10/20/2016 **Anti Derivative**

DEFINITION → A function $f(x)$ is an antiderivative of a function if $F'(x) = f(x)$ for all x in the DOMAIN.

EXAMPLE: FIND Function whose Derivative is $3x^2$

$f(x) = 3x^2$

$\Rightarrow F(x) = x^3$

B/C $F'(x) = 3x^2$

MUST BE CAREFUL! THIS is only 1 option.

Also $F(x) = x^3 + 5$ } AND THERE ARE
$F'(x) = 3x^2$ } INFINITELY MORE!

So... $F(x) = x^3$ IS CALLED AN ANTIDERIVATIVE NOT THE ANTIDERIVATIVE.

THUS! $F(x) = x^3 + C$ where C is REAL. IS AN ANTIDERIVATIVE.

Anti Derivatives

EXAMPLE: $f(x) = \sin x$

FIND $F(x)$ WHOSE DERIVATIVE IS $\sin x$

KNOW $\frac{dy}{dx} = -\sin x$ when $y = \cos x$

SO... $F(x) = -\cos x$ IS AN ANTI-DERIVATIVE

GENERAL FORM

$F(x) = -\cos x + C$

C: AN ARBITRARY CONSTANT

EXAMPLE: $f(x) = x^n \quad n \geq 0$

$F(x) = \frac{x^{n+1}}{n+1}$ SINCE $F'(x) = \frac{n+1}{n+1}(x^n)$

GENERAL FORM

$F(x) = \frac{x^{n+1}}{n+1} + C$ ARBITRARY CONSTANT

EXAMPLE: $f(x) = x^{-3}$ or $\frac{1}{x^3}$ INVERSE VARIATION

$x \neq 0$

SO... $F(x) = -\frac{1}{2}x^{-2}$ or $-\frac{1}{2x^2}$ (BUT what about him!)

GENERAL FORM

$f(x) = x^{-3}$

$$F(x) = \begin{cases} -\frac{1}{2}x^{-2} + C_1 & x < 0 \\ -\frac{1}{2}x^{-2} + C_2 & x > 0 \end{cases}$$

TABLE OF ANTIDERIVATIVES

Function	Anti Derivative
$C f(x)$	$C F(x)$
$f(x) + g(x)$	$F(x) + G(x)$
$x^n \ (n \neq -1)$	$\frac{x^{n+1}}{n+1}$
$\cos x$	$\sin x$
$\sin x$	$-\cos x$
$\sec^2 x$	$\tan x$
$\sec x \tan x$	$\sec x$

Remember all must have + C

$$g'(x) = 4\sin x - 3x^5 + 6\sqrt[4]{x^3}$$

$$g'(x) = 4\sin x - 3x^5 + 6x^{\frac{3}{4}}$$

$$-4\cos x - \frac{3x^6}{6} + \frac{6x^{\frac{7}{4}}}{\frac{7}{4}}$$

notice NO = sign

$$g(x) = -4\cos x - \frac{1}{2}x^6 + \frac{24}{7}x^{\frac{7}{4}} + C$$

? must wait till end