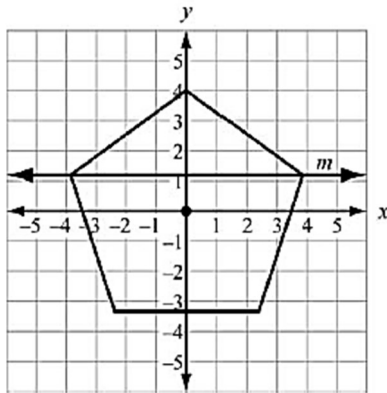


**WHAT YOU NEED TO KNOW**

- **Translations:**  $(x \pm a, y \pm b)$
- **Rotations about origin:**  $90^\circ \text{ CW} \rightarrow (y, -x)$ ,  $90^\circ \text{ CCW} \rightarrow (-y, x)$ ,  $180^\circ \rightarrow (-x, -y)$ ,  $270^\circ \rightarrow$  change to  $90^\circ$  in the OPPOSITE direction
- **Rotational Symmetry:**  $\frac{360^\circ}{\text{\# of identical sides}}$ , order - # of identical sides
- **Lines of Symmetry:** # of lines that cuts a figure exactly in half
- **Reflections:** Over x-axis  $\rightarrow (x, -y)$ , over y-axis  $\rightarrow (-x, y)$ , over  $y = x$   $\rightarrow (y, x)$ , over  $y = -x$   $\rightarrow (-y, -x)$ , over any other line  $\rightarrow$  reflect the same distance in the opposite direction (HOY/VUX)
- **Writing rules from images (new) and pre-images (old)**
- **Composition transformations (multiple):**  $A \rightarrow A' \rightarrow A'' \rightarrow A'''$

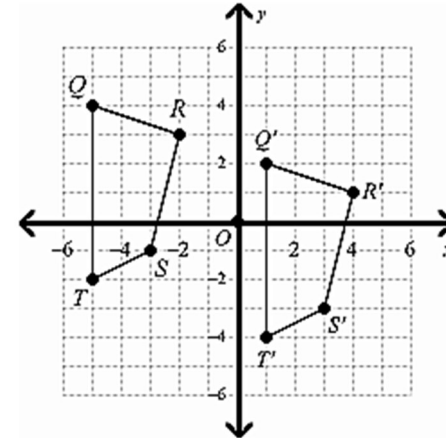
**Practice Problems**

- 1) A regular pentagon is centered about the origin and has a vertex at  $(0, 4)$ . Which transformation maps the pentagon to itself?



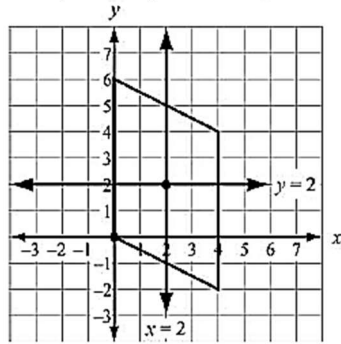
- A. a reflection across line  $m$
- B. a reflection across the x-axis
- C. a clockwise rotation of  $100^\circ$  about the origin
- D. a clockwise rotation of  $144^\circ$  about the origin

- 2) What is the rule that describes the translation  $QRST \rightarrow Q'R'S'T'$ ?



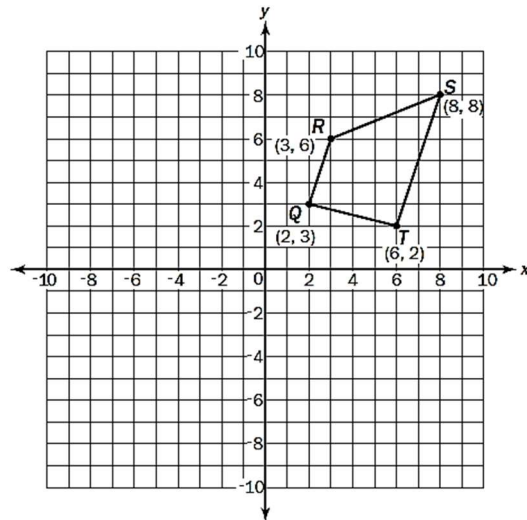
- A.  $(x, y) \rightarrow (x - 6, y + 2)$
- B.  $(x, y) \rightarrow (x + 2, y - 6)$
- C.  $(x, y) \rightarrow (x - 2, y + 6)$
- D.  $(x, y) \rightarrow (x + 6, y - 2)$

- 3) 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  $(0, 0)$

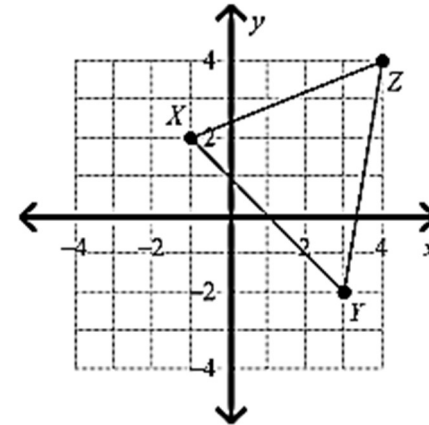
- 5) Look at quadrilateral QRST.



What is the image point R after a clockwise rotation of  $270^\circ$  about the origin?

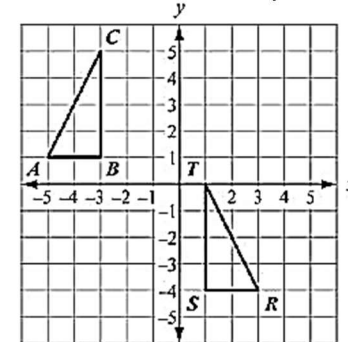
- A.  $(6, -3)$
- B.  $(-3, 6)$
- C.  $(-6, 3)$
- D.  $(3, -6)$

- 4) If triangle XYZ is rotated  $90^\circ$  clockwise about the origin to form triangle X'Y'Z', what are the coordinates of Y'?



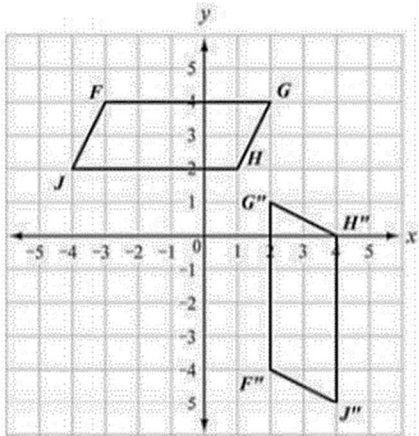
- A.  $(2, -3)$
- B.  $(-2, 3)$
- C.  $(-2, -3)$
- D.  $(-3, -2)$

- 6) 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  $(1, 1)$ .

- 7) 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.

## 8) **CONSTRUCTED RESPONSE**

Rectangle  $WXYZ$  has coordinates  $W(1, 2)$ ,  $X(3, 2)$ ,  $Y(3, -3)$ , and  $Z(1, -3)$ .

- a. What would the coordinates be of  $W'X'Y'Z'$  after a rotation of  $90^\circ$  clockwise about the origin?
- b. What would the coordinates be of  $W''X''Y''Z''$  after a translation 2 units left and 3 units up?
- c. Is rectangle  $WXYZ$  congruent to rectangle  $W''X''Y''Z''$ ? Explain.

