Key

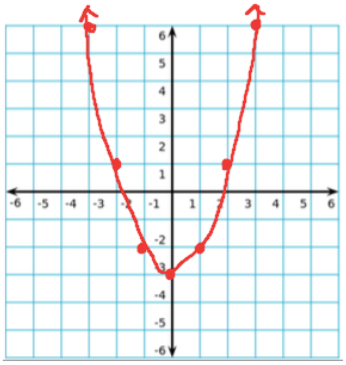
Transformations of Quadratic Functions

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

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

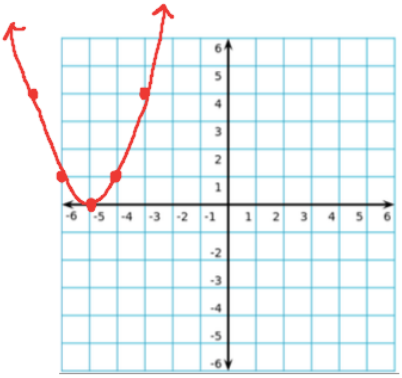
$(x-0)^2 - 3$

trans. 3 units down



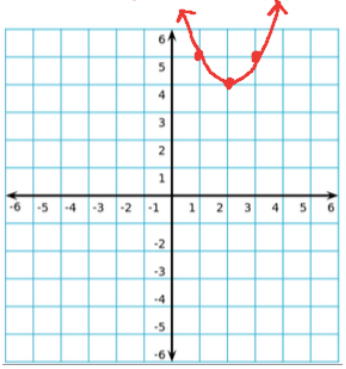
2. $g(x) = (x + 5)^2 + 0$

trans. 5 units left



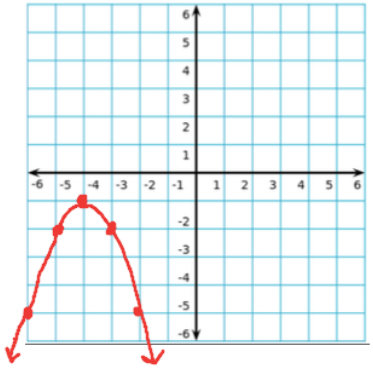
3. $g(x) = (x - 2)^2 + 4$

trans. 2 units right
4 units up



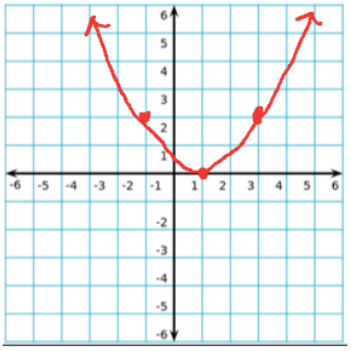
4. $g(x) = -(x + 4)^2 - 1$

- ref x-axis
- trans. 4 left
- trans 1 down



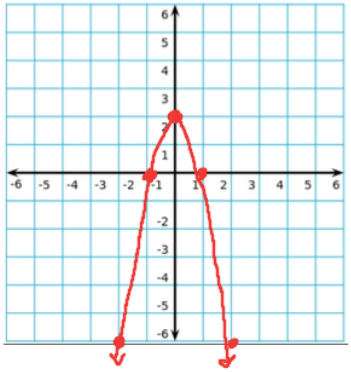
5. $g(x) = \frac{1}{2}(x - 1)^2$

- vert. comp. scale fac $\frac{1}{2}$
- trans 1 right



6. $g(x) = -2x^2 + 2 = -2(x-0)^2 + 2$

- ref x-axis
- vert stretch fac 2
- trans 2 up



In Exercises 7 – 11, write a rule for g(x) described by the transformations of graph f(x). Then identify the vertex.

7. $f(x) = x^2$; vertical stretch by a factor of 4 and a reflection in the x-axis, followed by a translation 2 units up.

$g(x) = -4x^2 + 2$ or $-4(x-0)^2 + 2$ vertex: $(0, 2)$

8. $f(x) = x^2$; vertical compression by a factor of 1/3, followed by a translation 3 units right and 4 units down.

$g(x) = \frac{1}{3}(x-3)^2 - 4$ vertex: $(3, -4)$

9. $f(x) = (x + 6)^2 + 3$; vertical stretch by a factor of 2 and a translation 1 unit down, followed by a reflection over the x-axis.

-1

$g(x) = -2(x+6)^2 + 2$ vertex: $(-6, 2)$

10. $f(x) = -2(x - 1)^2 - 4$; translation 3 units left and 4 units up.

