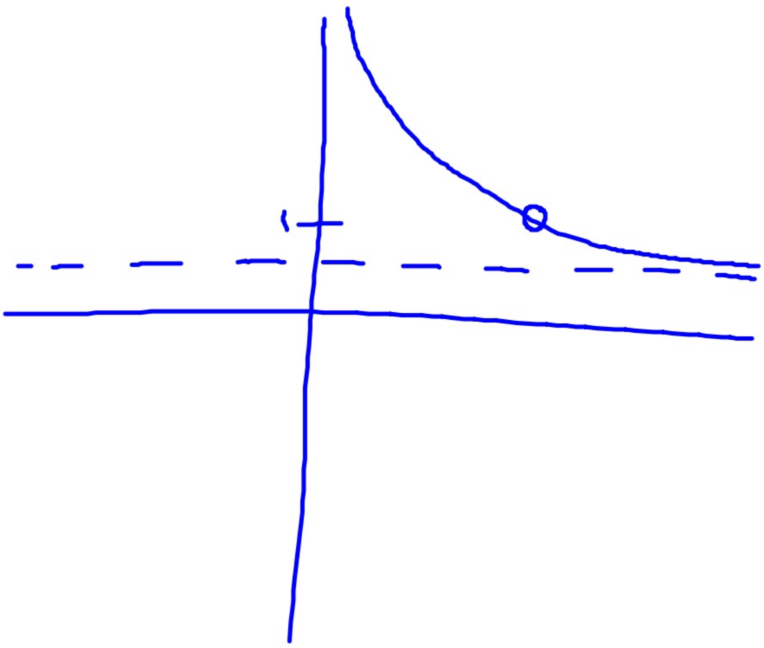
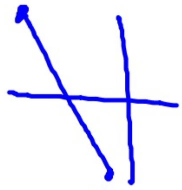


21) $[-5,-1]$

$f(x) = x^2 - x - 12$

$f(-5) = 18$

$f(-1) = -10$



Since f(x) is continuou
on [-5, -1] and
f(-1) < 0 < f(-5), by IVT
there must exist a
value c such that
f(c) = 0

$0 = x^2 - x - 12$

$0 = (x-4)(x+3)$

$x = 4, -3$

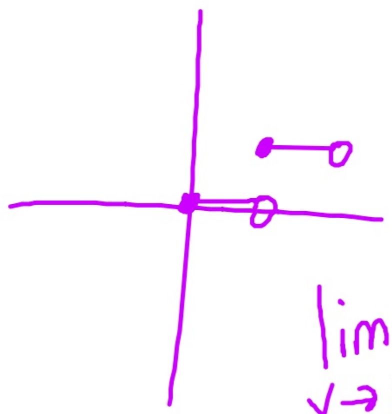
10.) $\lim\limits_{x \to 6^-} 3[x-3]$

$3[5.9-3]$

$3[2.9]$

$3 \cdot 2$

6



$\lim\limits_{x \to 1} [x]$

dne

$\lim\limits_{x \to 1^-} [x] \neq \lim\limits_{x \to 1^+} [x]$

7.) $\lim_{x\to 2} \frac{3x^2-4x-4}{2x^2-8}$

$\lim_{x\to 2} \frac{(3x+2)\cancel{(x-2)}}{2(x+2)\cancel{(x-2)}}$

$\frac{8}{8}$

1

$\lim_{x\to \frac{\pi}{2}^-} \tan x$

∞ or $-\infty$

8.) $\lim_{x \to 0} \frac{\sqrt{x+1}-1}{x} \cdot \frac{(\sqrt{x+1}+1)}{(\sqrt{x+1}+1)}$

$\lim_{x \to 0} \frac{\cancel{x}+\cancel{1}-\cancel{1}}{\cancel{x}(\sqrt{x+1}+1)}$

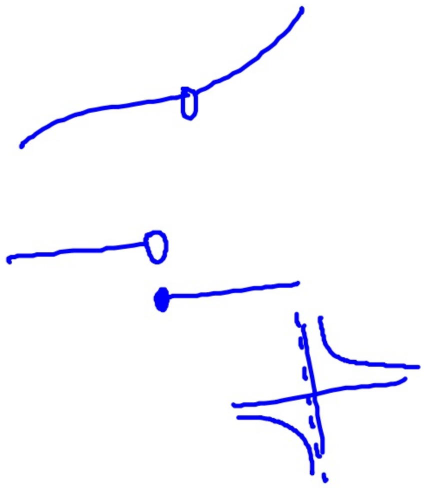
$\lim_{x \to 0} \frac{1}{\sqrt{x+1}+1}$

$\frac{1}{2}$

19.) $f(x) = \begin{cases} 3x+a, & x \le -3 \\ ax^2+4, & x > -3 \end{cases}$

$$\lim_{x\to -3^-} f(x) = \lim_{x\to -3^+} f(x) = f(-3)$$

$$\lim_{x\to -3^-} (3x+a) = \lim_{x\to -3^+} (ax^2+4)$$



$$-9+a = 9a+4$$

$$-13 = 8a$$

$$-13/8 = a$$

20.) $f(x) = \begin{cases} 2x - 3ax^2, & x < 1 \\ bx - 4, & 1 \leq x < 2 \\ x^2 + a, & x > 2 \end{cases}$