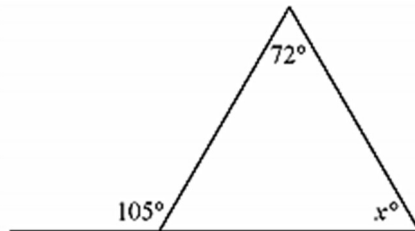
## Unit 2A: Properties of Angles, Triangles, and Quadrilaterals

### WHAT YOU NEED TO KNOW

- **Angle Relationships:** *Adjacent angles* (angles that share a middle ray), *supplementary angles* (linear pair makes a straight line =  $180^\circ$ ), *complementary angles* (makes a corner =  $90^\circ$ ), *vertical angles* (across from each other  $\cong$  congruent)
- **Angle Addition Postulate:** (big angle = the sum of the two smaller angles)
- **Angle Bisector:** (small angle =  $\frac{1}{2}$  big angle)
- **Distance Formula:**  $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$  or Pythagorean Theorem method
- **Interior Sum Theorem of Triangles** ( $= 180^\circ$ )
- **Isosceles Triangle Characteristics:** (base angles across from the legs are  $\cong$ )
- **Exterior Sum Theorem of Triangles** (outside angle = sum of 2 non-adjacent interior angles)
- **Parallel Lines cut by Transversal:** *Alternate angles* (BOTH inside or outside and "jumps" over the transversal;  $\cong$ ), *same-side* (BOTH inside or outside and does NOT "jump" over the transversal; also called consecutive angles;  $= 180^\circ$ ), *corresponding angles* (SAME LOCATION;  $\cong$ )
- **Parallelogram Properties:** *Parallelogram* (opposite sides are parallel and congruent; diagonals bisect each other), *Rectangle* (diagonals are congruent and all corner angles are  $90^\circ$ ), *Rhombus* (all sides are congruent, diagonals are perpendicular and bisect opposite angles), *Square* (all parallelogram, rectangle, and rhombus properties)
- **Proving Types of Triangles:** *Distance* ( $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$  or Pythagorean Theorem method)  $\rightarrow$  Prove sides, *slope*  $\frac{\text{rise}}{\text{run}}$  or  $\frac{y_2 - y_1}{x_2 - x_1} \rightarrow$  Prove perpendicular lines
- **Proving Types of Parallelograms:** *Distance*  $\rightarrow$  Prove sides and diagonals, *slope*  $\rightarrow$  Prove parallel sides and perpendicular sides/diagonals

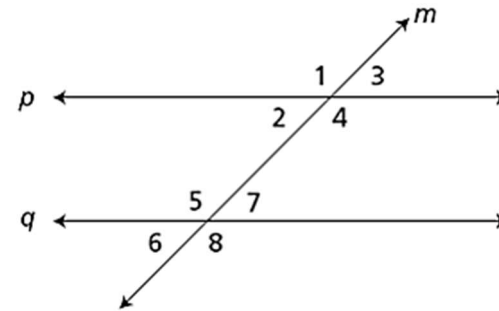
### Practice Problems

9) What is the value of x?



- A. 33      B. 75      C. 147      D. 162

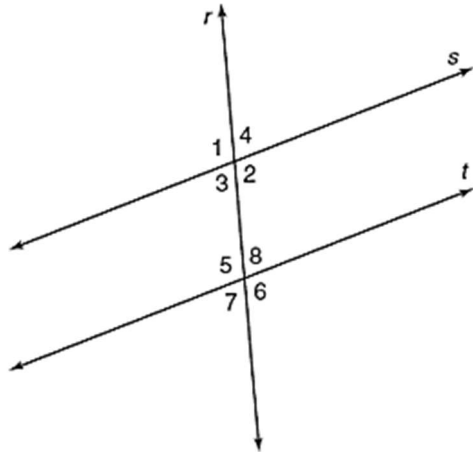
10) In the figure below,  $p \parallel q$ .



Which of these statements is NOT true?

- A.  $m\angle 1 = m\angle 4$       C.  $m\angle 6 + m\angle 3 = 180^\circ$   
 B.  $m\angle 6 = m\angle 2$       D.  $m\angle 2 + m\angle 5 = 180^\circ$

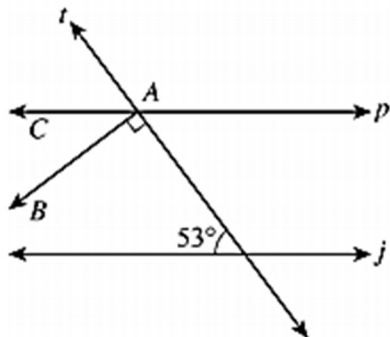
11) Lines  $s$  and  $t$  are parallel and  $r$  is a transversal.



Which angles are congruent to  $\angle 4$ ?

- A.  $\angle 2, \angle 5, \angle 8$       B.  $\angle 3, \angle 5, \angle 7$   
 C.  $\angle 2, \angle 6, \angle 8$       D.  $\angle 3, \angle 7, \angle 8$

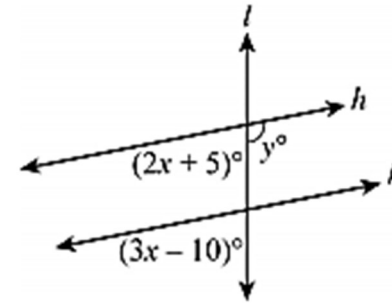
13) In the drawing, line  $p$  is parallel to line  $j$  and line  $t$  is perpendicular to  $\overline{AB}$ .



What is the measure of  $\angle BAC$ ?

- A.  $37^\circ$       B.  $53^\circ$       C.  $90^\circ$       D.  $127^\circ$

12) In the drawing below, line  $h$  is parallel to line  $k$ .



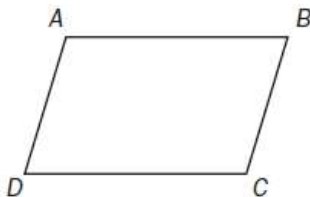
What is the value of  $y$ ?

- A. 135      B. 15      C. 35      D. 145

14) 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.

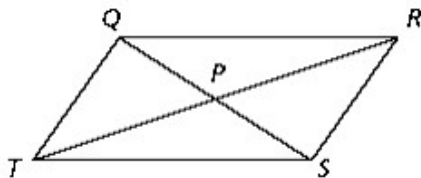
- 15) Look at quadrilateral ABCD.



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

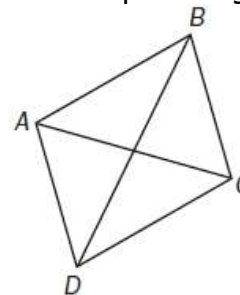
- A. Use the distance formula to show that diagonals AC and BD have the same length.
- B. Use the slope formula to show that segments AB and CD are perpendicular and segments AD and BC are perpendicular.
- C. Use the slope formula to show that segments AB and CD have the same slope and segments AD and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

- 17) Which of the following would be enough information to prove that quadrilateral QRST is a parallelogram?



- A.  $\overline{QR} \cong \overline{ST}$
- B.  $\overline{QR} \parallel \overline{ST}$
- C.  $\overline{QP} \cong \overline{PS}$  and  $\overline{TP} \cong \overline{PR}$
- D. Two pairs of sides are congruent.

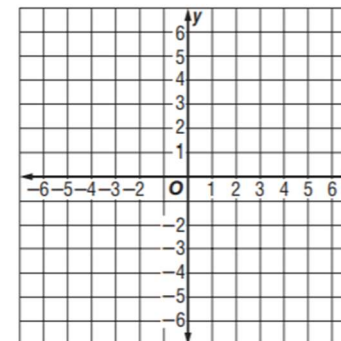
- 16) What proves that figure ABCD is a parallelogram?



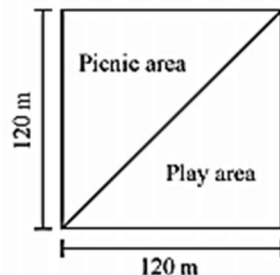
- A. Diagonal BD bisects angle ABC.
- B. Side AB is equal to diagonal AC.
- C. Diagonal BD bisects diagonal AC.
- D. Diagonal BD is greater than diagonal AC.

- 18) Quadrilateral RSTU has vertices R(-6, -3), S(3, 3), and T(4, -1). What are the coordinates of vertex U if RSTU is a parallelogram?

