**69.** $g(x) = \frac{1}{x} - \frac{3}{x+2}$

Domain: All real numbers except $x = 0$, $x = -2$

**72.** $f(x) = \frac{\sqrt{x+6}}{6+x}$

$x + 6 \geq 0 \Rightarrow x \geq -6$ and

$6 + x \neq 0 \Rightarrow x \neq -6$

The domain is all real numbers $x > -6$.

**32.** $f(x) = x^2 - 4x$

(a) The graph is decreasing on $(-\infty, 2)$ and increasing on $(2, \infty)$.

(b) $f(-x) = (-x)^2 - 4(-x) = x^2 + 4x$

$x^2 + 4x \neq f(x)$

$x^2 + 4x \neq -f(x)$

The function is neither odd nor even.

Homework

p76 74, 87

p88 80

p89 93

p106 5, 16, 23

p114 19a only, 45 no graph

**68.** $f(-3) = -8$, $f(1) = 2$

$(-3, -8)$, $(1, 2)$

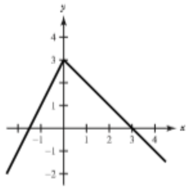
$$m = \frac{2-(-8)}{1-(-3)} = \frac{10}{4} = \frac{5}{2}$$

$$y - 2 = \frac{5}{2}(x - 1)$$

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

$$f(x) = \frac{5}{2}x - \frac{1}{2}$$

**79.** $f(x) = \begin{cases} 2x + 3, & x < 0 \\ 3 - x, & x \geq 0 \end{cases}$



**102.** $g(s) = 4s^{2/3}$

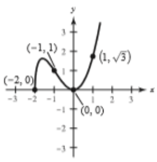
$g(-s) = 4(-s)^{2/3}$

$= 4s^{2/3}$

$= g(s)$

The function is even.

**113.**




(a) $f(-1) = 1$

(b) $f(1) = \sqrt{3}$

(c) $f$ is increasing on $(-2, -1.6)$ and $(0, \infty)$
$f$ is decreasing on $(-1.6, 0)$.

**44.** $f(x) = \sqrt[3]{x-5}$, $g(x) = x^3 + 1$

(a) $(f \circ g)(x) = f(g(x)) = f(x^3 + 1) = \sqrt[3]{x^3 + 1 - 5} = \sqrt[3]{x^3 - 4}$ Domain of $f, g, f \circ g, g \circ f$: all real numbers

(b) $(g \circ f)(x) = g(f(x)) = g\left(\sqrt[3]{x-5}\right) = \left(\sqrt[3]{x-5}\right)^3 + 1 = x - 5 + 1 = x - 4$

**51.** $f(x) = \frac{1}{x}$ Domain: all real numbers except $x = 0$

$g(x) = x + 3$ Domain: all real numbers

(a) $(f \circ g)(x) = f(g(x)) = f(x + 3) = \frac{1}{x+3}$

Domain: all real numbers except $x = -3$

(b) $(g \circ f)(x) = g(f(x)) = g\left(\frac{1}{x}\right) = \frac{1}{x} + 3$

Domain: all real numbers except $x = 0$

**56.** $f(x) = \frac{3x+4}{5}$

$$y = \frac{3x+4}{5}$$

$$x = \frac{3y+4}{5}$$

$$5x = 3y + 4$$

$$5x - 4 = 3y$$

$$\frac{5x-4}{3} = y$$

This is a function of $x$, so $f$ has an inverse.

$$f^{-1}(x) = \frac{5x-4}{3}$$

**63.** The graph represents a one-to-one function, so the function has an inverse.

$$f(x) = \sqrt{2x+3} \Rightarrow x \geq -\frac{3}{2}, y \geq 0$$

$$y = \sqrt{2x+3},\ x \geq -\frac{3}{2},\ y \geq 0$$

$$x = \sqrt{2y+3},\ y \geq -\frac{3}{2},\ x \geq 0$$

$$x^2 = 2y + 3,\ x \geq 0,\ y \geq -\frac{3}{2}$$

$$y = \frac{x^2-3}{2},\ x \geq 0,\ y \geq -\frac{3}{2}$$

$$f^{-1}(x) = \frac{x^2-3}{2},\ x \geq 0$$

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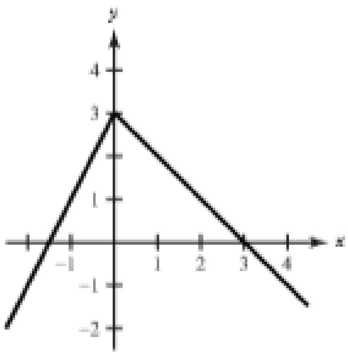
**79.** $f(x) = \begin{cases} 2x + 3, & x < 0 \\ 3 - x, & x \geq 0 \end{cases}$



