

ES: What is an antiderivative?

what we  
know?

If  $f(x) = 3x^2$  what is the antiderivative  $F(x)$ ?

$$F(x) = x^3 + C$$

The above process is called antidifferentiation which is known as indefinite integration.

So,

$f(x) = 3x^2$  can be written as

$$\int 3x^2 dx$$

$\int$  is the symbol called the Integral sign.

It is the operating symbol and tells you to integrate (antidifferentiate) the expression.

Indefinite  
Integration

$$Y = \int f(x) dx = F(x) + C$$

↓  
Integrand

↓  
antiderivative

↓  
constant  
of  
integration

Read as "the integral of  $f(x)$  with respect to  $x$ "

# Integration Rules

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ES: what are the properties of integration?

$$\textcircled{1} \int 0 dx = C$$

$$\textcircled{2} \int k dx = kx + C$$

$$\textcircled{3} \int k \cdot f(x) dx = k \int f(x) dx$$

$$\textcircled{4} \int (f(x) \pm g(x)) dx = \int f(x) dx \pm \int g(x) dx$$

$$\textcircled{5} \int x^n dx = \frac{x^{n+1}}{n+1} + C$$

$$\textcircled{6} \int \cos x dx = \sin x + C$$

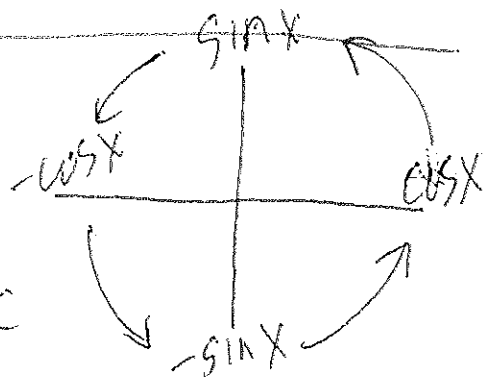
$$\textcircled{7} \int \sin x dx = -\cos x + C$$

$$\textcircled{8} \int \sec^2 x dx = \tan x + C$$

$$\textcircled{9} \int \sec x \cdot \tan x dx = \sec x + C$$

$$\textcircled{10} \int \csc^2 x dx = -\cot x + C$$

$$\textcircled{11} \int \csc x \cot x dx = -\csc x + C$$



Trig Functions

Other functions (12)  $\int e^x dx = e^x + c$

(13)  $\int \frac{1}{x} dx = \ln|x| + c$

Rewrite before  
Integrating

$$\int \sqrt{x} dx$$

Rewrite

$$\int x^{1/2} dx$$

Integrate

$$\frac{x^{1/2+1}}{\frac{1}{2}+1} + c$$

Simplify

$$\frac{x^{3/2}}{\frac{3}{2}} + c$$

$$= \frac{2}{3} x^{3/2} + c$$

$$= \frac{2}{3} \sqrt{x^3} + c$$

Summary