- A. (-5, -6)
- B. (-5, -7)
- C. (-6, -7)
- D. (-6, 3)

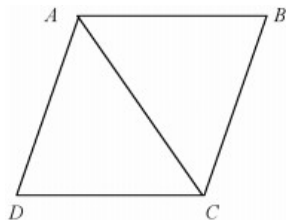


- 19) A community is building a square park with sides that measure 120 meters. To separate the picnic area from the play area, the park is split by a diagonal line from opposite corners. Determine the approximate length of the diagonal line that splits the square. If necessary, round your answer to the nearest meter.



- A. 28,800 meters  
B. 170 meters  
C. 240 meters  
D. 120 meters

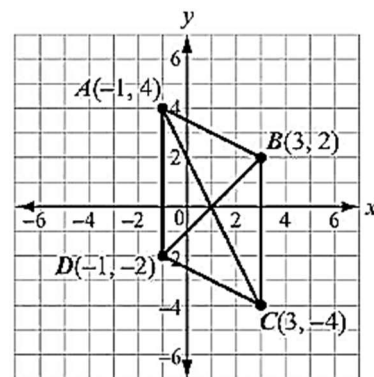
- 21) ABCD is a rhombus. How do you complete the explanation that states why  $\triangle ABC \cong \triangle CDA$ ?



$\overline{AB} \cong \overline{CD}$  and  $\overline{BC} \cong \overline{DA}$  by the definition of a rhombus.  $\overline{AC} \cong \overline{AC}$  by the Reflexive Property of Congruence, so  $\triangle ABC \cong \triangle CDA$  by \_\_\_\_\_.

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

- 20) Parallelogram ABCD has vertices as shown.



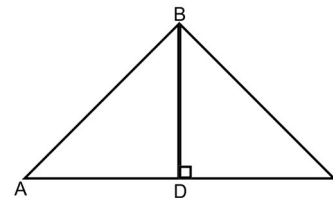
Which equation would be used in proving that the diagonals of parallelogram ABCD bisect each other?

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

- 22) Which set of statements would not be used to complete the proof?

Given:  $\overline{AD} \cong \overline{CD}$ ;  $\overline{BD} \perp \overline{AC}$

Proof:  $\angle A \cong \angle C$



- A.  $\triangle ABD \cong \triangle CBD$  by HL Congruence  
B.  $\angle A \cong \angle C$  by CPCTC  
C.  $\angle ADB$  and  $\angle CDB$  are right angles since perpendicular lines form right angles  
D.  $\overline{BD} \cong \overline{BD}$  by the Reflexive Property

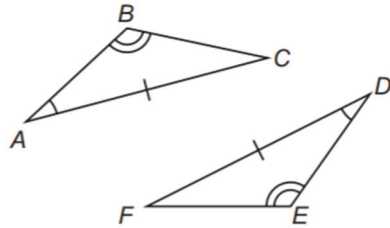
## Unit 2B: Congruence

### WHAT YOU NEED TO KNOW

- **Triangle Congruence:** SSS, SAS, ASA, AAS, HL
- **Congruent Figures:** Corresponding Parts, naming in the same order with a congruency statement
- **CPCTC:** ONLY AFTER TWO TRIANGLES ARE PROVED CONGRUENT
- **Proofs:** Statements and Reasons; build off your givens. Remember, they won't mark shared sides or vertical angles!

### Practice Problems

23) Consider the triangles shown.



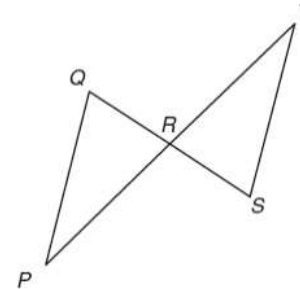
Which can be used to prove the triangles are congruent?

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

25) If  $\triangle DNP \cong \triangle HKF$ , which of the following is NOT true?

- A.  $\overline{NP} \cong \overline{KF}$       C.  $\angle D \cong \angle H$   
 B.  $\overline{DP} \cong \overline{HF}$       D.  $\angle P \cong \angle K$

24) Rita is creating an abstract design that includes the figure below.

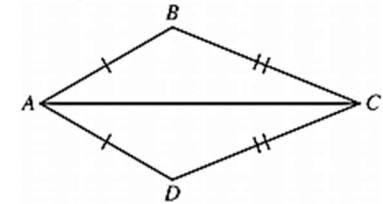


She knows that  $\angle PQR \cong \angle TSR$ . What additional information would she need to prove that  $\triangle PQR \cong \triangle TSR$  using ASA?

- A.  $\angle QPR \cong \angle SRT$       C.  $\overline{PR} \cong \overline{TR}$   
 B.  $\overline{QP} \cong \overline{ST}$       D.  $\overline{QR} \cong \overline{SR}$

26) In the proof below, what is the missing reason?

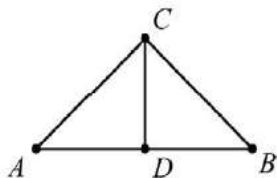
**Given:**  $ABCD$  is a kite  
**Prove:**  $\angle B \cong \angle D$



Statement	Reason
1. $\overline{AB} \cong \overline{AD}$ and $\overline{BC} \cong \overline{CD}$	1. Definition of kite
2. $\overline{AC} \cong \overline{AC}$	2. Reflexive Property of equality
3. $\triangle ABC \cong \triangle ADC$	3. SSS
4. $\angle B \cong \angle D$	4. ?

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

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

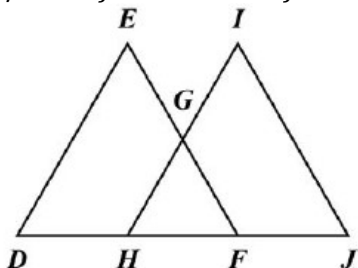


Step	Statement	Justification
1	$\overline{CD}$ is the perpendicular bisector of $\overline{AB}$ .	Given
2	$\overline{AD} \cong \overline{BD}$	Definition of bisector
3	$\overline{CD} \cong \overline{CD}$	Reflexive Property of Congruence
4	$\angle ADC$ and $\angle BDC$ are right angles.	Definition of perpendicular 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

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



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

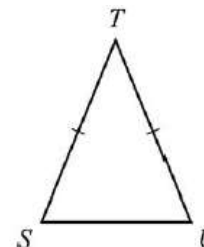
- A.  $\overline{ED} \cong \overline{IH}$       C.  $\overline{DH} \cong \overline{JF}$   
 B.  $\overline{HG} \cong \overline{GI}$       D.  $\overline{HF} \cong \overline{JF}$

- 28) What other information is needed in order to prove the triangles congruent using the SAS Congruence Postulate?



- A.  $\angle BAC \cong \angle DAC$       C.  $\overline{AB} \parallel \overline{AD}$   
 B.  $\overline{AC} \perp \overline{BD}$       D.  $\overline{AC} \cong \overline{BD}$

- 29) In this diagram, 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

## Unit 2C: Similarity

### WHAT YOU NEED TO KNOW

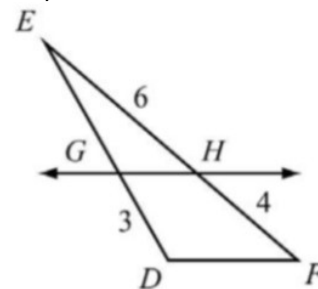
- **Scale Factor/Dilation:**  $\frac{A' \text{ (new)}}{A \text{ (old)}}$ , center of dilation (connect image and pre-image coordinates to form an intersection)
- **Relationship with Scale Factor:** area = scale factor<sup>2</sup> and perimeter = scale factor
- **Triangle Proportionality Theorem:** When two lines are parallel;  $\frac{\text{top}}{\text{bottom}} = \frac{\text{top}}{\text{bottom}}$  OR  $\frac{\text{left}}{\text{right}} = \frac{\text{left}}{\text{right}}$
- **Similar Figures:** Angles → congruent, sides → proportional (same scale factor)
- **Triangle Similarity:** SSS Similarity, AA Similarity, SAS Similarity
- **Word Problems using similarity:** Shadows, ladders, enlarging/shrinking images

### Practice Problems

- 31) What transformation results in a figure that is similar to the original figure but has a greater area?