$2x+3$

| x | y |
|---|---|
| 0 | 3 |
| -1 | |
| -2 | |
| -3 | |

$3-x$

| x | y |
|---|---|
| 0 | 3 |

Oct 2-2:21 PM

44

$f(x) = \sqrt[3]{x-5}$ $g(x) = x^3 + 1$

$(-\infty, \infty)$ $(-\infty, \infty)$

D $f(g(x)) = \sqrt[3]{(x^3+1)-5}$

Oct 2-10:10 AM

44a $[5,\infty)$ $(-\infty,\infty)$

$f(x) = \sqrt{x-5}$ $g(x) = x^2+1$

$D$ $f(g(x)) = \sqrt{g(x)-5}$

$$g(x) - 5 \geq 0$$

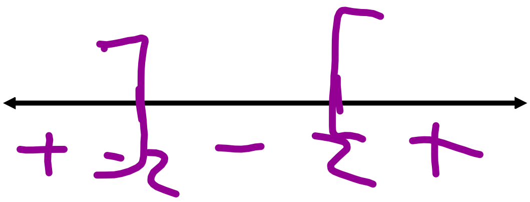
$$x^2+1-5 \geq 0$$

$$x^2-4 \geq 0$$

$$(x+2)(x-2) \geq 0$$

$(x+2)$

$(x-2)$



**74.** $f(x) = \dfrac{\sqrt[3]{x-5}}{x^2-9}$

The domain is all real numbers except $x = \pm 3$.

**87.** $g(x) = 3x - 1$

$$\frac{g(x) - g(3)}{x-3} = \frac{(3x-1) - 8}{x-3}$$
$$= \frac{3(x-3)}{x-3} = 3,\ x \neq 3$$

Homework

p87. 28

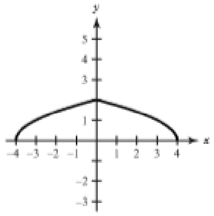
p89 114

p106 17, 25

p114 20a only, 42 no graph

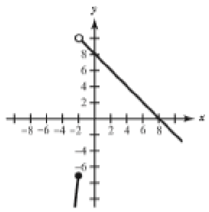
p154 15, 19, 33

**80.** $f(x) = \begin{cases} \sqrt{4+x}, & x < 0 \\ \sqrt{4-x}, & x \geq 0 \end{cases}$



**93.** $f(x) = \begin{cases} 1 - 2x^2, & x \leq -2 \\ -x + 8, & x > -2 \end{cases}$

$f(x) \geq 0$ on $(-2, 8]$



**5.** $f(x) = x^2 + 6$, $g(x) = \sqrt{1-x}$

$(f+g)(x) = f(x) + g(x) = (x^2+6) + \sqrt{1-x}$

$(f-g)(x) = f(x) - g(x) = (x^2+6) - \sqrt{1-x}$

$(fg)(x) = f(x) \cdot g(x) = (x^2+6)\sqrt{1-x}$

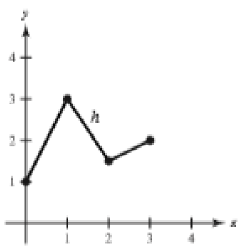
$\left(\dfrac{f}{g}\right)(x) = \dfrac{f(x)}{g(x)} = \dfrac{x^2+6}{\sqrt{1-x}}$,

Domain: $x < 1$

**16.** $\left(\dfrac{f}{g}\right)(0) = \dfrac{f(0)}{g(0)} = \dfrac{0^2+1}{0-4} = -\dfrac{1}{4}$

**23.**

| | | | | |
|---|---|---|---|---|
| $x$ | 0 | 1 | 2 | 3 |
| $f$ | 2 | 3 | 1 | 2 |
| $g$ | $-1$ | 0 | $\frac{1}{2}$ | 0 |
| $f+g$ | 1 | 3 | $\frac{3}{2}$ | 2 |




**19.** (a) $f(g(x)) = f\left(\sqrt{9-x}\right),\ x \leq 9$
$$= 9 - \left(\sqrt{9-x}\right)^2 = x$$
$$g(f(x)) = g(9 - x^2),\ x \geq 0$$
$$= \sqrt{9 - (9 - x^2)} = x$$

**45.**
$$f(x) = \frac{x+1}{x-2}$$
$$y = \frac{x+1}{x-2}$$
$$x = \frac{y+1}{y-2}$$
$$x(y-2) = y+1$$
$$xy - 2x = y + 1$$
$$xy - y = 2x + 1$$
$$y(x-1) = 2x + 1$$
$$y = \frac{2x+1}{x-1}$$
$$f^{-1}(x) = \frac{2x+1}{x-1}$$

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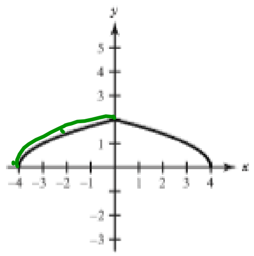
80. $f(x) = \begin{cases} \sqrt{4+x}, & x < 0 \\ \sqrt{4-x}, & x \geq 0 \end{cases}$



$\sqrt{4+x}$

| x | y |
|---|---|
| 0 | 2 |
| -1 | $\sqrt{3}$ |
| -2 | $\sqrt{2}$ |
| -3 | 1 |
| -4 | 0 |

