

3. (a) $\lim_{x \rightarrow -3} f(x) = \infty$

As x approaches -3 , $f(x)$ approaches ∞

(b) $\lim_{x \rightarrow 4^+} f(x) = -\infty$

As x approaches 4 from the right, $f(x)$ approaches $-\infty$

8. (a) $\lim_{x \rightarrow 2} R(x) = -\infty$

(b) $\lim_{x \rightarrow 5} R(x) = \infty$

(c) $\lim_{x \rightarrow -3^-} R(x) = -\infty$

(d) $\lim_{x \rightarrow -3^+} R(x) = \infty$

(e) $x = -3$ [because of (c) and (d)]

$x = 2$ [because of (a)]

$x = 5$ [because of (b)]

9. (a) $\lim_{x \rightarrow -7} f(x) = -\infty$

(f) $x = -7$ [because of (a)]

(b) $\lim_{x \rightarrow -3} f(x) = \infty$

$x = -3$ [because of (b)]

(c) $\lim_{x \rightarrow 0} f(x) = \infty$

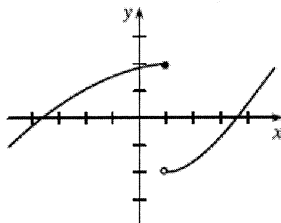
$x = 0$ [because of (c)]

(d) $\lim_{x \rightarrow 6^-} f(x) = -\infty$

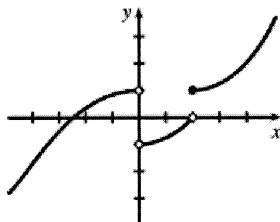
$x = 6$ [because of (d) and (e)]

(e) $\lim_{x \rightarrow 6^+} f(x) = \infty$

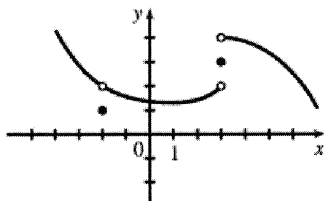
13. $\lim_{x \rightarrow 1^-} f(x) = 2$, $\lim_{x \rightarrow 1^+} f(x) = -2$, $f(1) = 2$



14. $\lim_{x \rightarrow 0^-} f(x) = 1$, $\lim_{x \rightarrow 0^+} f(x) = -1$, $\lim_{x \rightarrow 2^-} f(x) = 0$,
 $\lim_{x \rightarrow 2^+} f(x) = 1$, $f(2) = 1$, $f(0)$ is undefined



15. $\lim_{x \rightarrow 3^+} f(x) = 4$, $\lim_{x \rightarrow 3^-} f(x) = 2$, $\lim_{x \rightarrow -2} f(x) = 2$,
 $f(3) = 3$, $f(-2) = 1$



$$25. \lim_{x \rightarrow -3^+} \frac{x+2}{x+3} = -\infty$$

scratch work: as $x \rightarrow -3^+$, $x+2 \rightarrow -1$
as $x \rightarrow -3^+$, $x+3 \rightarrow 0^+$

$$27. \lim_{x \rightarrow 1} \frac{2-x}{(x-1)^2} = \infty$$

scratch work: as $x \rightarrow 1$, $2-x \rightarrow 1$
as $x \rightarrow 1$, $(x-1)^2 \rightarrow 0^+$

$$29. \lim_{x \rightarrow -2^+} \frac{x-1}{x^2(x+2)} = -\infty$$

scratch work: as $x \rightarrow -2^+$, $(x-1) \rightarrow -3$
as $x \rightarrow -2^+$, $x^2 \rightarrow 4$
as $x \rightarrow -2^+$, $(x+2) \rightarrow 0^+$

$$31. \lim_{x \rightarrow 2\pi^-} x \csc(x) = \lim_{x \rightarrow 2\pi^-} \frac{x}{\sin(x)} = -\infty$$

scratch work: as $x \rightarrow 2\pi^-$, $x \rightarrow 2\pi$
as $x \rightarrow 2\pi^-$, $\sin(x) \rightarrow 0^-$

33. let $f(x) = \frac{1}{x^3 - 1}$

x	f(x)	x	f(x)
0.9	$f(0.9) = -3.6900369$	1.1	$f(1.1) \approx 3.021148036$
0.99	$f(0.99) = -33.66890004$	1.01	$f(1.01) \approx 33.00221115$
0.999	$f(0.999) = -333.666889$	1.001	$f(1.001) \approx 333.0002221$

$$\lim_{x \rightarrow 1^-} f(x) = -\infty$$

$$\lim_{x \rightarrow 1^+} f(x) = \infty$$

(b) $\lim_{x \rightarrow 1^-} \frac{1}{x^3 - 1} = -\infty$

as $x \rightarrow 1^-$, $(x^3 - 1) \rightarrow 0^-$

$$\lim_{x \rightarrow 1^+} \frac{1}{x^3 - 1} = \infty$$

as $x \rightarrow 1^+$, $(x^3 - 1) \rightarrow 0^+$

(c) $\lim_{x \rightarrow 1^-} f(x) = -\infty$

$$\lim_{x \rightarrow 1^+} f(x) = \infty$$

