1. Here is the graph of \( y = f(x) \). What is the graph of its image after a translation of 2 units right?
2. For the graph of $y = f(x)$ shown below, what graph represents $y = f(-4x)$?

A. 

B. 

C. 

D. 
3. Here is the graph of $y = f(x)$. What is the graph of its inverse.

A. 

B. 

C. 

D.
4. The graph of \( y = f(x) \) is translated 3 units down. What is the equation of the translation image in terms of the function \( f \)?

A. \( y = f(x + 3) \)  
B. \( y - 3 = f(x) \)  
C. \( y + 3 = f(x) \)  
D. \( y = f(x - 3) \)

5. What description describes how the graph of \( y = f(x) \) has been transformed to get the graph of \( y = f(-2(x-2)) \)?

It is the image of the graph of \( y = f(x) \) after:

A. a vertical stretch by a factor of 2, a reflection in both axes, and a translation of 2 units right.
B. a horizontal compression by a factor of \( \frac{1}{2} \), a reflection in the y-axis, and a translation of 2 units right.
C. a vertical compression by a factor of \( \frac{1}{2} \), a reflection in the y-axis, and a translation of 2 units down.
D. a horizontal stretch by a factor of 2, a reflection in the y-axis, and a translation of 2 units right.

6. What description describes how the graph of \( y = f(x) \) has been transformed to get the graph of \( y - 5 = \frac{1}{2}f(x) \)?

It is the image of the graph of \( y = f(x) \) after:

A. a horizontal compression by a factor of \( \frac{1}{2} \), a reflection in the x-axis, and a translation of 5 units right.
B. a vertical compression by a factor of \( \frac{1}{2} \), a reflection in the x-axis, and a translation of 5 units down.
C. a vertical compression by a factor of \( \frac{1}{2} \), no reflection, and a translation of 5 units up.
D. a horizontal compression by a factor of \( \frac{1}{2} \), no reflection, and a translation of 5 units up.
7. The graph of \( y - 4 = \frac{1}{2} f(3(x + 5)) \) is the image of the graph of \( y = f(x) \) after a combination of transformations. Which statement below is true?

A. The graph of \( y = f(x) \) was compressed horizontally by a factor of \( \frac{1}{3} \).
B. The graph of \( y = f(x) \) was compressed horizontally by a factor of \( \frac{1}{2} \).
C. The graph of \( y = f(x) \) was reflected in the \( y \)-axis.
D. The graph of \( y = f(x) \) was translated 5 units up.

**Moderate** (Show work for non-MC)

8. The function \( y = f(x) \) has domain \(-3 \leq x \leq 3\) and range \(2 \leq y \leq 6\). What are the domain and range of \( y + 3 = f(x - 2) \)?

A. domain: \(-6 \leq x \leq 0\)  
range: \(1 \leq y \leq 3\)
B. domain: \(-6 \leq x \leq 0\)  
range: \(-1 \leq y \leq 3\)
C. domain: \(-1 \leq x \leq 5\)  
range: \(-1 \leq y \leq 3\)
D. domain: \(-1 \leq x \leq 5\)  
range: \(1 \leq y \leq 3\)

9. The function \( y = f(x) \) undergoes two translations; 2 units right, and then 3 units down. What is the new equation for the translated function?

A. \( y + 3 = f(x + 2) \)
B. \( y + 3 = f(x - 2) \)
C. \( y - 3 = f(x + 2) \)
D. \( y - 3 = f(x - 2) \)

10. The graph of \( y = f(x) \) is compressed horizontally by a factor of \( \frac{1}{10} \), and reflected in the \( y \)-axis. What is the equation of the image graph in terms of the function \( f \)?

A. \( y = -10f(x) \)
B. \( y = f\left(\frac{1}{10}x\right) \)
C. \( y = \frac{1}{10}f(x) \)
D. \( y = f(-10x) \)
11. Here is the graph of \( y = f(x) \). What are the domain and range of its image after a reflection in the \( x \)-axis?

A. domain: \(-8 \leq x \leq -2\)  
   range: \(2 \leq y \leq 10\)  

B. domain: \(2 \leq x \leq 8\)  
   range: \(-10 \leq y \leq -2\)  

C. domain: \(-8 \leq x \leq -2\)  
   range: \(-10 \leq y \leq -2\)  

D. domain: \(2 \leq x \leq 8\)  
   range: \(2 \leq y \leq 10\)

12. The graph of \( y = \left| (x + 7)^2 - 5 \right| \) was reflected in the \( x \)-axis and its image is shown. What is an equation of the image?

A. \( y = -\left| (x + 7)^2 - 5 \right| \)  

B. \( y = \left| (-x + 7)^2 - 5 \right| \)  

C. \( y = \left| (x - 7)^2 + 5 \right| \)  

D. \( y = \left| (-x - 7)^2 + 5 \right| \)
13. Here is the graph of \( y = f(x) \). What are the domain and range of \( y = -f(x) \)?

