Name: _____

SM3 6.5: Inverse Functions

For problems 1-4, a) Tell if the relation is a function, b) If it is a function, tell if it is one-to-one, c) Find the inverse of the relation, and d) Tell if the inverse is a function.

1) $\{(3,1),(4,-3),(8,-3)\}$

a)	Function?	Yes
b)	One-to-one?	No
c)	Inverse:	$\{(1,3),(-3,4),(-3,8)\}$
d)	Inverse Function?	No

2) $\{(-7,1),(0,5),(5,-1)\}$

a)	Function?	Yes
b)	One-to-one?	Yes
c)	Inverse:	$\{(1,-7),(5,0),(-1,5)\}$
d)	Inverse Function?	Yes

3) $\{(-10,-2),(-7,6),(-4,-2),(-4,0)\}$

a)	Function?	No
b)	One-to-one?	n/a
c)	Inverse:	$\{(-2,-10),(6,-7),(-2,-4),(0,-4)\}$
d)	Inverse Function?	No

4) $\{(0,-9),(5,-3),(6,6),(8,-3)\}$

a)	Function?	Yes
b)	One-to-one?	No
c)	Inverse:	$\{(-9,0),(-3,5),(6,6),(-3,8)\}$
d)	Inverse Function?	No

For problems 5-16, find the inverse of each function (restrict the domain as necessary). Then state the domain of the inverse.

5) $y = x + 2$

$y^{-1} = x - 2, D: \mathbb{R}$

6) $y = -\frac{4}{5}x + 1$

$y^{-1} = -\frac{5}{4}x + \frac{5}{4}, D: \mathbb{R}$

7) $g(x) = 2x - 1$

$g^{-1}(x) = \frac{x}{2} + \frac{1}{2}, D: \mathbb{R}$

8) $y = x^2 - 3$

Restricted domain to make one-to-one:
$x \geq 0$ or $[0, \infty)$

$y^{-1} = \sqrt{x+3}, D: x \geq -3 \text{ or } [-3, \infty)$

9) $y = (x-4)^2 + 3$

Restricted domain to make one-to-one:
$x \geq 4$ or $[4, \infty)$

$y^{-1} = \sqrt{x-3} + 4, D: x \geq 3 \text{ or } [3, \infty)$

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

$y^{-1} = \frac{-2x-3}{x-1}, D: x \neq 1$

11) $y = x^3 - 4$

$y^{-1} = \sqrt[3]{x+4}, D: \mathbb{R}$

12) $y = \sqrt{x+4} - 2$

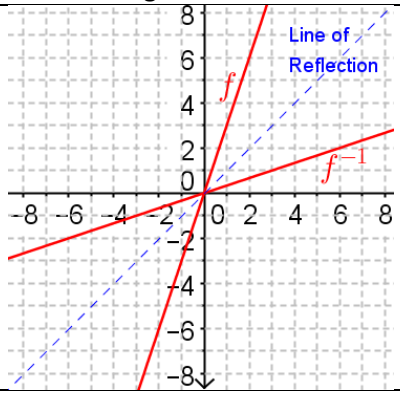
$y^{-1} = (x+2)^2 - 4, D: x \geq -2 \text{ or } [-2, \infty)$

13) $f(x) = \sqrt[3]{2x-8} + 2$

$f^{-1}(x) = \frac{1}{2}(x-2)^3 + 4, D: \mathbb{R}$

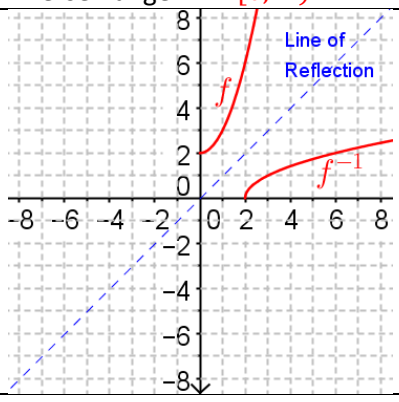
For problems 14-19, a) Find the inverse of the each function (restrict the domain as necessary), b) State the domain and range of the function and its inverse, and c) Graph both the function and its inverse (remember to label).

14) $f(x) = 3x$

a)	Inverse:	$f^{-1}(x) = \frac{x}{3}$
b)	Function Domain:	$\mathbb{R}$
	Function Range:	$\mathbb{R}$
	Inverse Domain:	$\mathbb{R}$
	Inverse Range:	$\mathbb{R}$
c)		

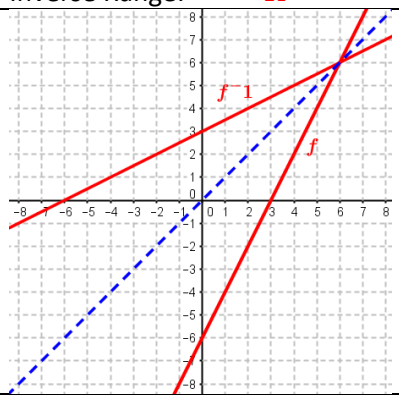
15) $f(x) = x^2 + 2$

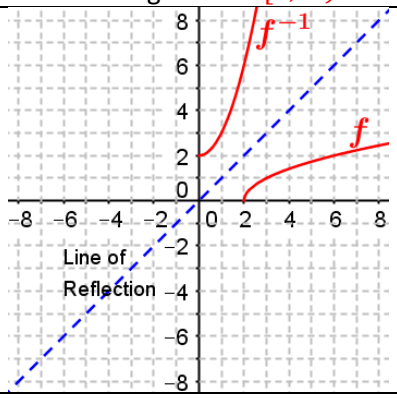
Restrict domain to make one-to-one: $x \geq 0$

a)	Inverse:	$f^{-1}(x) = \sqrt{x-2}$
b)	Function Domain:	$[0, \infty)$
	Function Range:	$[2, \infty)$
	Inverse Domain:	$[2, \infty)$
	Inverse Range:	$[0, \infty)$
c)		

