

3.3 Piecewise Functions

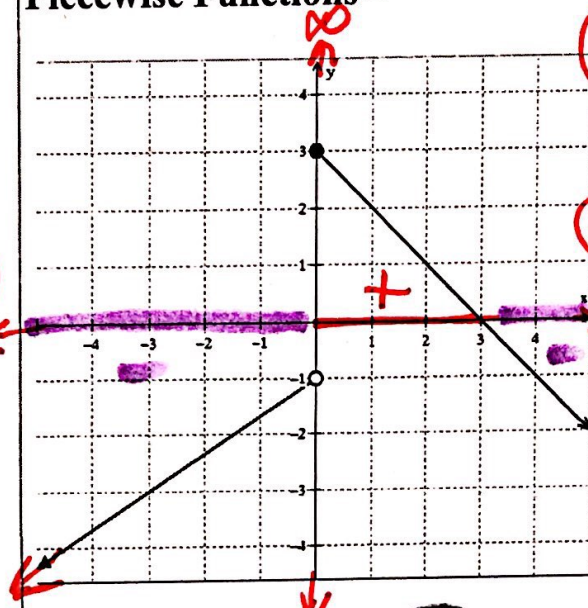
Key

NOTES

Write your questions here!

Piecewise Functions -

y int (0, 3)
x int (3, 0)
-∞ ←



(X) Domain: $(-\infty, \infty)$
 (Y) Range: $(-\infty, 3]$
 Incr: $(-\infty, 0)$
 Decr: $[0, \infty)$
 Pos: $[0, 3)$
 Neg: $(-\infty, 0) \cup (3, \infty)$

Algebraically

$$f(x) = \begin{cases} 2x + 8, & x \leq -2 \\ x^2 - 3, & -2 < x \leq 3 \\ \sqrt{x + 3}, & x > 3 \end{cases}$$

$f(-4) = 2(-4) + 8 = 0$

$f(6) = \sqrt{6+3} = \sqrt{9} = 3$

$f(-2) = 2(-2) + 8 = 4$

$f(0) = 0^2 - 3 = -3$

$2f(-4) = 2(0) = 0$

$f(6) + 3 = 3 + 3 = 6$

$f(-2) + 4f(-4) = 4 + 4(0) = 4$

$3f(0) - f(6) = 3(-3) - 3 = -12$

TRY IT!

$$f(x) = \begin{cases} 2x^3 - 1, & x < 1 \\ 3, & 1 \leq x < 5 \\ |x - 2|, & x \geq 5 \end{cases}$$

$f(8) = 6$

$f(0) = 2(0)^3 - 1 = 0 - 1 = -1$

$f(4) = 3$

$f(5) = |5 - 2| = 3$

$-3f(8) = -3(6) = -18$

$2f(0) + 4 = 2(-1) + 4 = 2$

$f(4) + 2f(0) = 3 + 2(-1) = 1$

$2f(5) - 3f(7) = 2(3) - 3(5) = 6 - 15 = -9$

Domain: $[-5, 5]$

Range: $(-2, 0] \cup [1, 2.5]$

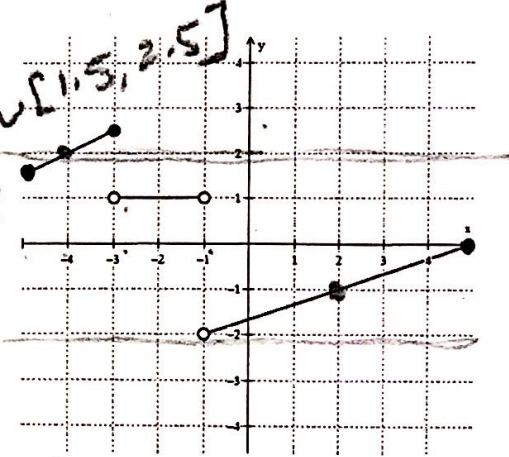
Incr: $(-5, -3) \cup (-1, 5]$

Decr: Never

Constant:

$(-3, -1)$

Graphically



$$f(2) = -1$$

$$f(-3) = 2.5$$

$$f(-1) = \text{DNE}$$

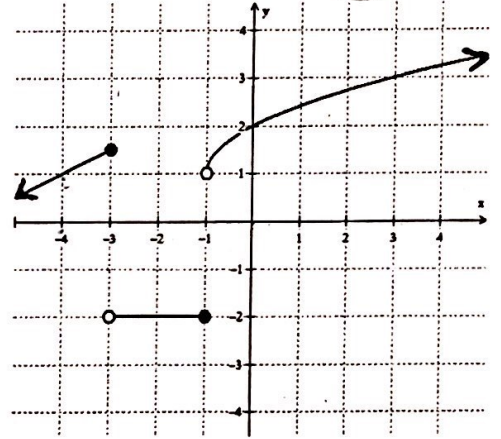
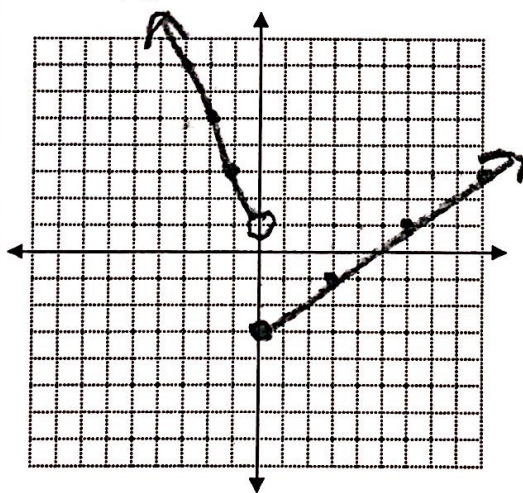
$$f(-4) = 2$$

$$f(x) = 2 \quad x = -4$$

$$f(x) = -2 \quad x = \text{DNE}$$

TRY IT!

$$f(x) = \begin{cases} -2x + 1, & x < 0 \\ \frac{2}{3}x - 3, & x \geq 0 \end{cases}$$



$$f(0) = 2$$

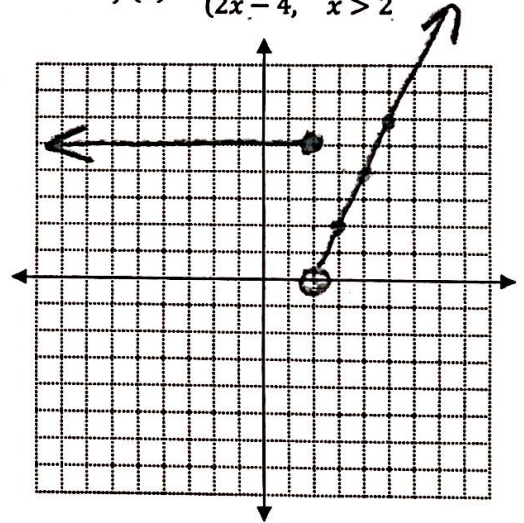
$$f(-4) = 1$$

$$f(-1) = -2$$

$$f(3) = 3$$

$$f(x) = 1 \quad x = -4$$

$$f(x) = \begin{cases} 5, & x \leq 2 \\ 2x - 4, & x > 2 \end{cases}$$



3.3 Piecewise Functions

PRACTICE

Use the piecewise function to evaluate the following.

1.

$$f(x) = \begin{cases} -2x^2 - 1, & x \leq 2 \\ \frac{4}{5}x - 4, & x > 2 \end{cases}$$

a. $f(0) = -1$
 $-2(0)^2 - 1 = -1$

b. $f(5) = 0$
 $\frac{4}{5}(5) - 4 = 4 - 4 = 0$

c. $f(2) = -9$
 $-2(2)^2 - 1 = -8 - 1 = -9$

d. $f(-3) = -19$
 $-2(-3)^2 - 1 = -18 - 1 = -19$

e. $f(2) - 3f(0) = -9 - 3(-1) = -9 + 3 = -6$

2.

