

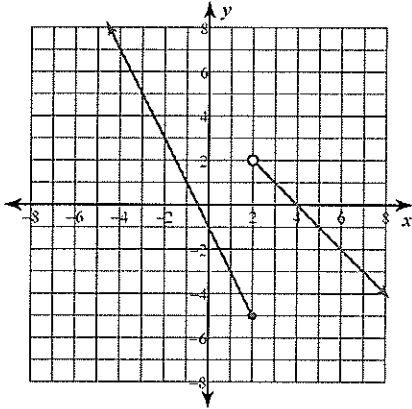
Piecewise Functions

Name KEY

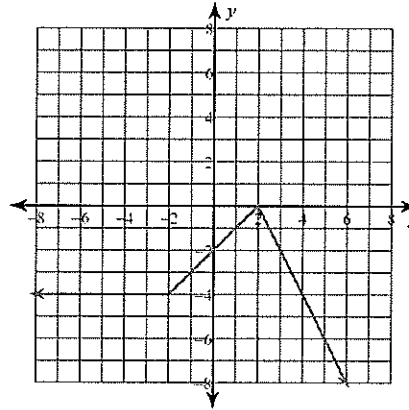
Date _____ Period _____

Sketch the graph of each function.

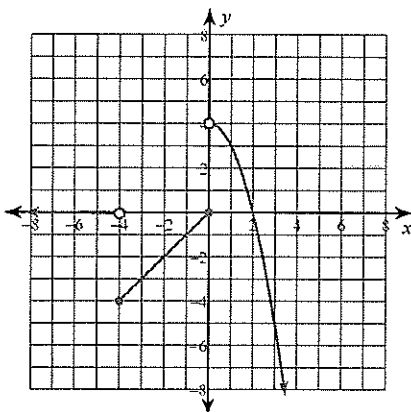
$$1) f(x) = \begin{cases} -2x - 1, & x \leq 2 \\ -x + 4, & x > 2 \end{cases}$$



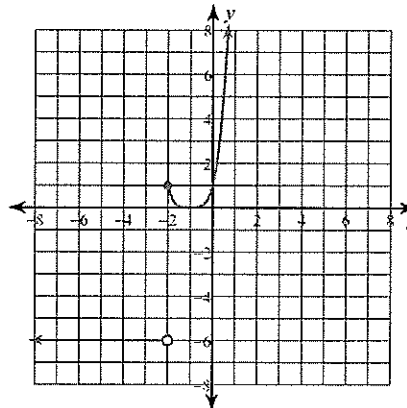
$$2) f(x) = \begin{cases} -4, & x \leq -2 \\ x - 2, & -2 < x < 2 \\ -2x + 4, & x \geq 2 \end{cases}$$



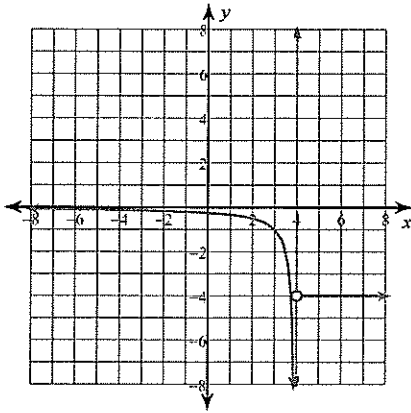
$$3) f(x) = \begin{cases} -2^x, & x < -4 \\ -|x|, & -4 \leq x \leq 0 \\ 4 - x^2, & x > 0 \end{cases}$$



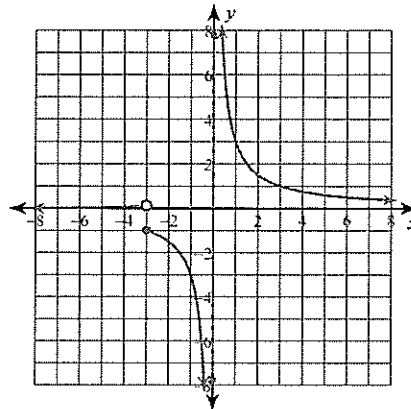
$$4) g(x) = \begin{cases} -6, & x < -2 \\ (x + 1)^4, & x \geq -2 \end{cases}$$



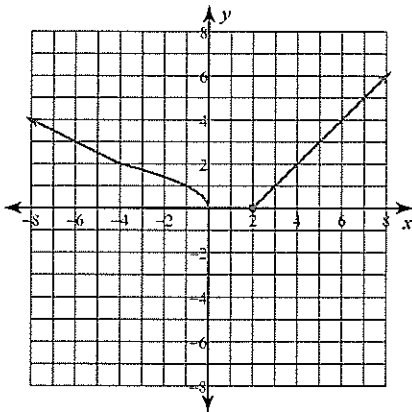
$$5) f(x) = \begin{cases} \frac{1}{x-4}, & x \leq 4 \\ -4, & x > 4 \end{cases}$$



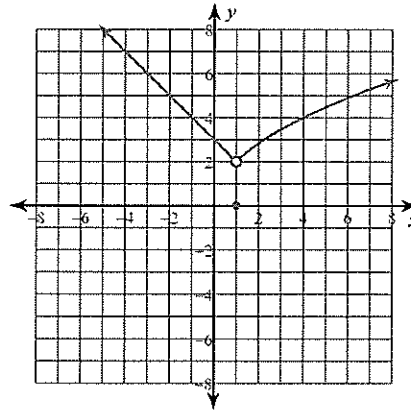
$$6) h(x) = \begin{cases} 2^x, & x < -3 \\ \frac{3}{x}, & x \geq -3 \end{cases}$$



$$7) w(x) = \begin{cases} \frac{|x|}{2}, & x \leq -4 \\ \sqrt{-x}, & -4 < x < 2 \\ |x-2|, & x \geq 2 \end{cases}$$



$$8) w(x) = \begin{cases} |x-3|, & x < 1 \\ (x-1)^4, & x = 1 \\ \sqrt{4x}, & x > 1 \end{cases}$$