$\sqrt{4-x}$

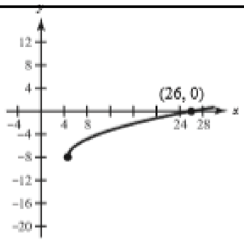
| x | y |
|---|---|
| 0 | |
| 1 | |
| 2 | |
| 3 | |
| 4 | |

**28.** $0 = \sqrt{3x - 14} - 8$

$8 = \sqrt{3x - 14}$

$64 = 3x - 14$

$x = 26$




Homework

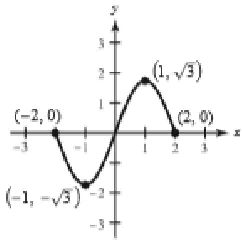
p90 126 a only

p106 6, 18, 25, 27,28

p154 17,36

p155 49, 52

**114.**




(a) $g(-1) = -\sqrt{3}$

(b) $g(1) = \sqrt{3}$

(c) $g$ is increasing on $(-1, 1)$.
$g$ is decreasing on $(-2, -1)$ and $(1, 2)$.

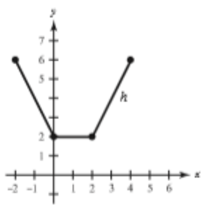
**17.** $\left(\frac{f}{g}\right)(-1) - 2g(3) = \frac{f(-1)}{g(-1)} - 2g(3)$

$= \frac{2}{-5} - 2(-1)$

$= \frac{8}{5}$

**25.**

| | | | | | |
|---|---|---|---|---|---|
| $x$ | $-2$ | 0 | 1 | 2 | 4 |
| $f$ | 2 | 0 | 1 | 2 | 4 |
| $g$ | 4 | 2 | 1 | 0 | 2 |
| $f+g$ | 6 | 2 | 2 | 2 | 6 |




**20.** (a) $f(x) = \frac{1}{1+x},\ x \ge 0;\ g(x) = \frac{1-x}{x},\ 0 < x \le 1$

$$f(g(x)) = f\left(\frac{1-x}{x}\right) = \frac{1}{1 + \left(\frac{1-x}{x}\right)} = \frac{1}{\frac{x}{x} + \frac{1-x}{x}} = \frac{1}{\frac{1}{x}} = x$$

$$g(f(x)) = g\left(\frac{1}{1+x}\right) = \frac{1 - \left(\frac{1}{1+x}\right)}{\left(\frac{1}{1+x}\right)} = \frac{\frac{1+x}{1+x} - \frac{1}{1+x}}{\frac{1}{1+x}} = \frac{\frac{x}{1+x}}{\frac{1}{1+x}} = \frac{x}{1+x} \cdot \frac{x+1}{1} = x$$

**42.** $f(x) = x^2 - 2,\ x \le 0$

$y = x^2 - 2$

$x = y^2 - 2$

$\pm\sqrt{x+2} = y$

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

**15.** $g(x) = 5 - \frac{7}{2}x - 3x^2$

Degree: 2

Leading coefficient: $-3$

The degree is even and the leading coefficient is negative. The graph falls to the left and falls to the right.

**19.** $f(x) = 6 - 2x + 4x^2 - 5x^3$

Degree: 3

Leading coefficient: $-5$

The degree is odd and the leading coefficient is negative. The graph rises to the left and falls to the right.

**33.** $f(x) = 3x^2 - 12x + 3$

$0 = 3(x^2 - 4x + 1)$

$x = \frac{4 \pm \sqrt{16 - 4}}{2} = 2 \pm \sqrt{3}$

**20.** (a) $f(x) = \frac{1}{1+x}$, $x \geq 0$; $g(x) = \frac{1-x}{x}$, $0 < x \leq 1$

$$f(g(x)) = f\left(\frac{1-x}{x}\right) = \frac{1}{1 + \left(\frac{1-x}{x}\right)} = \frac{1}{\frac{x}{x} + \frac{1-x}{x}} = \frac{1}{\frac{1}{x}} = x$$

$$g(f(x)) = g\left(\frac{1}{1+x}\right) = \frac{1 - \left(\frac{1}{1+x}\right)}{\left(\frac{1}{1+x}\right)} = \frac{\frac{1+x}{1+x} - \frac{1}{1+x}}{\frac{1}{1+x}} = \frac{\frac{x}{1+x}}{\frac{1}{1+x}} = \frac{x}{1+x} \cdot \frac{x+1}{1} = x$$

$$f\left(\frac{1-x}{x}\right) = \frac{1}{\left(1 + \left(\frac{1-x}{x}\right)\right)} \frac{x}{x} = \frac{x}{x+1-x} = \frac{x}{1} = x$$

**28.** $0 = \sqrt{3x - 14} - 8$

$(8)^2 = (\sqrt{3x - 14})^2$

$64 = 3x - 14$

$x = 26$

**42.** $f(x) = x^2 - 2$ $\boxed{x \le 0}$

$y = x^2 - 2$

$x = y^2 - 2$ $x+2 = y^2$

$\sqrt{x+2} = \sqrt{y^2}$

$\pm\sqrt{x + 2} = y$

$f^{-1}(x) = -\sqrt{x + 2}$ $\pm\sqrt{x+2} = y$

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