Name: Key

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Algebra 2

Quadratic Functions Study Guide

2.1 Transformations of Quadratic Functions

1. Let the graph of g be a translation 1 unit left and 2 units up of the function $f(x) = x^2 + 1$. Write a rule for g.

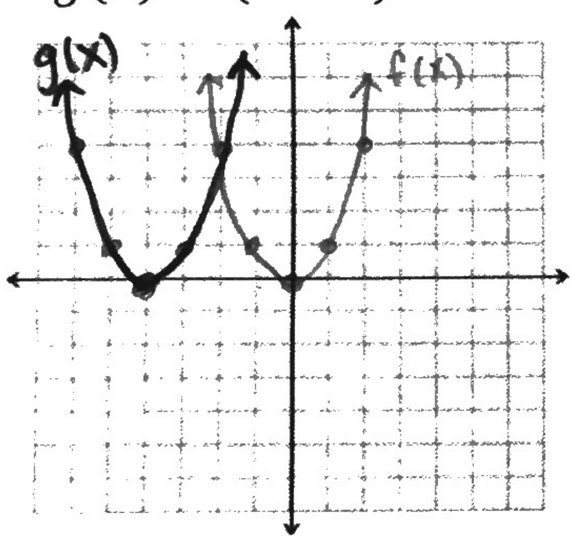
$g(x) = f(x+1) + 2$

$g(x) = (x+1)^2 + 1 + 2$

$\boxed{g(x) = (x+1)^2 + 3}$

Describe the transformation of $f(x) = x^2$ represented by g. Then graph each function.

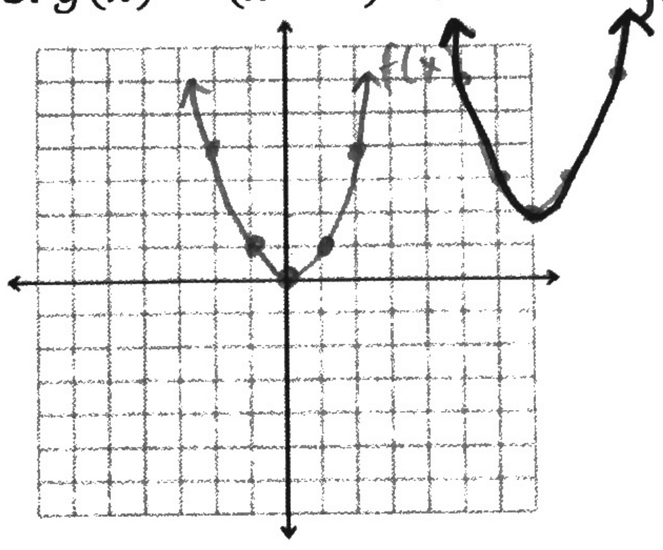
2. $g(x) = (x+4)^2$



translation left

4 units

3. $g(x) = (x-7)^2 + 2$

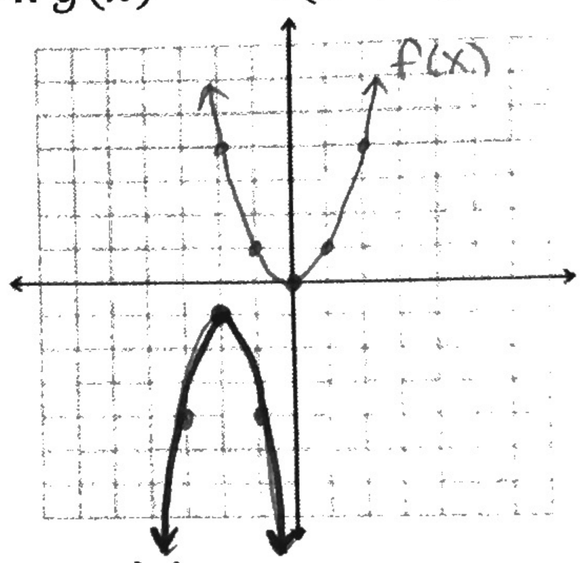


translation right

7 units and up

2 units

4. $g(x) = -3(x+2)^2 - 1$



vertical stretch by a factor of 3, reflection over the x-axis, translation left 2 units and down 1 unit

Write a rule for g.

5. Let g be a horizontal ~~shrink~~ stretch by a factor of $\frac{2}{3}$, followed by a translation 5 units left and 2 units down of the graph of $f(x) = x^2$.

① horizontal stretch by a factor of $2/3$

$h(x) = f\left(\frac{2}{3}x\right)$

$h(x) = \left(\frac{2}{3}x\right)^2$

$h(x) = \frac{4}{9}x^2$

② translation 5 units left and 2 units down

$g(x) = h(x+5) - 2$

$\boxed{g(x) = \frac{4}{9}(x+5)^2 - 2}$

6. Let g be a translation 2 units left and 3 units up, followed by a reflection in the y-axis of the graph of $f(x) = x^2 - 2x$.

