

## DEPTH OF KNOWLEDGE EXAMPLE ITEMS

Example items that represent the applicable DOK levels across various Geometry content domains are provided on the following pages.

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### Example Item 1

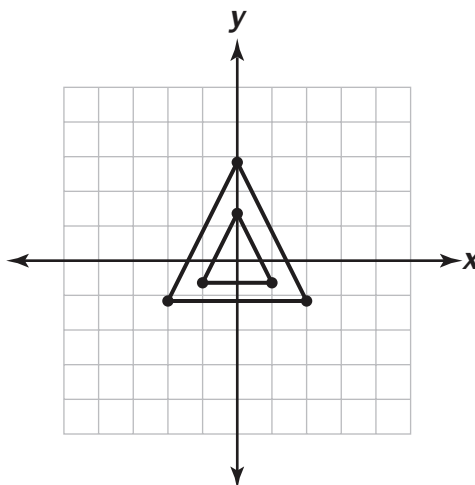
#### Selected-Response

**DOK Level 1:** This is a DOK Level 1 item because it requires the student to demonstrate an understanding of dilations and determining the scale factor.

**Geometry Content Domain:** Congruence and Similarity

**Standard:** MGSE9-12.G.SRT.1b. The dilation of a line segment is longer or shorter according to the ratio given by the scale factor.

**The smaller triangle is transformed to create the larger triangle. Which of these is the scale factor of the dilation centered at the point (0, 0)?**



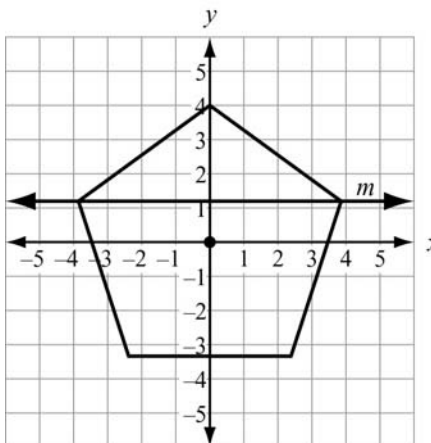
- A. 4
- B. 2
- C. 1
- D.  $\frac{1}{2}$

**Correct Answer:** B

**Explanation of Correct Answer:** The correct answer is choice (B). Since the length of each segment has doubled, the scale factor is 2, choice (B).  $\overline{AB}$  increases to a length of 4, but the scale factor is found by determining what the length is multiplied by, so choice (A) is incorrect. Choice (C) is incorrect since a scale factor of 1 does not change the size of the pre-image. Choice (D) is incorrect because it represents the scale factor when the pre-image and image are reversed.

**SAMPLE ITEMS**

1. A regular pentagon is centered about the origin and has a vertex at  $(0, 4)$ .

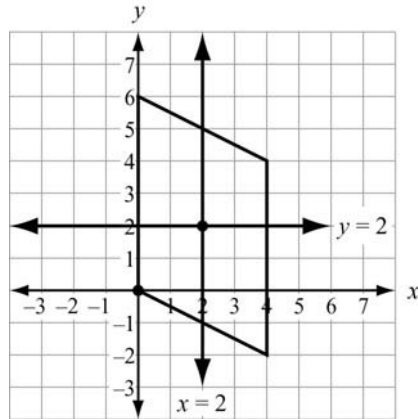


Which transformation maps the pentagon to itself?

- A. a reflection across line  $m$
- B. a reflection across the  $x$ -axis
- C. a clockwise rotation of  $100^\circ$  about the origin
- D. a clockwise rotation of  $144^\circ$  about the origin

**Correct Answer:** D

2. A parallelogram has vertices at  $(0, 0)$ ,  $(0, 6)$ ,  $(4, 4)$ , and  $(4, -2)$ .

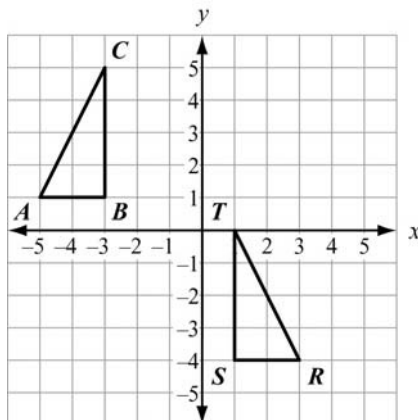


Which transformation maps the parallelogram to itself?

- A. a reflection across the line  $x = 2$
- B. a reflection across the line  $y = 2$
- C. a rotation of  $180^\circ$  about the point  $(2, 2)$
- D. a rotation of  $180^\circ$  about the point  $(0, 0)$

Correct Answer: C

3. Which sequence of transformations maps  $\triangle ABC$  to  $\triangle RST$ ?

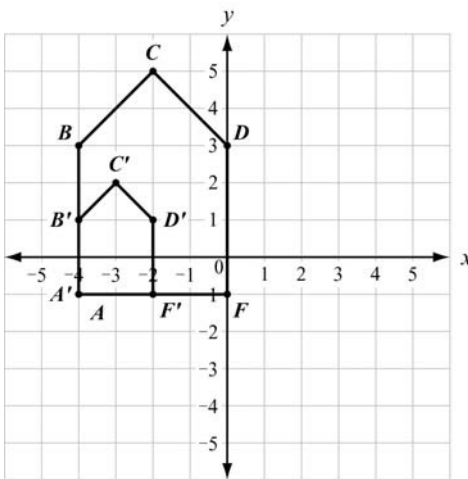


- A. Reflect  $\triangle ABC$  across the line  $x = -1$ . Then translate the result 1 unit down.
- B. Reflect  $\triangle ABC$  across the line  $x = -1$ . Then translate the result 5 units down.
- C. Translate  $\triangle ABC$  6 units to the right. Then rotate the result  $90^\circ$  clockwise about the point  $(1, 1)$ .
- D. Translate  $\triangle ABC$  6 units to the right. Then rotate the result  $90^\circ$  counterclockwise about the point  $(1, 1)$ .

Correct Answer: B

## SAMPLE ITEMS

1. Figure  $A'B'C'D'F'$  is a dilation of figure  $ABCDF$  by a scale factor of  $\frac{1}{2}$ . The dilation is centered at  $(-4, -1)$ .



Which statement is true?

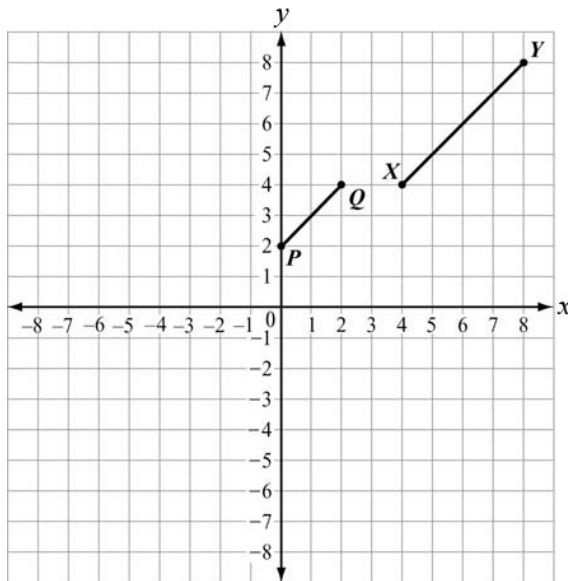
- A.  $\frac{AB}{A'B'} = \frac{B'C'}{BC}$
- B.  $\frac{AB}{A'B'} = \frac{BC}{B'C'}$
- C.  $\frac{AB}{A'B'} = \frac{BC}{D'F'}$
- D.  $\frac{AB}{A'B'} = \frac{D'F'}{BC}$

Correct Answer: B

2. Which transformation results in a figure that is similar to the original figure but has a greater area?
- A. a dilation of  $\triangle QRS$  by a scale factor of 0.25
- B. a dilation of  $\triangle QRS$  by a scale factor of 0.5
- C. a dilation of  $\triangle QRS$  by a scale factor of 1
- D. a dilation of  $\triangle QRS$  by a scale factor of 2

Correct Answer: D

3. In the coordinate plane, segment  $\overline{PQ}$  is the result of a dilation of segment  $\overline{XY}$  by a scale factor of  $\frac{1}{2}$ .



