Assignment

1. Describe how the graphs of the following functions relate to the graph of $y = f(x)$.

   a) $y = f(x + 9)$

   $x \rightarrow x + 9$
   horizontal, 9 units left

   b) $y = f(x) + 7$

   $y - 7 = f(x)$
   $y \rightarrow y - 7$
   vertical, 7 units up

   c) $y = f(x - 4) + 4$

   $y - 4 = f(x - 4)$
   $x \rightarrow x - 4$ — translation 4 units
   $y \rightarrow y + 4$ right + 4 units up

   d) $y - 6 = f(x)$

   $y \rightarrow y - 6$
   vertical 6 units up

   e) $y = 3 + f(x - 5)$

   $x \rightarrow x - 5$
   $y \rightarrow y - 3$
   translation 5 units right +
   3 units up.

   f) $y + 2 = f(x + 3) - 10$

   $y + 12 = f(x + 3)$
   $x \rightarrow x + 3$ ⎰ translation
   $y \rightarrow y + 12$ ⎱ 3 units left
                              12 units down

2. Write the equation of the image of $y = f(x)$ after each transformation.

   a) a vertical translation of 10 units down

   $y \rightarrow y + 10$ $y + 10 = f(x)$ or $y = f(x) - 10$

   b) a horizontal translation of 8 units right and a vertical translation of 9 units up

   $x \rightarrow x - 8$
   $y \rightarrow y - 9$ $y - 9 = f(x - 8)$ or $y = f(x - 8) + 9$

   c) a translation of t units up and s units left

   $x \rightarrow x + s$
   $y \rightarrow y + t$ $y - t = f(x + s)$ or $y = f(x + s) + t$

3. The function $y = f(x)$ is transformed to $y = f(x - h) + k$. Find the values of h and k for the following translations.

   a) 7 units right

   $h = 7, k = 0$

   b) 4 units up and 2 units left

   $h = -2, k = 4$

   c) a units right and b units down.

   $h = a, k = -b$

4. The point $(-3, 5)$ lies on the graph of $y = f(x)$. State the coordinates of the image of this point under the following transformations.

   a) $y = f(x) + 3$

   $y \rightarrow y - 3$ $5 + 3$
   $y - 3 = f(x)$
   3 units up $(-3, 8)$

   b) $y + 5 = f(x + 2)$

   $y \rightarrow y + 5 \cdot 5 \downarrow$
   $x \rightarrow x + 2 \cdot 2 \leftarrow$
   $(-5, 0)$

   c) $(x, y) \rightarrow (x - 7, y - 1)$

   mapping notation
   x decreased by 7
   y decreased by 1
   $(-10, 4)$

5. What happens to the graph of the function $y = f(x)$ if you make these changes to its equation?

   a) replace x with $x - 8$

   horizontal translation 8 units right
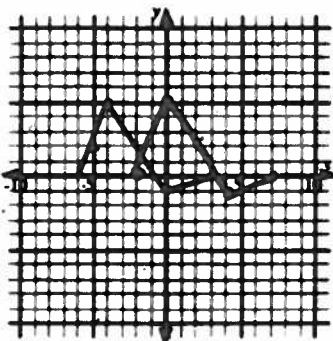
   b) replace y with $y + 2$

   vertical translation 2 units down

   c) replace x with $x + 4$, and y with $y - 7$
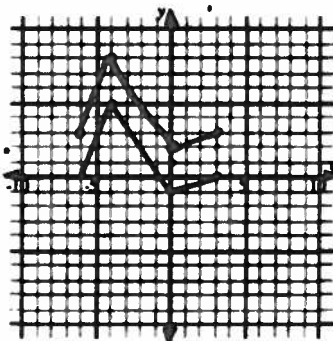
   translation 4 units left + 7 units up.

6. Given the graph of the function $y = f(x)$, sketch the graph of the indicated function.
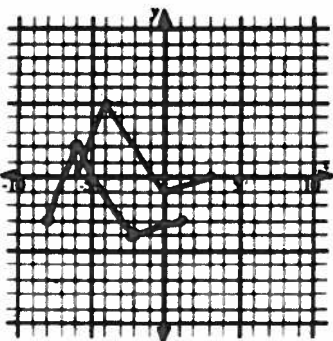
a) $y = f(x - 4)$
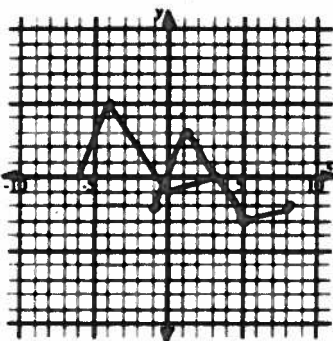

$x \to x-4$

4 units right

b) $y - 3 = f(x)$

$y \to y-3$

3 units up.

c) $y = f(x + 2) - 3$

$y+3 = f(x+2)$

$x \to x+2$

$y \to y+3$

2 units left

+

3 units down.

d) $y + 2 = f(x - 5)$

$x \to x-5$

$y \to y+2$.

