# Math Geometry FAIM 2015 Form 1-A [1530458]

Student _____
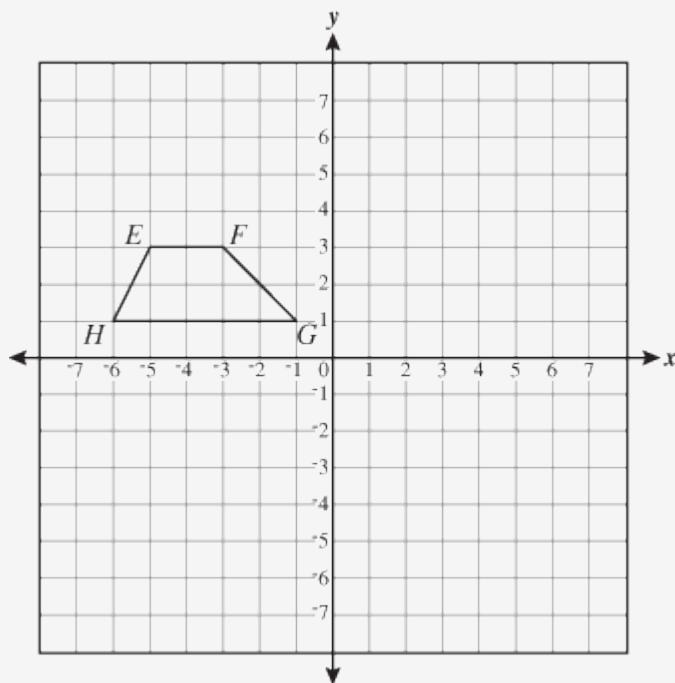
Class _____

Date _____

Instructions

Use your Response Document to answer question 13.

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**1.** Given: Trapezoid *EFGH* with vertices $E(-5, 3), F(-3, 3), G(-1, 1),$ and $H(-6, 1)$ as shown in the diagram below.



Trapezoid *EFGH* is rotated 180° clockwise about the origin to yield trapezoid *E'F'G'H'*. Which ordered pair gives the coordinates of vertex *E'*?

A. $(3, 5)$

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**B.** $(3, -5)$

**C.** $(5, 3)$

**D.** $(5, -3)$

**2.** Which statement **best** explains why the dilation of a triangle produces a similar triangle?
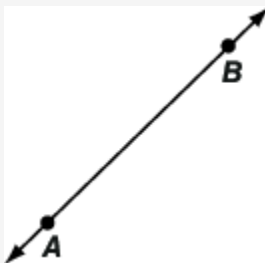
    **A.** Dilation always preserves side lengths.

    **B.** Dilation always preserves angle measures.

    **C.** Dilation always preserves the location of the center of the triangle.

    **D.** Dilation always preserves the locations of the vertices of the triangle.

**3.** Carol has drawn line $\overleftrightarrow{AB}$ as shown.

If Carol draws line $\overleftrightarrow{PQ}$, such that the distance from each point on $\overleftrightarrow{AB}$ to $\overleftrightarrow{PQ}$ and the distance from each point on $\overleftrightarrow{PQ}$ to $\overleftrightarrow{AB}$ are equal and greater than zero, what term best describes these lines?

4. The population of a state is approximately 5 million people. The state is in the shape of a rectangle that is 280 miles by 380 miles. To the nearest whole number, what is the average number of people living on each square mile of the state?

5. Maricela needs to write instructions for how to construct a regular hexagon inscribed in a circle. She begins by writing the following two steps:

   Step 1: Start by drawing a circle using a compass.
   Step 2: Mark a point on the circle.

   What is the **best** statement for Maricela to write for Step 3?

   A. Using a straightedge, draw a segment that passes through the marked point to the center of the circle.

   B. Without changing the width of the compass, put the compass point at the marked point, then draw an arc that intersects the circle in two places.

   C. Using a straightedge, draw a line segment from the center of the circle through the marked point, then extend the segment and label a point outside the circle.

**D.** Widen the radius of the compass to the width of the diameter, then place the compass point at the marked point and draw an arc that intersects the circle in one place.