A. domain: \( x \leq -4 \)  
   range: \( y \geq 4 \)  
B. domain: \( x \in \mathbb{R} \)  
   range: \( y \leq -4 \)  
C. domain: \( x \in \mathbb{R} \)  
   range: \( y \in \mathbb{R} \)  
D. domain: \( x \in \mathbb{R} \)  
   range: \( y \leq 4 \)

14. The point A (16, 64) lies on the graph of \( y = \sqrt[3]{x^3} \). What are the coordinates of its image \( A' \) on the graph of \( y = \frac{1}{4} \sqrt[3]{(-2x)^3} \)?

A. (4, 16)  
B. (−8, −32)  
C. (−8, 16)  
D. Not enough information is given.

15. The function \( f(x) = x^2 + 5x + 6 \) has zeros at −2 and −3. What are the zeros of the function \( y = 4f\left(\frac{1}{7} x\right) \)?

A. \( \frac{2}{7}, \frac{3}{7} \)  
B. 14 and 21  
C. −14 and −21  
D. 8 and 12

16. Determine an equation of the inverse of the function \( y = (x + 7)^2 - 5 \).

A. \( y = -(x - 5)^2 - 7 \)  
B. \( y = \pm \sqrt{x - 5} + 7 \)  
C. \( y = (x + 5)^2 - 7 \)  
D. \( y = \pm \sqrt{x + 5} - 7 \)
17. The graph of \( y = f(x) \) is horizontally compressed by a factor of \( \frac{1}{3} \), vertically stretched by a factor of 2, reflected in the y-axis, and translated 2 units down and 2 units left. What is an equation of the image graph in terms of the function \( f \)?

A. \( y + 2 = 3f(-2(x - 2)) \)
B. \( y - 2 = 2f(-3(x - 2)) \)
C. \( y - 2 = 3f(-2(x + 2)) \)
D. \( y + 2 = 2f(-3(x + 2)) \)

18. The graph of \( y = g(x) \) is the image of the graph of \( y = f(x) \) after a combination of transformations. What description describes the transformations? Use algebra if non-MC.

A. vertical stretch by a factor of 2, a reflection in the x-axis, and a translation of 3 units right
B. horizontal stretch by a factor of 2, a reflection in the x-axis, and a translation of 3 units up
C. vertical compression by a factor of \( \frac{1}{2} \), a reflection in the x-axis, and a translation of 3 units right
D. horizontal compression by a factor of \( \frac{1}{2} \), a reflection in the x-axis, and a translation of 3 units down
19. What description describes how the graph of \( y + 3 = \left( \frac{4}{-3(x + 2)} \right)^3 \) is related to the graph of \( y = \frac{1}{x^3} \)?

A. The graph of \( y = \frac{1}{x^3} \) is horizontally compressed by a factor of \( \frac{1}{3} \), vertically compressed by a factor of \( \frac{1}{4} \), reflected in both axes, then translated 2 units left and 3 units down.

B. The graph of \( y = \frac{1}{x^3} \) is horizontally stretched by a factor of 3, vertically compressed by a factor of \( \frac{1}{4} \), reflected in the y-axis, then translated 2 units right and 3 units up.

C. The graph of \( y = \frac{1}{x^3} \) is horizontally compressed by a factor of \( \frac{1}{3} \), vertically stretched by a factor of 4, reflected in both axes, then translated 2 units right and 3 units up.

D. The graph of \( y = \frac{1}{x^3} \) is horizontally compressed by a factor of \( \frac{1}{3} \), vertically stretched by a factor of 4, reflected in the y-axis, then translated 2 units left and 3 units down.

20. What description describes how the graph of \( y - 3 = \frac{2}{3} [-2(x + 2)]^3 \) is related to the graph of \( y = x^3 \)?

A. The graph of \( y = x^3 \) is horizontally stretched by a factor of 2, vertically compressed by a factor of \( \frac{2}{3} \), reflected in the y-axis, then translated 2 units right and 3 units down.

B. The graph of \( y = x^3 \) is vertically stretched by a factor of 2, horizontally stretched by a factor of \( \frac{3}{2} \), reflected in the y-axis, then translated 2 units left and 3 units up.

C. The graph of \( y = x^3 \) is vertically compressed by a factor of \( \frac{1}{2} \), horizontally compressed by a factor of \( \frac{2}{3} \), reflected in the y-axis, then translated 2 units right and 3 units down.

D. The graph of \( y = x^3 \) is horizontally compressed by a factor of \( \frac{1}{2} \), vertically compressed by a factor of \( \frac{2}{3} \), reflected in the y-axis, then translated 2 units left and 3 units up.
**Difficult** (Show work for non-MC)

___ 21. The graph of \( y - 2 = \sqrt{x - 2} \) is translated 5 units right and 5 units down. What is an equation of the image graph?

