9/11/15.

$$f(x) = \frac{x^2+5x+6}{x+2}.$$

- Where is f undefined
- How can you define f to make it continuous everywhere.

f is undefined at $x=-2$.

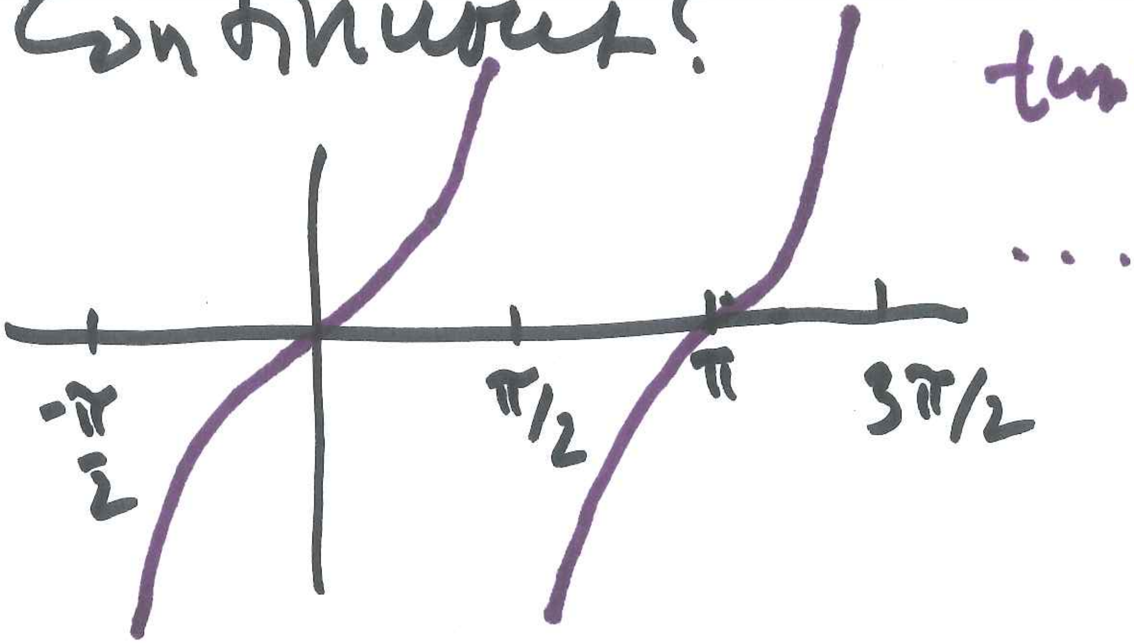
$$\frac{x^2+5x+6}{x+2} = \frac{(x+3)\cancel{(x+2)}}{\cancel{x+2}}$$

~~[illegible]~~ Want $\lim_{x\to -2} f(x) = f(-2)$.

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

Where is $f(x) = \tan(x)$ continuous?

$\tan(x) = \dfrac{\sin(x)}{\cos(x)}$




f is continuous on its domain which is

$\{x : x \neq \pm\frac{\pi}{2}, \pm\frac{3\pi}{2}, \pm\frac{5\pi}{2}, \ldots \}$

Find
$$\lim_{x \to 2} \frac{\tan(x)}{1+e^x}$$

Recognize $\tan(x)$ & $1+e^x$ are continuous at 2

So $\frac{\tan(x)}{1+e^x}$ is continuous

(Use $1+e^2 \neq 0$). Use substitution to evaluate limit.

$$\lim_{x \to 2} \frac{\tan(x)}{1+e^x} = \frac{\tan(2)}{1+e^2}$$

Find

$$\lim_{x \to 9} \frac{x-9}{\sqrt{x}-3}$$

$\sqrt{9}-3=0$ ☹

For $x$ near 9 $x-9$ is near 0.

Simplify

$$\frac{x-9}{\sqrt{x}-3} = \frac{(\sqrt{x})^2 - 3^2}{\sqrt{x}-3}$$

$$= \frac{\cancel{(\sqrt{x}-3)}(\sqrt{x}+3)}{\cancel{\sqrt{x}-3}}$$

$f(x) = \sqrt{x} + 3$ for $x \neq 9$.

near 9

$\sqrt{x} + 3$ is continuous at 9.

$$\lim_{x \to 9} f(x) = \lim_{x \to 9} \sqrt{x} + 3$$

$$= \underline{6}$$

Find tangent line to $y = \frac{1}{x}$ at $x = 3$.

Find slope of secant line between $(3, 1/3)$ and $(x, 1/x)$.

$$\frac{1}{(x-3)}\left(\frac{1}{x} - \frac{1}{3}\right) = \frac{1}{(x-3)}\left(\frac{3}{3x} - \frac{x}{3x}\right)$$

$$= \frac{1}{x-3}\left(\frac{3-x}{3x}\right) = \frac{-\cancel{(x-3)}}{\cancel{(x-3)}(3x)}$$

$$= -1/3x.$$

Slope of tangent is

$$\lim_{x \to 3} \frac{-1}{3x} = -1/9.$$

Tangent is line w/ slope

$-1/9$ & thru $(3, 1/3)$

$$y - \frac{1}{3} = -\frac{1}{9}(x-3).$$

Particle's position is $p(t) = \sqrt{2t+3}$ meters to the right of O at t sec. Find instantaneous velocity at 3, $V(3)$.

Average velocity on the interval $[3, t]$ is

$$\frac{p(t) - p(3)}{t-3}$$

$$\frac{\sqrt{2t+3}-\sqrt{9}}{t-3}\;\frac{\left(\sqrt{2t+3}+\sqrt{9}\right)}{\left(\sqrt{2t+3}+\sqrt{9}\right)}.$$

$$= \frac{2t+3-9}{t-3}\;\frac{1}{\sqrt{2t+3}+\sqrt{9}}.$$

$$= \frac{2t-6}{t-3}\;\frac{1}{\sqrt{2t+3}+3}.$$

$$= \frac{2}{\sqrt{2t+3}+3}$$

$$\lim_{t\to 3}\frac{p(t)-p(3)}{t-3} = \lim_{t\to 3}\frac{2}{\sqrt{2t+3}+3}$$

$$= \frac{2}{6} = \frac{1}{3}\ \mathrm{m/s}.$$