

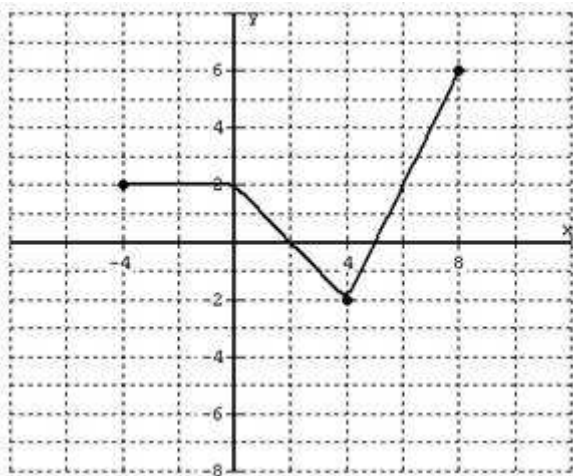
## Using Horizontal and Vertical Shifts

Quick Review	
When $x$ is replaced with $x - h$ the graph of $y = f(x)$ is shifted $h$ units horizontally. If $h$ is positive the graph is shifted to the right, if $h$ is negative the graph is shifted to the left	If the function $y = x^2$ is shifted 3 units to the right, the new graph is $y = (x - 3)^2$
When $y$ is replaced with $y - k$ the graph of $y = f(x)$ is shifted $k$ units vertically. If $k$ is positive the graph is shifted down, if $k$ is negative the graph is shifted up.	If the function $y = x^2$ is shifted 5 units down, the new graph is $y + 5 = x^2$ or $y = x^2 - 5$ .

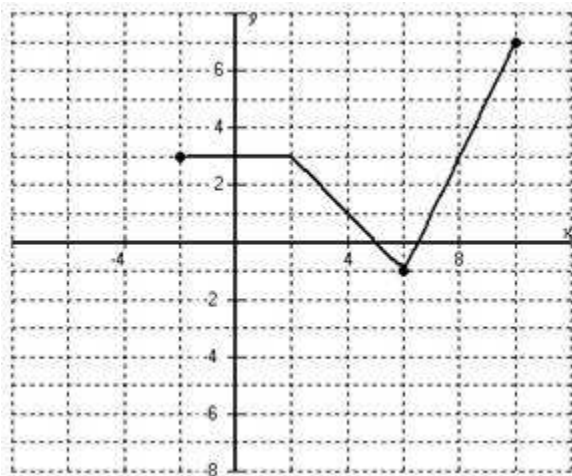
### Problems

1. Find the equation of the parabola formed by shifting  $y = x^2$  three units to the right and five units down.
2. Find the equation of the parabola formed by shifting  $y = x^2$  five units left and two units up.
3. Find the equation of the parabola formed by shifting  $y = x^2 - 3$  six units to the right and three units down.
4. Find the equation of the parabola formed by shifting  $y = 2x^2 - 4x$  eight units to the left and two units down.
5. Find the equation of the absolute value graph formed by shifting  $y = |x|$  nine units to the right and 18 units upward.
6. Each of the following equations is a shift of  $y = x^3$ . Identify the amount of shift and the direction for each.
  - a)  $y = (x + 1)^3$
  - b)  $y = 4 + (x + 11)^3$
  - c)  $y + 5 = x^3 + 3$
7. The graph on the left is some function  $y = f(x)$ . The graph on the right is  $y = f(x - 2) + 1$ , a shift of  $y = f(x)$ . Each of the graphs below are also shifts of  $y = f(x)$ . Find an equation for

each of those graphs.