5 units right

+

2 units down.

7. The function $y = f(x)$ is transformed to $y = f(x + 2) + 4$. If the point $(3, -1)$ lies on the graph of $y = f(x)$, which of the following points must lie on the graph of $y = f(x + 2) + 4$?

A. $(5, 3)$ **B.** $(1, 3)$

C. $(7, 1)$ D. $(7, -3)$

$y - 4 = f(x+2)$

$x \to x+2$ 2 units left $(3, -1) \to (1, 3)$

$y \to y-4$ 4 units up

8. The function $y = f(x)$ is transformed to $y - 3 = f(x - 1)$. If the point $(-2, 4)$ lies on the graph of $y - 3 = f(x - 1)$, which of the following points must lie on the graph of $y = f(x)$?

A. $(-1, 7)$ $x \to x-1$ 1 unit right $(?, ?) \to$ 1 right $\to (-2, 4)$

B. $(-1, 1)$ $y \to y-3$ 3 units up   3 up

C. $(-3, 7)$

**D.** $(-3, 1)$ so $(-2, 4)$ 1 left $\to$ point is $(-3, 1)$

3 down

9. The graph of $y = g(x)$ was transformed to the graph of $y = g(x - 7) + 2$. Which of the following statements describes the transformation?

A. The graph of $y = g(x)$ has been translated 2 units to the right and 7 units upward.

B. The graph of $y = g(x)$ has been translated 7 units to the left and 2 units downward.

C. The point (x, y) on the graph $y = g(x)$ has been translated to point $(x + 7, y + 2)$.

D. The point (x, y) on the graph $y = g(x)$ has been translated to point $(x - 7, y - 2)$.
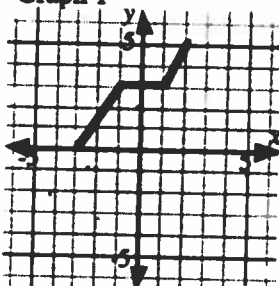
translation 7 units right + 2 units up.

Use the following information to answer the next question.

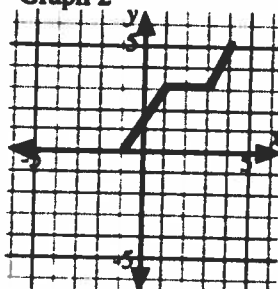The graph of $y = f(x)$ is shown on the grid to the right.
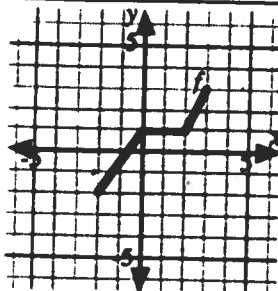
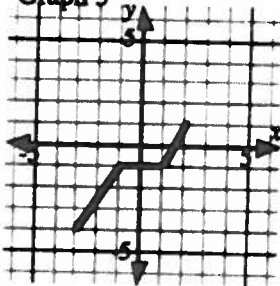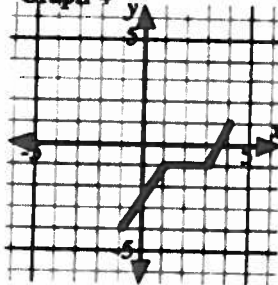Transformations of the graph of $y = f(x)$ are shown below.

Graph 1

Graph 2

Graph 3

Graph 4

(handwritten annotations)

1 left
2 up
$X \to X+1$
$y \to y-2$

1 left
2 down
$X \to X+1$
$y \to y+2$

1 right
2 up
$X \to X-1$
$y \to y-2$

1 right
2 down
$X \to X-1$
$y \to y+2$

Numerical Response **10.** Write the graph number corresponding to $y - 2 = f(x - 1)$ in the first box. –2
Write the graph number corresponding to $y + 2 = f(x - 1)$ in the second box. –4
Write the graph number corresponding to $y - 2 = f(x + 1)$ in the third box. –1
Write the graph number corresponding to $y + 2 = f(x + 1)$ in the fourth box. –3

(Record your answer in the numerical response box from left to right.)

| 2 | 4 | 1 | 3 |

Answer Key

1. a) horizontal translation 9 units left   b) vertical translation 7 units up
   c) translation 4 units right and 4 units up   d) vertical translation 6 units up
   e) translation 5 units right and 3 units up   f) translation 3 units left and 12 units down
2. a) $y = f(x) - 10$ b) $y = f(x - 8) + 9$ c) $y = f(x + s) + t$
3. a) $h = 7, k = 0$ b) $h = -2, k = 4$ c) $h = a, k = -b$
4. a) $(-3, 8)$ b) $(-5, 0)$ c) $(-10, 4)$
5. a) horizontal translation 8 units right   b) vertical translation 2 units down
   c) translation 4 units left and 7 units up
6. a) the graph is translated 4 units right   b) the graph is translated 3 units up
   c) the graph is translated 2 units left and 3 units down
   d) the graph is translated 5 units right and 2 units down

7. B   8. D   9. C   10.

| 2 | 4 | 1 | 3 |