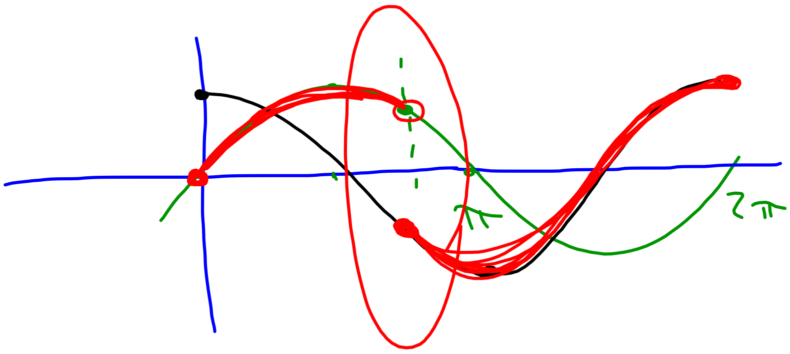
18.

$$f(x) = \begin{cases} \sin x & 0 \le x < \frac{3\pi}{4} \\ \cos x & \frac{3\pi}{4} \le x \le 2\pi \end{cases}$$



no, because $f(x)$ is not cont. @ $x = \frac{3\pi}{4}$

28.

$s = 11.44t^2 \qquad t = 2$

$$\lim_{h\to 0} \frac{f(2+h) - f(2)}{h}$$

$$\lim_{h\to 0} \frac{(11.44(2+h)^2) - (11.44(2)^2)}{h}$$

$$\frac{11.44(4+4h+h^2) - 45.76}{h}$$

$$\frac{\cancel{45.76} + 45.76\cancel{h} + 11.44h^{\cancel{2}} - \cancel{45.76}}{\cancel{h}}$$

$$\lim_{h\to 0} 45.76 + 11.44h = 45.76 \tfrac{m}{sec.}$$

12.

$f(x) = x^2 - 3x - 1 \quad x=0$

$$\frac{f(0+h) - f(0)}{h}$$

$$\frac{\left((0+h)^2 - 3(0+h) - 1\right) - \left(\cancel{0^2} - \cancel{3(0)} - 1\right)}{h}$$

$$\frac{h^{\cancel{2}} - 3\cancel{h} - \cancel{1} \cancel{+1}}{\cancel{h}}$$

$$\lim_{h \to 0} h - 3 = -3$$

tangent line

pt $(0, -1)$

$m = -3$

29. $x^2 + 4x - 1$ Horizontal tangent

25. $A = \pi r^2 \quad r = 3$

23. $100 - 4.9t^2 \quad t = 2$

$$\frac{\left(100 - 4.9(2+h)^2\right) - \left(100 - 4.9(2)^2\right)}{h}$$

$4.9 \cdot 4$

$$\frac{100 - 19.6 - 19.6h - 4.9h^2 - 100 + 19.6}{h}$$

25. $A = \pi r^2 \quad r = 3$ $\qquad \frac{f(x+h) - f(x)}{h}$

$$\lim_{h \to 0} \frac{\left(\pi(3+h)^2\right) - \left(\pi(3)^2\right)}{h}$$

$$\lim_{h \to 0} \frac{9\pi + 6h\pi + h^2\pi - 9\pi}{h} \qquad \frac{in^2}{in}$$

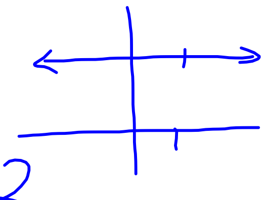
2.1a Limits

Write a sentence explaining the meaning of the following equation to someone not in calculus: $\lim_{h \to 0}(4+h) = 4$

$$\frac{f(x+h) - f(x)}{h} \qquad \frac{y_2 - y_1}{x_2 - x_1}$$

Estimate the following limits using either: graphical, numerical, or symbolic methods.