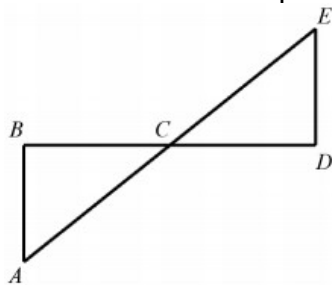
- A. a dilation of  $\triangle QRS$  by a scale factor of 0.25
- B. a dilation of  $\triangle QRS$  by a scale factor of 0.5
- C. a dilation of  $\triangle QRS$  by a scale factor of 1
- D. a dilation of  $\triangle QRS$  by a scale factor of 2

- 32) In the triangle shown,  $\overline{GH} \parallel \overline{DF}$ .



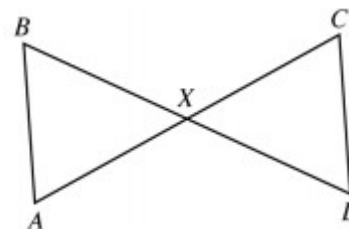
What is the length of  $\overline{GE}$ ?

- 33) Given:  $\overline{AB} \parallel \overline{DE}$ . Which can be used to prove  $\triangle ABC \sim \triangle EDC$ ?



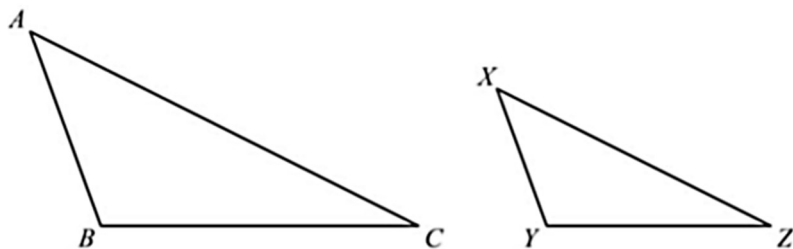
- A. AA Similarity Postulate
- B. SSS Similarity Theorem
- C. ASA Similarity Theorem
- D. SAS Similarity Theorem

- 34) Given:  $\angle B \cong \angle D$ . Which of the following conjectures can NOT be made based on the diagram and the given information?



- A.  $\overline{AB} \parallel \overline{CD}$
- B.  $\triangle AXB \sim \triangle CXD$
- C.  $\overline{BD} \perp \overline{AC}$
- D.  $\angle A \cong \angle C$

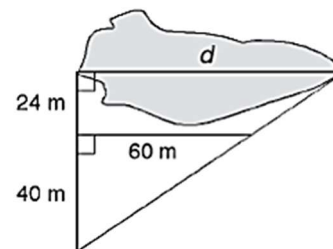
- 35) In the triangles shown,  $\triangle ABC$  is dilated by a factor of  $\frac{2}{3}$  to form  $\triangle XYZ$ .



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

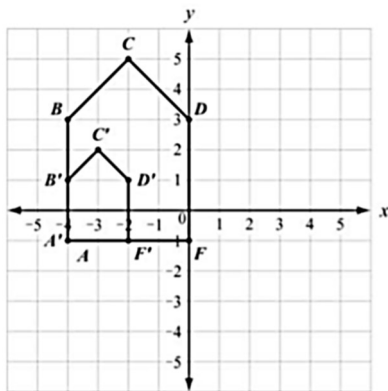
- A.  $15^\circ$       B.  $25^\circ$       C.  $30^\circ$       D.  $50^\circ$

- 36) A landowner wants to find the distance  $d$  across a pond. The two overlapping right triangles shown are similar. Using the measurements shown, what is  $d$ ?



- A. 36 meters      B. 76 meters      C. 96 meters      D. 124 meters

- 37) Figure  $A'B'C'D'F'$  is a dilation of figure  $ABCD$  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.  $\frac{AB}{A'B'} = \frac{D'F'}{BC}$

- 38) 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  $270^\circ$ .

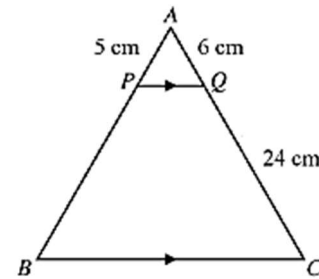
- 39) Helena creates similar rectangles using exactly 100 cm of string. The smaller rectangle is 4 cm by 6 cm. What are the dimensions of the larger rectangle?

- A. 18 cm by 22 cm      B. 20 cm by 30 cm  
 C. 16 cm by 24 cm      D. 36 cm by 54 cm

- 40) A bell tower is 17 meters tall. It casts a long shadow on the ground below. The tip of the shadow of the bell tower is 51 meters from the base of the bell tower. At the same time, a tall elm tree casts a shadow that is 63 meters long. If the right triangle formed by the tower and its shadow is similar to the right triangle formed by the elm and its shadow, how tall is the elm to the nearest tenth?

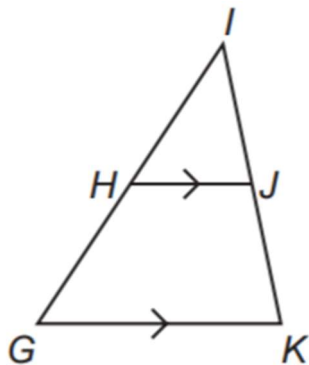
A. 13.8 m    B. 21 m    C. 189 m    D. 3.7 m

- 41) In triangle ABC,  $\overline{PQ}$  is parallel to  $\overline{BC}$ . What is the length of  $\overline{PB}$ , in centimeters?



A. 10 cm    B. 12 cm    C. 20 cm    D. 30 cm

- 42) 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."

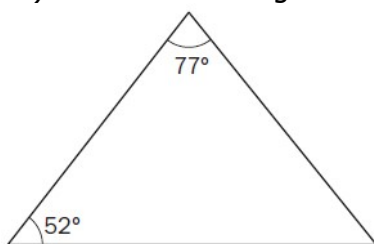


Step	Statement	Reason
1	$\overline{GK}$ is parallel to $\overline{HJ}$ .	Given
2	$\angle IGK \cong \angle IHJ$ $\angle IKG \cong \angle IJH$	?
3	$\triangle GIK \sim \triangle HIJ$	AA Similarity
4	$\frac{IG}{IH} = \frac{IK}{IJ}$	Corresponding sides of similar triangles are proportional.
5	$\frac{HG +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

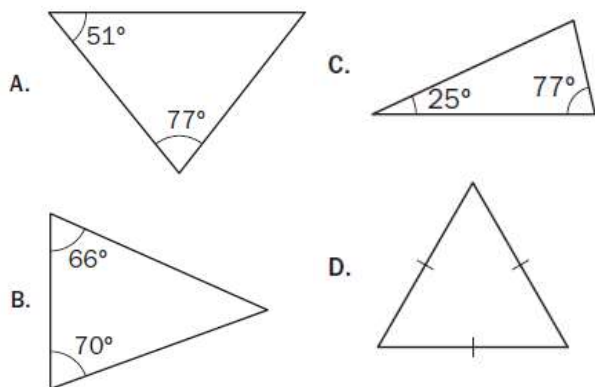
Which reason justifies Step 2?

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

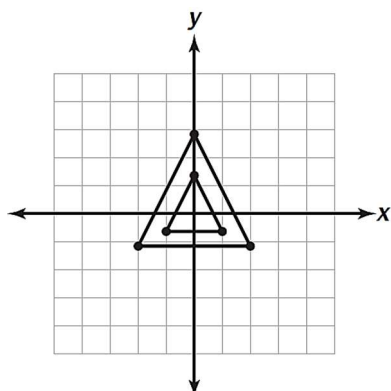
43) Look at the triangle.



