EXAMPLE 5 TAKS PRACTICE: Multiple Choice

How would the graph of the function $y = x^2 + 5$ be affected if the function were changed to $y = x^2 + 3$?

(A) The graph would shift 2 units up.

(B) The graph would shift 3 units up.

(C) The graph would shift 2 units down.

(D) The graph would shift 2 units to the left.

ELIMINATE CHOICES
You can eliminate choice D because changing the value of c in a function of the form $y = x^2 + c$ translates the graph up or down.

Solution

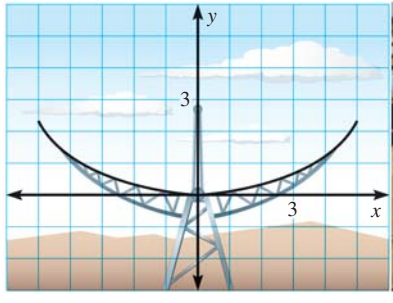
The vertex of the graph of $y = x^2 + 5$ is 5 units above the origin, or (0, 5). The vertex of the graph of $y = x^2 + 3$ is 3 units above the origin, or (0, 3). Moving the vertex from (0, 5) to (0, 3) translates the graph 2 units down.

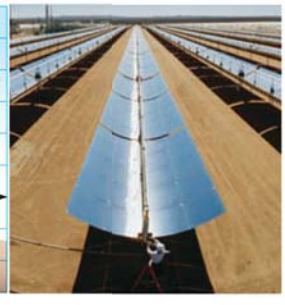
▶ The correct answer is C. (A) (B) (C) (D)

EXAMPLE 6 Use a graph

SOLAR ENERGY A solar trough has a reflective parabolic surface that is used to collect solar energy. The sun's rays are reflected from the surface toward a pipe that carries water. The heated water produces steam that is used to produce electricity.

The graph of the function $y = 0.09x^2$ models the cross section of the reflective surface where x and y are measured in meters. Use the graph to find the domain and range of the function in this situation.





Solution

STEP 1 **Find** the domain. In the graph, the reflective surface extends 5 meters on either side of the origin. So, the domain is $-5 \le x \le 5$.

STEP 2 **Find** the range using the fact that the lowest point on the reflective surface is (0, 0) and the highest point, 5, occurs at each end.

$y = 0.09(5)^2 = 2.25$ **Substitute 5 for x. Then simplify.**

The range is $0 \le y \le 2.25$.

GUIDED PRACTICE for Examples 5 and 6

7. *Describe* how the graph of the function $y = x^2 + 2$ would be affected if the function were changed to $y = x^2 - 2$.

8. **WHAT IF?** In Example 6, suppose the reflective surface extends just 4 meters on either side of the origin. Find the domain and range of the function in this situation.