$y =$

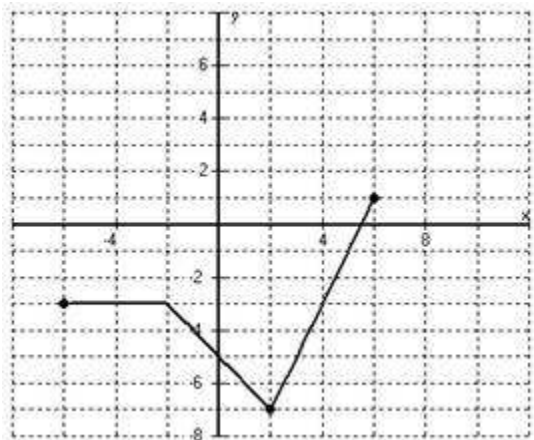


$y =$

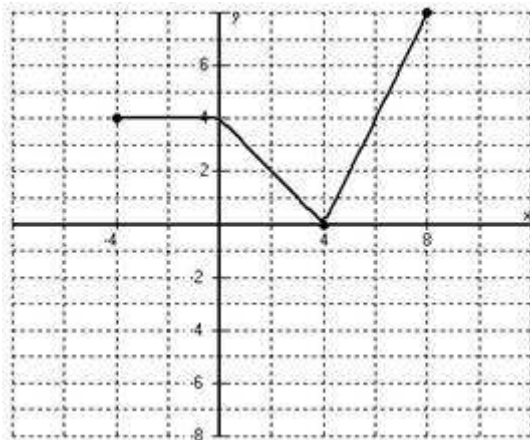
(x)

$f(x - 2) + 1$

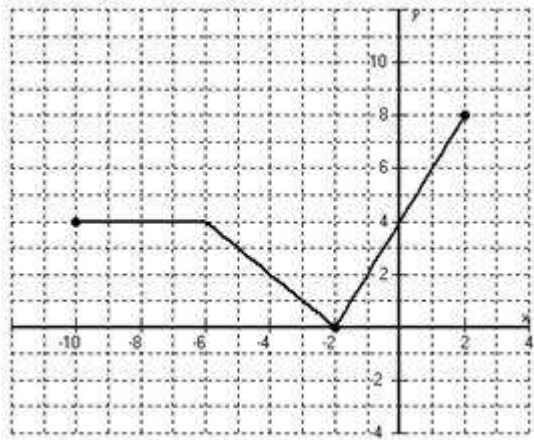
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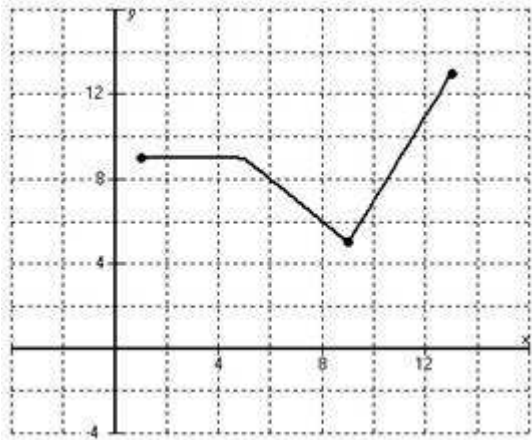
b)



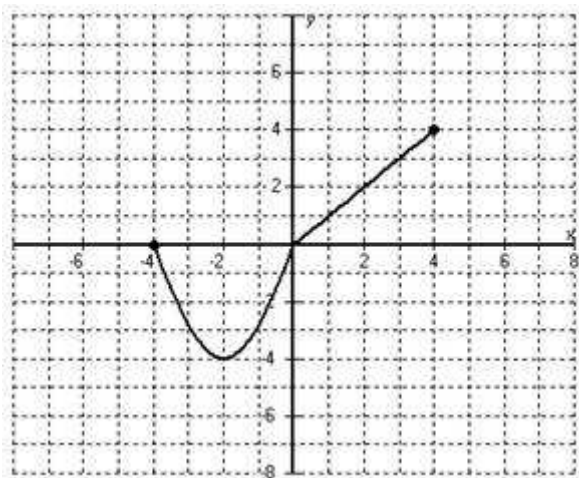
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d)



8. This question is about the function  $y = g(x)$  shown here. For each equation below, sketch the graph of the shifted function.



- a)  $y = g(x - 4) + 2$
- b)  $y = g(x + 2) - 5$
- c)  $y = g(x - 24) + 30$
- d)  $y = g(x + 1) - 1$
- e)  $y = g(x - 8) + 2$