- 1. Point J(p,q) is a vertex of quadrilateral *JKLM*. What are the coordinates of J' after *JKLM* is rotated 180° about the origin?
  - A (-p, -q)
  - B  $(^-p, q)$
  - $C (p, \bar{q})$
  - D (q, p)
- 2.  $\triangle GHI$  will be dilated by a scale factor of 3, resulting in  $\triangle G'H'I'$ . What rule describes this transformation?
  - A  $(x', y') = \left(\frac{1}{3}x, \frac{1}{3}y\right)$
  - B (x', y') = (3x, 3y)
  - C (x', y') = (x + 3, y + 3)
  - D (x', y') = (x 3, y 3)

- 3.  $\Delta P'Q'R'$  is the image produced after reflecting  $\Delta PQR$  across the y-axis. If vertex P has coordinates (s, t), what are the coordinates of P'?
  - A (*t*, *s*)
  - B (s, -t)
  - C (-s, -t)
  - D (-*s*, *t*)

- 4. What is the rule for the transformation formed by a translation 2 units to the left and 3 units up followed by a 90° counterclockwise rotation?
  - A (x'', y'') = (-3y, -2x)
  - B (x'', y'') = (x 2, y + 3)
  - C (x'', y'') = [-(y+3), x-2]

D 
$$(x'', y'') = [-(y-2), x+3]$$

- 5. The point G(2, -7) is transformed according to the rule (x', y') = (x + 2, y - 3). The image G'of the transformation is then reflected over the line y = x, resulting in point G''. What are the coordinates of G''?
  - A (4, 10)
  - B (4, <sup>-</sup>10)
  - C (<sup>-</sup>10, 4)
  - D (<sup>-</sup>4, 10)

6.  $\Delta G'H'I'$  is the image of  $\Delta GHI$  after a transformation.



Which choice describes the transformation shown?

- A reflection over *x*-axis
- B reflection over y-axis
- C (x', y') = (x 8, y)
- D (x', y') = (x, y 8)

- 7. Point J(p,q) is a vertex of  $\Delta JKL$ . What are the coordinates of J'after  $\Delta JKL$  is reflected across the line y = x?
  - A (-p, -q)
  - B  $(p, \neg q)$
  - C (q, -p)
  - $\mathbf{D}$  (q, p)

- 8.  $\Delta XYZ$  is dilated by a factor of  $\frac{1}{2}$ . What is the ratio of the area of  $\Delta XYZ$  to the area of its image,  $\Delta X'Y'Z'$ ?
  - A 4:1
  - B 2:1
  - C 1:2
  - D 1:4

9.  $\triangle DEF$  is reflected across the line y = x.



Which matrix multiplication shows how to find  $\Delta D' E' F'$ ?

 $\begin{array}{c} A & \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 4 & 5 & 6 \\ 1 & 3 & 1 \end{bmatrix} \\ B & \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} 4 & 5 & 6 \\ 1 & 3 & 1 \end{bmatrix} \\ C & \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} 4 & 5 & 6 \\ 1 & 3 & 1 \end{bmatrix} \\ D & \begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix} \begin{bmatrix} 4 & 5 & 6 \\ 1 & 3 & 1 \end{bmatrix}$ 

10. Triangle *MRT* has vertices at M(3, 8), R(7, -2), and T(-5, -4). If the triangle is to be translated by the rule (x', y') = (x + 3, y - 2), which matrix expression models the translation?

## $\begin{array}{cccc} A & \begin{bmatrix} 3 & 7 & -5 \\ 8 & -2 & -4 \end{bmatrix} + \begin{bmatrix} 3 & 3 & 3 \\ -2 & -2 & -2 \end{bmatrix} \\ B & \begin{bmatrix} 3 & 7 & -5 \\ 8 & -2 & -4 \end{bmatrix} - \begin{bmatrix} -2 & -2 & -2 \\ 3 & 3 & 3 \end{bmatrix} \\ C & \begin{bmatrix} 3 & 7 & -5 \\ 8 & -2 & -4 \end{bmatrix} + \begin{bmatrix} -2 & -2 & -2 \\ 3 & 3 & 3 \end{bmatrix} \\ D & \begin{bmatrix} 3 & 7 & -5 \\ 8 & -2 & -4 \end{bmatrix} - \begin{bmatrix} 3 & 3 & 3 \\ -2 & -2 & -2 \end{bmatrix}$

