U1 L7A Transformations: Shifts & Reflections — Practice

Name: ANSWER KEY HR: _____

Skills: Read function notation to find h, k, and reflections; write equations from descriptions and graphs; and sketch transformed parent functions.

Review & Prerequisites

1. *Review (1.6)* Evaluate [[−2.5]]. greatest integer ≤ −2.5 [[−2.5]] = −3	**2.** *Review (1.6)* State the domain and range of $f(x) = \sqrt{x}$. Domain: [0, ∞) Range: [0, ∞)	**3.** *Review (1.6)* Write the linear function with $f(0) = 2$ and $f(3) = 8$. m = (8 − 2)/(3 − 0) = 2 b = f(0) = 2 f(x) = 2x + 2

Group A — Describe Transformation

Find h, k, and any reflection, then describe how g compares to f. Outside → vertical (does what it says). Inside → horizontal (does the opposite).

4. $g(x) = f(x) + 7$ h = 0 k = 7 reflection? none +7 outside → up 7 Vertical shift up 7 units	**5.** $g(x) = f(x - 4)$ h = 4 k = 0 reflection? none x − 4 inside → opposite Horizontal shift right 4 units
6. $g(x) = f(x + 1) - 6$ h = −1 k = −6 reflection? none x + 1 = x − (−1) Left 1 unit and down 6 units	**7.** $g(x) = -f(x)$ h = 0 k = 0 reflection? x-axis − outside flips outputs Reflection in the x-axis
8. $g(x) = f(-x) + 2$ h = 0 k = 2 reflection? y-axis −x inside → reflect in y-axis Reflect in y-axis, then up 2	**9.** $g(x) = -f(x - 5)$ h = 5 k = 0 reflection? x-axis x − 5 → right 5; − → x-axis Right 5, reflect in x-axis
10. $g(x) = -f(x) - 3$ h = 0 k = −3 reflection? x-axis − outside → reflect in x-axis Reflect in x-axis, then down 3	**11.** $g(x) = f(x + 8) + 1$ h = −8 k = 1 reflection? none x + 8 = x − (−8) Left 8 units and up 1 unit

Group B — Write an Equation from a Description

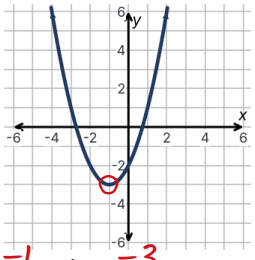
(Textbook #39–46)

12. The shape of $f(x) = x^2$, but shifted three units to the right and seven units down. *(#39)* h = 3, k = −7 $g(x) = (x - 3)^2 - 7$	**13.** The shape of $f(x) = x^3$, but shifted 13 units to the right. *(#41)* h = 13, k = 0 $g(x) = (x - 13)^3$	**14.** The shape of $f(x) = \lvert x \rvert$, but shifted four units to the left and eight units down. *(#44)* h = −4, k = −8 $g(x) = \lvert x + 4 \rvert - 8$
15. The shape of $f(x) = \sqrt{x}$, but shifted three units to the right and one unit up. h = 3, k = 1 $g(x) = \sqrt{x - 3} + 1$	**16.** The shape of $f(x) = \lvert x \rvert$, but reflected in the x-axis and then shifted five units up. reflect: −f(x), k = 5 $g(x) = -\lvert x \rvert + 5$	**17.** The shape of $f(x) = x^3$, but shifted four units to the left and two units down. h = −4, k = −2 $g(x) = (x + 4)^3 - 2$

Group C — Write an Equation from a Graph

Each graph is a transformation of the given parent. The vertex or starting point is $(h,\ k)$.

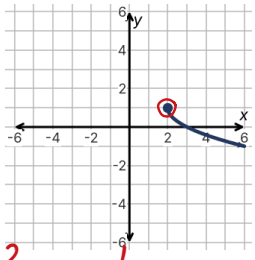
18. Parent: x^2



h = −1 k = −3

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

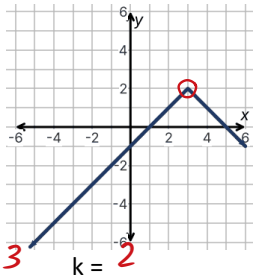
19. Parent: $\sqrt{x}$



h = 2 k = 1

$g(x)$ = $-\sqrt{x - 2} + 1$

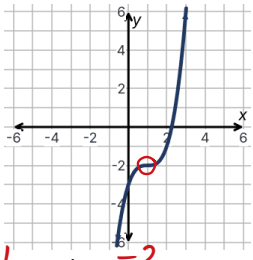
20. Parent: $|x|$



h = 3 k = 2

$g(x)$ = $-|x - 3| + 2$

21. Parent: x^3



h = 1 k = −2

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

Group D — Identify, Describe, Rewrite, and Sketch

g is related to one of the parent functions from Section 1.6. (Textbook #21–28)