Which point is the center of dilation?

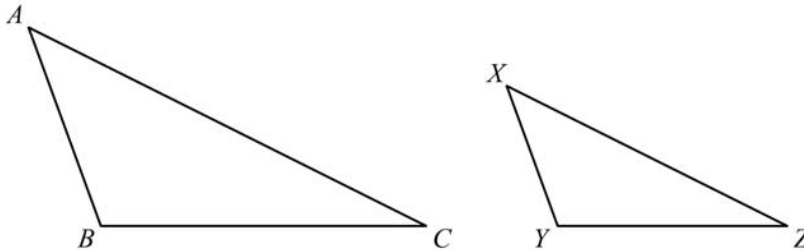
- A.  $(-4, 0)$
- B.  $(0, -4)$
- C.  $(0, 4)$
- D.  $(4, 0)$

**Correct Answer:** A

**Note:** Draw lines connecting corresponding points to determine the point of intersection (center of dilation).

## SAMPLE ITEMS

1. In the triangles shown,  $\triangle ABC$  is dilated by a factor of  $\frac{2}{3}$  to form  $\triangle XYZ$ .

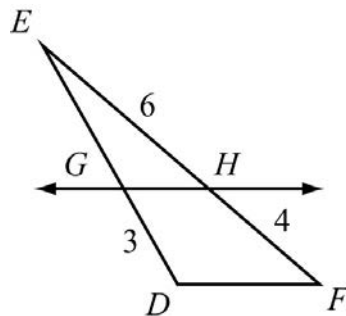


Given that  $m\angle A = 50^\circ$  and  $m\angle B = 100^\circ$ , what is  $m\angle Z$ ?

- A.  $15^\circ$
- B.  $25^\circ$
- C.  $30^\circ$
- D.  $50^\circ$

Correct Answer: C

2. In the triangle shown,  $\overline{GH} \parallel \overline{DF}$ .

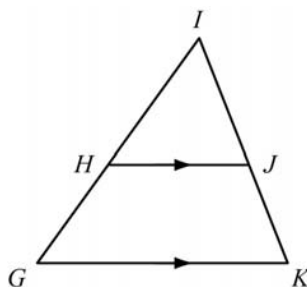


What is the length of  $\overline{GE}$ ?

- A. 2.0
- B. 4.5
- C. 7.5
- D. 8.0

Correct Answer: B

3. Use this triangle to answer the question.



This is a proof of the statement “If a line is parallel to one side of a triangle and intersects the other two sides at distinct points, then it separates these sides into segments of proportional lengths.”

Step	Statement	Justification
1	$\overline{GK}$ is parallel to $\overline{HJ}$ .	Given
2	$\angle HGK \cong \angle IHJ$ $\angle IKG \cong \angle IJH$	?
3	$\triangle GIK \sim \triangle HIJ$	AA Similarity
4	$\frac{IG}{IH} = \frac{IK}{IJ}$	Corresponding sides of similar triangles are proportional.
5	$\frac{HG + IH}{IH} = \frac{JK + IJ}{IJ}$	Segment Addition Postulate
6	$\frac{HG}{IH} = \frac{JK}{IJ}$	Subtraction Property of Equality

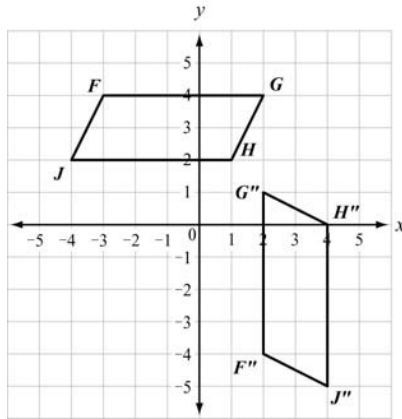
Which reason justifies Step 2?

- A. Alternate interior angles are congruent.
- B. Alternate exterior angles are congruent.
- C. Corresponding angles are congruent.
- D. Vertical angles are congruent.

Correct Answer: C

**SAMPLE ITEMS**

1. Parallelogram  $FGHJ$  was translated 3 units down to form parallelogram  $F'G'H'J'$ . Parallelogram  $F'G'H'J'$  was then rotated  $90^\circ$  counterclockwise about point  $G'$  to obtain parallelogram  $F''G''H''J''$ .

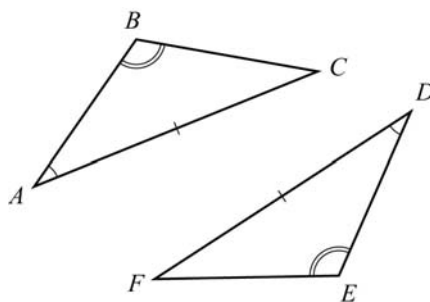


Which statement is true about parallelogram  $FGHJ$  and parallelogram  $F''G''H''J''$ ?

- A. The figures are both similar and congruent.
- B. The figures are neither similar nor congruent.
- C. The figures are similar but not congruent.
- D. The figures are congruent but not similar.

**Correct Answer:** A

2. Consider the triangles shown.



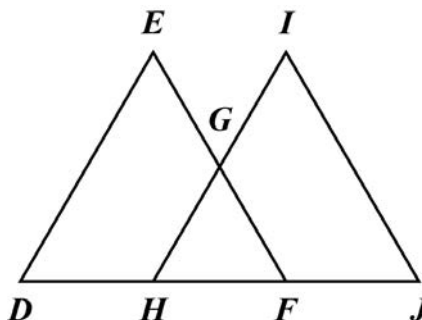
Which can be used to prove the triangles are congruent?

- A. SSS
- B. ASA
- C. SAS
- D. AAS

**Correct Answer:** D



3. In this diagram,  $\overline{DE} \cong \overline{JI}$  and  $\angle D \cong \angle J$ .



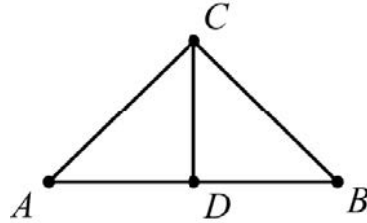
Which additional information is sufficient to prove that  $\triangle DEF$  is congruent to  $\triangle JIH$ ?

- A.  $\overline{ED} \cong \overline{IH}$
- B.  $\overline{DH} \cong \overline{JF}$
- C.  $\overline{HG} \cong \overline{GI}$
- D.  $\overline{HF} \cong \overline{JF}$

**Correct Answer: B**

## SAMPLE ITEMS

1. In this diagram,  $\overline{CD}$  is the perpendicular bisector of  $\overline{AB}$ . The two-column proof shows that  $\overline{AC}$  is congruent to  $\overline{BC}$ .



