1. A triangle with vertices $D(3, 5)$, $E(3, 9)$, and $F(5, 5)$ is reflected over the line $x = -1$, followed by a reflection over the line $y = 4$. What are the coordinates of the image of $D$ after the two reflections?  

[A] $(-3, -5)$  
[B] $(-5, 3)$  
[C] $(-5, -1)$  
[D] $(2, 9)$

2. What is the angle of rotational symmetry for this symmetric polygon?  

[A] $18^\circ$  
[B] $72^\circ$  
[C] $36^\circ$  
[D] $30^\circ$

3. The coordinates of the vertices of $\triangle ABC$ are $A(-5, 1)$, $B(-2, 4)$, and $C(-3, 6)$. What are the coordinates of the image of $C$ after the translation $(x, y) \rightarrow (x + 2, y - 9)$?  

[A] $(-1, -3)$  
[B] $(-2, 4)$  
[C] $(-5, 1)$  
[D] $(-12, 8)$

4. What is the angle of rotational symmetry for this figure?  

[A] $36^\circ$  
[B] $72^\circ$  
[C] $60^\circ$  
[D] $180^\circ$

5. Triangle $DEF$ is reflected across the line $y = x$. The coordinates of the vertices of $\triangle DEF$ are $D(-9, 2)$, $E(-8, 5)$, and $F(-3, 4)$. What are the coordinates of $F''$?  

[A] $(-3, -3)$  
[B] $(4, -3)$  
[C] $(3, -4)$  
[D] $(3, -3)$

6. A triangle with vertices $A(-8, 6)$, $B(-2, 8)$, and $C(7, -5)$ is transformed into a triangle with vertices  

$A'(\frac{-2}{3}, \frac{2}{3})$, $B'(\frac{-2}{3}, \frac{2}{3})$, and $C'(\frac{2}{3}, -\frac{1}{3})$ by a dilation centered at the origin. What is the scale factor of the dilation?  

[A] $3$  
[B] $\frac{1}{3}$  
[C] $\frac{1}{4}$  
[D] $4$
7. In the diagram below, $EFGH \sim RSTU$. By what scale factor must the length of each side of $EFGH$ be multiplied to get the length of the corresponding side of $RSTU$?

![Diagram of EFGH ~ RSTU]

(A) $\frac{4}{27}$  
(B) $\frac{9}{2}$  
(C) $\frac{2}{9}$  
(D) $\frac{27}{4}$

8. Triangle $PQR$ is reflected across the line $y = -4$. The coordinates of the vertices of the image of $\triangle PQR$ are $P'(5, -8)$, $Q'(3, -7)$, and $R'(5, -9)$. What are the coordinates of $Q'$?

(A) $(3, -1)$  
(B) $(-11, -7)$  
(C) $(19, -1)$  
(D) $(-15, -5)$

9. Quadrilateral $KLMN$ is reflected across the line $x = -3$. The coordinates of the vertices of $KLMN$ are $K(-9, -3)$, $L(-7, 2)$, $M(-5, -6)$, and $N(-7, -6)$. What are the coordinates of $M'$?

(A) $(-8, -6)$  
(B) $(-1, -6)$  
(C) $(-1, 0)$  
(D) $(-5, 0)$

10. A dilation centered at the origin with a scale factor of $k = 4$ is applied to a triangle with vertices $D(6, -10)$, $E(4, -8)$, and $F(7, -7)$. What are the coordinates of $F''$?

(A) $\left(\frac{3}{4}, -\frac{3}{4}\right)$  
(B) $(28, -28)$  
(C) $(24, -40)$  
(D) $(11, -3)$

11. A dilation centered at the origin with a scale factor of $k = 0.8$ is applied to a triangle with vertices $D(8, 2)$, $E(6, 5)$, and $F(4, 3)$. What are the coordinates of $D'$?

(A) $(4.8, 4)$  
(B) $(10, 2.5)$  
(C) $(6.4, 1.6)$  
(D) $(8.8, 2.8)$
12. The translation \((x, y) \rightarrow (x + 5, y - 1)\) is applied to the rectangle below, followed by the translation \((x, y) \rightarrow (x - 3, y + 7)\).

What are the coordinates of the image of \(J\) after the two translations are applied?

[A] \((0, -10)\)  
[B] \((-6, -10)\)  
[C] \((0, 0)\)  
[D] \((-2, 2)\)

13. What is the angle of rotational symmetry for this figure?

[A] \(180^\circ\)  
[B] \(90^\circ\)  
[C] \(45^\circ\)  
[D] no rotational symmetry

14. The coordinates of the endpoints of \(\overline{EF}\) are \(E(8, -8)\) and \(F(5, -6)\). After a translation, the coordinates of the endpoints of the image of \(\overline{EF}\) are \(E'(3, -5)\) and \(F'(0, -3)\). What translation was performed on \(\overline{EF}\)?

