Scoring Instructions: 08/01/16, Math Geometry FAIM 2016 Form 2-B

2. What transformation takes $\triangle ABC$ to $\triangle A'B'C'$ as shown in the figure below?



Be specific:

For a rotation, specify the angle of rotation and the center of rotation.

For a reflection, specify the line of reflection.

For a translation, specify the units and direction the figure is translated.

```
Scoring Instructions:
Reflection over the line x = 2.
```

5. Part A. Using a compass and straightedge, construct a regular hexagon *ABCDEF* inscribed in a circle with center *O*. Do not erase the arcs made during your construction.

Part B. Explain the steps you took to construct the regular hexagon in part A. What is it about the angle measures of a regular hexagon that makes this method of construction possible? Explain.

Use words and/or numbers to show your work.

Place an "X" in the answer box below. Answer the question on the Response Document provided. Click next. Scoring Instructions: Rubric:

- Work demonstrates a clear and complete understanding of the mathematical concepts and/or procedures required by the task.
 Appropriate strategy is shown with clear and complete explanations and interpretations.
- Response demonstrates a **partial** understanding of the mathematical concepts and/or procedures. Appropriate strategy is shown, but explanation or interpretation has minor flaws. OR

Response is incorrect because of calculation errors. Work and strategy indicate a **clear** understanding of the mathematical concepts and/or procedures required by the task.

0 Response is irrelevant, inappropriate, or not provided.

SCORING EXEMPLAR Maximum Points—2

Part A – 1 point

Size of construction may vary. A sample is provided below.



or equivalent work

Part B – 1 point

- 1. Construct a circle with center O. The compass width should remain set to the width of the radius of the circle.
- 2. Put the compass point on the circle and mark an arc on the circle.
- **3**. Put the compass point on the marked arc and mark another arc on the circle. Repeat until 6 arcs are marked on the circle.
- 4. Use a straightedge to connect each of the consecutive marked arcs. These line segments form a regular hexagon.



• The measures of the angles of a regular hexagon are 120°. When the diagonals are drawn to the opposite vertices, they create six equilateral triangles that share a vertex at the center of the circle. Therefore, the length of the radius of the circle is equivalent to the length of one side of the regular hexagon.

or equivalent work

8. What is the equation of the line passing through the point (2,3) and perpendicular to the line y = 2x + 7?

Scoring Instructions: $y = -\frac{1}{2}x + 4$ or equivalent answer

10. The coordinates of a quadrilateral are A(-3, 1); B(-2, 4); C(1, 2); D(0, -1).

Part A. What are the lengths and slopes of \overline{AB} , \overline{BC} , \overline{CD} , and \overline{AD} ?

Part B. What type of quadrilateral is *ABCD*? Use the most specific name possible and explain your answer.

Use words and/or numbers to show your work.



Scoring Instructions:

Rubric:

- Work demonstrates a clear and complete understanding of the mathematical concepts and/or procedures required by the task.
 Appropriate strategy is shown with clear and complete explanations and interpretations.
- Response demonstrates a partial understanding of the mathematical concepts and/or procedures. Appropriate strategy is shown, but explanation or interpretation has minor flaws.
 OR

Response is incorrect because of calculation errors. Work and strategy indicate a clear understanding of the mathematical concepts and/or procedures required by the task.

0 Response is irrelevant, inappropriate, or not provided.

SCORING EXEMPLAR Maximum Points—2 Part A – [1 point]

Strategies may vary

• To find side lengths and slopes:

Quadrilateral coordinates:

A(-3,1); B(-2,4); C(1,2); D(0,-1)



or equivalent work

Part B – [1 point]

• To find the type of quadrilateral:

In the quadrilateral ABCD, AB=CD and BC=AD.

Also, the slopes of \overline{AB} and \overline{CD} are equal as are the slopes of \overline{BC} and \overline{AD} . In the quadrilateral *ABCD*, the opposite sides are equal and parallel. The adjacent sides however are not perpendicular or equal. Hence, *ABCD* is a parallelogram but not a rectangle, rhombus, or square.

or equivalent work

14. What are the coordinates of the center of the circle given by the equation $x^2 + y^2 + x - 4y - 93.75 = 0$?

Scoring Instructions:	
(-0.5, 2)	
OR equivalent	

15. Kristin is standing on a 78 ft tall building and looking at the fountain in a nearby park. The angle of depression from the top of the apartment building to the base of the fountain is 72°.

