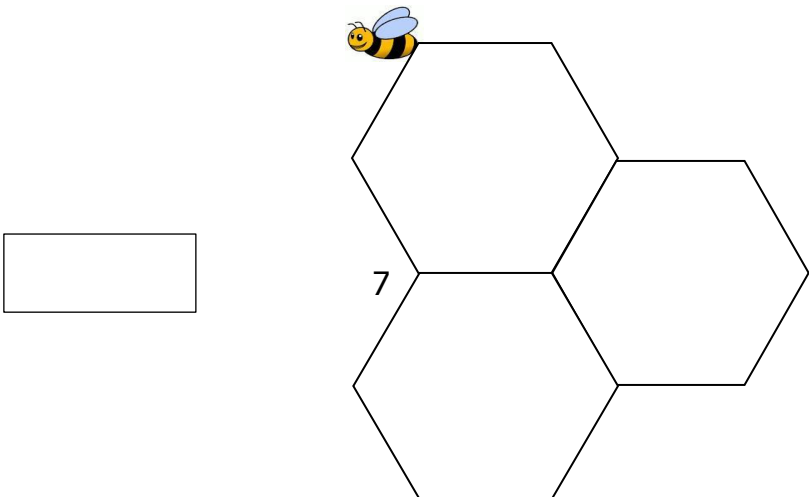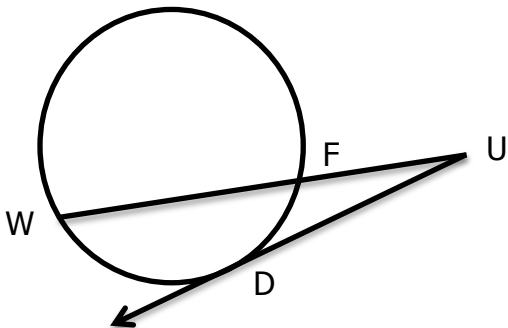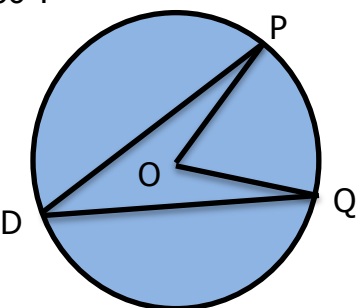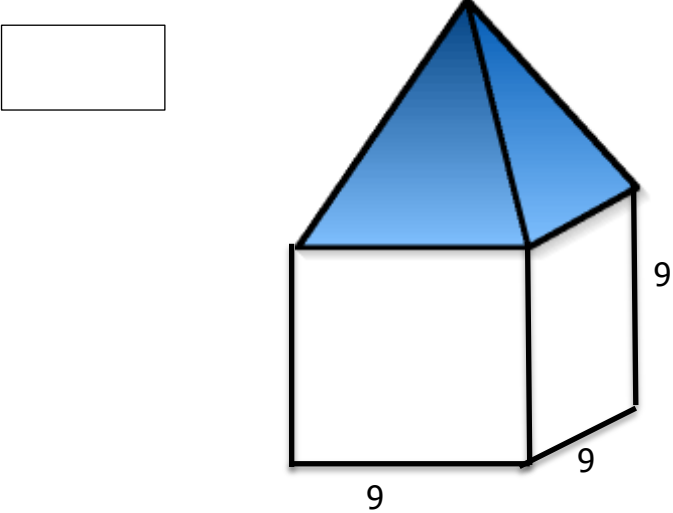| G.9	Directions: Write your answer in the box.
	Find the m∠BAC. [ ] A · · · B 42 C 69° D
G.9	In the rhombus, AC = 24 and BD = 32. Find the perimeter of the rhombus. A · · · B D · · · C A. 20 B. 80 C. 96 C. 128
G.10	The student will solve real-world problems involving angles of polygons.
G.10	Find m∠7. Both polygons are regular polygons. 7 A. 144 B. 135 C. 90 D. 81
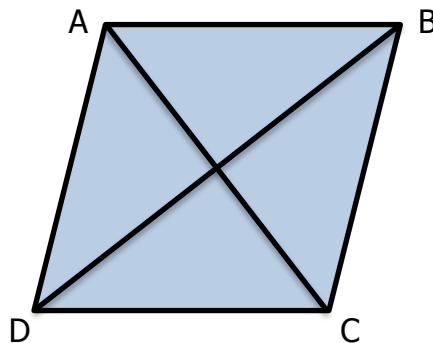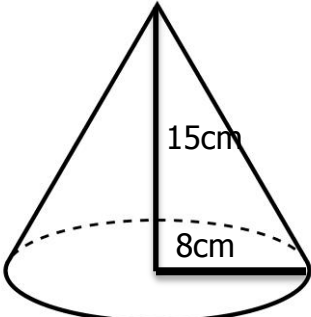
G.10	Directions: Write your answer in the box.
	The diagram below shows part of a honeycomb in a beehive. Find m∠7. 7