6. Mrs. Kennsington is in charge of designing the plans for the new community garden being built in her town. She designs the garden in the shape of a trapezoid and plots her plans on a coordinate grid with vertices at $P(-3, 6), Q(-6, 6), R(-9, 1), S(-3, 1)$.

   Part A. If each unit on the grid represents 1 foot, how many feet of fencing are required to put a fence around the garden? Round your answer to the nearest hundredth of a foot.

   Part B. What is the area of the community garden? Show your work.

   Use words and/or numbers to show your work.

7. Circle $P$ has a radius of $\dfrac{2}{3}$ units. It includes a sector with a central angle of $x°$ and an area of 1 square unit. Which proportion could be used to determine the value of $x$?

   **A.** $\dfrac{4}{9\pi} = \dfrac{x}{180}$

   **B.** $\dfrac{9}{4\pi} = \dfrac{x}{180}$

   **C.** $\dfrac{4}{9\pi} = \dfrac{x}{360}$

D. $\dfrac{9}{4\pi} = \dfrac{x}{360}$

8. Two triangles, with vertices at $P(-3, 2), Q(-7, 3),$ and $R(-2, 5)$ and at $S(5, 5), T(3, 0),$ and $U(2, 4)$ are drawn in the standard *xy*-coordinate plane.

   Part A: Is there a set of rigid motions under which the image of $\triangle PRQ$ is transformed onto $\triangle UST?$ If so, describe the rigid motions. If not, explain why such a set of rigid motions is impossible.

   Part B: What is the relationship between the two given triangles? Support your answer with precise mathematical evidence.

9. Which of these points lies on the circle that is centered at $(3, 0)$ and passes through the point $(3, 2)$?
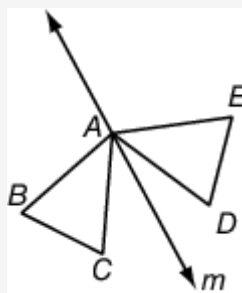
   A. $(0, 1)$

   B. $(1, 2)$

   C. $\left(2, \sqrt{3}\right)$

   D. $\left(4, -\sqrt{2}\right)$

10. $\triangle ABC$ is reflected across line *m* to result in the image shown below. Which of these statements correctly shows that the triangles are congruent based on the reflection over line *m*?

**A.** As reflections preserve angle and side measures, $\angle BAC \cong \angle DAE$, $\overline{AB} \cong \overline{AE}$, and $\overline{BC} \cong \overline{ED}$.

**B.** As reflections preserve angle measures, $\angle BAC \cong \angle DAE$, $\angle ABC \cong \angle AED$, and $\angle ACB \cong \angle ADE$.

**C.** As reflections preserve side lengths, $\overline{AB} \cong \overline{AD}$, $\overline{AC} \cong \overline{AE}$, and $\overline{BC} \cong \overline{DE}$.

**D.** As reflections preserve side lengths, $\overline{AB} \cong \overline{AE}$, $\overline{AC} \cong \overline{AD}$, and $\overline{BC} \cong \overline{ED}$.

**11.** A rhombus is drawn in the standard *xy*-coordinate plane. The line $2x + y = 4$ includes one of the rhombus' diagonals. What is the slope of the other diagonal?

**12.** Use the proof below to answer the question.

Given: *ABCD* is a parallelogram

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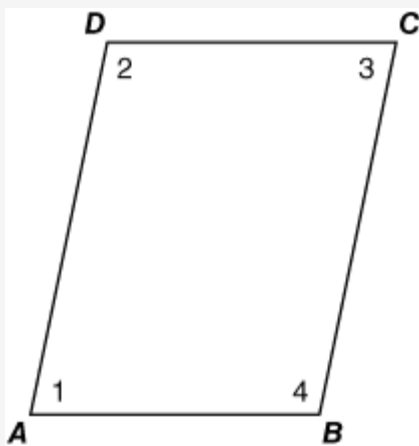
Prove: $\angle 1$ and $\angle 2$ are supplementary.

Proof:

It is given that *ABCD* is a parallelogram with angles named, in consecutive order, $\angle 1, \angle 2, \angle 3$, and $\angle 4$.