22. $g(x) = x^2 - 2$ *(#22)*

(a) Parent f: $f(x) = x^2$

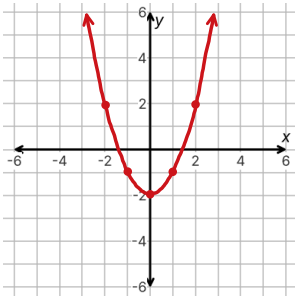
(b) h = 0 k = −2

reflection? none

(c) f-notation: $g(x)$ =

$g(x) = f(x) - 2$

pts: (0,−2), (±1,−1), (±2,2)



23. $g(x) = -(x - 2)^3$ *(#23)*

(a) Parent f: $f(x) = x^3$

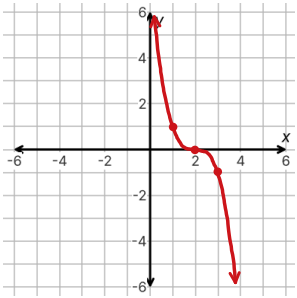
(b) h = 2 k = 0

reflection? yes, x-axis

(c) f-notation: $g(x)$ =

$g(x) = -f(x - 2)$

pts: (2,0), (1,1), (3,−1)



24. $g(x) = -3 - (x + 1)^2$ *(#25)*

(a) Parent f: $f(x) = x^2$

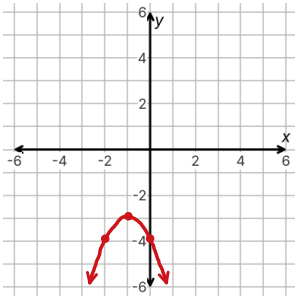
(b) h = −1 k = −3

reflection? yes, x-axis

(c) f-notation: $g(x)$ =

$g(x) = -f(x + 1) - 3$

pts: (−1,−3), (0,−4), (−2,−4)



25. $g(x) = 4 - (x - 2)^2$ *(#26)*

(a) Parent f: $f(x) = x^2$

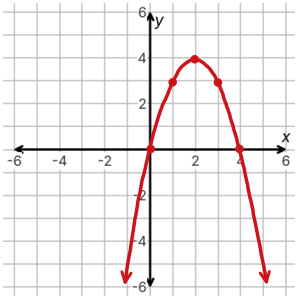
(b) h = 2 k = 4

reflection? yes, x-axis

(c) f-notation: $g(x)$ =

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

pts: (2,4), (1,3), (3,3), (0,0)



26. $g(x) = |x - 1| + 2$ *(#27)*

(a) Parent f: $f(x) = |x|$

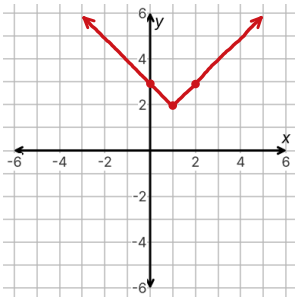
(b) h = 1 k = 2

reflection? none

(c) f-notation: $g(x)$ =

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

pts: (1,2), (0,3), (2,3)



27. $g(x) = |x + 3| - 2$ *(#28)*

(a) Parent f: $f(x) = |x|$

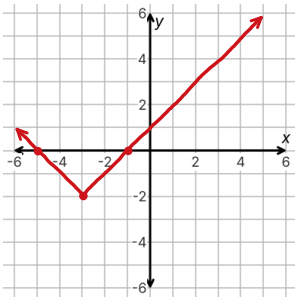
(b) h = −3 k = −2

reflection? none

(c) f-notation: $g(x)$ =

$g(x) = f(x + 3) - 2$

pts: (−3,−2), (−5,0), (−1,0)



Group E — Think About It

28. True or False? The graph of $y = f(-x)$ is a reflection of the graph of $y = f(x)$ in the x-axis. Justify. *(#63)*

FALSE. (a, b) → (−a, b) is a reflection in the y-axis, not the x-axis.

29. True or False? The graph of $y = -f(x)$ is a reflection of the graph of $y = f(x)$ in the y-axis. Justify. *(#64)*

FALSE. (a, b) → (a, −b) is a reflection in the x-axis, not the y-axis.

30. Error Analysis A student says the graph of g is a right shift of one unit of $f(x) = x^3$, so $g(x) = (x + 1)^3$. Describe the error. *(#69)*

Inside does the opposite, so $(x + 1)^3$ shifts LEFT 1. Right 1 is $g(x) = (x - 1)^3$.