$\lim_{x \to 1}(5) = 5$



limit of a constant is the constant

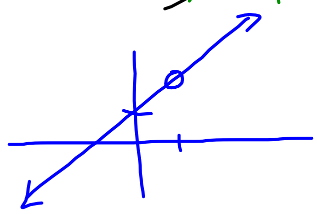
$\lim_{x \to 1}(x+1) = 2$

$\lim_{x \to 5} 3(x+1) = 18$

$$\lim_{x\to 2}\left(2x(x^2-3)\right) = 4$$

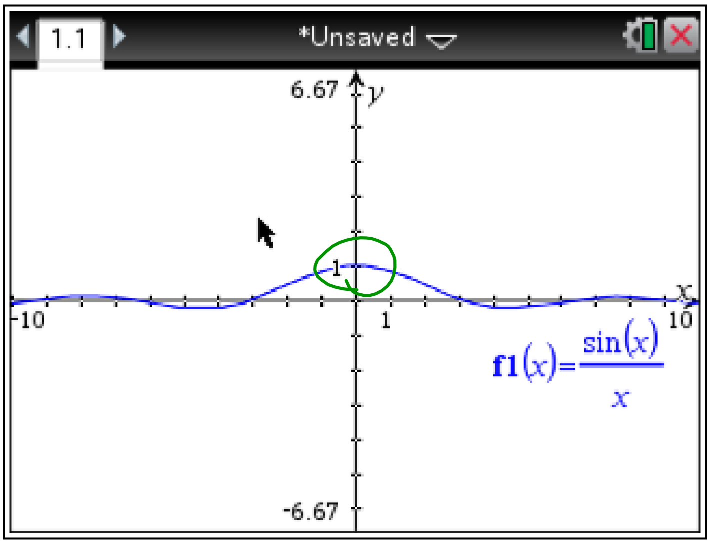
$$\lim_{x\to -1}\frac{5x^2}{3x+1} = -\frac{5}{2}$$

$$\lim_{x\to 1}\frac{x^2-1}{x-1} = \lim_{x\to 1}\frac{(x+1)\cancel{(x-1)}}{\cancel{x-1}} = \boxed{\lim_{x\to 1}(x+1) = 2}$$



$$\lim_{x\to 1}\begin{cases}\dfrac{x^2-1}{x-1}, & x \neq 1\\ 2 & x = 1\end{cases}$$

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



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

One-sided limits

$\lim_{x\to c^+} f(x)$ look on the right side of c

$\lim_{x\to c^-} f(x)$ look on the left side of c

$\lim_{x\to c} f(x) = L$ iff $\lim_{x\to c^+} f(x) = \lim_{x\to c^-} f(x) = L$

$\lim_{x\to 1^+}\frac{x^2-1}{x-1} = 2$ ∴ $\lim_{x\to 1}\frac{x^2-1}{x-1} = 2$

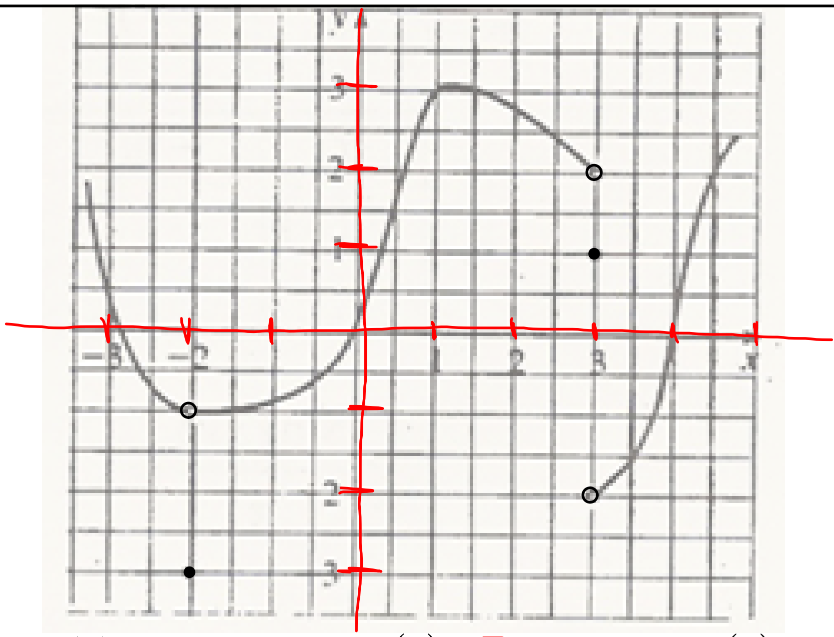
$\lim_{x\to 1^-}\frac{x^2-1}{x-1} = 2$

the limit doesn't necessarily equal the function!!!

$\lim_{x\to 2} 5x+7 = 17$

$\lim_{x\to 2^+} = 17$

$\lim_{x\to 2^-} = 17$



(a) $\lim_{x\to 1} f(x) = 3$ (b) $\lim_{x\to 3^-} f(x) = 2$ (c) $\lim_{x\to 3^+} f(x) = -2$

(d) $\lim_{x\to 3} f(x) =$ DNE (e) $f(3) = 1$ (f) $\lim_{x\to -2^-} f(x) = -1$

(g) $\lim_{x\to -2^+} f(x) = -1$ (h) $\lim_{x\to -2} f(x) = -1$ (i) $f(-2) = -3$