Opposite angles of a parallelogram are congruent. Thus, $m\angle 1 = m\angle 3$ and $m\angle 2 = m\angle 4$ by the definition of congruence.

The sum of the interior angles of any quadrilateral is 360°, so ___(i)___.

Using the substitution property, $m\angle 1 + m\angle 1 + m\angle 2 + m\angle 2 = 360°$.

Therefore, $2(m\angle 1 + m\angle 2) = 360°$.

By the division property of equality, ___(ii)___

Therefore, $\angle 1$ and $\angle 2$ are supplementary.

What statements should go in the blanks of the proof?

A.  i. $m\angle 1 + m\angle 2 + m\angle 3 + m\angle 4 = 360°$

   ii. $m\angle 1 + m\angle 2 = 90°$

B.  i. $m\angle 1 + m\angle 2 + m\angle 3 + m\angle 4 = 360°$

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ii. $m\angle 1 + m\angle 2 = 180°$

C. i. $m\angle 1 + m\angle 2 + m\angle 1 + m\angle 2 = 360°$

ii. $m\angle 1 + m\angle 2 = 90°$

D. i. $m\angle 1 + m\angle 2 + m\angle 1 + m\angle 2 = 360°$

ii. $m\angle 1 + m\angle 2 = 180°$

**13.** Sebastian is fencing in a rectangular pasture by a river for his horses. The river will serve as the boundary for one side of the pasture. Sebastian has a total of 240 yards of fence for the other three sides.

Part A.

Draw a model of the pasture. Label the length along the river *l* and the width *w*.

Part B.

Write an equation to represent the amount of fence that Sebastian will need to enclose the pasture in terms of *l* and *w*. (Remember that he only needs to use fence for three sides.)  Be sure to consider the constraint of the number of yards of fence that Sebastian has when you write the equation.

Part C.

Write an equation in terms of *w* to represent the area of the pasture in square yards.  Show how you derived the equation.

Part D.

What is the greatest area, in square yards, that Sebastian can fence in? Show your work.

Place an "X" in the answer box below.

Answer the question on the Response Document provided.

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Click next.

**14.** Line segment $\overline{MT}$ is dilated about the origin by a scale factor of 3, which results in $\overline{M'T'}$. If $\overline{MT}$ is dilated by a scale factor of $\dfrac{1}{3}$, then the resulting line segment is $M''T''$. Which equation about the relationship of the lengths of the dilated line segments is true?

A. $M'T' = 9 \times M''T''$

B. $M'T' = 6 \times M''T''$

C. $M'T' = 3 \times M''T''$

D. $M'T' = \dfrac{1}{6} \times M''T''$

**15.** What is the minimum angle in degrees that any rectangle that is not a square should be rotated about its center so that the rectangle maps onto itself?

