1. If the graph of $y = f(x)$ is translated 5 units to the left, determine the resulting equation.
   A. $y - 5 = f(x)$       B. $y + 5 = f(x)$       C. $y = f(x - 5)$       D. $y = f(x + 5)$

2. How is the graph $5y = \sqrt{x}$ related to the graph $y = \sqrt{x}$?
   A. $y = \sqrt{x}$ has been vertically translated 5 units up
   B. $y = \sqrt{x}$ has been expanded vertically by a factor of 5
   C. $y = \sqrt{x}$ has been compressed vertically by a factor of 5
   D. $y = \sqrt{x}$ has been compressed horizontally by a factor of 5

3. Simplify: $f^{-1}(f(x))$
   A. $x$       B. $-x$       C. $\frac{1}{x}$       D. $-\frac{1}{x}$

4. Given the function $f(x) = (x - 1)^3 + 2$, determine $f^{-1}(x)$, the inverse function.
   A. $f^{-1}(x) = \sqrt[3]{x + 2} + 1$       B. $f^{-1}(x) = \sqrt[3]{x - 2} + 1$
   C. $f^{-1}(x) = \sqrt[3]{x + 2} - 1$       D. $f^{-1}(x) = \sqrt[3]{x - 2} - 1$

5. The function $y = f(x)$ is transformed to $y = f(2x + 4)$. Identify the horizontal expansion or compression factor, then the translation to the graph of the function.
   A. horizontal expansion by a factor of 2, then a translation of 4 units left.
   B. horizontal compression by a factor of 2, then a translation of 4 units left.
   C. horizontal expansion by a factor of 2, then a translation of 2 units left.
   D. horizontal compression by a factor of 2, then a translation of 2 units left.
6. The graph of \( y = \sqrt{9 - x^2} \) is shown.

Which of the following graphs represents \( 2y = \sqrt{9 - x^2} \)?

A. \[
\begin{array}{c}
\text{graph1} \\
\end{array}
\]  
B. \[
\begin{array}{c}
\text{graph2} \\
\end{array}
\]  
C. \[
\begin{array}{c}
\text{graph3} \\
\end{array}
\]  
D. \[
\begin{array}{c}
\text{graph4} \\
\end{array}
\]

**SAMPLE 2001**

7. If \( (6, -5) \) is a point on the graph of \( y = f(x) \), what must be a point on the graph of \( y = -f(2(x + 2)) - 3 \)?

A. \((-1, 2)\)  
B. \((1, -2)\)  
C. \((1, 2)\)  
D. \((10, 2)\)

8. Given the function \( y_1 = f(x) \), describe how the graph of the new function, \( y_2 = 4f(x - 2) \), is related to the graph of \( y_1 \).

A. The graph of \( y_1 \) has been vertically compressed by a factor of 4 then translated 2 units right to form the graph of \( y_2 \).

B. The graph of \( y_1 \) has been vertically expanded by a factor of 4 then translated 2 units right to form the graph of \( y_2 \).

C. The graph of \( y_1 \) has been vertically compressed by a factor of 4 then translated 2 units left to form the graph of \( y_2 \).

D. The graph of \( y_1 \) has been vertically expanded by a factor of 4 then translated 2 units left to form the graph of \( y_2 \).
9. The graph of the function \( y = f(x) \) is shown below.

Sketch the graphs of:

A. \( y = f(-x) \)  
B. \( y = f(x - 3) \)  
C. \( y = 2f(x) \)  
D. \( x = f(y) \)
10. Which equation represents the graph of $y = \sqrt{x}$ after it is translated 4 units to the right?
   A. $y = \sqrt{x} - 4$  B. $y = \sqrt{x} - 4$  C. $y = \sqrt{x} + 4$  D. $y = \sqrt{x} + 4$

11. If $y = 5x - 1$, determine the equation of $f^{-1}(x)$, the inverse of $f(x)$.
   A. $f^{-1}(x) = \frac{1}{5x - 1}$  B. $f^{-1}(x) = \frac{1}{5}x - 1$  C. $f^{-1}(x) = \frac{x + 1}{5}$  D. $f^{-1}(x) = \frac{x - 1}{5}$

12. The graph of $y = f(x)$ is shown.

Which of the following graphs represents $y = -2f(x)$?
13. The graph of \( y = f(x) \) is shown.

