

Find the limits. If a limit does not exist but has a direction, give the direction.

1.  $\lim_{x \rightarrow -\infty} \frac{5x+1}{x-1}$

5

2.  $\lim_{x \rightarrow \infty} \frac{2x+7}{x^2-x}$

0

3.  $\lim_{x \rightarrow \infty} \frac{3-2x}{x+5}$

-2

4.  $\lim_{x \rightarrow -\infty} \frac{2x^2-x+5}{5x^2+6x-1}$

2  
5

5.  $\lim_{x \rightarrow \infty} \frac{4x^2-2x+3}{3x-1}$

DNE  
( $\infty$ )

6.  $\lim_{x \rightarrow \infty} \frac{3x^3-x+1}{6x^3+2x^2-7}$

1  
2

7.  $\lim_{x \rightarrow -\infty} \frac{-3x^3-6x^2+4x-3}{-2x^2+5x}$

DNE  
( $-\infty$ )

8.  $\lim_{x \rightarrow \infty} \frac{(3x-2)(2x+4)}{(2x+1)(x+2)}$

3

9.  $\lim_{x \rightarrow \infty} \frac{(-3x-1)(-2x+4)(-5x-3)}{(-6x-1)(-2x+3)}$

DNE  
( $-\infty$ )

10.  $\lim_{x \rightarrow -\infty} \frac{3x^3-4x+1}{(x^2+1)(x^2-1)}$

0

11.  $\lim_{x \rightarrow \infty} \frac{(2x+1)^2}{(x-3)(x+5)}$

4

12.  $\lim_{x \rightarrow \infty} \frac{3x\sqrt{x}+3x+1}{x^2-x+11}$

0

13.  $\lim_{x \rightarrow \infty} (3-x^3)$

DNE  
( $-\infty$ )

14.  $\lim_{x \rightarrow \infty} \left( -\frac{5}{x} + 6 \right)$

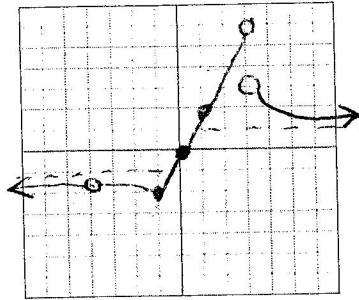
6

Draw a function with the following characteristics:

\* answers may vary \*

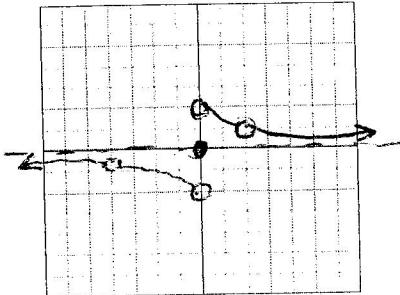
### Function #1

- ◆  $f(0) = 0$
  - ◆  $f(1) = 2$
  - ◆  $f(-1) = -2$
  - ◆ at  $f(3)$  there is a non-removable discontinuity — jump or asymptote
  - ◆ at  $f(-4)$  there is a removable discontinuity — hole
- points*
- end behavior*
- jump or asymptote*
- hole*



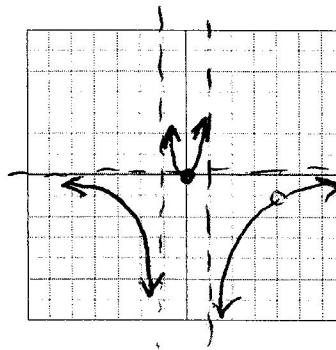
### Function #2

- ◆  $\lim_{x \rightarrow \infty} f(x) = 0$
  - ◆  $\lim_{x \rightarrow -\infty} f(x) = 0$
  - ◆  $f(0) = 0$
  - ◆ at  $f(-4)$  there is a removable discontinuity — hole
  - ◆  $\lim_{x \rightarrow 2^-} f(x)$  exists, but the graph is discontinuous — hole
- end behavior*
- jump*
- point*
- hole*



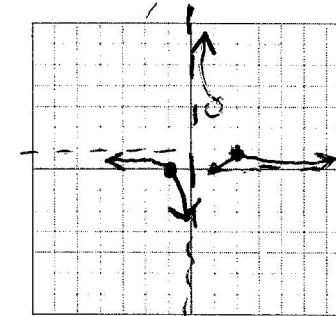
### Function #3

- ◆  $\lim_{x \rightarrow \infty} f(x) = 0$
- ◆  $\lim_{x \rightarrow -\infty} f(x) = 0$
- ◆  $f(0) = 0$  point
- ◆  $\lim_{x \rightarrow 1^+} f(x) = -\infty$
- ◆  $\lim_{x \rightarrow 1^-} f(x) = -\infty$
- ◆  $\lim_{x \rightarrow 1^-} f(x) = \lim_{x \rightarrow 1^+} f(x) = \infty$
- ◆  $\lim_{x \rightarrow 4} f(x)$  exists, but the graph is discontinuous — hole



### Function #4

- ◆  $\lim_{x \rightarrow \infty} f(x) = 0$
  - ◆  $\lim_{x \rightarrow -\infty} f(x) = 1$
  - ◆  $f(-1) = 0$  pt.
  - ◆  $\lim_{x \rightarrow 1} f(x)$  does not exist
  - ◆  $\lim_{x \rightarrow 0^+} f(x) = \infty$
  - ◆  $\lim_{x \rightarrow 0^-} f(x) = -\infty$
  - ◆  $f(2) = 1$  pt.
- end behavior  
jump or vertical asymptote



### Function #5

- ◆  $f(-3) = 0$  pt.
  - ◆  $\lim_{x \rightarrow \infty} f(x) = -1$  r.e.b.
  - ◆  $\lim_{x \rightarrow -2^+} f(x) = \lim_{x \rightarrow -2^-} f(x) = \infty$  V.A.
  - ◆ at  $f(5)$  there is a removable discontinuity hole
  - ◆  $\lim_{x \rightarrow 1} f(x)$  does not exist
- $f(0) = 3$  pt  
 $\lim_{x \rightarrow 4^+} f(x) = \infty$  V.A.  
jump or V.A.