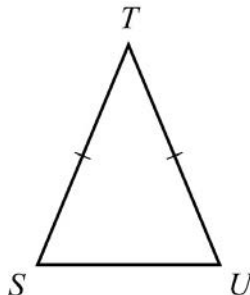
Step	Statement	Justification
1	$\overline{CD}$ is the perpendicular bisector of $\overline{AB}$ .	Given
2	$\overline{AD} \cong \overline{BD}$	Definition of bisector
3	$\overline{CD} \cong \overline{CD}$	Reflexive Property of Congruence
4	$\angle ADC$ and $\angle BDC$ are right angles.	Definition of perpendicular lines
5	$\angle ADC \cong \angle BDC$	All right angles are congruent.
6	$\triangle ADC \cong \triangle BDC$	_____ ? _____
7	$\overline{AC} \cong \overline{BC}$	CPCTC

Which of the following would justify Step 6?

- A. AAS
- B. ASA
- C. SAS
- D. SSS

Correct Answer: C

2. In this diagram,  $\triangle STU$  is an isosceles triangle where  $\overline{ST}$  is congruent to  $\overline{UT}$ . The paragraph proof shows that  $\angle S$  is congruent to  $\angle U$ .



It is given that  $\overline{ST}$  is congruent to  $\overline{UT}$ . Draw  $\overline{TV}$  such that V is on  $\overline{SU}$  and  $\overline{TV}$  bisects  $\angle T$ . By the definition of an angle bisector,  $\angle STV$  is congruent to  $\angle UTV$ . By the Reflexive Property of Congruence,  $\overline{TV}$  is congruent to  $\overline{TV}$ . Triangle  $STV$  is congruent to triangle  $UTV$  by SAS.  $\angle S$  is congruent to  $\angle U$  by \_\_\_\_\_ ?

Which step is missing in the proof?

- A. CPCTC
- B. Reflexive Property of Congruence
- C. Definition of right angles
- D. Angle Congruence Postulate

Correct Answer: A

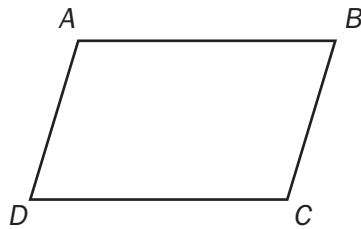
**SAMPLE ITEMS**

1. Which information is needed to show that a parallelogram is a rectangle?

- A. The diagonals bisect each other.
- B. The diagonals are congruent.
- C. The diagonals are congruent and perpendicular.
- D. The diagonals bisect each other and are perpendicular.

**Correct Answer:** B

2. Look at quadrilateral  $ABCD$ .

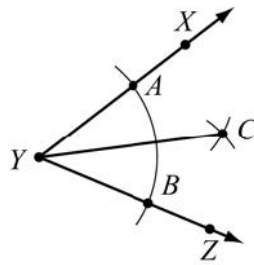


Which information is needed to show that quadrilateral  $ABCD$  is a parallelogram?

- A. Use the distance formula to show that diagonals  $AC$  and  $BD$  have the same length.
- B. Use the slope formula to show that segments  $AB$  and  $CD$  are perpendicular and segments  $AD$  and  $BC$  are perpendicular.
- C. Use the slope formula to show that segments  $AB$  and  $CD$  have the same slope and segments  $AD$  and  $BC$  have the same slope.
- D. Use the distance formula to show that segments  $AB$  and  $AD$  have the same length and segments  $CD$  and  $BC$  have the same length.

**Correct Answer:** C

3. Consider the construction of the angle bisector shown.



Which could have been the first step in creating this construction?

- A. Place the compass point on point  $A$  and draw an arc inside  $\angle Y$ .
- B. Place the compass point on point  $B$  and draw an arc inside  $\angle Y$ .
- C. Place the compass point on vertex  $Y$  and draw an arc that intersects  $\overline{YX}$  and  $\overline{YZ}$ .
- D. Place the compass point on vertex  $Y$  and draw an arc that intersects point  $C$ .

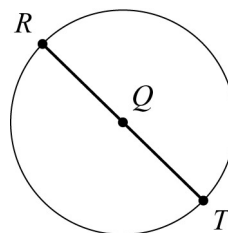
**Correct Answer:** C

4. Consider the beginning of a construction of a square inscribed in circle  $Q$ .

Step 1: Label point  $R$  on circle  $Q$ .

Step 2: Draw a diameter through  $R$  and  $Q$ .

Step 3: Label the point where the diameter intersects the circle as point  $T$ .



What is the next step in this construction?

- A. Draw radius  $\overline{SQ}$ .
- B. Label point  $S$  on circle  $Q$ .
- C. Construct a line segment parallel to  $\overline{RT}$ .
- D. Construct the perpendicular bisector of  $\overline{RT}$ .

**Correct Answer:** D

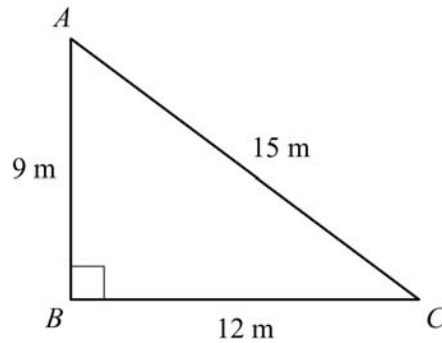
**SAMPLE ITEMS**

1. In right triangle  $ABC$ , angle  $A$  and angle  $B$  are complementary angles. The value of  $\cos A$  is  $\frac{5}{13}$ . What is the value of  $\sin B$ ?

- A.  $\frac{5}{13}$
- B.  $\frac{12}{13}$
- C.  $\frac{13}{12}$
- D.  $\frac{13}{5}$

**Correct Answer:** A

2. Triangle  $ABC$  is given below.



What is the value of  $\cos A$ ?

- A.  $\frac{3}{5}$
- B.  $\frac{3}{4}$
- C.  $\frac{4}{5}$
- D.  $\frac{5}{3}$

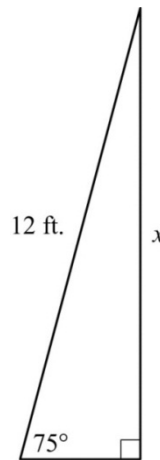
**Correct Answer:** A

3. In right triangle  $HJK$ ,  $\angle J$  is a right angle and  $\tan \angle H = 1$ . Which statement about triangle  $HJK$  must be true?

- A.  $\sin \angle H = \frac{1}{2}$
- B.  $\sin \angle H = 1$
- C.  $\sin \angle H = \cos \angle H$
- D.  $\sin \angle H = \frac{1}{\cos \angle H}$

**Correct Answer: C**

4. A 12-foot ladder is leaning against a building at a  $75^\circ$  angle with the ground.

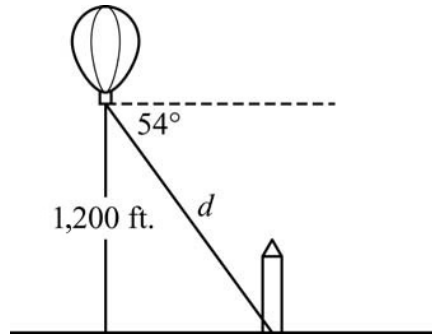


Which equation can be used to find how high the ladder reaches up the side of the building?

- A.  $\sin 75^\circ = \frac{12}{x}$
- B.  $\tan 75^\circ = \frac{12}{x}$
- C.  $\cos 75^\circ = \frac{x}{12}$
- D.  $\sin 75^\circ = \frac{x}{12}$

**Correct Answer: D**

5. A hot air balloon is 1,200 feet above the ground. The angle of depression from the basket of the hot air balloon to the base of a monument is  $54^\circ$ .



Which equation can be used to find the distance,  $d$ , in feet, from the basket of the hot air balloon to the base of the monument?