11. Which matrix calculation was used to transform  $\Delta STU$  to  $\Delta S'T'U'$ ?



 $\begin{array}{ccc} A & \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} -7 & -4 & -3 \\ 0 & 2 & 8 \end{bmatrix} \\ B & \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} -7 & -4 & -3 \\ 0 & 2 & 8 \end{bmatrix} \\ C & \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} -7 & -4 & -3 \\ 0 & 2 & 8 \end{bmatrix} \\ D & \begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix} \begin{bmatrix} -7 & -4 & -3 \\ 0 & 2 & 8 \end{bmatrix}$ 

- 12.  $\triangle GHJ$  with vertex matrix  $\begin{bmatrix} -2 & 3 & 3 \\ 4 & 6 & -2 \end{bmatrix}$  is dilated by a factor of  $\frac{1}{3}$ . In the image  $\triangle G'H'J'$ , what are the coordinates of the vertex that lies in the second quadrant?
  - A  $\begin{pmatrix} -\frac{7}{3}, \frac{13}{3} \end{pmatrix}$ B  $\begin{pmatrix} -\frac{2}{3}, \frac{4}{3} \end{pmatrix}$ C  $\begin{pmatrix} 1, -\frac{2}{3} \end{pmatrix}$ D  $\begin{pmatrix} 1, 2 \end{pmatrix}$
- 13. The vertices of quadrilateral GHIJ are G(-1, -1), H(3, -2), I(2, 4), and J(-2, 3). G'H'I'J' is the image produced by translating quadrilateral GHIJ 6 units to the left. Which matrix represents G'H'I'J'?

A	$\begin{bmatrix} -7 & -3 & -4 & -8 \\ -7 & -8 & -2 & -3 \end{bmatrix}$
В	$\begin{bmatrix} -7 & -3 & -4 & -8 \\ -1 & -2 & 4 & 3 \end{bmatrix}$
С	$\begin{bmatrix} -1 & 3 & 2 & -2 \\ -7 & -8 & -2 & -3 \end{bmatrix}$
D	$\begin{bmatrix} 5 & 9 & 8 & 4 \\ -1 & -2 & 4 & 3 \end{bmatrix}$

14.  $\Delta M'N'O'$  is the image of  $\Delta MNO$  produced by a translation 3 units left and 1 unit up.

The vertex matrix for  $\Delta M'N'O'$  is  $\begin{bmatrix} -1 & 2 & 4 \\ 1 & 6 & -3 \end{bmatrix}$ . Which is the vertex matrix for  $\Delta MNO$ ?

 $\begin{array}{cccc}
A & \begin{bmatrix} 2 & 5 & 7 \\ 0 & 5 & -4 \end{bmatrix} \\
B & \begin{bmatrix} -4 & -1 & 1 \\ 2 & 7 & -2 \end{bmatrix} \\
C & \begin{bmatrix} -2 & 1 & 3 \\ 4 & 9 & 0 \end{bmatrix} \\
D & \begin{bmatrix} 0 & 3 & 5 \\ -2 & 3 & -6 \end{bmatrix}$ 

15. Polygon *FGHI* is represented by vertex matrix *M*.

$$M = \begin{bmatrix} 2 & 4 & 4 & 2 \\ -2 & -2 & -5 & -5 \end{bmatrix}$$

Which multiplication would be used to reflect polygon *FGHI* across the *x*-axis?