**16.** Jay and Libby are working outside when they see a blimp flying over the neighborhood. Jay is mowing the lawn approximately 2,500 feet (ft) from Libby when they both see the blimp. Libby looks up from her gardening at an angle of $43°$ while Jay looks up at an angle of $35°$.
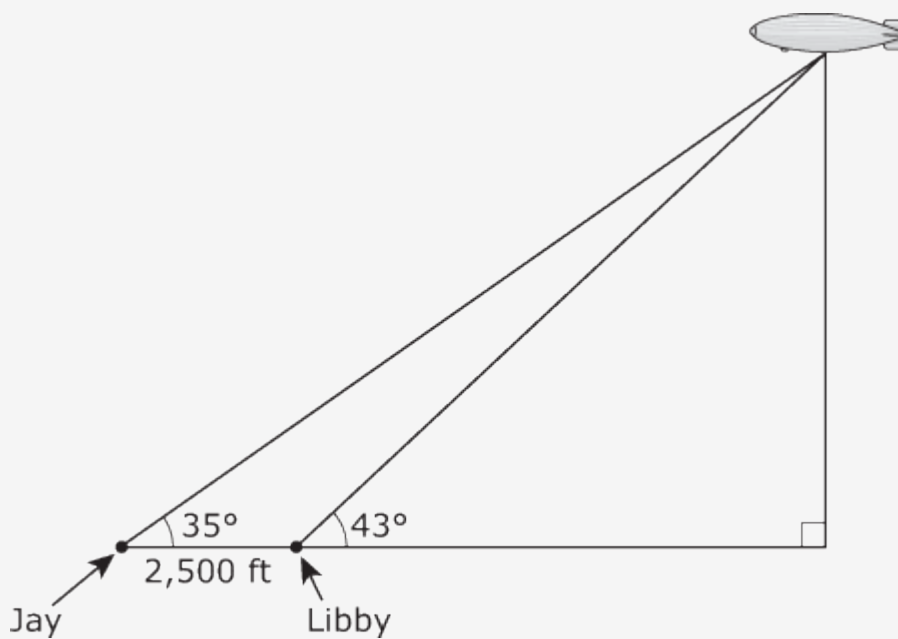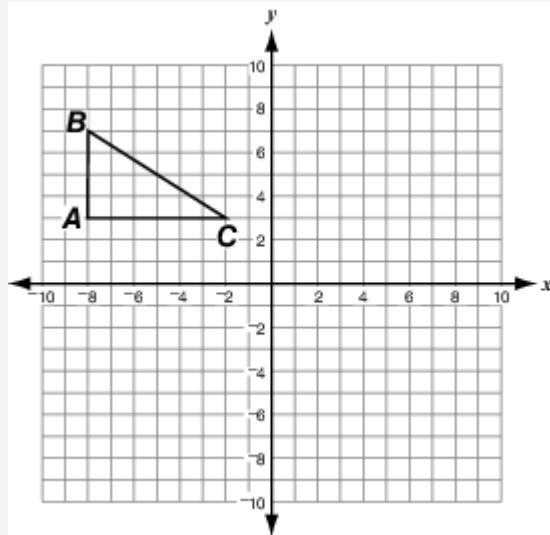
Which distance, in feet, is closest to the vertical height of the blimp above the ground?

**A.** 1,751 feet

**B.** 2,331 feet

**C.** 7,027 feet

**D.** 7,535 feet

**17.** Given $P(2, 2)$ and $Q(8, 11)$ what are the coordinates of the point that divides the $\overline{PQ}$ two-thirds of the way from $P$ to $Q$?

**18.** Use the figure below to answer the following questions.

Part A. Transform $\triangle ABC$ into $\triangle A'B'C'$ by translating each segment of the triangle 9 units to the right and down 7 units. Examine the triangles. Is $\triangle ABC \cong \triangle A'B'C'$? Explain your answer using congruence criteria for triangles.
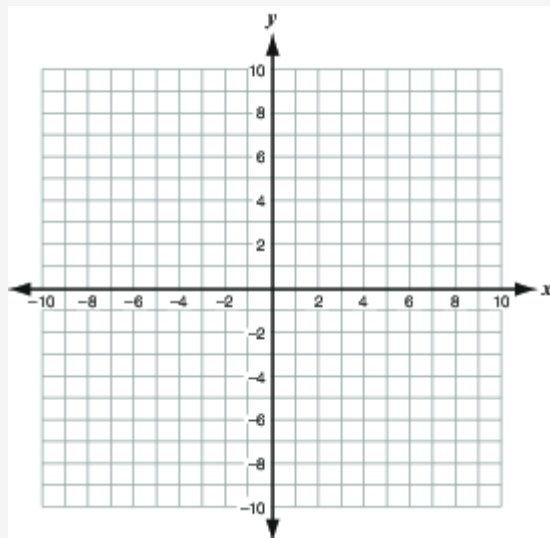


Part B. Transform $\overline{AB}$ to $\overline{A'B'}$, $\overline{AC}$ to $\overline{A'C'}$, and $\angle BAC$ to $\angle B'A'C'$ by rotating both segments and the angle 90° clockwise about the origin. Then, draw a segment connecting the points $B'$ and $C'$ to create $\triangle A'B'C'$ that is different from the one in Part A. Examine the triangles in this part only.