Part A. Draw a diagram to represent the given situation. Label the fountain base and all known angle measures and lengths. How far away from the fountain is the building? Round your answer to the nearest hundredth of a foot.

Part B. The angle of depression from the top of the apartment building to the top of the fountain is 68°, and the top of the fountain is directly above the base of the fountain that was measured in part A. How tall is the fountain? Show your work and round your answer to the nearest tenth of a foot.

Use words, numbers, and/or pictures to show your work.

Place an "X" in the answer box below.

Answer the question on the Response Document provided.

Click next.



Scoring Instructions: Rubric:

- Work demonstrates a clear and complete understanding of the mathematical concepts and/or procedures required by the task.
 Appropriate strategy is shown with clear and complete explanations and interpretations.
- 1 Response demonstrates a **partial** understanding of the mathematical concepts and/or procedures. Appropriate strategy is shown, but explanation or interpretation has minor flaws.

OR

Response is incorrect because of calculation errors. Work and strategy indicate a **clear** understanding of the mathematical concepts and/or procedures required by the task.

0 Response is irrelevant, inappropriate, or not provided.

SCORING EXEMPLAR

Maximum Points-2

Part A – 1 point

• Height of building = 78 ft

Angle of depression = 72°

Let the fountain be *x* feet away from the building:



Part B – 1 point

 Height of building = 78 ft Angle of depression = 68°





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?

Scoring Instructions: (6,8)

21. Transformations

Given: $\triangle ABC$ with vertices A(-3,5), B(-2,2), and C(-4,2).

Given: $\Delta A'B'C'$ with vertices A'(3,1), B'(4,-2), and C'(2,-2).

Part A

Write a rule to map $\triangle ABC$ onto $\triangle A'B'C'$.

Part B

 ΔABC is reflected across the x-axis and then rotated counterclockwise 90° about the origin to yield $\Delta A''B''C''$. Draw $\Delta A''B''C''$ on a coordinate plane similar to the one shown below.



Part C

Determine a different set of two or more transformations that map $\triangle ABC$ to $\triangle A''B''C''$.

Part D

Maggie is applying transformations to $\triangle ABC$. She is supposed to reflect the triangle over the y-axis and translate it down four units, but she cannot remember the order in which she was instructed to perform the transformations.

- Explain to Maggie why the order of the transformations does not matter for her assignment.
- In your explanation, include an example of when the order in which the transformation is performed does matter.
- Justify your explanation with words and/or diagrams.

Place an "X" in the answer box below.

Answer the question on the Response Document provided.

Click next.



Scoring Instructions:

Teacher Directions:

Before administration, discuss rigid motions. Read the problem aloud and respond to any questions. Instruct students to use words, numbers, pictures, and/or models to show their work. Allow 15-20 minutes for this task. Make all necessary materials available. Guide students and answer questions, but encourage independent thinking. After the task, discuss answers as time permits. Suggested Materials: Grid paper Maximum Points—5 Part A – 1 point

Write a rule to map $\triangle ABC$ onto $\triangle A'B'C'$.

Student writes a rule to map $\triangle ABC$ onto $\triangle A'B'C'$.

Sample response

(x + 6, y - 4)

OR

translate 6 units right, 4 units down

or other appropriate response

Part B – 1 point

Student draws $\Delta A''B''C''$ on the coordinate plane. $\Delta A''B''C''$ should have vertices $\Delta A''(5, -3), B''(2, -2)$, and C''(2, -4).

Part C – 1 point

Student gives a set of two or more transformations that map $\triangle ABC$ onto $\triangle A''B''C''$.

Sample response

A reflection over the *y*-axis followed by a clockwise rotation of 90° about the origin

OR

A translation of 6 units right and 3 units down followed by a 90° clockwise rotation about the point (1, -2).

Other solutions that yield the same triangle are acceptable.

Part D – 2 points

[1 point]

Student gives an explanation of why the order of the transformations does not matter.

Sample explanation

The order of the transformations in Maggie's assignment does not matter because the reflection and the translation assigned both impact only one coordinate. The reflection impacts only the x-values and the translation impacts only the y-values. This set of transformations can be done in any order.

or other appropriate response

[1 point]

Student provides an example of a set of transformations that will yield different images depending on the order of the transformations. The example should include at least one transformation in which both the x and y coordinates change. The example may involve words, pictures, or both.

22. The triangles below are similar.



Write a numerical ratio that can be used to find the value of $\tan F$.

Scoring Instructions: $\tan F = \frac{10}{7.5}$ or equivalent

