Section 3.5 Solutions
#1 – 56: Let \( f(x) = x^2 \), \( g(x) = \sqrt{x} \), \( h(x) = |x| \), \( k(x) = \sqrt[3]{x} \), \( m(x) = x^3 \)
a) find the requested function
b) describe the transformation from the original function.

1a) \( h(x + 2) = |x + 2| \) 
   1b) shifts left 2
   put +2 inside absolute value since it is inside the parenthesis

3a) \( h(x + 5) = |x + 5| \) 
   3b) shifts left 5
   put +5 inside absolute value since it is inside the parenthesis

5a) \( f(x + 3) = (x + 3)^2 \) 
   5b) shifts left 3
   put +3 inside a parenthesis since it is inside the parenthesis

7a) \( f(x + 6) = (x + 6)^2 \) 
   7b) shifts left 6
   put +6 inside a parenthesis since it is inside the parenthesis

9a) \( h(x - 2) = |x - 2| \) 
   9b) shifts right 2
   put -2 inside absolute value since it is inside the parenthesis

11a) \( h(x - 5) = |x - 5| \) 
    11b) shifts right 5
    put -5 inside absolute value since it is inside the parenthesis

13a) \( g(x - 3) = \sqrt{x - 3} \) 
    13b) shifts right 3
    put -5 under the square root since it is inside the parenthesis

15a) \( g(x - 4) = \sqrt{x - 4} \) 
    15b) shifts right 4
    put -4 under the square root since it is inside the parenthesis

17a) \( f(x) + 2 = x^2 + 2 \) 
    17b) shifts up 2
    the +2 goes after the \( x^2 \) since it is not in a parenthesis

19a) \( g(x) + 5 = \sqrt{x} + 5 \) 
    19b) shifts up 5
    the +5 goes after the square root since it is not in a parenthesis

21a) \( h(x) - 3 = |x| - 3 \) 
    21b) shifts down 3
    the -3 goes after the absolute value since it is not in a parenthesis

23a) \( k(x) - 6 = \sqrt[3]{x} - 6 \) 
    23b) shifts down 6
    the -6 goes after the cubed root since it is not in a parenthesis

25a) \( h(x + 2) + 1 = |x + 2| + 1 \) 
    25b) shifts left 2, up 1
    the +2 goes inside the absolute value since it is inside the parenthesis, the +1 goes after since it is not in the parenthesis
27a) $h(x + 5) - 1 = |x + 5| - 1$  
27b) shifts left 5, down 1
the +5 goes inside the absolute value since it is inside the parenthesis, the -1 goes after since it is not in the parenthesis

29a) $g(x - 2) + 1 = \sqrt{x - 2} + 1$  
29b) shifts right 2 up 1
put -2 under the square root since it is inside the parenthesis, the +1 goes after the square root since it is not in a parenthesis

31a) $g(x - 5) - 1 = \sqrt{x - 5} - 1$  
31b) shifts right 5 down 1
the -5 goes under the square root since it is inside the parenthesis, the -1 goes after since it is not in the parenthesis

33a) $-k(x) = -\sqrt{x}$  
33b) reflects over x-axis
the negative goes in front since it is not in the parenthesis

35a) $-h(x) = -|x|$  
35b) reflects over x-axis
the negative goes in front since it is not in the parenthesis

37a) $k(-x) = \sqrt{-x}$  
37b) reflects over y-axis
the negative goes under the cubed root since it is inside the parenthesis

39a) $h(-x) = |x| or just |x|$  
39b) reflects over y-axis
the negative goes inside the absolute value since it is inside the parenthesis

41a) $-f(x + 2) + 1 = -(x + 2)^2 + 1$  
41b) reflects over x-axis, shifts left 2 and up 1
the negative goes in front of the parenthesis since it is not inside the parenthesis, the +2 belongs inside the parenthesis since it is in the parenthesis, the +1 goes after since it is not in the parenthesis

43a) $-f(x + 5) - 1 = -(x + 5)^2 - 1$  
43b) reflects over x-axis, shifts left 5 and down 1
the negative goes in front of the parenthesis since it is not inside the parenthesis, the +5 belongs inside the parenthesis since it is in the parenthesis, the -1 goes after since it is not in the parenthesis

45a) $-m(x - 2) + 1 = -(x - 2)^3 + 1$  
45b) reflects over x-axis, shifts right 2, up 1
the negative goes in front of the parenthesis since it is not inside the parenthesis, the -2 belongs inside the parenthesis since it is in the parenthesis, the +1 goes after since it is not in the parenthesis

47a) $-m(x - 5) - 1 = -(x - 5)^3 - 1$  
47b) reflects over x-axis, shifts right 5, down 1
the negative goes in front of the parenthesis since it is not inside the parenthesis, the -5 belongs inside the parenthesis since it is in the parenthesis, the -1 goes after since it is not in the parenthesis

49a) $2f(x) = 2x^2$  
49b) stretches
the 2 goes in front since it is not in a parenthesis
numbers greater than 1 multiplied by a function stretch the graph
53a) \( \frac{1}{2} h(x) = \frac{1}{2} |x| \)  
53b) compresses 
the \( \frac{1}{2} \) goes in front of the absolute value since it is not in the parenthesis 

55a) \( -\frac{1}{2} h(x) = -\frac{1}{2} |x| \)  
55b) reflects over x axis, and compresses 
the \(-1/2\) goes in front since it is not in the parenthesis 
fractions between 0 and 1 compress, negative numbers reflect over x-axis 

57) \( f(x - 2) \) (shift each point 2 to the right) 

59) \( f(x) - 2 \) shift each point down 2
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61) \( f(x-2) + 1 \)  shift each point right 2 and up 1

63) \( -f(x) \)  reflect over x-axis by changing y-coordinate of each point
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65) \( f(x - 1) \) shift each point to the right 1

67) \( f(x) - 1 \) shift each point down 1
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69) \( f(x - 1) + 2 \) shift each point 1 to the right and up 2

71) \( f(-x) \) reflect over y-axis by changing the sign of each \( x \)

This will give you the original graph back. The original graph is symmetric to the y-axis, so reflecting the graph over the y-axis produces the original graph again.