$\lim_{x \to 1^-} f(x) = \lim_{x \to 1^+} f(x) = f(1)$

$2 - 3a = b - 4$

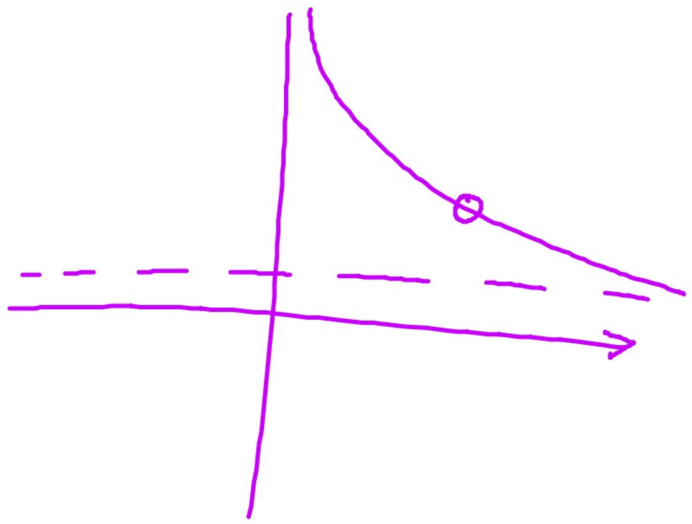
$3a + b = 6$

$a - 2b = -8$

$\lim_{x \to 2^-} f(x) = \lim_{x \to 2^+} f(x) = f(2)$

$2b - 4 = 4 + a$

$a - 2b = -8$



2.) $\lim_{x \to 0} \frac{\sin 4x}{11x}$

$\lim_{x \to 0} \frac{\sin x}{x} = 1$

$\frac{1}{11} \lim_{x \to 0} \frac{\sin 4x}{x} \cdot \frac{4}{4}$

$\frac{4}{11} \left[\lim_{x \to 0} \frac{\sin 4x}{4x} \right]$

$\frac{4}{11} \cdot 1$

$\frac{4}{11}$

7.) $\lim_{x \to 2} \frac{3x^2-4x-4}{2x^2-8}$

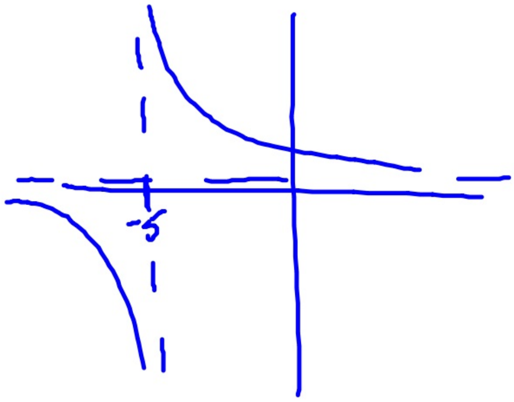
$\lim_{x \to 2} \frac{(3x+2)\cancel{(x-2)}}{2(x+2)\cancel{(x-2)}}$