- A.  $\sin 54^\circ = \frac{d}{1200}$
- B.  $\sin 54^\circ = \frac{1200}{d}$
- C.  $\cos 54^\circ = \frac{d}{1200}$
- D.  $\cos 54^\circ = \frac{1200}{d}$

**Correct Answer:** B



## UNIT 4: CIRCLES AND VOLUME

This unit investigates the properties of circles and addresses finding the volume of solids. Properties of circles are used to solve problems involving arcs, angles, sectors, chords, tangents, and secants. Volume formulas are derived and used to calculate the volumes of cylinders, pyramids, cones, and spheres.

### Understand and Apply Theorems about Circles

**MGSE9-12.G.C.1** Understand that all circles are similar.

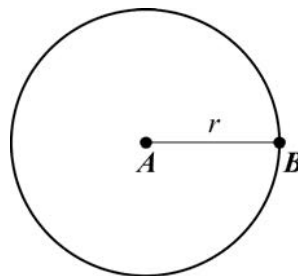
**MGSE9-12.G.C.2** Identify and describe relationships among inscribed angles, radii, chords, tangents, and secants. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.

**MGSE9-12.G.C.3** Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.

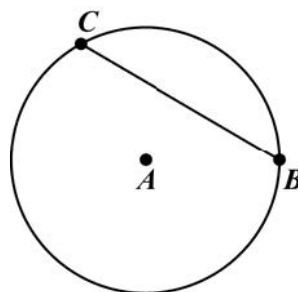
**MGSE9-12.G.C.4** Construct a tangent line from a point outside a given circle to the circle.

### KEY IDEAS

1. A **circle** is the set of points in a plane equidistant from a given point, which is the center of the circle. All circles are similar.
2. A **radius** is a line segment from the center of a circle to any point on the circle. The word radius is also used to describe the length,  $r$ , of the segment.  $\overline{AB}$  is a radius of circle  $A$ .



3. A **chord** is a line segment whose endpoints are on a circle.  $\overline{BC}$  is a chord of circle  $A$ .

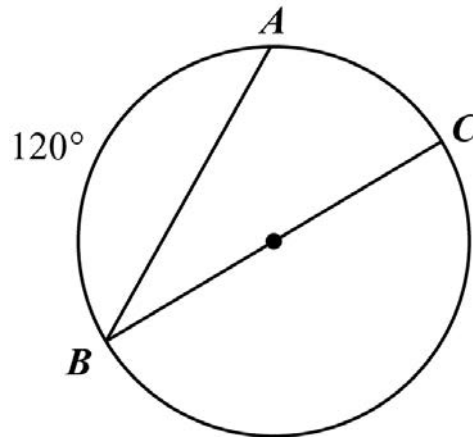


**SAMPLE ITEMS**

1. Circle  $P$  is dilated to form circle  $P'$ . Which statement is ALWAYS true?
- A. The radius of circle  $P$  is equal to the radius of circle  $P'$ .
  - B. The length of any chord in circle  $P$  is greater than the length of any chord in circle  $P'$ .
  - C. The diameter of circle  $P$  is greater than the diameter of circle  $P'$ .
  - D. The ratio of the diameter to the circumference is the same for both circles.

Correct Answer: D

2. In the circle shown,  $\overline{BC}$  is a diameter and  $m\widehat{AB} = 120^\circ$ .



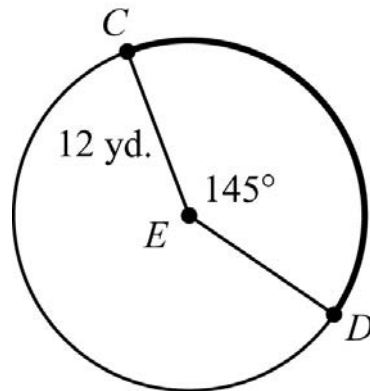
What is the measure of  $\angle ABC$ ?

- A.  $15^\circ$
- B.  $30^\circ$
- C.  $60^\circ$
- D.  $120^\circ$

Correct Answer: B

## SAMPLE ITEMS

1. Circle  $E$  is shown.

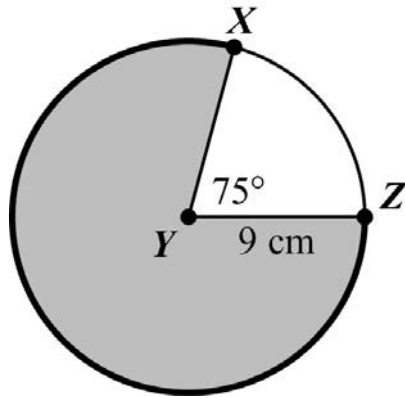


What is the length of  $\widehat{CD}$ ?

- A.  $\frac{29}{72}\pi$  yd.
- B.  $\frac{29}{6}\pi$  yd.
- C.  $\frac{29}{3}\pi$  yd.
- D.  $\frac{29}{2}\pi$  yd.

Correct Answer: C

2. Circle Y is shown.

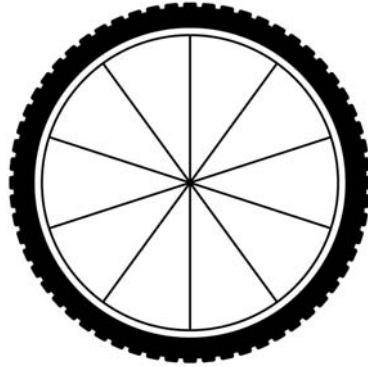


What is the area of the shaded part of the circle?

- A.  $\frac{57}{4}\pi \text{ cm}^2$
- B.  $\frac{135}{8}\pi \text{ cm}^2$
- C.  $\frac{405}{8}\pi \text{ cm}^2$
- D.  $\frac{513}{8}\pi \text{ cm}^2$

Correct Answer: D

3. The spokes of a bicycle wheel form 10 congruent central angles. The diameter of the circle formed by the outer edge of the wheel is 18 inches.



What is the length, to the nearest 0.1 inch, of the outer edge of the wheel between two consecutive spokes?

- A. 1.8 inches
- B. 5.7 inches
- C. 11.3 inches
- D. 25.4 inches

**Correct Answer: B**

## Explain Volume Formulas and Use Them to Solve Problems

**MGSE9-12.G.GMD.1** Give informal arguments for geometric formulas.

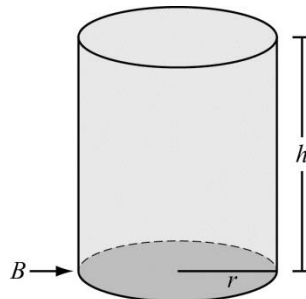
- Give informal arguments for the formulas of the circumference of a circle and area of a circle using dissection arguments and informal limit arguments.
- Give informal arguments for the formula of the volume of a cylinder, pyramid, and cone using Cavalieri's principle.

**MGSE9-12.G.GMD.2** Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.

**MGSE9-12.G.GMD.3** Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

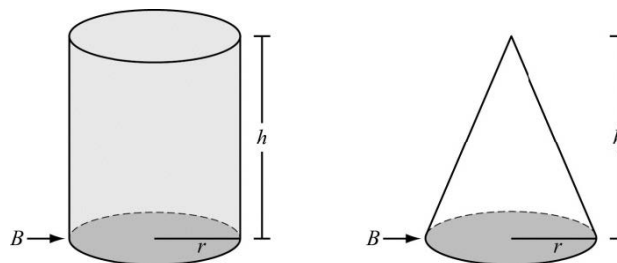
### KEY IDEAS

- The **volume** of a figure is a measure of how much space it takes up. Volume is a measure of capacity.
- The formula for the volume of a cylinder is  $V = \pi r^2 h$ , where  $r$  is the radius and  $h$  is the height. The volume formula can also be given as  $V = Bh$ , where  $B$  is the area of the base. In a cylinder, the base is a circle and the area of a circle is given by  $A = \pi r^2$ . Therefore,  $V = Bh = \pi r^2 h$ .