A. \( y + 5 = \sqrt{x - 5} \)  
B. \( y + 3 = \sqrt{x - 7} \)  
C. \( y + 7 = \sqrt{x - 3} \)  
D. \( y - 7 = \sqrt{x + 3} \)

___ 22. The graph of \( y = g(x) \) is a transformation image of the graph of \( y = |x - 2| + 3 \). What is an equation of the image graph in terms of \( x \)?

![Graph of \( y = |x - 2| + 3 \) and \( y = g(x) \)]

A. \( y = -|2x - 2| + 3 \)  
B. \( y = (|2x - 2| + 3) \)  
C. \( y = 2(|-x - 2| + 3) \)  
D. \( y = -2(|x - 2| + 3) \)

___ 23. A transformation image of the graph of \( y = f(x) \) is represented by the equation \( y - 2 = -4f\left(3(x - 2)\right) \). The point (5,10) lies on the image graph. What are the coordinates of the corresponding point on the graph of \( y = f(x) \)?

A. (10,5)  
B. (3,8)  
C. (9, -2)  
D. (2,2)
Short Answer

Easy

24. The graph of \( y = g(x) \) is the image of the graph of \( y = f(x) \) after a single translation. What is the equation of the translation image in terms of the function \( f \)?

25. The graph of \( y = f(x) \) is translated 4 units left. What is an equation of the translation image in terms of the function \( f \)?

26. The graph of \( y = g(x) \) is translated 2 units left and 5 units up. What is an equation of the translation image in terms of the function \( g \)?

27. What is an equation for the image of \( y = |x^3 - 4| \) after a reflection of its graph in the \( y \)-axis?

28. The graph of \( y = f(x) \) is stretched vertically by a factor of 5. What is the equation of the image graph in terms of the function \( f \)?

Moderate (Show work for non-MC)

29. Determine the coordinates of the point where the graph of \( f(x) = \frac{5}{x^2 + 10x + 25} \) intersects the graph of \( y = f(-x) \).
30. The graph of \( y = f(x) \) is the image of the graph of \( y = -x^3 \) after a horizontal and vertical translation. What is an equation of the image graph?

\[ y = -x^3 \]

31. The graph of \( y = g(x) \) is a transformation image of the graph of \( y = f(x) \). Corresponding points are labelled. Write the equation of the image graph in terms of the function \( f \). Solve with algebra.

32. The graph of \( y = |x| \) is vertically stretched by a factor of 2, horizontally stretched by a factor of 2, reflected in the y-axis, then translated 4 units right and 3 units up. Write an equation of the image graph in terms of \( x \).
33. The graph of $y = g(x)$ is the image of the graph of $y = f(x)$ after a stretch or compression, and a pair of translations. Corresponding points are indicated. Describe the transformations. Use algebra to solve.

34. The graph of $y = \sqrt{x}$ is vertically compressed by a factor of $\frac{1}{3}$, horizontally compressed by a factor of $\frac{1}{4}$, reflected in the y-axis, then translated 2 units left and 2 units up. Write an equation of the image graph in terms of $x$.

35. A graph was reflected in the line $y = x$. Its reflection image is shown. Determine an equation of the original function in terms of $x$ and $y$. 
**Difficult** (Show work for non-MC)

36. A function \( f(x) \) is an even function when \( f(x) = f(-x) \). A function \( f(x) \) is an odd function when \( f(-x) = -f(x) \). Is \( y = \frac{1}{x} \) an even function or an odd function?

37. A transformation image of the graph of \( y = f(x) \) is represented by the equation \( y + 3 = \frac{1}{2}(2x - 2) \). The point \((-1, -\frac{3}{2})\) lies on the image graph. What are the coordinates of the corresponding point on the graph of \( y = f(x) \)?

**Problem**

**Moderate** (Show work for non-MC)

38. Here is the graph of \( y = f(x) \). On the same grid, sketch the graph of \( y - 2 = f(x + 2) \). Describe how the graph of \( y = f(x) \) was translated. State the domain and range of each function.
39. Here is the graph of \( y = f(x) \). On the same grid, sketch the graph of \( y = \frac{1}{2} f(2x) \). State the domain and range of each function.

40. Describe how the graph of \( y - 4 = \frac{1}{2} f(2(x - 3)) \) is related to the graph of \( y = f(x) \).
41. The graph of \( y = g(x) \) is the image of the graph of \( y = f(x) \) after a combination of transformations. Corresponding points are labelled. What is an equation of the image graph in terms of the function \( f \)? Use algebra to solve.

42. The graph of \( y = -5x^2 - 10x - 16 \) is translated vertically so that its vertex lies on the \( x \)-axis. Determine the translation.

43. The graphs of \( y = dx + 3 \) and its inverse coincide. Determine the value of \( d \).