On the grids provided, sketch the graphs of:

A. \( y = f(x + 2) - 3 \)
B. \( y = f(2x) \)
C. \( y = |f(2x)| \)
14. Which equation represents the graph of $y = x^3 + x^2$ after it is reflected in the $y$-axis?
   
   A. $y = -x^3 + x^2$  
   B. $y = -x^3 - x^2$  
   C. $y = \frac{1}{x^3 + x^2}$  
   D. $y = y^3 + y^2$

APR 2002

15. Given the function $y = f(x)$, which of the following represents its reflection in the $y$-axis?
   
   A. $y = f(-x)$  
   B. $y = -f(x)$  
   C. $y = f(y)$  
   D. $y = \frac{1}{f(x)}$

16. How is the graph of $y = \frac{1}{f(x)}$ related to the graph of $y = f(x)$?
   
   A. $y = f(x)$ has been compressed vertically by a factor of 7  
   B. $y = f(x)$ has been compressed horizontally by a factor of 7  
   C. $y = f(x)$ has been expanded vertically by a factor of 7  
   D. $y = f(x)$ has been expanded horizontally by a factor of 7

17. Given $f(x) = x^3 - 27$, determine $f^{-1}(x)$, the inverse of $f(x)$.
   
   A. $f^{-1}(x) = \sqrt[3]{x+27}$  
   B. $f^{-1}(x) = \sqrt[3]{x-27}$  
   C. $f^{-1}(x) = \sqrt{x} + 3$  
   D. $f^{-1}(x) = x^3 + 27$

18. If $(4, -3)$ is a point on the graph of $y = f(x)$, what must be a point on the graph of $y = f(2x + 10)$?
   
   A. $(-8, -3)$  
   B. $(-3, -3)$  
   C. $(3, -3)$  
   D. $(18, -3)$
19. The graph of the function \( y = f(x) \) is shown below.

Sketch the graphs of:

A. \( y = 3f(x - 2) \)

B. \( y = -f\left(\frac{x}{2}\right) \)
20. Given the graph of $y = f(x)$, select the graph of $y = \frac{1}{2}f(x)$.
21. Two functions are graphed below, $y = f(x)$ and $y = f(a(x - b))$. Determine the values of $a$ and $b$.

![Graph of $y = f(x)$ and $y = f(a(x - b))$](image)

A. $a = -1$, $b = 2$  
B. $a = -1$, $b = 2$  
C. $a = 1$, $b = -2$  
D. $a = 1$, $b = 2$

22. The graph of $y = f(x)$ is shown.

![Graph of $y = f(x)$](image)

On the grids provided, sketch the graphs of:

A. $y = 2f(x + 3) - 1$  
B. $y = f^{-1}(x)$
23. How is the graph of \( y = \sqrt{x - 3} + 1 \) related to the graph of \( y = \sqrt{x} \)?

A. \( y = \sqrt{x} \) has been translated 3 units right and 1 unit up.
B. \( y = \sqrt{x} \) has been translated 3 units right and 1 unit down.
C. \( y = \sqrt{x} \) has been translated 3 units left and 1 unit up.
D. \( y = \sqrt{x} \) has been translated 3 units left and 1 unit down.

24. Given \( f(x) = 3x + 2 \), determine \( f^{-1}(x) \), the inverse of \( f(x) \).

A. \( f^{-1}(x) = \frac{x}{3} - 2 \)  
B. \( f^{-1}(x) = \frac{x - 2}{3} \)  
C. \( f^{-1}(x) = \frac{1}{3x + 2} \)  
D. \( f^{-1}(x) = 2 - \frac{x}{3} \)

25. Which equation represents a reflection of the graph of \( 5 - x = 2y^2 + y \) in the \( y \)-axis?

A. \( 5 + x = 2y^2 + y \)  
B. \( 5 - x = 2y^2 - y \)  
C. \( 5 + y = 2x^2 + x \)  
D. \( -5 - x = 2y^2 + y \)

26. In the point \((-3, -6)\) is on the graph of \( y = f(x) \), determine a point on the graph of \( y = 3|f(x)| + 1 \).

A. \((3, 3)\)  
B. \((3, 19)\)  
C. \((-3, 3)\)  
D. \((-3, 19)\)

27. Which equation represents the graph of \( y = f(x) \) after it is compressed horizontally by a factor of 2 and then translated 4 units right?