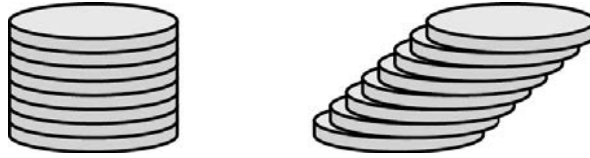
- When a cylinder and a cone have congruent bases and equal heights, the volume of exactly three cones will fit into the cylinder. So, for a cone and cylinder that have the same radius  $r$  and height  $h$ , the volume of the cone is one-third of the volume of the cylinder.

The formula for the volume of a cone is  $V = \frac{1}{3}\pi r^2 h$ , where  $r$  is the radius and  $h$  is the height.



**SAMPLE ITEMS**

1. Jason constructed two cylinders using solid metal washers. The cylinders have the same height, but one of the cylinders is slanted as shown.



Which statement is true about Jason's cylinders?

- A. The cylinders have different volumes because they have different radii.
- B. The cylinders have different volumes because they have different surface areas.
- C. The cylinders have the same volume because each of the washers has the same height.
- D. The cylinders have the same volume because they have the same cross-sectional area at every plane parallel to the bases.

**Correct Answer:** D

2. What is the volume of a cylinder with a radius of 3 in. and a height of  $\frac{9}{2}$  in.?

- A.  $\frac{81}{2}\pi$  in.<sup>3</sup>
- B.  $\frac{27}{4}\pi$  in.<sup>3</sup>
- C.  $\frac{27}{8}\pi$  in.<sup>3</sup>
- D.  $\frac{9}{4}\pi$  in.<sup>3</sup>

**Correct Answer:** A

**SAMPLE ITEMS**

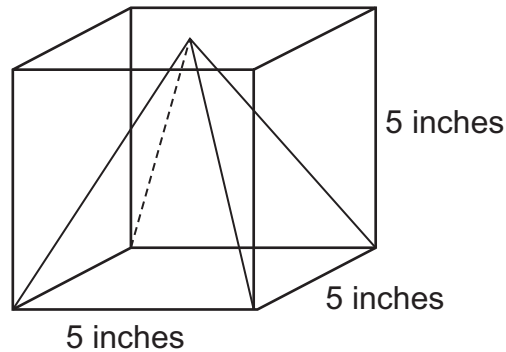
1. Joe counts 250 peach trees on 25% of the land he owns. He determined that there are 10 trees for every 1,000 square feet of land. About how many acres of land does Joe own?

$$1 \text{ acre} = 43,560 \text{ square feet}$$

- A. 2.3 acres
- B. 10 acres
- C. 43.56 acres
- D. 2,500 acres

**Correct Answer: A**

2. A square pyramid is packaged inside a box.



The space inside the box around the pyramid is then filled with protective foam. About how many cubic inches of foam is needed to fill the space around the pyramid?

- A. 8 cubic inches
- B. 41 cubic inches
- C. 83 cubic inches
- D. 125 cubic inches

**Correct Answer: C**



### SAMPLE ITEMS

1. Which is an equation for the circle with a center at  $(-2, 3)$  and a radius of 3?

- A.  $x^2 + y^2 + 4x - 6y + 22 = 0$
- B.  $2x^2 + 2y^2 + 3x - 3y + 4 = 0$
- C.  $x^2 + y^2 + 4x - 6y + 4 = 0$
- D.  $3x^2 + 3y^2 + 4x - 6y + 4 = 0$

**Correct Answer:** C

2. What is the center of the circle given by the equation  $x^2 + y^2 - 10x - 11 = 0$ ?

- A.  $(5, 0)$
- B.  $(0, 5)$
- C.  $(-5, 0)$
- D.  $(0, -5)$

**Correct Answer:** A

### SAMPLE ITEMS

1. Which information is needed to show that a parallelogram is a rectangle?

- A. The diagonals bisect each other.
- B. The diagonals are congruent.
- C. The diagonals are congruent and perpendicular.
- D. The diagonals bisect each other and are perpendicular.

**Correct Answer:** B

2. Which point is on a circle with a center of  $(3, -9)$  and a radius of 5?

- A.  $(-6, 5)$
- B.  $(-1, 6)$
- C.  $(1, 6)$
- D.  $(6, -5)$

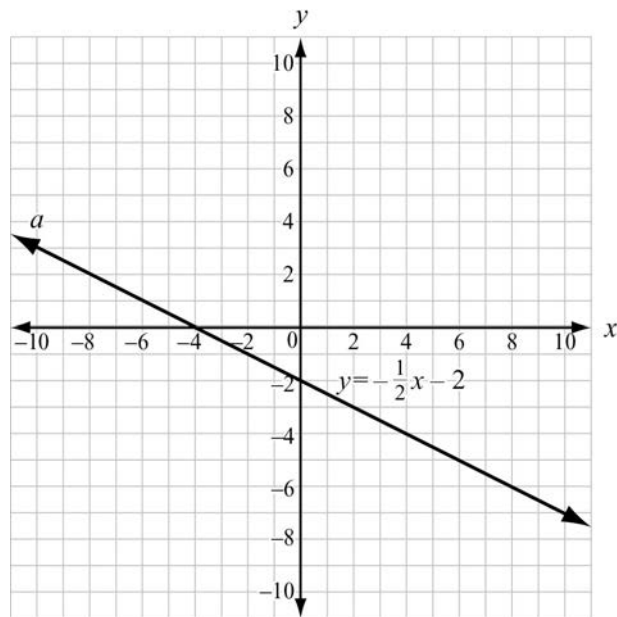
**Correct Answer:** D

3. Given the points  $P(2, -1)$  and  $Q(-9, -6)$ , what are the coordinates of the point on directed line segment  $\overline{PQ}$  that partitions  $\overline{PQ}$  in the ratio  $\frac{3}{2}$ ?

- A.  $\left(-\frac{23}{5}, -4\right)$
- B.  $\left(-\frac{12}{5}, -3\right)$
- C.  $\left(\frac{5}{3}, \frac{8}{3}\right)$
- D.  $\left(-\frac{5}{3}, -\frac{8}{3}\right)$

**Correct Answer:** A

4. An equation of line  $a$  is  $y = -\frac{1}{2}x - 2$ .

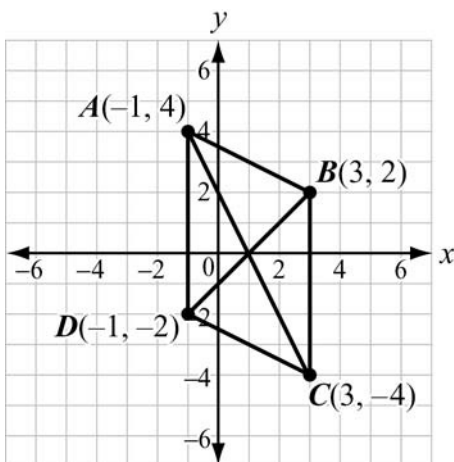


Which is an equation of the line that is perpendicular to line  $a$  and passes through the point  $(-4, 0)$ ?