[A] \((x, y) \rightarrow (x - 3, y + 2)\)  
[B] \((x, y) \rightarrow (x + 3, y - 2)\)  
[C] \((x, y) \rightarrow (x + 5, y - 3)\)  
[D] \((x, y) \rightarrow (x - 5, y + 3)\)

15. \(\triangle L'M'N'\) is the image of \(\triangle LMN\) after the translation \((x, y) \rightarrow (x + 2, y - 3)\). The coordinates of the vertices of \(\triangle L'M'N'\) are \(L'(-3, 1)\), \(M'(1, 2)\), and \(N'(0, -2)\). What are the coordinates of \(N'\)?

[A] \((1, -2)\)  
[B] \((-2, 1)\)  
[C] \((-3, 1)\)  
[D] \((2, 1)\)
16. In the diagram below, \( \Delta ABC \sim \Delta DEF \). By what scale factor must the length of each side of \( \Delta ABC \) be multiplied to get the length of the corresponding side of \( \Delta DEF \)?

![Diagram of \( \Delta ABC \sim \Delta DEF \)]

\[
\begin{align*}
[A] \quad & \frac{4}{3} \\
[B] \quad & \frac{7}{5} \\
[C] \quad & \frac{5}{7} \\
[D] \quad & \frac{3}{4}
\end{align*}
\]

17. The rectangle below is reflected over the \( y \)-axis, and then the translation \((x, y) \rightarrow (x - 4, y + 7)\) is applied. What is the image of \((3, -4)\) after the reflection and translation?

![Diagram of reflection and translation]

\[
\begin{align*}
[A] \quad & (-7, 1) \\
[B] \quad & (-7, 3) \\
[C] \quad & (-1, 1) \\
[D] \quad & (1, -3)
\end{align*}
\]
18. In the diagram below, $CDEF \sim TUVW$. By what scale factor must the length of each side of $CDEF$ be multiplied to get the length of the corresponding side of $TUVW$?  

(not drawn to scale)

$C$ $D$ $E$ $F$
$20.8$ $40.8$

$T$ $U$ $V$ $W$
$5.1$
$3.2$

[A] $\frac{1}{8}$  
[B] 8  
[C] $\frac{4}{3}$  
[D] $\frac{3}{4}$

19. The translation $(x, y) \rightarrow (x - 5, y - 4)$ is applied to the figure below, followed by a reflection over the line $y = -2$. What is the image of $(-4, 5)$ after the translation and reflection?  

[A] $(-9, 1)$  
[B] $(-1, 1)$  
[C] $(-9, -5)$  
[D] $(9, -9)$
20. In the diagram below, \( VWXYZ \sim CDEFG \). By what scale factor must the length of each side of \( VWXYZ \) be multiplied to get the length of the corresponding side of \( CDEFG \)?

![Diagram of similar polygons]

- [A] \( \frac{9}{10} \)
- [B] \( \frac{8}{9} \)
- [C] \( \frac{10}{9} \)
- [D] \( \frac{9}{8} \)

21. What is the angle of rotational symmetry for this regular polygon?

![Diagram of a regular triangle]

- [A] 240°
- [B] 90°
- [C] 120°
- [D] 36°

22. The translation \((x, y) \rightarrow (x + 1, y + 3)\) is applied to the triangle below, followed by a 90° rotation counterclockwise about the origin. What is the image of \((2, 1)\) after the translation and rotation?

![Diagram of a triangle with coordinates]

- [A] \((-3, 4)\)
- [B] \((-4, 3)\)
- [C] \((3, -4)\)
- [D] \((-4, -3)\)
23. The coordinates of the vertices of rectangle RSTU are R(1, -6), S(1, -5), T(5, -5), and U(5, -6). The translation \((x, y) \rightarrow (x - 6, y - 4)\) is applied to the rectangle, followed by the translation \((x, y) \rightarrow (x + 10, y - 2)\). What are the coordinates of the image of T after the two translations are applied?

[A] (9, -11)  [B] (4, -6)  [C] (1, 1)  [D] (-5, 3)

24. In the diagram below, \(\triangle ABC \sim \triangle DEF\). By what scale factor must the length of each side of \(\triangle ABC\) be multiplied to get the length of the corresponding side of \(\triangle DEF\)?

![Diagram](not drawn to scale)

[A] \(\frac{2}{3}\)  [B] \(\frac{3}{2}\)  [C] \(\frac{15}{7}\)  [D] \(\frac{7}{15}\)

25. The triangle below is first reflected over the x-axis and then reflected over the y-axis.

What are the coordinates of the image of A after these two reflections?