G.11	The student will use angles, arcs, chords, tangents, and secants to
	    a) investigate, verify, and apply properties of circles;
	    b) solve real-world problems involving properties of circles; and
	    c) find arc lengths and areas of sectors in circles.

G.11a	UD is a tangent ray. If UD = 15 and UF = 9, find WF. F U W D A. 6 B. 16 C. 25 D. 90
G.11b	A new brand of clothing wants to use the logo below on their clothes. What must be m∠PDQ if m∠POQ = 66º? P O D Q A. 132º B. 66º C. 33º D. 16.5º

G.11c	The light from the lighthouse makes a 12° angle. If the light can be seen for 3 miles, what is the area covered by the light? A. $\frac{3}{10} \pi \text{mi}^2$ B. $\frac{10}{3} \pi \text{mi}^2$ C. $9\pi \text{mi}^2$ D. $108\pi \text{mi}^2$
G.12	The student, given the coordinates of the center of a circle and a point on the circle, will write the equation of the circle.
G.12	Carolyn is going to make a crop circle in a cornfield to be viewed from a hot air balloon. She has mapped out a coordinate plane in the cornfield and designated (-6, 2) as the center of her circle and (3, -38) as one point on her circle. What will be the equation of Carolyn's crop circle? A. $(x - 3)^2 + (y + 38)^2 = 1681$ B. $(x + 6)^2 + (y - 2)^2 = 1681$ C. $(x - 6)^2 + (y + 2)^2 = 1681$ D. $(x + 6)^2 + (y - 2)^2 = 41$
G.12	Directions: Circle all possible points on the circle. You must choose all answers. A circle has a center with coordinate (-2, -4) and the point (4, -4) lies on the circle. Circle all points that lie on the circle. (-2, 2) (-8, -4) (0, 0) (1, -1) (-2, -10) (4, 0)

G.13	The student will use formulas for surface area and volume of three-dimensional objects to solve real-world problems.
G.13	Directions: Write your answer in the box.
	The volume of the solid pictured below is 999. What is the height of the pyramid?

9

9

9

G.13	Calculate the surface area of the cone.

15cm

8cm

A. $64\pi cm^2$ B. $136\pi cm^2$ C. $184\pi cm^2$ D. $200\pi cm^2$

G.14	The student will use similar geometric objects in two- or three-dimensions to
	    a) compare ratios between side lengths, perimeters, areas, and volumes;
	    b) determine how changes in one or more dimensions of an object affect area and/or volume of the object;
	    c) determine how changes in area and/or volume of an object affect one or more dimensions of the object; and
	    d) solve real-world problems about similar geometric objects.