- A.  $y = -\frac{1}{2}x + 2$
- B.  $y = -\frac{1}{2}x + 8$
- C.  $y = 2x - 2$
- D.  $y = 2x + 8$

**Correct Answer:** D

5. Parallelogram  $ABCD$  has vertices as shown.

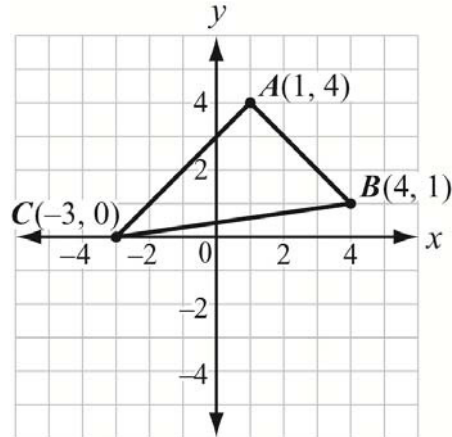


Which equation would be used in proving that the diagonals of parallelogram  $ABCD$  bisect each other?

- A.  $\sqrt{(3-1)^2 + (2-0)^2} = \sqrt{(1-3)^2 + (0+4)^2}$
- B.  $\sqrt{(3+1)^2 + (2+0)^2} = \sqrt{(1+3)^2 + (0-4)^2}$
- C.  $\sqrt{(-1-1)^2 + (4-0)^2} = \sqrt{(1-3)^2 + (0+4)^2}$
- D.  $\sqrt{(-1+1)^2 + (4+0)^2} = \sqrt{(1+3)^2 + (0-4)^2}$

**Correct Answer: C**

6. Triangle  $ABC$  has vertices as shown.



What is the area of the triangle?

- A.  $\sqrt{72}$  square units
- B. 12 square units
- C.  $\sqrt{288}$  square units
- D. 24 square units

**Correct Answer:** B

## SAMPLE ITEMS

1. In a particular state, the first character on a license plate is always a letter. The last character is always a digit from 0 to 9.

If  $V$  represents the set of all license plates beginning with a vowel, and  $O$  represents the set of all license plates that end with an odd number, which license plate belongs to the set  $V$  and  $O'$ ?



Correct Answer: A

2. For which set of probabilities would events  $A$  and  $B$  be independent?

- A.  $P(A) = 0.25$ ;  $P(B) = 0.25$ ;  $P(A \text{ and } B) = 0.5$   
 B.  $P(A) = 0.08$ ;  $P(B) = 0.4$ ;  $P(A \text{ and } B) = 0.12$   
 C.  $P(A) = 0.16$ ;  $P(B) = 0.24$ ;  $P(A \text{ and } B) = 0.32$   
 D.  $P(A) = 0.3$ ;  $P(B) = 0.15$ ;  $P(A \text{ and } B) = 0.045$

Correct Answer: D

3. Assume that the following events are independent:

- The probability that a high school senior will go to college is 0.72.
- The probability that a high school senior will go to college and live on campus is 0.46.

What is the probability that a high school senior will live on campus, given that the person will go to college?

- A. 0.26
- B. 0.33
- C. 0.57
- D. 0.64

Correct Answer: D

4. A random survey was conducted about gender and hair color. This table records the data.

	Brown	Blonde	Red	Total
Male	548	876	82	1,506
Female	612	716	66	1,394
Total	1,160	1,592	148	2,900

What is the probability that a randomly selected person has blonde hair, given that the person selected is male?

- A. 0.51
- B. 0.55
- C. 0.58
- D. 0.63

Correct Answer: C

**SAMPLE ITEMS**

1. Mrs. Klein surveyed 240 men and 285 women about their vehicles. Of those surveyed, 155 men and 70 women said they own a red vehicle. If a person is chosen at random from those surveyed, what is the probability of choosing a woman or a person who does NOT own a red vehicle?
- A.  $\frac{14}{57}$
- B.  $\frac{71}{105}$
- C.  $\frac{74}{105}$
- D.  $\frac{88}{105}$

Correct Answer: C

2. Bianca spins two spinners that have four equal sections numbered 1 through 4. If she spins a 4 on at least one spin, what is the probability that the sum of her two spins is an odd number?
- A.  $\frac{1}{4}$
- B.  $\frac{7}{16}$
- C.  $\frac{4}{7}$
- D.  $\frac{11}{16}$

Correct Answer: C



3. Each letter of the alphabet is written on separate cards in red ink. The cards are placed in a container. Each letter of the alphabet is also written on separate cards in black ink. The cards are placed in the same container. What is the probability that a card randomly selected from the container has a letter written in black ink or the letter is A or Z?

A.  $\frac{1}{2}$

B.  $\frac{7}{13}$

C.  $\frac{15}{26}$

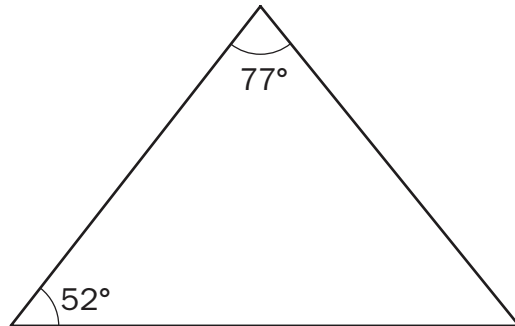
D.  $\frac{8}{13}$

**Correct Answer: B**

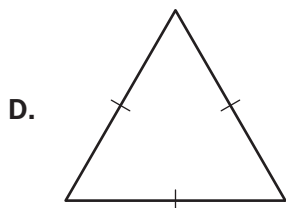
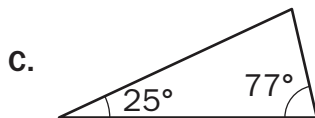
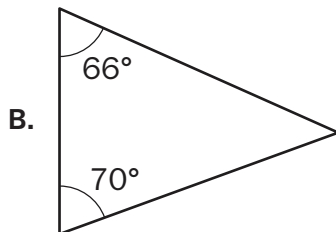
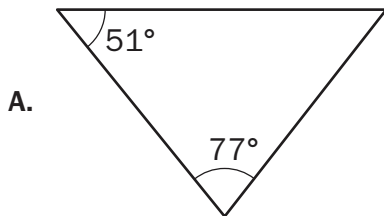
**Item 1**

**Selected-Response**

Look at the triangle.



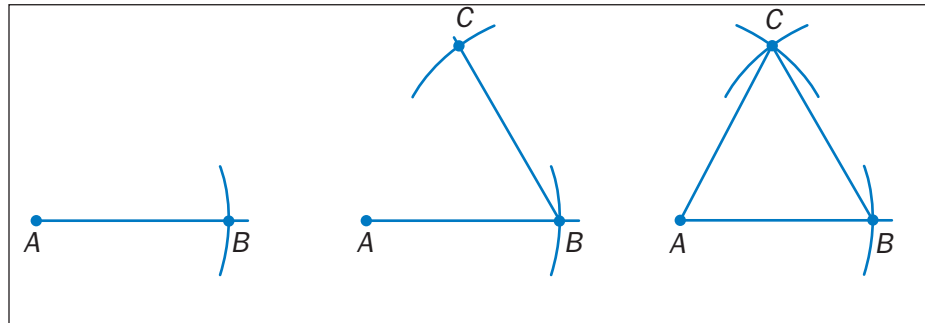
Which triangle is similar to the given triangle?



**Item 2**

**Constructed-Response**

The following are the steps to construct an equilateral triangle. Determine the error in the steps. Write your answer on the lines provided.



