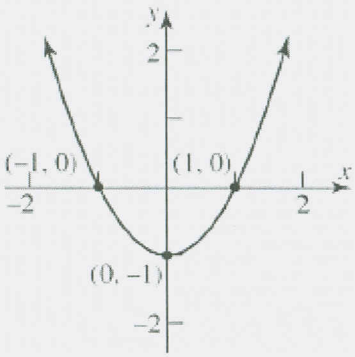
In Problems 35–64, graph each function using the techniques of shifting, compressing, stretching, and/or reflecting. Start with the graph of the basic function (for example, $y = x^2$) and show all stages.

35. $f(x) = x^2 - 1$

35. $f(x) = x^2 - 1$

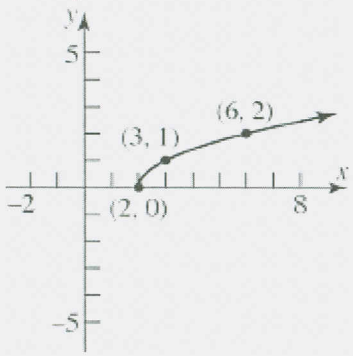
Using the graph of $y = x^2$, vertically shift downward 1 unit.



39. $h(x) = \sqrt{x-2}$

39. $h(x) = \sqrt{x-2}$

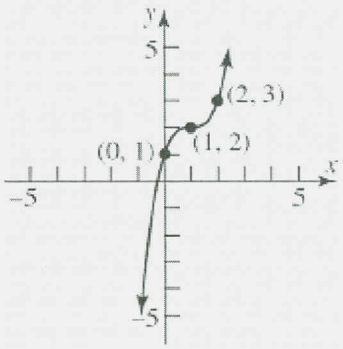
Using the graph of $y = \sqrt{x}$, horizontally shift to the right 2 units.



41. $f(x) = (x-1)^3 + 2$

41. $f(x) = (x-1)^3 + 2$

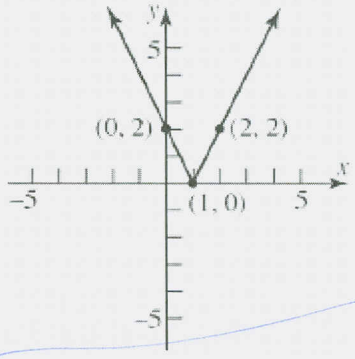
Using the graph of $y = x^3$, horizontally shift to the right 1 unit, then vertically shift up 2 units.



61. $f(x) = 2|1-x|$

61. $g(x) = 2|1-x| = 2|-(-1+x)| = 2|x-1|$

Using the graph of $y = |x|$, horizontally shift to the right 1 unit, and vertically stretch by a factor or 2.



Context — 1pt
"Shape" Graph — 1pt
Labels — 1pt
#35

Context — 1pt
Shape & position — 1p
Labels of points — 1pt

6 pts

69. Suppose that the x-intercepts of the graph of $y = f(x)$ are -5 and 3.
(a) What are the x-intercepts of the graph of $y = f(x+2)$?
(b) What are the x-intercepts of the graph of $y = f(x-2)$?

69. a. The graph of $y = f(x+2)$ is the same as the graph of $y = f(x)$, but shifted 2 units to the left. Therefore, the x-intercepts are -7 and 1.

b. The graph of $y = f(x-2)$ is the same as the graph of $y = f(x)$, but shifted 2 units to the right. Therefore, the x-intercepts are -3 and 5.

c. The graph of $y = 4f(x)$ is the same as the graph of $y = f(x)$, but stretched vertically by a factor of 4. Therefore, the x-intercepts are still -5 and 3 since the y-coordinate of each is 0.

d. The graph of $y = f(-x)$ is the same as the graph of $y = f(x)$, but reflected about the y-axis. Therefore, the x-intercepts are 5 and -3.

71. Suppose that the function $y = f(x)$ is increasing on the interval $(-1, 5)$.
(a) Over what interval is the graph of $y = f(x+2)$ increasing?
(b) Over what interval is the graph of $y = f(x-5)$ increasing?