A	$\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} 2 & 4 & 4 & 2 \\ -2 & -2 & -5 & -5 \end{bmatrix}$
В	$\begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 2 & 4 & 4 & 2 \\ -2 & -2 & -5 & -5 \end{bmatrix}$
С	$\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} 2 & 4 & 4 & 2 \\ -2 & -2 & -5 & -5 \end{bmatrix}$
D	$\begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix} \begin{bmatrix} 2 & 4 & 4 & 2 \\ -2 & -2 & -5 & -5 \end{bmatrix}$

## End of Goal 3 Sample Items

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## Geometry Goal 3 Sample Items Key Report

1	<b>Objective:</b> 3.01 Describe the transfor	mation (translation, reflection, rota	ation, dilation) of polygo	ons in
	the coordinate plane Thinking Skill:	in simple algebraic terms. Applying	Correct Answer:	А
2	Objective:3.01Describe the transforthe coordinate planeThinking Skill:	mation (translation, reflection, rota in simple algebraic terms. Applying	ation, dilation) of polygo <b>Correct Answer:</b>	ons in B
3	<b>Objective:</b> 3.01 Describe the transfor the coordinate plane <b>Thinking Skill:</b>	mation (translation, reflection, rota in simple algebraic terms. Applying	ation, dilation) of polygo	ons in D
4	Objective:3.01Describe the transforthe coordinate planeThinking Skill:	mation (translation, reflection, rota in simple algebraic terms. Analyzing	ation, dilation) of polygo	ons in C
5	<b>Objective:</b> 3.01 Describe the transfor the coordinate plane <b>Thinking Skill:</b>	rmation (translation, reflection, rota in simple algebraic terms. Analyzing	ation, dilation) of polygo <b>Correct Answer:</b>	ons in C
6	<b>Objective:</b> 3.01 Describe the transfor the coordinate plane <b>Thinking Skill:</b>	mation (translation, reflection, rota in simple algebraic terms. Analyzing	ation, dilation) of polygo <b>Correct Answer:</b>	ons in D
7	Objective:3.01Describe the transforthe coordinate planeThinking Skill:	mation (translation, reflection, rota in simple algebraic terms. Applying	ation, dilation) of polygo <b>Correct Answer:</b>	ons in D
8	<b>Objective:</b> 3.01 Describe the transfor the coordinate plane <b>Thinking Skill:</b>	mation (translation, reflection, rota in simple algebraic terms. Analyzing	ation, dilation) of polygo <b>Correct Answer:</b>	ons in A

## Geometry Goal 3 Sample Items Key Report

9	<b>Objective:</b> 3.02 Use matrix operation describe the transform	s (addition, subtr mation of polygon	action, multiplication, scalar multiplica s in the coordinate plane.	tion) to
	Thinking Skill:	Analyzing	Correct Answer:	В
10	<b>Objective:</b> 3.02 Use matrix operation describe the transform <b>Thinking Skill:</b>	s (addition, subtr mation of polygon Applying	action, multiplication, scalar multiplica s in the coordinate plane. <b>Correct Answer:</b>	ntion) to A
11	<b>Objective:</b> 3.02 Use matrix operation describe the transform <b>Thinking Skill:</b>	s (addition, subtr mation of polygon Applying	action, multiplication, scalar multiplica s in the coordinate plane. <b>Correct Answer:</b>	ution) to B
12	<b>Objective:</b> 3.02 Use matrix operation describe the transform <b>Thinking Skill:</b>	s (addition, subtr mation of polygon Analyzing	action, multiplication, scalar multiplica s in the coordinate plane. <b>Correct Answer:</b>	ntion) to B
13	<b>Objective:</b> 3.02 Use matrix operation describe the transform <b>Thinking Skill:</b>	s (addition, subtr mation of polygon Applying	action, multiplication, scalar multiplica s in the coordinate plane. <b>Correct Answer:</b>	ution) to B
14	Objective:3.02Use matrix operationdescribe the transformThinking Skill:	s (addition, subtr mation of polygon Applying	action, multiplication, scalar multiplica s in the coordinate plane. <b>Correct Answer:</b>	ntion) to A
15	<b>Objective:</b> 3.02 Use matrix operation describe the transform <b>Thinking Skill:</b>	s (addition, subtr mation of polygon Applying	action, multiplication, scalar multiplica s in the coordinate plane. <b>Correct Answer:</b>	tion) to A