\_\_\_\_\_

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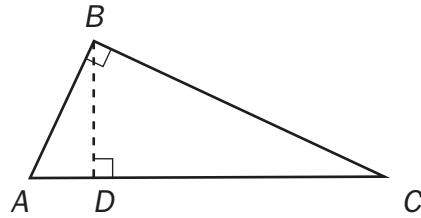
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**Item 3**

**Extended Constructed-Response**

**Right  $\triangle ABC$  with altitude  $BD$ .**



**Prove  $\triangle ABC$  is similar to  $\triangle BDC$ .**

Statement	Reason

**Item 4**

**Technology-Enhanced**

**Triangle  $ABC$  is similar but not congruent to triangle  $DEF$ .**

**Part A**

**Which series of transformations could map triangle  $ABC$  onto triangle  $DEF$ ?**

- A. translation 4 units up, rotation  $75^\circ$  about the origin
- B. reflection across the line  $y = 2$ , rotation  $90^\circ$  about the origin
- C. translation 3 units left, dilation of scale factor 2 centered at the origin
- D. reflection across the line  $x = 1$ , reflection across the line  $y = 5$

**Part B**

**Which equation must be true about triangle  $ABC$  and triangle  $DEF$ ?**

- A.  $AB = DE$
- B.  $AC = EF$
- C.  $m\angle A + m\angle B = m\angle D + m\angle F$
- D.  $m\angle A + m\angle C = m\angle D + m\angle F$

### Item 5

#### Selected-Response

Which equation is true?

- A.  $\sin 40^\circ = \tan 50^\circ$
- B.  $\cos 40^\circ = \cos 50^\circ$
- C.  $\sin 40^\circ = \sin 50^\circ$
- D.  $\cos 40^\circ = \sin 50^\circ$

### Item 6

#### Technology-Enhanced

Triangle  $GHJ$  is a right triangle. Angle  $G$  has a measure of  $g^\circ$ , angle  $H$  has a measure of  $h^\circ$ , and angle  $J$  is a right angle.

#### Part A

Select TWO equations that must be true.

- A.  $\sin(h^\circ) = \sin(g^\circ)$
- B.  $\cos(g^\circ) = \sin(h^\circ)$
- C.  $\cos(h^\circ) = \cos(g^\circ)$
- D.  $\sin(h^\circ) + \cos(h^\circ) = \sin(g^\circ) + \cos(g^\circ)$
- E.  $\sin(g^\circ) + \cos(h^\circ) = \cos(g^\circ) + \sin(h^\circ)$

#### Part B

Given that  $\tan(g^\circ) = \frac{\sin(g^\circ)}{\cos(g^\circ)}$ , which ratio must have a value equivalent to the tangent of  $g^\circ$ ?

- A.  $\frac{\cos(h^\circ)}{\sin(g^\circ)}$
- B.  $\frac{\cos(h^\circ)}{\sin(h^\circ)}$
- C.  $\frac{\sin(h^\circ)}{\cos(h^\circ)}$
- D.  $\frac{\sin(h^\circ)}{\cos(g^\circ)}$

**Item 7****Selected-Response**

Which point is NOT on a circle with a center of  $(0, 0)$  and a radius of 10?

- A.  $(0, 5)$
- B.  $(10, 0)$
- C.  $(0, -10)$
- D.  $(-8, 6)$



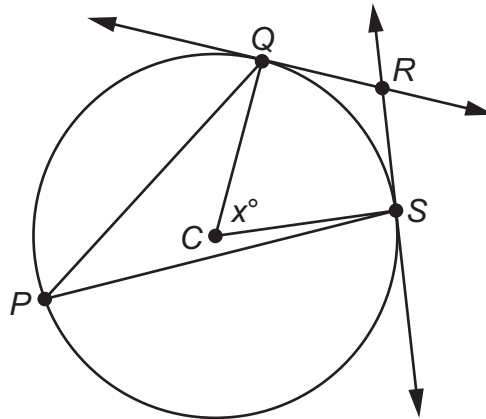




**Item 10**

**Technology-Enhanced**

The figure shows circle  $C$  with tangent lines  $\overline{QR}$  and  $\overline{SR}$ .



The measure of  $\angle QCS$  is  $x^\circ$ .

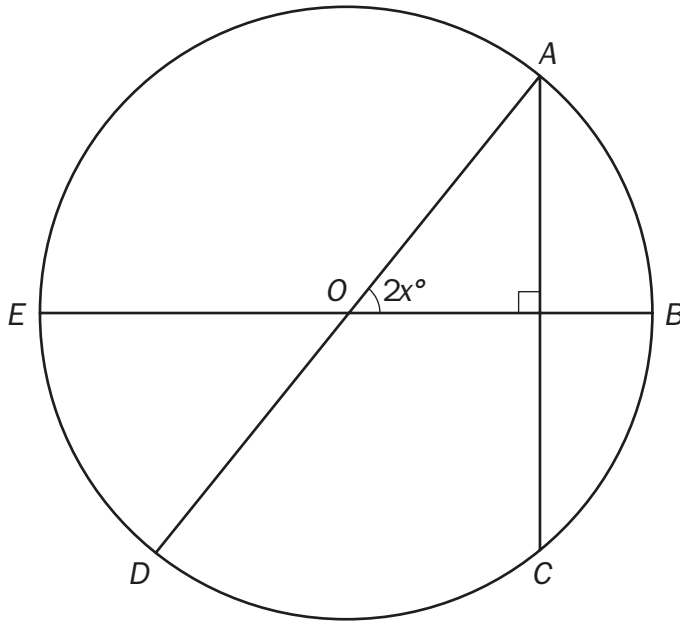
Select **THREE** statements that are true about the figure.

- A. The measure of  $\angle QPS$  is  $(90 - x)^\circ$ .
- B. The measure of  $\angle QPS$  is  $\frac{1}{2}x^\circ$ .
- C. The measure of  $\angle PSR$  is  $90^\circ$ .
- D. The measure of  $\angle CQR$  is  $90^\circ$ .
- E. The measure of  $\angle QRS$  is  $(180 - x)^\circ$ .
- F. The measure of  $\angle QRS$  is  $2x^\circ$ .

**Item 11**

**Selected-Response**

Points  $A$ ,  $B$ ,  $C$ ,  $D$ , and  $E$  are located on the circle  $O$ , as shown in this figure.



The measure of  $\widehat{CD}$  is  $80^\circ$ . What is the value of  $x$ ?

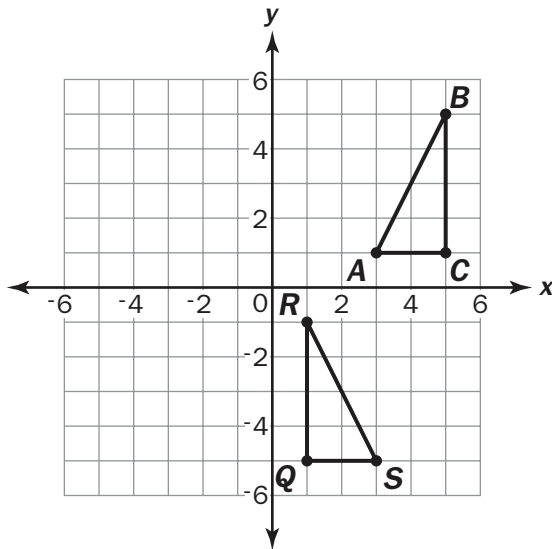
- A. 50
- B. 40
- C. 35
- D. 25



**Item 13**

**Selected-Response**

What is the sequence of transformations that carry triangle  $ABC$  to triangle  $QRS$ ?