Which triangle is similar to the given triangle?

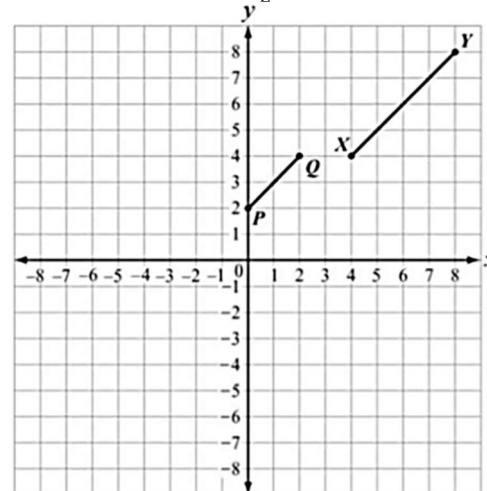


45) The smaller triangle is transformed to create the larger triangle. Which of these is the scale factor of the dilation centered at the point (0, 0)?



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

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

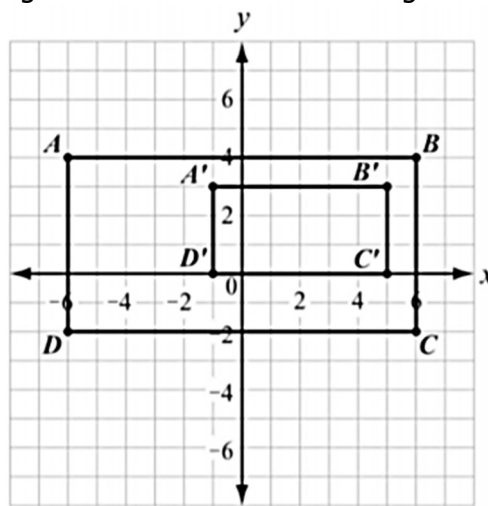


Which point is the center of dilation?

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

46) **Constructed Response**

Figure A'B'C'D' is a dilation of figure ABCD.



A. Determine the center of dilation.

B. Determine the scale factor of the dilation.

C. What is the relationship between the sides of the pre-image and the corresponding sides of the image?

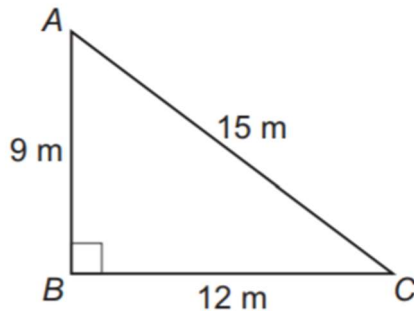
### Unit 3: Right Triangle Trigonometry

#### WHAT YOU NEED TO KNOW

- ☐ **Pythagorean Theorem:**  $a^2 + b^2 = c^2$  (c is the hypotenuse)
- ☐ **Trig Ratios:**  $\text{Sine} = \frac{\text{opp}}{\text{hyp}}$ ;  $\text{cosine} = \frac{\text{adj}}{\text{hyp}}$ ;  $\text{tangent} = \frac{\text{opp}}{\text{adj}}$
- ☐ **Co-Functions:**  $\sin(\theta) = \cos(90 - \theta)$ ;  $\cos(\theta) = \sin(90 - \theta)$ ;  $\tan(\theta) = \frac{1}{\tan(90 - \theta)}$
- ☐ **Solving sides using trig ratios:** Label all sides from the given angle (hypotenuse, opposite, adjacent) and circle the sides that have your important information and cross multiply
- ☐ **Solving angles with trig inverses** ( $^{-1}$ ): Label all sides from the given angle (hypotenuse, opposite, adjacent) and circle the sides that have your important information and use the inverse
- ☐ **Angle of Elevation and Depression:** Angle goes in the bottom of the triangle
- ☐ **Other Word Problems:** Kites, ladders, etc.
- ☐ **Square and Equilateral Triangles:** Diagonals and altitudes

#### Practice Problems

47) 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.  $\frac{5}{3}$

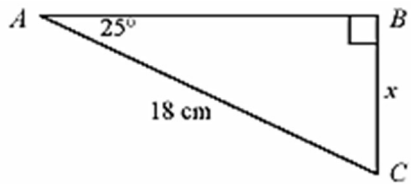
48) In triangle ABC, angle A and angle B are complementary angles. The value of  $\cos A$  is  $\frac{5}{13}$ . What is the value of  $\sin B$ ?

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

49) 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.  $\cos 40^\circ = \sin 50^\circ$

50) What is the approximate value of  $x$  in the diagram below?

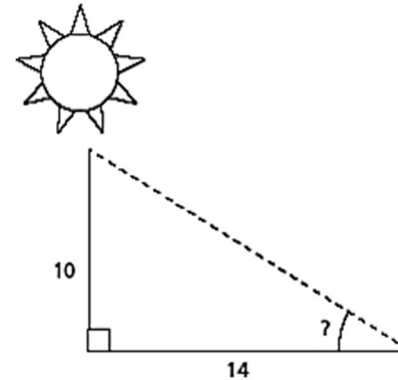


- A. 7.6 cm    B. 8.4 cm    C. 16.3 cm    D. 19.9 cm

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

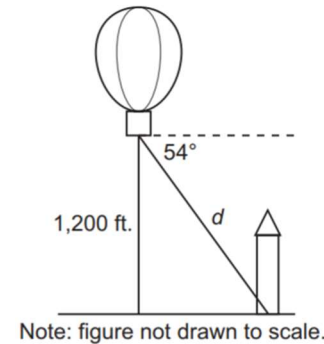
- A.  $\sin \angle H = \frac{1}{2}$   
 B.  $\sin \angle H = 1$   
 C.  $\sin \angle H = \cos \angle H$   
 D.  $\sin \angle H = \frac{1}{\cos \angle H}$

51) At a certain time, a vertical pole 10 feet tall casts a 14-foot shadow. What is the angle of elevation of the sun to the nearest degree?



- A.  $36^\circ$     B.  $44^\circ$     C.  $46^\circ$     D.  $54^\circ$

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

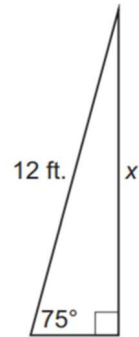


Note: figure not drawn to scale.

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

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

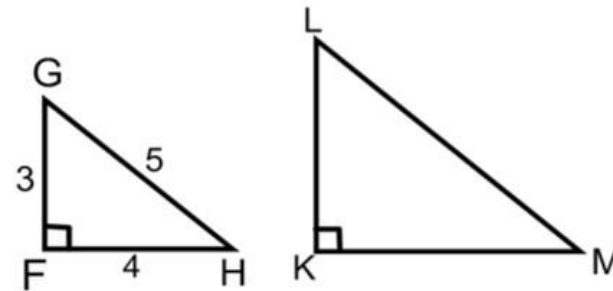
56) **Constructed Response**

Jane and Mark each build ramps to jump their remote-controlled cars. Both ramps are right triangles when viewed from the side. The incline of Jane's ramp makes a 30-degree angle with the ground, and the length of the inclined ramp is 14 inches. The incline of Mark's ramp makes a 45-degree angle with the ground, and the length of the inclined ramp is 10 inches.

**Part A:** What is the horizontal length of the base of each ramp? Explain how you found your answers. Write your answers below.