16) $y = 2x - 6$

17) $f(x) = \sqrt{x-2}$

a)	Inverse: $y^{-1} = \frac{x}{2} + 3$
b)	Function Domain: $\mathbb{R}$ Function Range: $\mathbb{R}$ Inverse Domain: $\mathbb{R}$ Inverse Range: $\mathbb{R}$
c)	

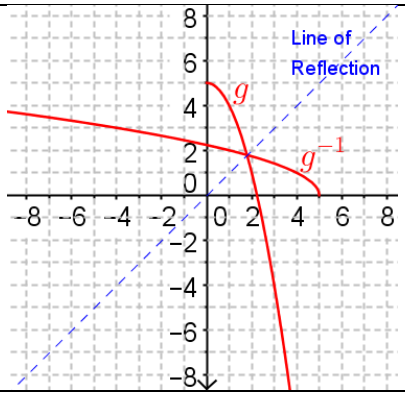
a)	Inverse: $f^{-1}(x) = x^2 + 2$
b)	Function Domain: $[2, \infty)$ Function Range: $[0, \infty)$ Inverse Domain: $[0, \infty)$ Inverse Range: $[2, \infty)$
c)	

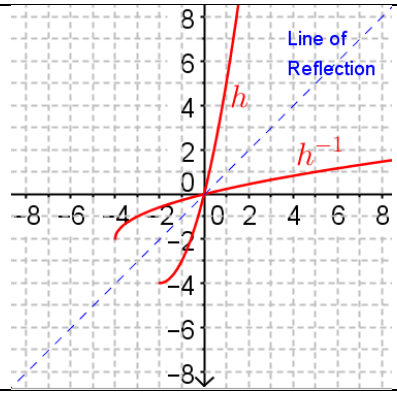
18) $g(x) = -x^2 + 5$

Restrict domain to make one-to-one: $x \geq 0$

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

Restrict domain to make one-to-one: $x \geq -2$

a)	Inverse: $g^{-1}(x) = \sqrt{-x+5}$
b)	Function Domain: $[0, \infty)$ Function Range: $(-\infty, 5]$ Inverse Domain: $(-\infty, 5]$ Inverse Range: $[0, \infty)$
c)	

a)	Inverse: $h^{-1}(x) = \sqrt{x+4} - 2$
b)	Function Domain: $[-2, \infty)$ Function Range: $[-4, \infty)$ Inverse Domain: $[-4, \infty)$ Inverse Range: $[-2, \infty)$
c)	

Determine whether each pair of functions are inverse functions.

20) $f(x) = x - 1$
$g(x) = 1 - x$
No

21) $f(x) = 2x + 3$
$g(x) = \frac{1}{2}(x - 3)$
Yes

22) $f(x) = x^2, x \geq 0$
$g(x) = \sqrt{x}$
Yes

23) $f(x) = (x + 2)^3$
$g(x) = \sqrt[3]{x} - 2$
Yes

24) $f(x) = 6x - 2$
$g(x) = \frac{1}{6}x + 3$
No

25) Gary is jogging. The total distance he has traveled in miles, can be estimated using the function $f(x) = 9x$, where x is his jogging time in hours.

a. Identify the independent and dependent variables of the function.
I: jogging time in hours, D: miles traveled

b. Find the inverse of the function.
$f^{-1}(x) = \frac{1}{9}x$

c. Identify the independent and dependent variables of the inverse function.
I: miles traveled, D: jogging time in hours

d. If Gary jogs for 3 hours, how many miles will he go?
$f(3) = 9(3) = 27\ miles$

e. How long will it take Gary to jog 6 miles?
$f^{-1}(6) = \frac{1}{9}(6) = \frac{2}{3}\ hr$

26) Camryn sells computers. She earns commission on her computer sales plus a fixed wage for each day she works. Her daily earnings, in dollars, can be estimated using the function $f(x) = .15x + 50$, where x represents her computer sales in dollars.

a. Identify the independent and dependent variables of the function.
I: computer sales in dollars, D: daily earnings in dollars

b. Find the inverse of the function.
$f^{-1}(x) = \frac{(x - 50)}{.15}$

c. Identify the independent and dependent variables of the inverse function.
I: daily earnings in dollars, D: computer sales in dollars

d. How much money will Camryn make is she sells $3500 in computers in a day?
$f(3500) = .15(3500) + 50 = \$575$

e. If Camryn wants to make $200 in a day, how much does she need in computer sales?
$f^{-1}(200) = \frac{(200 - 50)}{.15} = \$1000$

27) A rock band is selling tickets to a concert at a theater. The band earns money for each ticket sold, but has to pay some of the earnings to the theater. The total money earned by the band can be estimated using the function $f(x) = 7.5x - 300$, where x is the number of tickets sold.

a. Identify the independent and dependent variables of the function.
I: tickets sold, D: money earned

b. Find the inverse of the function.
$f^{-1}(x) = \frac{(x + 300)}{7.5}$

c. Identify the independent and dependent variables of the inverse function.
I: money earned, D: tickets sold

d. How many tickets would you need to sell in order to earn $5000?
$f^{-1}(5000) = \frac{(5000 + 300)}{7.5} = 706.667 \approx 707\ tickets$

e. If you sold 100 tickets, how much money would you earn?
$f(100) = 7.5(100) - 300 = \$450$