- A. Triangle  $ABC$  is reflected across the line  $x = 3$ . Then it is translated 2 units down.
- B. Triangle  $ABC$  is reflected across the line  $x = 3$ . Then it is translated 6 units down.
- C. Triangle  $ABC$  is translated 2 units to the left. Then it is rotated 90 degrees counterclockwise about the point  $(1, 1)$ .
- D. Triangle  $ABC$  is translated 2 units to the right. Then it is rotated 90 degrees counterclockwise about the point  $(1, 1)$ .

**Item 14**

**Selected-Response**

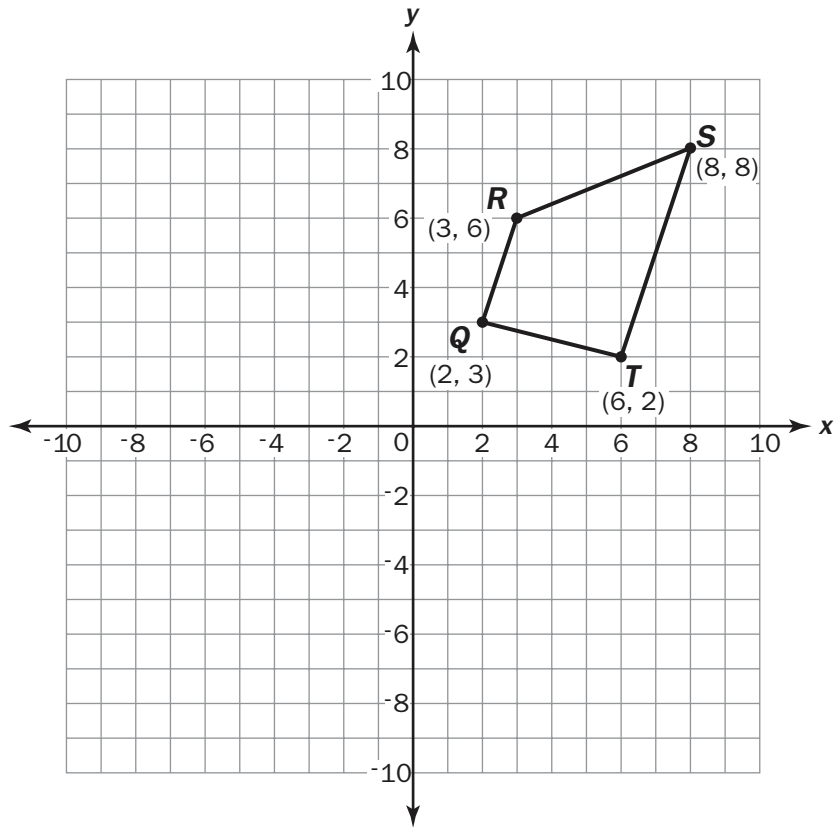
Which transformation on quadrilateral  $ABCD$  produces an image that does not preserve distance between points in quadrilateral  $ABCD$ ?

- A. reflection across  $y = x$
- B. translation 3 units down and 4 units to the right
- C. dilation by a scale factor of 2
- D. rotation of 270 degrees

**Item 15**

**Selected-Response**

Look at quadrilateral  $QRST$ .



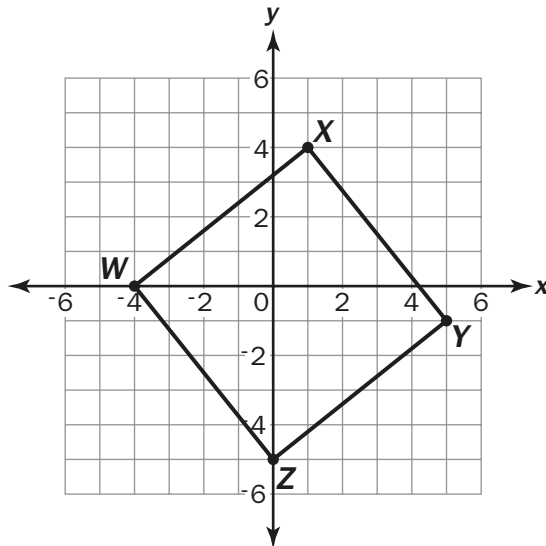
What is the image of point  $R$  after a counterclockwise rotation of 270 degrees about the origin?

- A.  $(6, -3)$
- B.  $(-3, 6)$
- C.  $(-6, 3)$
- D.  $(3, -6)$

**Item 16**

**Selected-Response**

Look at the square  $WXYZ$  on this coordinate plane.



What is the perimeter of the square  $WXYZ$ ?

- A. 20 units
- B. 25.6 units
- C. 32 units
- D. 40.9 units

**Item 17**

**Selected-Response**

What is the coordinate of point  $P$  that lies along the directed line segment from  $Q(2, 5)$  to  $R(7, 12)$  and partitions the segment in the ratio of 3 to 2?

- A. (3, 4.2)
- B. (4.5, 8.5)
- C. (5, 9.2)
- D. (5, 7)

**Item 18**

**Selected-Response**

What is the equation of a line that is perpendicular to  $y = \frac{1}{2}x - 6$  and passes through the point (6, 4)?

A.  $y = -\frac{1}{2}x + 1$

B.  $y = -\frac{1}{2}x + 7$

C.  $y = -2x - 8$

D.  $y = -2x + 16$

**Item 19**

**Selected-Response**

Study this equation of a circle.

$$x^2 - 6x + y^2 + 2y + 6 = 0$$

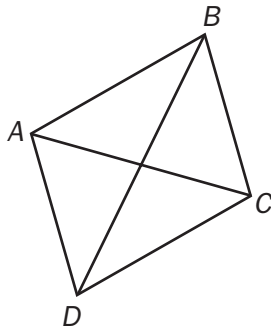
Which of these represents the center and radius of the circle?

- A. center: (3, -1), radius: 4
- B. center: (-3, 1), radius: 4
- C. center: (3, -1), radius: 2
- D. center: (-3, 1), radius: 2

**Item 20**

**Selected-Response**

What proves that figure *ABCD* is a parallelogram?



- A. Diagonal *BD* bisects angle *ABC*.
- B. Side *AB* is equal to diagonal *AC*.
- C. Diagonals *BD* and *AC* bisect one another.
- D. Diagonal *BD* is greater than diagonal *AC*.



### Item 21

#### Constructed-Response

One bag of lawn fertilizer can cover approximately 5,000 square feet. Mike's lawn is about 500 square feet. When Mike applies fertilizer to his lawn, he applies it to  $\frac{3}{4}$  of his lawn only.

**Part A:** About how many complete times can Mike fertilize his lawn with one bag of fertilizer?

\_\_\_\_\_

**Part B:** Mike fertilizes his lawn an average of 4 times per year. About how many full years will he be able to fertilize his lawn with one bag of fertilizer?

\_\_\_\_\_

### Item 22

#### Constructed-Response

A student draws a card from a standard deck and then draws another card without replacing the first card. Explain why the probability of picking an ace on the first draw and the probability of picking a 7 on the second draw are NOT independent events. Write your answer on the lines provided.

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**Item 23****Selected-Response**

When rolling a fair, six-sided number cube, what is the probability of rolling an even number or a number less than 3?

- A.  $\frac{5}{6}$
- B.  $\frac{2}{3}$
- C.  $\frac{1}{2}$
- D.  $\frac{1}{3}$

**Item 24****Selected-Response**

What is the probability of rolling a 5 on a fair, six-sided number cube if you know that you rolled an odd number?

- A.  $\frac{1}{6}$
- B.  $\frac{1}{3}$
- C.  $\frac{1}{2}$
- D.  $\frac{2}{3}$