① translation 2 units left and 3 units up

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

$h(x) = (x+2)^2 - 2(x+2) + 3$

$h(x) = x^2 + 4x + 4 - 2x - 4 + 3$

$h(x) = x^2 + 2x + 3$

② reflection in the y-axis

$g(x) = h(-x)$ $\quad g(x) = (-x)^2 + 2(-x) + 3$

$\boxed{g(x) = x^2 - 2x + 3}$

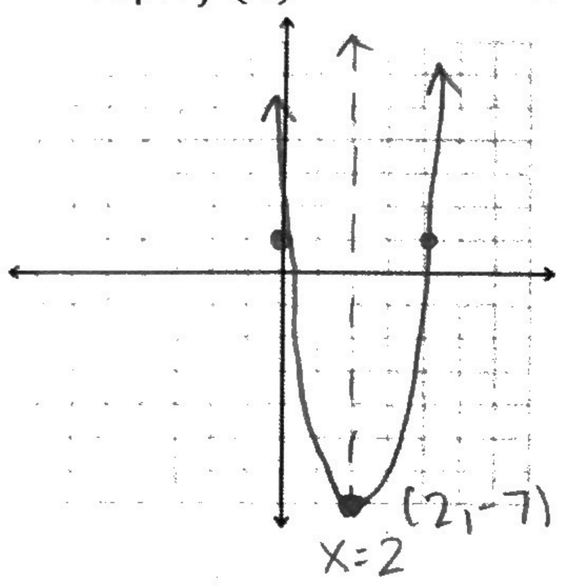
2.2 Characteristics of Quadratic Functions

7. Graph $f(x) = 2x^2 - 8x + 1$. Label the vertex and axis of symmetry.

$a = 2$

$b = -8$

$c = 1$



axis of symmetry: $x = \frac{-b}{2a}$ $\quad x = \frac{8}{4}$ $\quad x = 2$

$x = \frac{-(-8)}{2(2)}$

y-intercept: (0, 1)

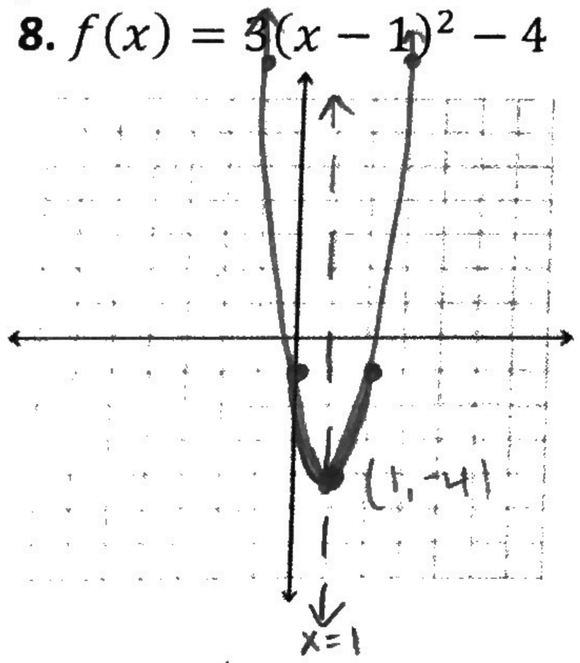
vertex: $f(2) = 2(2)^2 - 8(2) + 1$ $\quad f(2) = 8 - 16 + 1$

$= 2(4) - 16 + 1$ $\quad f(2) = -7$

(2, -7)

Graph the function. Label the vertex and axis of symmetry. Find the minimum or maximum value of f. Describe where the function is increasing and decreasing.

8. $f(x) = 3(x-1)^2 - 4$



vertex: (1, -4) $\quad$ aos: $x = 1$

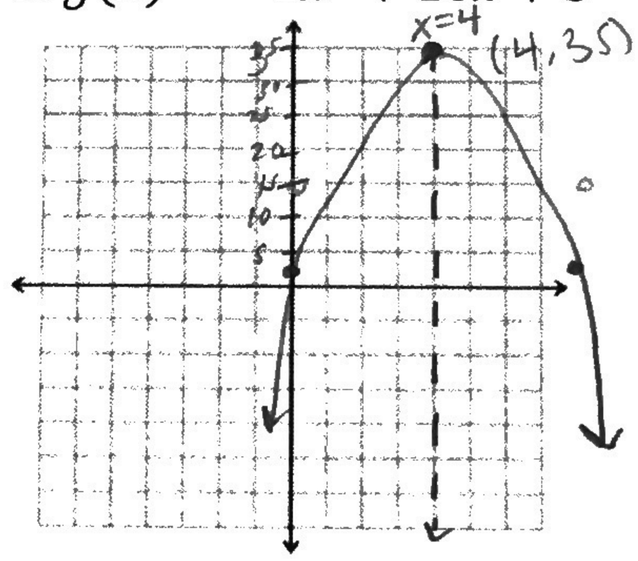
min = -4

increasing: right of $x = 1$

decreasing: left of $x = 1$

x	f(x)
-1	8
0	-1
1	-4
2	-1
3	8

9. $g(x) = -2x^2 + 16x + 3$



aos: $x = \frac{-16}{2(-2)} = 4$; $x = 4$

vertex: (4, 35)