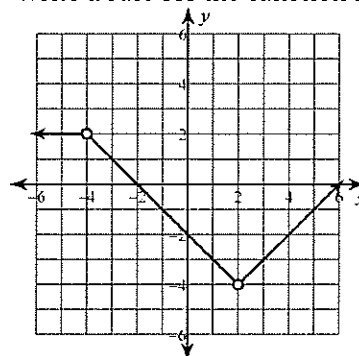


Critical thinking questions:

- 9) Write a rule for the sign function $s(n)$:
 $s(n)$ is -1 when n is negative, $+1$ when n is positive, and 0 otherwise.

$$s(n) = \begin{cases} -1, & n < 0 \\ 0, & n = 0 \\ 1, & n > 0 \end{cases}$$

- 10) Write a rule for the function shown.

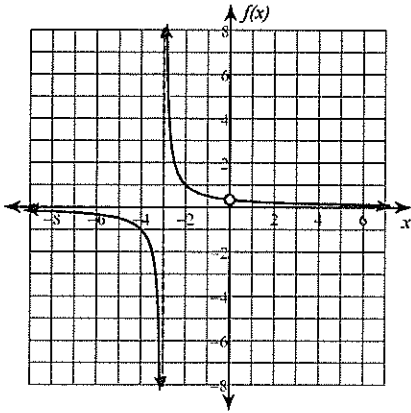


$$f(x) = \begin{cases} 2, & x < -4 \\ -x - 2, & -4 < x < 2 \\ x - 6, & x > 2 \end{cases}$$

Continuity

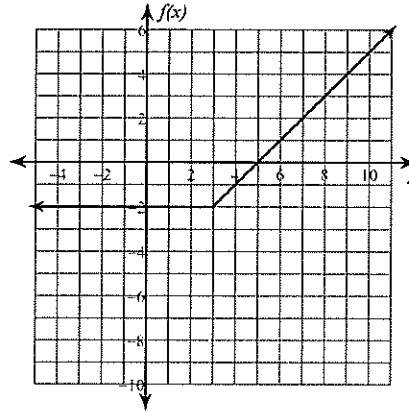
Determine if each function is continuous at the given x -values. If not continuous, classify each discontinuity.

1) $f(x) = \frac{x}{x^2 + 3x}$; at $x = -3$ and $x = 0$



Removable discontinuity at $x = 0$
 Infinite discontinuity at $x = -3$

2) $f(x) = \begin{cases} -2, & x \leq 3 \\ x - 5, & x > 3 \end{cases}$; at $x = 3$



Continuous at $x = 3$

3) $f(x) = \frac{x + 1}{x^2 + 2x + 2}$; at $x = -3$

Continuous at $x = -3$

4) $f(x) = \frac{x + 2}{x^2 - 4}$; at $x = -2$ and $x = 2$

Removable discontinuity at $x = -2$
 Infinite discontinuity at $x = 2$

5) $f(x) = \frac{x^2}{x + 1}$; at $x = -1$

Infinite discontinuity at $x = -1$

6) $f(x) = \begin{cases} -2x, & x < 3 \\ -x^2 + 8x - 16, & x \geq 3 \end{cases}$; at $x = 3$

Jump discontinuity at $x = 3$

Determine if each function is continuous. If the function is not continuous, find the x -axis location of and classify each discontinuity.

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

Continuous

8) $f(x) = \frac{x}{x^2 + 6x + 9}$

Infinite discontinuity at $x = -3$

$$9) f(x) = \frac{x^2 + 4x + 3}{x + 3}$$

Removable discontinuity at $x = -3$

$$10) f(x) = \frac{x}{x^2 - 4x}$$

Removable discontinuity at $x = 0$

Infinite discontinuity at $x = 4$

$$11) f(x) = \begin{cases} x + 4, & x \leq -2 \\ -2x - 11, & x > -2 \end{cases}$$

Jump discontinuity at $x = -2$

$$12) f(x) = \frac{x + 7}{x^2 + 3x}$$

Infinite discontinuities at $x = -3, x = 0$

Find the intervals on which each function is continuous.

$$13) f(x) = \begin{cases} x, & x \neq 4 \\ 2, & x = 4 \end{cases}$$

$(-\infty, 4), (4, \infty)$

$$14) f(x) = \begin{cases} -2, & x < 3 \\ -2x + 6, & x \geq 3 \end{cases}$$

$(-\infty, 3), [3, \infty)$

$$15) f(x) = \frac{x - 1}{x^2 - 4x + 3}$$

$(-\infty, 1), (1, 3), (3, \infty)$

$$16) f(x) = \frac{x^2}{2} + 4x + 10$$

$(-\infty, \infty)$

$$17) f(x) = -x^2 - 4x + 2$$

$(-\infty, \infty)$

$$18) f(x) = -\frac{x - 2}{x^2 - 3x + 2}$$

$(-\infty, 1), (1, 2), (2, \infty)$

$$19) f(x) = -\frac{x - 1}{x^2 - x}$$

$(-\infty, 0), (0, 1), (1, \infty)$

$$20) f(x) = \frac{x}{x^2 - 6x + 9}$$

$(-\infty, 3), (3, \infty)$

Critical thinking questions:

21) Write a function that has an infinite discontinuity at $x = 100$.

$$f(x) = \frac{1}{x - 100}$$

22) Write a function that is continuous over $(-\infty, 0)$, $(0, 1)$, and $(1, \infty)$ and discontinuous everywhere else.

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