**Part B:** Which car is launched from the highest point? Explain your reasoning. Write your answer below.

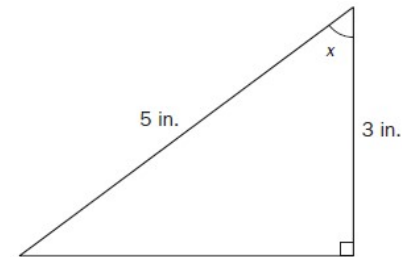
- 55) If  $\triangle FGH \sim \triangle KLM$  which of the following must be **TRUE**?



- A.  $\tan G = \tan L$   
 B.  $\tan G = \tan M$   
 C.  $\sin H = \sin L$   
 D.  $\sin H = \tan M$

57) **Constructed Response**

Study the triangle.



What is  $\sin x$ ? Explain how you determined your answer.

## Unit 4A: Circle Angle Relationships and Theorems

### WHAT YOU NEED TO KNOW

#### □ Circle Vocabulary

#### □ Angle Relationships:

- Central (vertex is in the center)  $\rightarrow$  equal to the arc measure
- 'ON' (vertex is on the edge circle)  $\rightarrow$  equal to  $\frac{1}{2}$  the arc measure
- 'IN' (vertex is in the circle, but NOT in the center)  $\rightarrow \frac{\text{big arc} + \text{small arc}}{2} = \text{angle}$
- 'OUT' (vertex is outside of the circle)  $\rightarrow \frac{\text{big arc} - \text{small arc}}{2} = \text{angle}$

#### □ Chord Theorems

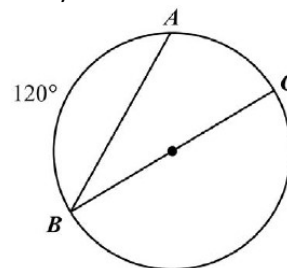
- **Tangent Theorems:** Radius and a tangent form a right angle; 2 tangents from the same point and go to the same circle are congruent

### Practice Problems

- 58) 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.

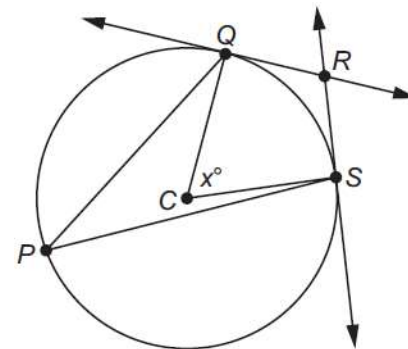
- 59) In the circle shown,  $\overline{BC}$  is a diameter and  $m\widehat{AB} = 120^\circ$ .



What is the measure of  $\angle ABC$ ?

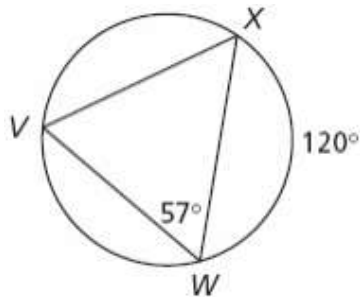
- A.  $15^\circ$       B.  $30^\circ$       C.  $60^\circ$       D.  $120^\circ$

- 60) The figure shows Circle C with tangent lines  $\overleftrightarrow{SR}$  and  $\overleftrightarrow{QR}$ . The measure of  $\angle QCS$  is  $x^\circ$ . Select THREE statements that are true about the figure.



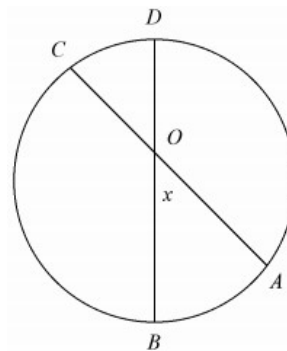
- A. The measure of  $\angle QCS$  is  $(90 - x)^\circ$
- B. The measure of  $\angle QPS$  is  $\frac{1}{2}x^\circ$
- C. The measure of  $\angle PSR$  is  $90^\circ$
- D. The measure of  $\angle CQR$  is  $90^\circ$
- E. The measure of  $\angle QRS$  is  $(180 - x)^\circ$
- F. The measure of  $\angle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

61) What is the measure of  $\angle V X W$ ?



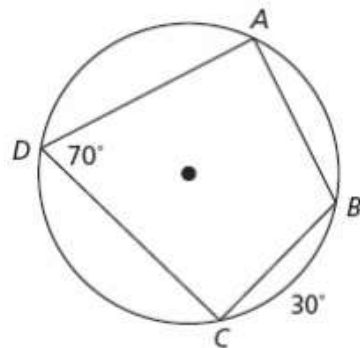
- A.  $120^\circ$     B.  $63^\circ$     C.  $60^\circ$     D.  $57^\circ$

62) What is the value of  $x$  for  $m\widehat{AB} = 45^\circ$  and  $m\widehat{CD} = 42^\circ$ ?



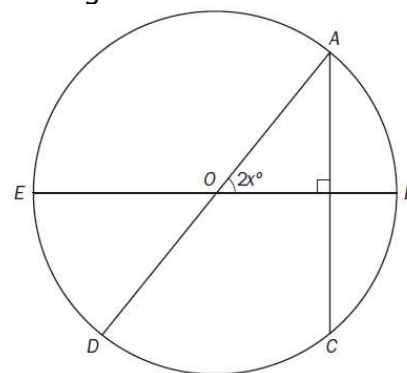
- A. 3    B. 43.5    C. 66    D. 87

63) What is the measure of arc  $AB$ ?



- A.  $40^\circ$     B.  $100^\circ$     C.  $110^\circ$     D.  $140^\circ$

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



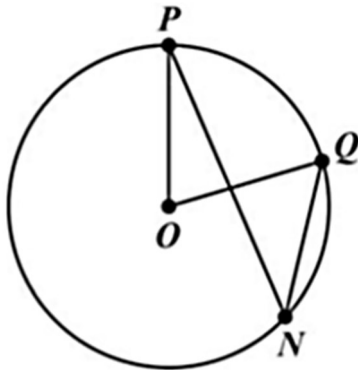
The measure of  $\widehat{CD}$  is  $80^\circ$ . What is the value of  $x$ ?

- A. 50    B. 40    C. 35    D. 25

65)

**Constructed Response**

$\angle PNQ$  is inscribed in circle O and  $m\widehat{PQ} = 70^\circ$ .

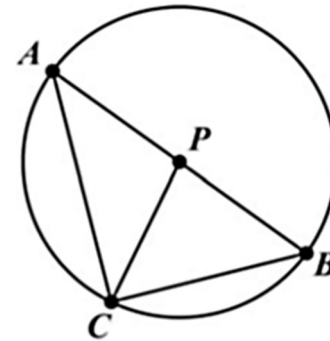


- A. What is the measure of  $\angle POQ$ ?
- B. What is the relationship between  $\angle POQ$  and  $\angle PNQ$ ?
- C. What is the measure of  $\angle PNQ$ ?

66)

**Constructed Response**

In circle P below,  $\overline{AB}$  is a diameter.



If  $m\angle APC = 100^\circ$ , find the following:

- A.  $m\angle BPC$
- B.  $m\angle BAC$
- C.  $m\widehat{BC}$
- D.  $m\widehat{AC}$

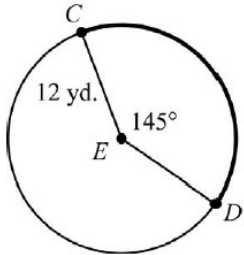
## Unit 4B – Arc length/Sector Area

### WHAT YOU NEED TO KNOW

- **Arc Length**  $\rightarrow \frac{\text{arc length}}{\text{circumference } (2\pi r)} = \frac{\text{angle } (\theta)}{360^\circ}$  OR  $\text{arc length} = \frac{2\pi r\theta}{360}$
- **Sector Area**  $\rightarrow \frac{\text{sector area}}{\text{Area } (\pi r^2)} = \frac{\text{angle } (\theta)}{360^\circ}$  OR  $\text{sector area} = \frac{\pi r^2\theta}{360}$

### Practice Problems

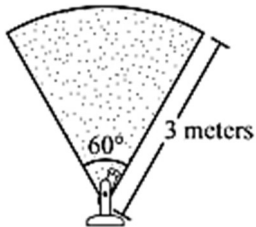
67) Circle E is shown.