$$f(x) = \begin{cases} x^3 - 7x, & x \leq -3 \\ 8, & -3 < x \leq 3 \\ \sqrt{2x+3}, & x > 3 \end{cases}$$

a. $f(-5) = -90$
 $(-5)^3 - 7(-5) = -125 + 35 = -90$

b. $f(11) = 5$
 $\sqrt{2(11)+3} = \sqrt{25} = 5$

c. $f(0) = 8$

d. $f(3) = 8$

e. $2f(11) + 3f(0) = 2(5) + 3(8) = 10 + 24 = 34$

3.

$$f(x) = \begin{cases} \frac{3}{x+4}, & x < -5 \\ x^2 - 3x, & -5 < x \leq 0 \\ x^4 - 7, & x > 0 \end{cases}$$

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

b. $f(4) = 249$
 $(4)^4 - 7 = 256 - 7 = 249$

c. $f(-10) = -\frac{1}{2}$
 $\frac{3}{-10+4} = \frac{3}{-6} = -\frac{1}{2}$

d. $f(0) = 0$
 $(0)^2 - 3(0) = 0$

e. $3f(-1) - f(4) = 3(4) - 249 = 12 - 249 = -237$

4.

$$f(x) = \begin{cases} |2x+7|, & x \leq -4 \\ 1+x^2, & -4 < x \leq 1 \\ 6, & 1 < x < 3 \\ \frac{1}{3}x+8, & x \geq 3 \end{cases}$$

a. $f(5) = \frac{29}{3}$
 $\frac{1}{3}(5) + 8 = \frac{5}{3} + 8 = \frac{29}{3}$

b. $f(1) = 2$
 $1 + (1)^2 = 2$

c. $f(-4) = 1$
 $|2(-4)+7| = |-8+7| = |-1| = 1$

d. $f(2) = 6$

5.

a. $f(-1) = 0$

b. $f(2) = 1$

c. $f(1) = 1$

d. $f(-2) = -1$

e. $f(0) = 1$

f. $f(x) = 0$ ($x = -1$)

domain: $[-5, 5]$
 range: $(-3, 2)$

6.

a. $f(-3) = -3$

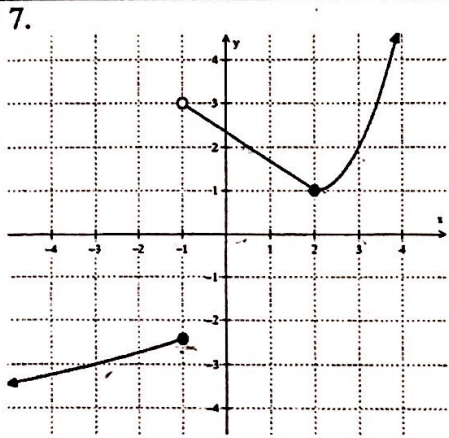
b. $f(4) = 4$

c. $f(1) = 1$

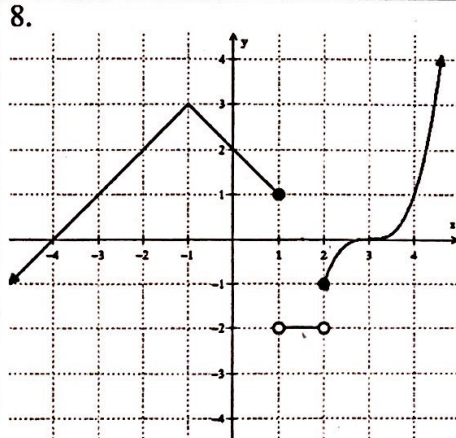
d. $f(-1) = \text{DNE}$

e. $f(0) = 1$

f. $f(x) = -1$ ($x = -2$)



- a. $f(3) = 2$
- b. $f(-1) = -2.5$
- c. $f(-3) = -3$
- d. $f(2) = 1$
- e. $f(0.5) = 2$

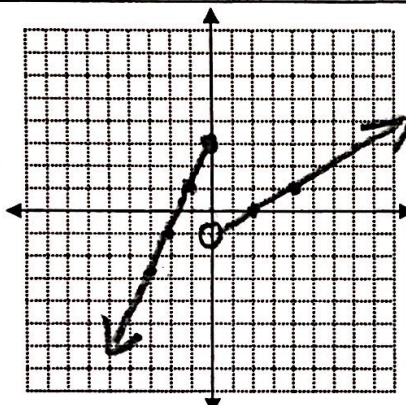


- a. $f(-4) = 0$
- b. $f(1) = 1$
- c. $f(3) = 0$
- d. $f(2) = -1$
- e. $f(1.5) = -2$

Graph the following piecewise functions.