$h = 1 - 4$, $h = -3$ $\quad$ $K = -4 + 4$, $K = 0$

$g(x) = -2(x+3)^2$ vertex: $(3, 0)$

11. $f(x) = x^2 - 6$; vertical compression by a factor of 1/4 and a translation 1 unit right followed by a reflection over the x-axis. $f(x) = (x-0)^2 - 6$

$h = 0 + 1$

$h = 1$

$g(x) = -\frac{1}{4}(x-1)^2 - 6$ vertex: $(1, -6)$

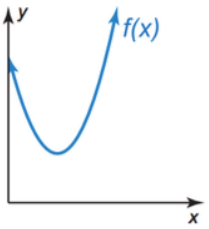
In Exercises 12 – 15, match the function with the correct transformation of the graph f(x).

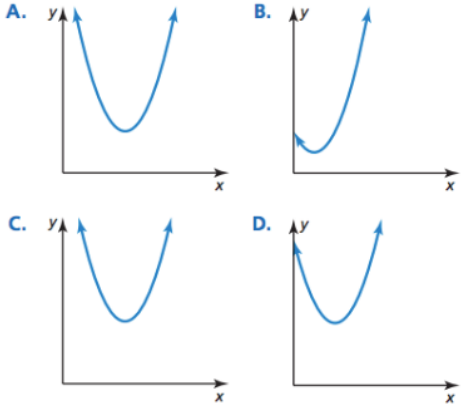
12. f(x – 1) A
right 1

13. f(x) + 1 D
up 1

14. f(x – 1) + 1 C
right 1 up 1

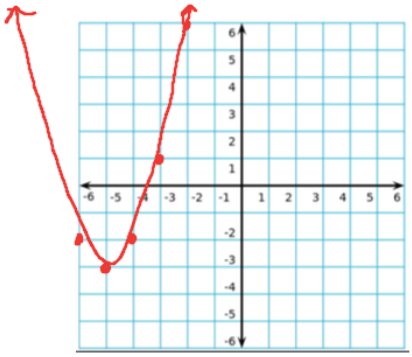
15. f(x + 1) – 1 B
left 1 down 1



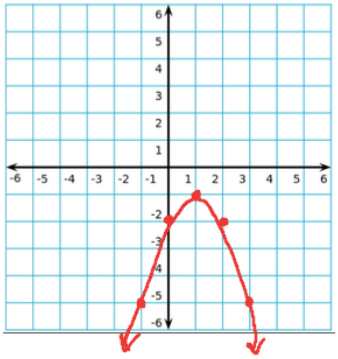


In Exercises 16 – 18 Describe and graph the transformations of $f(x) = x^2$ onto g(x). Then graph.

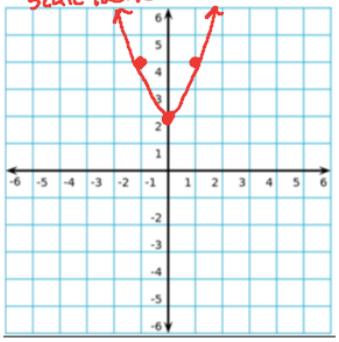
16. g(x) = f(x + 5) – 3
h=-5 left 5 k=-3 down 3



17. g(x) = -f(x – 1) – 1
ref. x-axis h=1 right 1 k=-1 down 1



18. g(x) = 2·f(x) + 2
vert. stretch scale fac. 2 h=0 k=2 up 2



In Exercises 19 – 21 the function f(x) is transformed onto g(x). Describe the transformation then write the rule for g(x).

19. $f(x) = 2(x + 1)^2 + 5$

g(x) = f(x – 6) + 1
right 6 (h+6) up 1 (k+1)

$f(x) = 2(x+1)^2 + 5$
h=-1 +6 h=5 k=5 +1 k=6

$g(x) = 2(x-5)^2 + 6$

20. $f(x) = -(x – 4)^2 + 1$

g(x) = -2·f(x) + 3
stretch & flip (a·-2) up 3 (k+3)

$f(x) = -(x-4)^2 + 1$
a=-1 x-2 a=2
k=1 +3 k=4

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

21. $f(x) = 3x^2 + 6x$

g(x) = -f(x + 2) + 2
refl. (a·-1) left 2 (h-2) up 2 (k+2)

set y-form
$f(x) = 3x^2 + 6x$
$= 3(x^2 + 2x + 1) - 1(3)$
$= 3(x+1)^2 - 3$
a=3 x-1 a=-3
h=-1 -2 h=-3
k=-3 +2 k=-1

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