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Is $\triangle ABC \cong \triangle A'B'C'$? Explain your answer using congruence criteria for triangles.
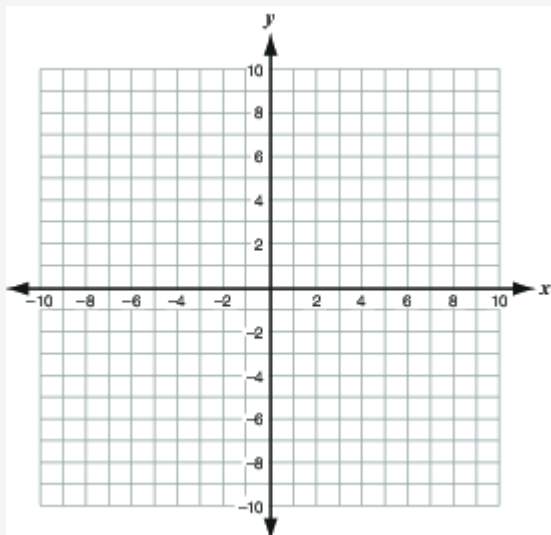


Part C. Transform $\overline{AC}$ to $\overline{A'C'}$, $\angle BAC$ to $\angle B'A'C'$, and $\angle ACB$ to $\angle A'C'B'$ by reflecting the segment and each angle across the x-axis. Then, extend $\overline{A'B'}$ and $\overline{C'B'}$ until they intersect to create $\triangle A'B'C'$ that is different from those in the previous parts. Examine the triangles. Is $\triangle ABC \cong \triangle A'B'C'$? Explain your answer using congruence criteria for triangles.
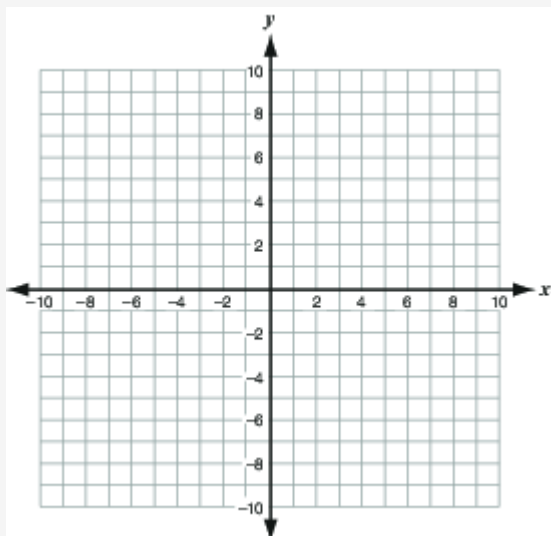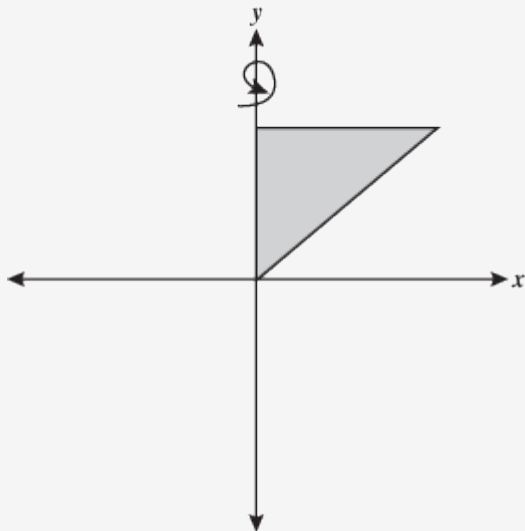


Part D. Based on the results of parts A, B, and C, describe how the rigid motion translations, rotations and reflections of side lengths, and angle measures affect triangle congruence.

Use words and/or numbers to show your work.

**19.** If $\sin(2x)° = \cos(x+15)°$ and $0 < x \leq 90$, what is the value of $x$?

**20.** The right triangle as shown is rotated $360°$ around the *y*-axis in three dimensions.



What is the 3-dimensional solid resulting from the rotation?

A. cone

B. cylinder

C. pyramid

D. prism