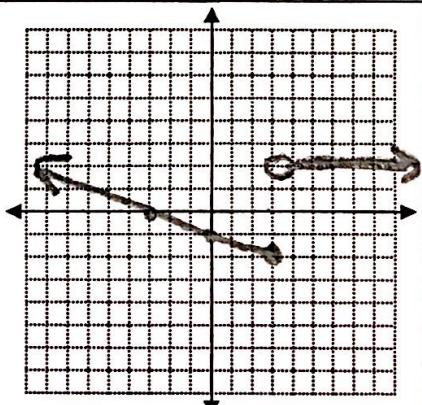
9.

$$f(x) = \begin{cases} 2x + 3, & x \leq 0 \\ \frac{1}{2}x - 1, & x > 0 \end{cases}$$



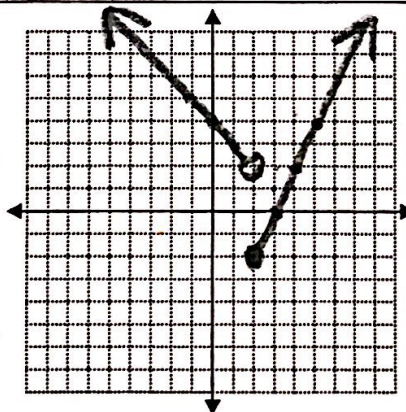
10.

$$f(x) = \begin{cases} -\frac{1}{3}x - 1, & x \leq 3 \\ 2, & x > 3 \end{cases}$$



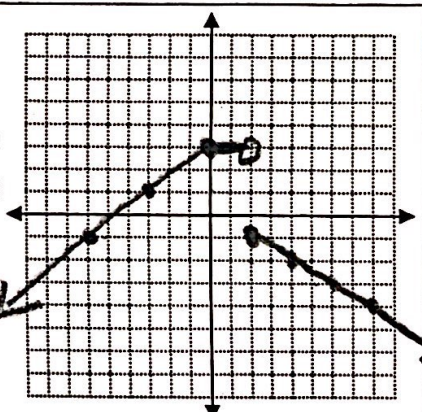
11.

$$f(x) = \begin{cases} 4 - x, & x < 2 \\ 2x - 6, & x \geq 2 \end{cases}$$



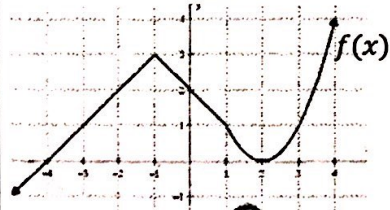
12.

$$f(x) = \begin{cases} \frac{2}{3}x + 3, & x \leq 0 \\ 3, & 0 < x < 2 \\ -\frac{1}{2}x, & x \geq 2 \end{cases}$$



ALGEBRA SKILLZ!

GRAPH



- a. $f(-1) = 3$
- b. y-intercept = $(0, 2)$
- $f(x) = 1$ when $x = -3$ or 1
- x-intercept(s) = $(-4, 0)$
 $(2, 0)$

SIMPLIFY

Simplify the radical.

a. $\sqrt{24} = 2\sqrt{6}$
 $\begin{matrix} \wedge \\ 4 \end{matrix} 6$

b. $4\sqrt{40} = 8\sqrt{10}$
 $\begin{matrix} \wedge \\ 4 \end{matrix} 10$

SOLVE

Solve for x.

a. $15 = \frac{5}{x} + 4$
 $11 = \frac{5}{x}$
 $x = \frac{5}{11}$

FACTOR

b. $x^2 - 12x + 35$
 $(x - 7)(x - 5)$