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

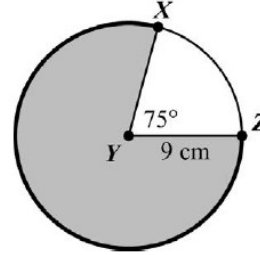
- A.  $\frac{29}{72}\pi$  yd      C.  $\frac{29}{3}\pi$  yd  
 B.  $\frac{29}{6}\pi$  yd      D.  $\frac{29}{2}\pi$  yd

69) A sprinkler rotates through  $60^\circ$ , watering a section of a field. The distance from the sprinkler to the farthest point reached is 3 meters. Approximately how many square meters of the field is watered?



- A. 0.6 square meters      C. 3.1 square meters  
 B. 0.8 square meters      D. 4.7 square meters

68) Circle Y is shown.



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

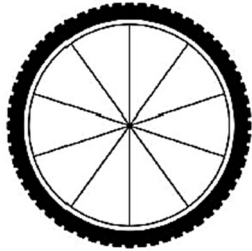
- A.  $\frac{57}{4}\pi$  cm<sup>2</sup>      C.  $\frac{405}{8}\pi$  cm<sup>2</sup>  
 B.  $\frac{135}{8}\pi$  cm<sup>2</sup>      D.  $\frac{513}{8}\pi$  cm<sup>2</sup>

70) An athlete is running along a circular path that has a diameter of 250 yards. The arc traveled by the athlete is  $120^\circ$ . Using 3.14 for  $\pi$ , how many yards did the athlete run? Round the answer to the nearest yard.



- A. 131 yards      C. 376 yards  
 B. 262 yards      D. 545 yards

- 71) 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                      C. 11.3 inches  
B. 5.7 inches                      D. 25.4 inches

### Unit 4C – Volume

#### WHAT YOU NEED TO KNOW

- ☐ **Volume:** Cavalieri's Principle, prisms ( $Bh \rightarrow (LW)h$ ), pyramids ( $\frac{1}{3}Bh \rightarrow \frac{1}{3}(LW)h$ ), cylinders ( $\pi r^2 h$ ), cones ( $\frac{1}{3}\pi r^2 h$ ), and spheres ( $\frac{4}{3}\pi r^3$ )
- ☐ **Composite Volume:** Adding or multiplying multiple 3D figures
- ☐ **Geometric Modeling:** Earth (sphere), human torso (cylinder), mountain (cone), bowl of cereal (hemisphere)
- ☐ **Population Density:**  $\frac{\text{population}}{\text{area}}$

#### Practice Problems

- 72) This is a hand drawing of a mountain. Explain which geometric shape could be used to estimate the total amount of Earth the mountain is made of.



- A. Triangle  
B. Cone  
C. Pyramid  
D. Rectangle

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

- A.  $\frac{81}{2}\pi \text{ in}^3$                       C.  $\frac{27}{8}\pi \text{ in}^3$   
B.  $\frac{27}{4}\pi \text{ in}^3$                       D.  $\frac{9}{4}\pi \text{ in}^3$

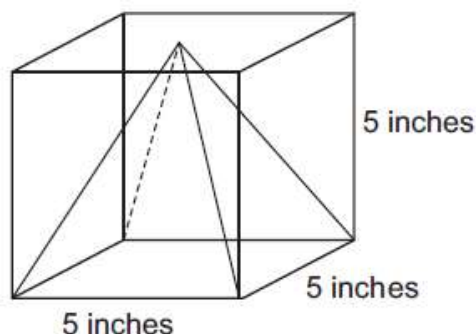
- 74) Jason constructed two cylinders using solid metal washers. The cylinders have the same height, but one of the cylinders is slanted as shown.



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 volumes because they are 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.

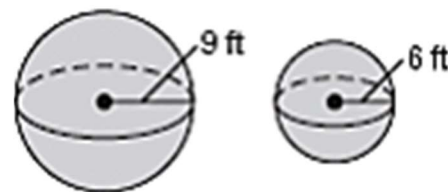
- 76) A square pyramid is packaged inside a box.



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?

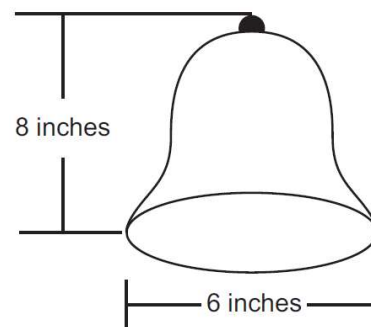
- A. 8 cubic inches
- B. 41 cubic inches
- C. 83 cubic inches
- D. 125 cubic inches

- 75) Find the difference in the volume of the two spheres below.



- A.  $972\pi$
- B.  $684\pi$
- C.  $180\pi$
- D.  $324\pi$

- 77) A company needs to package this bell in a rectangular box.



What are the smallest dimensions (length, width, and height) the rectangular box can have so that the lid of the box can also close?

- A. 6 inches long, 6 inches wide, and 6 inches high
- B. 6 inches long, 6 inches wide, and 8 inches high
- C. 8 inches long, 8 inches wide, and 8 inches high
- D. 8 inches long, 8 inches wide and 6 inches high

- 78) A construction company is preparing 10 acres of land for a new housing community. The land contains large rocks that need to be removed. A machine removes 10 rocks from 360 square feet of land.

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

How many rocks need to be removed from the 10 acres of land before the new housing community can be built?

- A. 360 rocks
- B. 1,210 rocks
- C. 12,100 rocks
- D. 435,600 rocks

80) **Constructed Response**

A sandcastle mold is in the shape of a cylinder with a diameter of 6 inches and a height of 8 inches. To the nearest cubic inch, how much sand will fit in the sandcastle mold? Explain how you determined your answer. In your explanation, use the word pi instead of the symbol  $\pi$ . Write your answer below.

- 79) 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

81) **Constructed Response**

A pyramid and rectangular prism have congruent bases and equal heights. Write a statement comparing the volume of the figures and explain your reasoning. Write your answer below.

## Unit 5 – Algebraic and Geometric Connections

### WHAT YOU NEED TO KNOW

- **Creating Equations of Parallel and Perpendicular Lines:** Parallel = same slope, perpendicular = opposite reciprocal slopes ( $\frac{1}{4} \rightarrow -4$ ,  $-2 \rightarrow \frac{1}{2}$ ), replace 'm', 'x', and 'y' to solve for 'b' to create a new linear equation
- **Midpoint:**  $\left(\frac{x_2+x_1}{2}, \frac{y_2+y_1}{2}\right)$
- **Partitioning:**  $\left(x_1 + \frac{a}{a+b}(x_2 - x_1), y_1 + \frac{a}{a+b}(y_2 - y_1)\right)$ , MAKE SURE TO PAY ATTENTION TO WHAT POINT YOU ARE COMING FROM!
- **Perimeter and Area:** Use distance formula
- **Conic Circles Properties:**  $(x - h)^2 + (y - k)^2 = r^2$ , center: (h, k), and radius = r
- **Creating Conic Circle Equations from different scenarios:** Center & radius, graph, general form (completing the square)

### Practice Problems

- 82) Given the points P(2, -1) and Q(-9, -6), what are the coordinates of the point on the directed line segment  $\overline{PQ}$  that partitions  $\overline{PQ}$  in the ratio  $\frac{3}{2}$ ?
- A.  $\left(-\frac{23}{5}, -4\right)$       C.  $\left(\frac{5}{3}, \frac{8}{3}\right)$
- B.  $\left(-\frac{12}{5}, -3\right)$       D.  $\left(-\frac{5}{3}, -\frac{8}{3}\right)$
- 83) 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.  $y = -2x + 16$

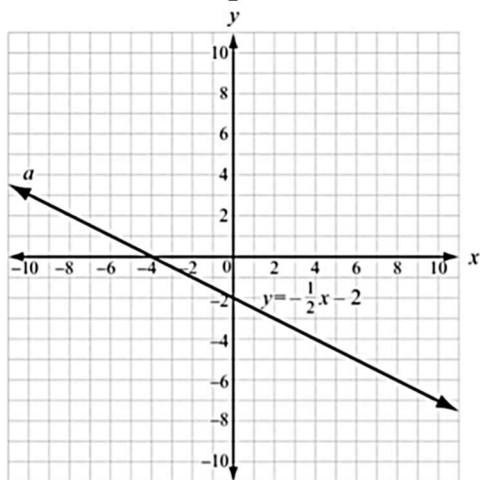
### 84) Constructed Response

Given the points A(-1, 2) and B(7, 8), find the coordinate of the point P on directed line segment  $\overline{AB}$  that partitions  $\overline{AB}$  in the ratio 1:3.