A. \( y = f(2x - 8) \)  
B. \( y = f(2x - 4) \)  
C. \( y = f\left(\frac{x - 4}{2}\right) \)  
D. \( y = f\left(\frac{x}{2} - 4\right) \)

JAN 2003

28. How is the graph of \( y = f(x) + 3 \) related to the graph of \( y = f(x) \)?

A. \( y = f(x) \) has been translated 3 units up.
B. \( y = f(x) \) has been translated 3 units down.
C. \( y = f(x) \) has been translated 3 units to the left.
D. \( y = f(x) \) has been translated 3 units to the right.
29. Which equation represents the graph of \( y = f(x) \) after it is reflected in the line \( y = x \)?

A. \( x = f(y) \)  
B. \( y = f(-x) \)  
C. \( y = -f(x) \)  
D. \( y = \frac{1}{f(x)} \)

30. If the graph of the function \( y = \sqrt{x} \) is horizontally expanded by a factor of 3 and the translated 2 units to the right, determine the equation of this new function.

A. \( y = \sqrt{3(x-2)} \)  
B. \( y = \sqrt{\frac{1}{3}(x-2)} \)  
C. \( y = \sqrt{3x-2} \)  
D. \( y = \sqrt{\frac{1}{3}x-2} \)

31. If \((8, -6)\) is a point on the graph of \( y = f(x) \), what must be a point on the graph of \( y = -f(2x) + 3 \)?

A. \((-16, -3)\)  
B. \((-4, -3)\)  
C. \((4, 9)\)  
D. \((16, 9)\)

32. The graph of \( y = f(x) \) is shown below on the left. Which equation represents the graph shown on the right?

![Graphs](image)

A. \( y = f(-x+8) \)  
B. \( y = f(-x-8) \)  
C. \( y = -f(x-8) \)  
D. \( y = -f(x+8) \)
33. The graph of \( y = f(x) \) is shown.

Sketch the graphs of

A. \( y = 2f(x + 3) \)

B. \( y = \frac{1}{f(x)} \)

34. The function \( y = f(x) \) is graphed to the left below. Determine the equation of the function shown to the right.

A. \( y = f(2(x - 1)) \)

B. \( y = f\left(\frac{1}{2}(x - 1)\right) \)

C. \( y = 2f(x - 1) \)

D. \( y = \frac{1}{2}(x - 1) \)
35. If the point \((a, b)\) is on the graph of \(y = f(x)\), which point must be on the graph of 
\[ y = \frac{1}{f(x-2)} \] \((a \neq 0, b = 0)\)

A. \((a - 2, \frac{1}{b})\)  
B. \((a + 2, \frac{1}{b})\)  
C. \((\frac{1}{a}, b)\)  
D. \((a + 2, b)\)

36. The graph of \(y = f(x)\) is shown below.

Sketch the graphs of
A. \(y = 2f(x) - 3\)

B. \(y = f^{-1}(x)\)

37. Which equation represents the graph of \(y = g(x)\) after it is translated 5 units up?

A. \(y = g(x) + 5\)  
B. \(y = g(x) - 5\)  
C. \(y = g(x + 5)\)  
D. \(y = g(x - 5)\)
38. The graph of \( y = f(x) \) is shown below.

Which graph represents \( x = f(y) \)?

![Graphs A, B, C, D](image)

39. If the point \((4, 6)\) is on the graph of \( y = f(x) \), what point must be on the graph of \( y = 3\left(\frac{1}{f(x)}\right) \)?

A. \((12, \frac{1}{6})\)  
B. \((4, \frac{1}{18})\)  
C. \((4, \frac{1}{2})\)  
D. \((2,18)\)
40. The graph of \( y = f(x) \) is shown below. Sketch the graphs of:

\[ y = -2f(x + 3) \]

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

\[ y = \left| f\left( \frac{x}{2} \right) \right| \]

B. \( y = \left| f\left( \frac{x}{2} \right) \right| \)

41. Which equation represents the graph of \( y = \tan x \) after it has been translated 4 units up and 7 units left?

A. \( y = \tan(x + 7) + 4 \)  
B. \( y = \tan(x + 7) - 4 \)  
C. \( y = \tan(x - 7) + 4 \)  
D. \( y = \tan(x - 7) - 4 \)

42. The point \((9, -12)\) is on the graph of a function. What will the coordinates of this point be after all of the following transformations are performed on the function, in the order given?
- horizontal expansion by a factor of 3
- reflection in the \(x\)-axis
- vertical translation of 5 downward
- reflection in the line \( y = x \)

A. \((-27, 7)\)  
B. \((-17, -27)\)  
C. \((7, 3)\)  
D. \((7, 27)\)