$\frac{8}{8}$

1

6.) $\lim\limits_{x \to -5} \dfrac{x-5}{x^2-25}$

$\lim\limits_{x \to -5} \dfrac{\cancel{x-5}}{(x+5)\cancel{(x-5)}}$



$\lim\limits_{x \to -5} \dfrac{1}{x+5}$

∞ or $-\infty$ or dne

9.) $\lim_{x \to 0} \frac{1}{2^x}$

1

$\lim_{x \to 2} \frac{1}{x-2}$

$\lim_{x \to 1^-} [x]$

4.) $\lim_{x \to 2} f(x)$

$f(x) = \begin{cases} 3x^2 - 7 & x \leq 2 \\ x^3 + 1 & x > 2 \end{cases}$

$\lim_{x \to 2^-} f(x) \neq \lim_{x \to 2^+} f(x)$

$\lim_{x \to 2^-} (3x^2 - 7) \neq \lim_{x \to 2^+} (x^3 + 1)$

$5 \neq 9$

10.) $\lim_{x \to 6^-} 3[x-3]$

$3[5.9-3]$

$3[2.9]$

$3 \cdot 2$

6

16.) $\lim_{x \to -\infty} \frac{7x^2-9}{4x+3}$

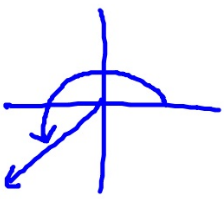
Both

∞ or $-\infty$

$\frac{+}{-}$

11.) $\lim\limits_{x \to 5} \csc \frac{\pi x}{4}$

$\csc \frac{5\pi}{4}$



$-\sqrt{2}$

$\sin \frac{\pi}{4}$

$\frac{\sqrt{2}}{2}$

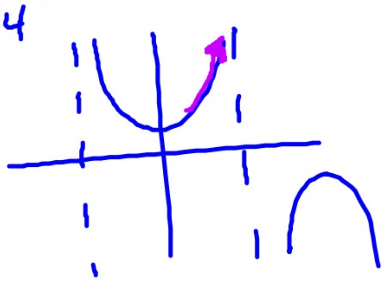
$\lim\limits_{x \to 2} \sec \frac{\pi x}{4}$

$\sec \frac{\pi}{2}$

dne

$\lim\limits_{x \to 2^-} \sec \frac{\pi x}{4}$

∞

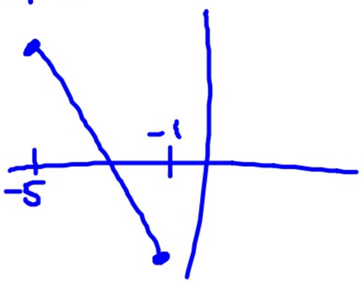


21.) $f(x) = x^2 - x - 12$ $\quad [-5, -1]$

$f(c) = 0$

$f(-5) = 18$

$f(-1) = -10$



Since f(x) is continuous on [-5, -1] and f(-1) < 0 < f(-5), by IVT there exists a value c such that f(c) = 0

$$0 = x^2 - x - 12$$

$$0 = (x-4)(x+3)$$

$$x = \cancel{4}, -3$$

$c = -3$

20.) $f(x) = \begin{cases} 2x - 3ax^2, & x < 1 \\ bx - 4, & 1 \le x \le 2 \\ x^2 + a, & x > 2 \end{cases}$

$\lim_{x \to 1^-} f(x) = \lim_{x \to 1^+} f(x) = f(1)$

$\lim_{x \to 1^-} (2x - 3ax^2) = \lim_{x \to 1^+} (bx - 4)$

$2 - 3a = b - 4$

$2 - 3(2b - 8) = b - 4$

$2 - 6b + 24 = b - 4$

$-7b = -30$

$b = \frac{30}{7}$

$\lim_{x \to 2^-} f(x) = \lim_{x \to 2^+} f(x) = f(2)$

$\lim_{x \to 2^-} (bx - 4) = \lim_{x \to 2^+} (x^2 + a)$

$2b - 4 = 4 + a$

$2b - 8 = a$

$$\lim_{x\to\infty}\left(2-\frac{5}{(x-1)^2}\right)$$

$$\lim_{x\to\infty} 2 - \lim_{x\to\infty}\frac{5}{(x-1)^2}$$

$$2 - 0$$

$$2$$

3.) $$\lim_{x\to 0}\frac{\sin x(1-\cos x)}{x^2}$$

$$\lim_{x\to 0}\frac{\sin x}{x}\cdot\frac{1-\cos x}{x}$$

$$1\cdot 0$$

$$0$$

19.) $f(x) = \begin{cases} 3x+a, & x \le -3 \\ ax^2+4, & x > -3 \end{cases}$

$$\lim_{x \to -3^-} f(x) = \lim_{x \to -3^+} f(x) = f(-3)$$

$$\lim_{x \to -3^-} (3x+a) = \lim_{x \to -3^+} (ax^2+4)$$

$$-9+a = 9a+4$$

$$-13/8 = a$$

17.) $\lim_{x \to -6} \frac{|x+6|}{x+6}$ dne

$$\lim_{x \to -6^-} \frac{|x+6|}{x+6} \neq \lim_{x \to -6^+} \frac{|x+6|}{x+6}$$

$$\frac{|-6.1+6|}{-6.1+6} \qquad \frac{|-5.9+6|}{-5.9+6}$$

$$-1 \neq 1$$

$$y = \frac{x}{5x^2 - 10x}$$

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

Remov. $x = 0$

Nonremov. $x = 2$

$$\lim_{x \to -\infty} \frac{4x}{\sqrt{6x^2+1}}$$

$$-\frac{4}{\sqrt{6}}$$