G.14a	The ratio of the edges of two cubes is 3:5. If the surface area of the smaller cube is 216, what is the surface area of the larger cube? A. 100 B. 200 C. 400 D. 600

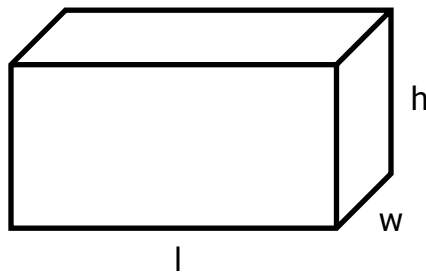|	
G.14b	If the radius of the cylinder is tripled, what will be the resulting effect on the volume of the cylinder? A. 3 times as much B. 6 times as much C. 8 times as much D. 9 times as much
G.14c	Directions: Circle the statements that are true. You must choose all correct answers. For the volume of the rectangular solid to double, which of the following must happen? Circle all of the following statements that are true.
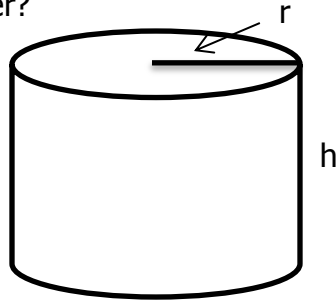
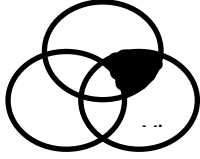| The length must be doubled.	The width and height must be doubled.
The length and width must be doubled.	The length or the width or the height must be doubled.
The length and height must be doubled.	The length and the width and the height must be doubled.
The width must be doubled.	The length must be doubled.

G.14d	Directions: Write your answer in the box. Shown below are a baseball, whose radius is 1.5 inches and a women's basketball, whose radius is 4.5 inches. What is the ratio of the surface area of the baseball to the surface area of the basketball?

Solutions

G.1a	D		G.4a	Chester
G.1a	B		G.4b	B
G.1a	If the batteries are dead, then the calculator is not working.		G.4c	S
			G.4d	B
G.1b	p ↔ q ∴p ∨ q q → p p ∧ q		G.4e	D
G.1c			G.4f	C
			G.4g	B
G.1d	B			
G.2a	D		G.5a	B
G.2b	• Vertical angles are congruent • Transitive Property • If two lines are intersected by a transversal so that each pair of corresponding angles is congruent, then the lines are parallel.		G.5b	B
			G.5c	9, 21, 29 24, 15, 33 19, 9, 13
			G.5d	18, 23, 25, 27, 30
G.2c	120°			
G.3a	B		G.6	2. Definition of ⊥ lines 3. ∠ABD ≅ ∠AEC 4. Reflexive Property 5. Angle-Angle-Side (AAS) 6. Corresponding parts of congruent triangles are congruent. OR Definition of congruent triangles 2. Def. of a segment bisector 3. Def. of a midpoint 5. All right angles are congruent 7. Side-Angle-Side (SAS)
G.3a	(8, -19)			
G.3a	D			
G.3b	Perpendicular			
G.3b	(-5, 8),(-3, 5), (-1, 2), (3, -4), (5, -7)			
G.3c	y = 1 and x = 3			
G.3c	Line Symmetry			
G.3d	(2, 3)			
G.3d	B			
G.3d	C			
G.3d	C			

G.7	1. Given 2. If two parallel lines are intersected by a transversal, then each pair of alternate interior angles is congruent. 3. Vertical angles are congruent 4. Angle-Angle (AA) $\Delta PQT \sim \Delta SQR$, Side-Angle-Side (SAS)		G.11a	B
			G.11b	C
			G.11c	C
G.8	B 12.3 feet		G.12	B (-2, 2), (-8,-4), (-2, -10)
G.9	21° B		G.13	10 D
G.10	D 120°		G.14a	600
			G.14b	D
			G.14c	The length must be doubled. The width must be doubled. The length must be doubled. The length or the width or the height must be doubled.
			G.14d	$\dfrac{1}{9}$