

## Section 4.1 - Antiderivative and Indefinite Integration

- Obj:
- To write the general solution of a differential equation.
  - To use basic integration rules to find antiderivative.
  - To find the particular solution of a differential equation.

1. Find  $f(x)$  if  $f'(x) = 3x^2$

2. Find  $f(x)$  if  $f'(x) = x^4$

This antiderivative is also known as the integral.

Parts of an Integral:  $\int f(x)dx$

- $\int$  integral sign – Leibniz choose sign to resemble the S in German word for summation
- $x$  from  $dx$  is the variable of integration
- $f(x)$  is the integrand

## Integration Rules:

- $\int x^n dx =$

- $\int kx^n dx = k \int x^n dx =$

- $\int (f(x) \pm g(x)) dx = \int f(x) dx \pm \int g(x) dx$

- $\int \sin x dx =$

- $\int \cos x dx =$

- $\int \sec^2 x dx =$

- $\int \csc^2 x dx =$

- $\int \sec x \tan x dx =$

- $\int \csc x \cot x dx =$

- $\int \sin(kx) dx =$

- $\int \cos(kx) dx =$

3.  $\int 5x^3 dx$

4.  $\int 3 dx$

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

6.  $\int (\sin 3x + \cos 2x) dx$

7. Find the general solution to  $\int (3x^2 - 1)dx$ . Then using the initial condition  $f(2) = 4$ , find the particular solution.

8. Find the equation of the curve containing  $(-1, 2)$  whose slope at  $(x, y)$  is  $9x^2 - 4x + 5$ .

9. Find  $y$  given  $\frac{d^2y}{dx^2} = \frac{3}{8}x$  ,  $\frac{dy}{dx}\Big|_{(4,6)} = 5$

10. A ball is thrown upward with an initial velocity of 64 feet per second from an initial height of 80 feet. Find the position function giving the height  $s$  as a function of time  $t$ .

\_\_\_\_\_  $s(t) \rightarrow v(t) \rightarrow a(t)$

\_\_\_\_\_  $a(t) \rightarrow v(t) \rightarrow s(t)$

Gravity =

Initial conditions:

\_\_\_\_\_ to go from  $a(t)$  to  $v(t)$

-apply initial condition  
 $v(0) = 64$  to find  $c$

\_\_\_\_\_ to go from  $v(t)$  to  $s(t)$

-apply initial condition  
 $s(0) = 80$  to find  $c$   
(this is a different  $c$ )