### 85) Constructed Response

Find the area of rectangle ABCD with vertices A(-3, 0), B(3, 2), C(4, -1), and D(-2, -3).

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



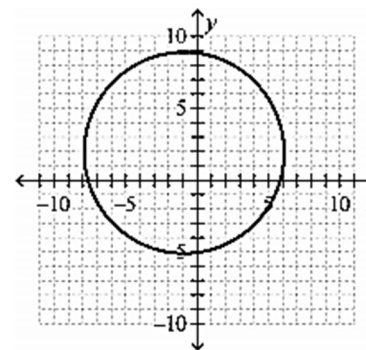
Which is an equation of the line that is perpendicular to line  $a$  and passes through the point  $(-4, 0)$ ?

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

- 87) What is the equation of a circle that has a center  $(-6, 2)$  and radius of  $\sqrt{106}$ ?

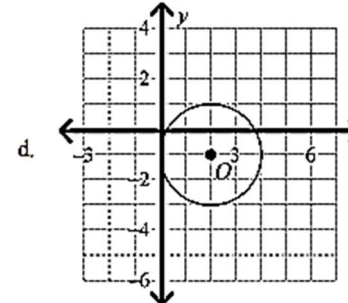
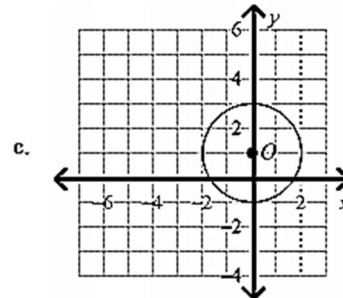
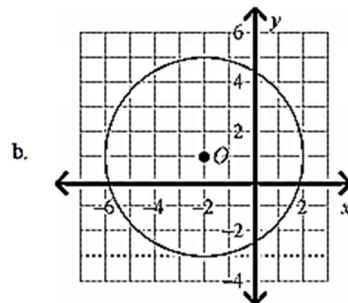
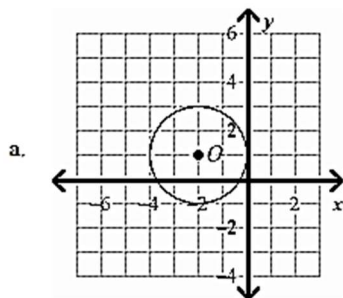
- A.  $(x - 6)^2 + (y + 2)^2 = \sqrt{106}$                       C.  $(x + 6)^2 + (y - 2)^2 = \sqrt{106}$   
 B.  $(x - 6)^2 + (y + 2)^2 = 106$                       D.  $(x + 6)^2 + (y - 2)^2 = 106$

- 88) Which of the following is the correct equation for the circle shown below?



- A.  $(x - 1)^2 + (y + 2)^2 = 49$                       C.  $(x - 1)^2 + (y + 2)^2 = 7$   
 B.  $(x + 1)^2 + (y - 2)^2 = 49$                       D.  $(x + 1)^2 + (y - 2)^2 = 7$

- 89) A manufacturer is designing a two-wheeled cart that can maneuver through tight spaces. On one test model, the wheel placement (center) and radius is modeled by the equation  $(x + 2)^2 + (y - 1)^2 = 4$ . What is the graph that shows the position and radius of the wheels?



90) 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.  $(-8, 6)$

92) 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.  $(0, -5)$

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

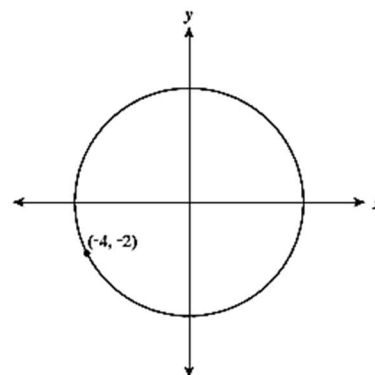
95) Which is an equation for the circle with a center at  $(-2, 3)$  and a radius of 3?

- 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.  $3x^2 + 3y^2 + 4x - 6y + 4 = 0$

91) 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.  $(6, -5)$

93) The circle shown below is centered at the origin and contains the point  $(-4, -2)$ .



Which of the following is closest to the length of the diameter of the circle?

- A. 13.41      B. 11.66      C. 8.94      D. 4.47

## Unit 6 – Applications of Probability

### WHAT YOU NEED TO KNOW

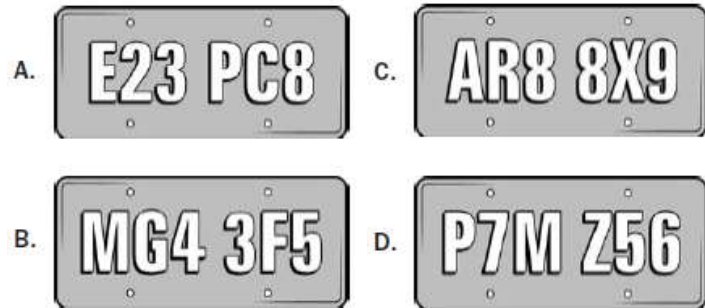
- **Sample Space:** All possible outcomes (rolling a die – {1, 2, 3, 4, 5, 6}; flipping a coin – {Heads, Tails})
- **Total Possible Outcomes:** # of possible outcomes multiplied from ALL possible scenarios
- **Simple probability:**  $\frac{\text{wanted outcomes}}{\text{all outcomes}}$
- **Set Notation:** Union ( $\cup$ ) – OR, Intersection ( $\cap$ ) – AND, Complement ( $'$ ) – NOT
- **'AND' events:**  $P(A \text{ and } B) = P(A) * P(B)$ , independent events (with replacement – denominator doesn't change), dependent events (without replacement – denominator changes)
- **'OR' events:**  $P(A \text{ or } B) = P(A) + P(B) - P(A)*P(B)$  (if needed), mutually exclusive – no overlapping outcomes (no subtraction needed), inclusive – overlapping outcomes (subtraction needed since the events have something in common), REMEMBER: you must subtract also if there are multiple sample spaces (flipping a coin and rolling a die)
- **Conditional events:** Based on a condition,  $P(A|B) = \frac{P(A \text{ and } B)}{P(B)}$ , Event B is ALREADY happened
- **Two-Way Frequency Tables:** Pay attention to wording and the correct totals, relative frequency  $\rightarrow$  percentage

### Practice Problems

- 96) 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.  $P(A) = 0.3$ ;  $P(B) = 0.15$ ;  $P(A \text{ and } B) = 0.045$
- 97) 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.  $\frac{11}{16}$
- 98) 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.  $\frac{8}{13}$
- 99) 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.  $\frac{88}{105}$

- 100) 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  $O$ ?



- 101) 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.  $\frac{1}{3}$

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

Hair Color				
	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 a male?

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

- 103) 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