71. a. The graph of $y = f(x+2)$ is the same as the graph of $y = f(x)$, but shifted 2 units to the left. Therefore, the graph of $f(x+2)$ is increasing on the interval $(-3, 3)$. 1pt
Plus 1pt context

b. The graph of $y = f(x-5)$ is the same as the graph of $y = f(x)$, but shifted 5 units to the right. Therefore, the graph of $f(x-5)$ is increasing on the interval $(4, 10)$. 1pt

c. The graph of $y = -f(x)$ is the same as the graph of $y = f(x)$, but reflected about the x-axis. Therefore, we can say that the graph of $y = -f(x)$ must be *decreasing* on the interval $(-1, 5)$.

d. The graph of $y = f(-x)$ is the same as the graph of $y = f(x)$, but reflected about the y-axis. Therefore, we can say that the graph of $y = f(-x)$ must be *decreasing* on the interval $(-5, 1)$.

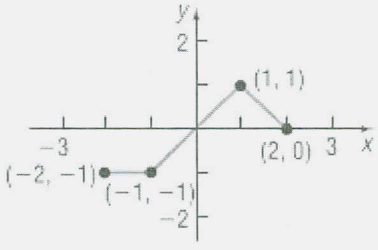
1pt
(a) $(-7, 0)$ & $(1, 0)$

(b)
$(-3, 0)$ & $(5, 0)$
1pt

1pt - context

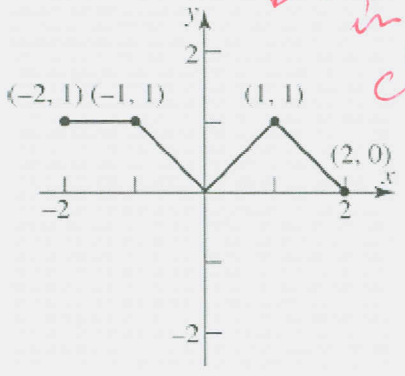
1pt

73. The graph of a function f is illustrated in the figure.
(a) Draw the graph of $y = |f(x)|$.
(b) Draw the graph of $y = f(|x|)$.

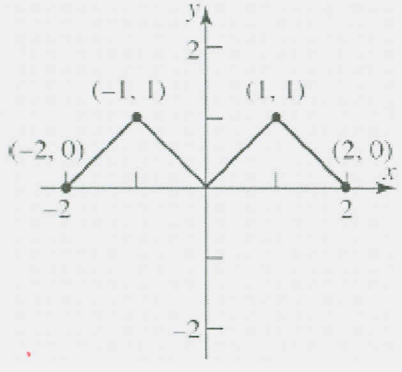


73. a. $y = |f(x)|$

Done in class



b. $y = f(|x|)$



In #s 75 – 84, complete the square of each quadratic expression. Then graph each function using the technique of shifting. (If necessary, refer to the Appendix, Section A.4, to review completing the square.

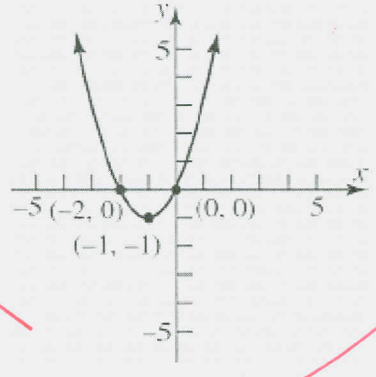
75. $f(x) = x^2 + 2x$

75. $f(x) = x^2 + 2x$

$f(x) = (x^2 + 2x + 1) - 1$

$f(x) = (x+1)^2 - 1$

Using $f(x) = x^2$, shift left 1 unit and shift down 1 unit.



Complete the square – 1pt
Correct graph – 1pt
Context – 1pt

Self-Assess. There are 15 points available, so you all can earn 150%. (Self-) honesty is best for learning. Everyone gets full credit for participating. 3pts