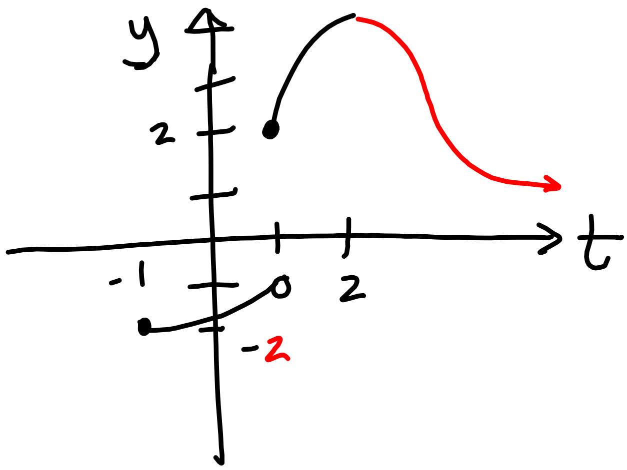
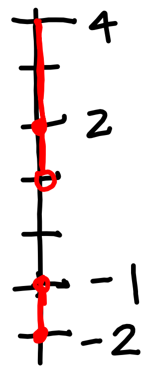
Assignments for the Week of Sept 12:

- Read 2.2-2.4
- 45 minutes of Khan Academy
- Due Fri. 16 Sept:
  2.2 #3-67 odd; 87-95 odd; 97-100 all; 105,106,111,113,115

- 2.3 #1-53 odd; 63-85 odd; 91-105 odd; 111-115 odd





$$\frac{\tan x}{\tan 2x} = \frac{\frac{\sin x}{\cos x}}{\frac{\sin 2x}{\cos 2x}} = \frac{\sin x}{\cos x} \cdot \frac{\cos 2x}{\sin 2x} =$$

$$= \frac{\cancel{\sin x}(\cos^2 x - \sin^2 x)}{\cos x(2\cancel{\sin x}\cos x)}$$

removable point discontinuity
when $\sin x = 0$
$x = 0, \pi, 2\pi$

non-removable vertical asymptotes
when $\cos x = 0$
$x = \pi/2, 3\pi/2$

Power Rule:
$\frac{d}{dx}[x^n] = nx^{n-1}$ d/dx [c]=0

Product Rule:
$\frac{d}{dx}[f(x)g(x)] = f'(x)g(x) + f(x)g'(x)$

Constant Multiple Rule:
$\frac{d}{dx}[cf(x)] = c\frac{d}{dx}[f(x)]$

Quotient Rule:
$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{f'(x)g(x) - f(x)g'(x)}{g^2(x)}$

Sum & Difference:
$\frac{d}{dx}[f(x) \pm g(x)] = f'(x) \pm g'(x)$

Chain Rule:
$\frac{d}{dx}[f(g(x))] = f'(g(x))g'(x)$

Trig Functions:

$\frac{d}{dx}[\sin x] = \cos x$

$\frac{d}{dx}[\cos x] = -\sin x$

$\frac{d}{dx}[\tan x] = \sec^2 x$

$\frac{d}{dx}[\cot x] = -\csc^2 x$

$\frac{d}{dx}[\sec x] = \sec x \tan x$

$\frac{d}{dx}[\csc x] = -\csc x \cot x$

2.3 Product & Quotient Rules

$$[fg]' = \frac{d}{dx}[f(x)g(x)] = f'(x)g(x) + f(x)g'(x)$$

$$\boxed{(fg)' = f'g + fg'}$$

$$\left[\frac{f}{g}\right]' = \frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$$

"low dee high less high dee low,
draw the line and square below"

$$\boxed{\left(\frac{f}{g}\right)' = \frac{f'g - fg'}{g^2}}$$

$$g(x) = \sqrt{x}\sin x = (x^{1/2})(\sin x)$$

$$g'(x) = (x^{1/2})'(\sin x) + (x^{1/2})(\sin x)'$$

$$= \boxed{\left(\tfrac{1}{2}x^{-1/2}\right)(\sin x) + (x^{1/2})(\cos x)}$$

$$f(t) = \frac{\cos t}{t^3}$$

$$f'(t) = \frac{(t^3)(\cos t)' - (\cos t)(t^3)'}{(t^3)^2}$$

$$= \boxed{\frac{(t^3)(-\sin t) - (\cos t)(3t^2)}{t^6}}$$

$$f(x) = \frac{x^3+3x+2}{x^2-1}$$

Note: as a product,
$f(x) = (x^3+3x+2)(x^2-1)^{-1}$
we don't know how to differentiate this yet
so we have to use the quotient rule!

$$f'(x) = \boxed{\frac{(x^2-1)(3x^2+3) - (x^3+3x+2)(2x)}{(x^2-1)^2}}$$

Find $f'(x)$

$$f(x) = \frac{x^3 - 3x^2 + 4}{x^2} = \frac{x^3}{x^2} - \frac{3x^2}{x^2} + \frac{4}{x^2} =$$

$$= x - 3 + 4x^{-2}$$

$$f'(x) = \boxed{1 - 8x^{-3}} = 1 \cdot \frac{x^3}{x^3} - \frac{8}{x^3} = \frac{x^3 - 8}{x^3}$$

$$\frac{d}{dx}[\tan x] = \sec^2 x$$

$$(\tan x)' = \left(\frac{\sin x}{\cos x}\right)' =$$

$$= \frac{(\cos x)(\sin x)' - (\sin x)(\cos x)'}{\cos^2 x}$$

$$= \frac{\cos x \cos x - \sin x(-\sin x)}{\cos^2 x}$$

$$= \frac{\cos^2 x + \sin^2 x}{\cos^2 x}$$

$$= \frac{1}{\cos^2 x} = \boxed{\sec^2 x}$$