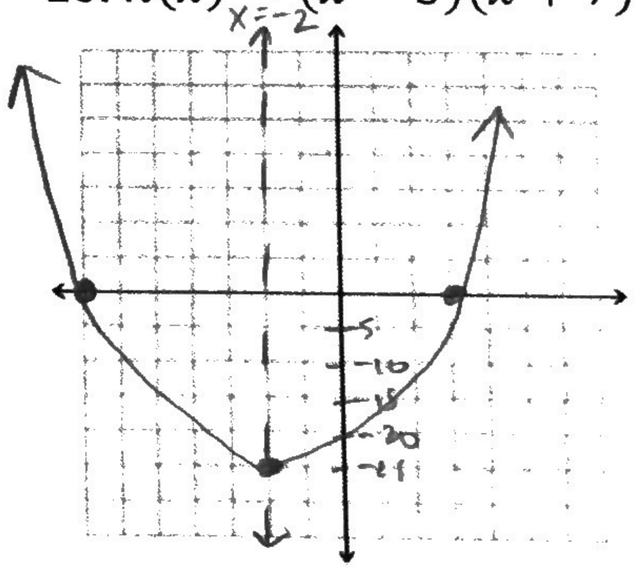
max = 35

increasing: left of $x = 4$

decreasing: right of $x = 4$

y-int: (0, 3)

10. $h(x) = (x-3)(x+7)$



x-ints = 3, -7

aos: $x = \frac{3 + -7}{2} = -2$; $x = -2$

vertex: (-2, -25)

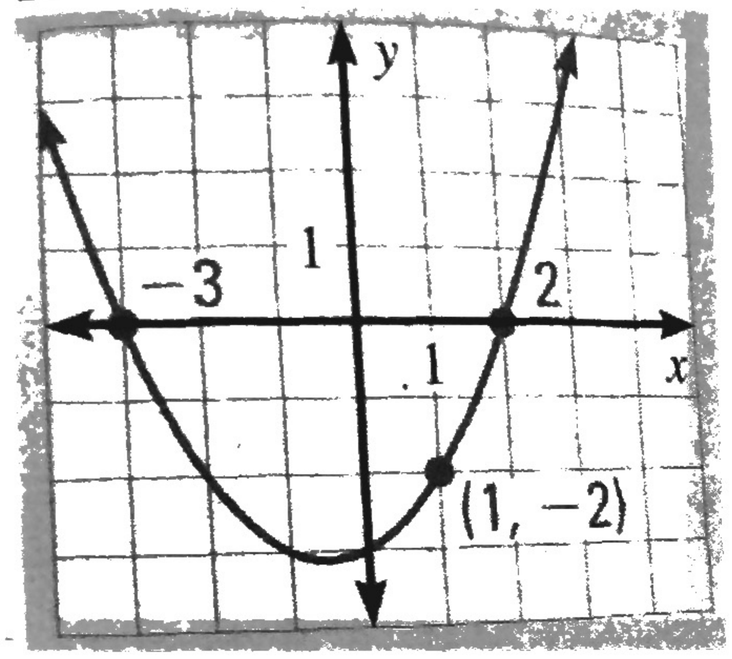
min = -25

increasing: right of $x = -2$

decreasing: left of $x = -2$

2.3 Writing Quadratic Functions

11. Write a quadratic function for the parabola shown.



intercept form: $y = a(x-p)(x-q)$

$p = -3, q = 2$

$y = a(x+3)(x-2)$

$(1,-2)$

$-2 = a(1+3)(1-2)$

$-2 = a(4)(-1)$

$-2 = -4a$

$\frac{1}{2} = a$

$y = \frac{1}{2}(x+3)(x-2)$

Write a quadratic function whose graph has the given characteristics.

12. x-intercepts: $-3, 2$

Passes through: $(3,12)$

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

$y = a(x-p)(x-q)$

$y = a(x+3)(x-2)$

$12 = a(3+3)(3-2)$

$12 = a(6)(1)$

$12 = 6a$

$2 = a$

13. passes through: $(5,2), (0,2), (8,-6)$

$y = ax^2+bx+c$ → $c = 2$

$$\begin{cases} 2 = a(5)^2+b(5)+2 \\ 2 = 25a+5b+2 \\ 0 = 25a+5b \end{cases} \Rightarrow \begin{array}{l} 25a = -5b \\ -5a = b \end{array}$$

$$\begin{cases} -6 = a(8)^2+b(8)+2 \\ -6 = 64a+8b+2 \\ -8 = 64a+8b \end{cases}$$

substitution:

$-8 = 64a+8(-5a)$

$-8 = 64a-40a$

$-8 = 24a$

$-\frac{1}{3} = a$

$y = -\frac{1}{3}x^2+\frac{5}{3}x+2$

$b = -5(-\frac{1}{3})$

$b = \frac{5}{3}$

14. Vertex: $(2,7)$

Passes through: $(4,2)$

$y = a(x-h)^2+k$

$y = a(x-2)^2+7$

$2 = a(4-2)^2+7$

$2 = a(2)^2+7$

$2 = 4a+7$

$-5 = 4a$

$-\frac{5}{4} = a$

$y = -\frac{5}{4}(x-2)^2+7$