[A] (-5, -2)  [B] (5, -2)  [C] (-5, 2)  [D] (5, 2)
26. \( \overline{AB} \) is reflected across the line \( y = -x \). The coordinates of the endpoints of the image of \( \overline{AB} \) are \( A'(5, 6) \) and \( B'(8, -2) \). What are the coordinates of \( A' \)?

[A] (5, -6)  [B] (-5, 6)  [C] (-6, -5)  [D] (-6, 5)

27. The figure below is rotated 180° about the origin. Then the rotated figure is reflected over the line \( x = -3 \). What is the image of \( (9, -2) \) after the rotation and reflection are applied?

![Diagram](image)

[A] (3, -2)  [B] (3, 2)  [C] (-3, 2)  [D] (-2, -3)

28. The coordinates of the endpoints of \( \overline{UV} \) are \( U(-9, -4) \) and \( V(-5, -2) \). What are the coordinates of the endpoints of the image of \( \overline{UV} \) after the translation \((x, y) \rightarrow (x + 5, y + 6)\)?

[A] \( U'(5, 2) \) and \( V'(0, 6) \)  [B] \( U'(-4, -10) \) and \( V'(-10, -8) \)

[C] \( U'(5, 6) \) and \( V'(0, 4) \)  [D] \( U'(-4, 2) \) and \( V'(0, 4) \)

29. \( \overline{AB} \) is reflected across the line \( y = -x \). The coordinates of the endpoints of \( \overline{AB} \) are \( A(7, 9) \) and \( B(-3, 5) \). What are the coordinates of \( B'' \)?

[A] (-5, 3)  [B] (5, -3)  [C] (-5, 5)  [D] (5, -5)
30. The figure below is rotated 180° about the origin. Then the translation \((x, y) \rightarrow (x + 5, y - 8)\) is applied to the rotated rectangle. What is the image of \((6, 2)\) after the rotation and translation?

![Diagram of a rectangle rotated 180° and translated](image)

[A] \((-1, -10)\)  [B] \((1, 6)\)  [C] \((-2, 6)\)  [D] \((-1, 10)\)

31. What is the angle of rotational symmetry for this figure?

![Image of a figure with rotational symmetry](image)


32. After undergoing a dilation centered at the origin, a triangle has vertices with coordinates \(G\left(\frac{1}{4}, -\frac{1}{2}\right)\), \(H\left(-\frac{1}{2}, -\frac{5}{4}\right)\), and \(I\left(-\frac{3}{4}, -\frac{1}{2}\right)\). If the scale factor is \(k = \frac{3}{4}\), what are the coordinates of \(G'\)?

[A] \((3, -3)\)  [B] \((-4, -2)\)  [C] \(\left(\frac{3}{4}, -\frac{3}{4}\right)\)  [D] \(0, -1\frac{1}{2}\)

33. The coordinates of the vertices of rectangle \(RSTU\) are \(R(-4, 8), S(-4, 9), T(9, 9), U(9, 8)\). The translation \((x, y) \rightarrow (x + 8, y - 6)\) is applied to the rectangle, followed by the translation \((x, y) \rightarrow (x - 4, y - 10)\). What are the coordinates of the image of \(R\) after the two translations are applied?

[A] \((-8, 24)\)  [B] \((-2, -6)\)  [C] \((0, -8)\)  [D] \((-18, 10)\)
34. The coordinates of the vertices of $\triangle HKM$ are $H(-1, -2)$, $K(3, -5)$, and $M(0, 1)$. After a translation, the coordinates of the vertices of the image of $\triangle HKM$ are $H'(-3, -3)$, $K'(1, -6)$, and $M'(-2, 0)$. What translation was performed on $\triangle HKM$?

[A] $(x, y) \rightarrow (x + 3, y + 4)$  [B] $(x, y) \rightarrow (x + 2, y + 1)$  [C] $(x, y) \rightarrow (x - 3, y - 4)$  [D] $(x, y) \rightarrow (x - 2, y - 1)$

35. A dilation centered at the origin is applied to a triangle with vertices $A(6, 3)$, $B(7, 1)$, and $C(10, 2)$. The result is a new triangle with vertices $A'(\frac{3}{2}, \frac{15}{4})$, $B'(\frac{36}{4}, \frac{5}{4})$, and $C'(\frac{52}{2}, \frac{10}{2})$. What is the scale factor of the dilation?

[A] $\frac{3}{4}$  [B] $\frac{5}{4}$  [C] $\frac{3}{4}$  [D] $\frac{4}{4}$