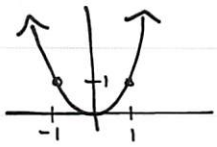
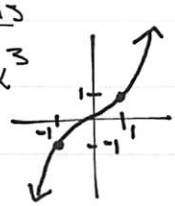
Common Functions

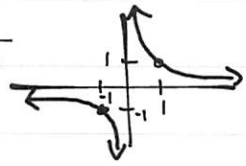
x^2



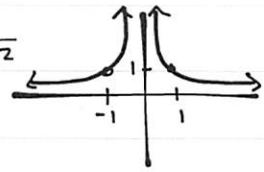
x^3



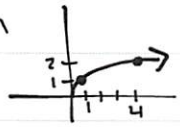
$\frac{1}{x}$



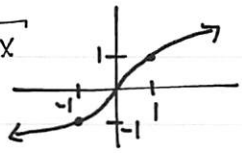
$\frac{1}{x^2}$



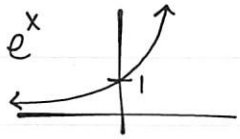
$\sqrt{x}$



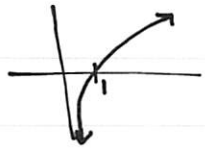
$\sqrt[3]{x}$



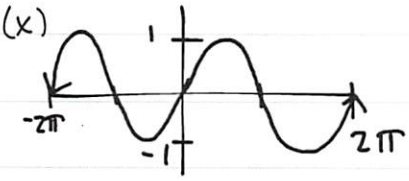
e^x



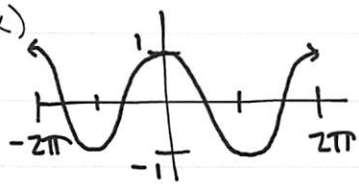
$\ln(x)$



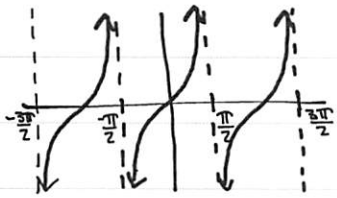
$\sin(x)$



$\cos(x)$



$\tan(x)$



Common Algebra

$x^n x^m = x^{n+m}$

$x^n / x^m = x^{n-m}$

$(x^n)^m = x^{nm}$

$\sqrt{x} = x^{1/2}$

$\sqrt[n]{x} = x^{1/n}$

$\sqrt[n]{x^m} = \left(\sqrt[n]{x}\right)^m = x^{m/n}$

$(xy)^n = x^n y^n$

$\cancel{(x+y)^n = x^n + y^n}$ NO!

$\sqrt[n]{xy} = \sqrt[n]{x}\,\sqrt[n]{y}$

$\sqrt[n]{\frac{x}{y}} = \frac{\sqrt[n]{x}}{\sqrt[n]{y}}$

$\ln(xy) = \ln(x) + \ln(y)$

$\ln\left(\frac{x}{y}\right) = \ln(x) - \ln(y)$

$\ln(x^m) = m\ln(x)$

$e^{\ln(x)} = x$

$\ln(e^x) = x \Rightarrow \ln(e) = 1$

$\ln(1) = 0$

Derivatives

$\frac{d}{dx}[\#] = 0$

$\frac{d}{dx}[x] = 1$

$\frac{d}{dx}[x^n] = nx^{n-1}$

$\frac{d}{dx}[e^x] = e^x$

$\frac{d}{dx}[\ln(x)] = \frac{1}{x}$

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

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

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

$\frac{d}{dx}[\sin^{-1}(x)] = \frac{1}{\sqrt{1-x^2}}$

$\frac{d}{dx}[\tan^{-1}(x)] = \frac{1}{1+x^2}$

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

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

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

$\frac{d}{dx}[\cos^{-1}(x)] = \frac{-1}{\sqrt{1-x^2}}$

$\frac{d}{dx}[\cot^{-1}(x)] = \frac{-1}{1+x^2}$

Sum/Difference Rule

$\frac{d}{dx}[f(x) \pm g(x)] = f'(x) \pm g'(x)$ Just take the derivatives of $f(x)$ & $g(x)$ separately.

Product Rule

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

I like to remember these by the derivatives on the ends/outside.

Quotient Rule

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

Chain Rule

$$\frac{d}{dx}[f(g(x))] = \underbrace{f'(g(x))}_{\text{derivative of outside}}\underbrace{g'(x)}_{\text{multiply by derivative of the inside}}$$

function inside

– leave inside alone/as is

ex) $\frac{d}{dx}[e^{2x}] = e^{2x} \cdot 2$ (inside)

ex) $\frac{d}{dx}[\ln|\sin(x)|] = \frac{1}{\sin(x)} \cdot \cos(x)$

ex) $\frac{d}{dx}[\sin^2(x)] = \frac{d}{dx}[(\sin(x))^2]$

$= 2\sin(x)\cos(x)$

Integrals

AKA "antiderivatives" so you don't need to memorize any integrals if you know your derivatives well!

ex) $\int \frac{1}{1+x^2}\,dx = \tan^{-1}(x) + C$

because the derivative of $\tan^{-1}(x)$ is $\frac{1}{1+x^2}$

$\int x^n\,dx = \frac{1}{n+1} x^{n+1} + C$

$\int \frac{1}{x}\,dx = \ln|x| + C$

$\int e^x\,dx = e^x + C$

$\int \sin(x)\,dx = -\cos(x) + C$

$\int \cos(x)\,dx = \sin(x) + C$

$\int \tan(x)\,dx$ use u-sub

$\int \ln(x)\,dx$ use IBP

$\int \frac{1}{\sqrt{1-x^2}} = \sin^{-1}(x) + C$

All of these can be figured out from understanding the derivatives above. Memorize these if you like, but it's not necessary.