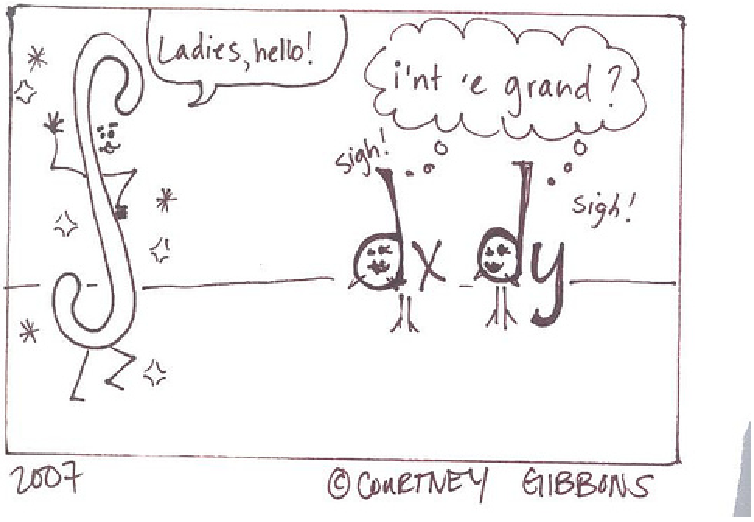
$$\int (2x+3)^2\,dx$$

$$\int 4x^2+12x+9\,dx$$

$$\frac{4x^3}{3}+\frac{12x^2}{2}+9x+C$$

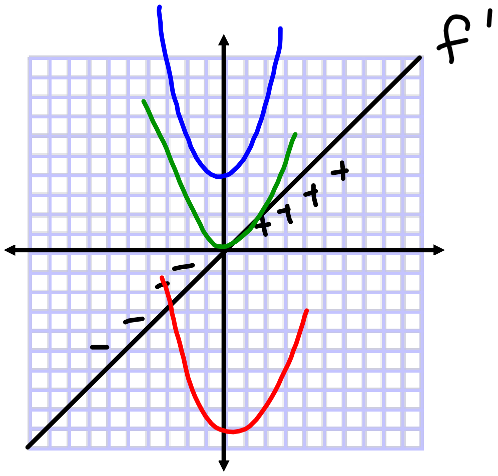
$$\frac{4x^3}{3}+6x^2+9x+c$$



end of day 1

f'

The graph of the **derivative** of a function is given. Sketch the graphs of *two* functions that have the given derivative.



Given: $\frac{dy}{dx} = 2x$

a. Integrate to find the general solution.

$\cancel{dx}\cdot\frac{dy}{\cancel{dx}} = 2x\,dx$

$\int dy = \int 2x\,dx$

$y = \int 2x\,dx$

$y = \int 2x\,dx$

$y = \cancel{2}\frac{x^2}{\cancel{2}} + C$

$\boxed{y = x^2 + C}$

b. If the point (3, 7) lies on the graph, find the particular solution.

(x, y)

$y = x^2 + c$

$7 = 3^2 + c$

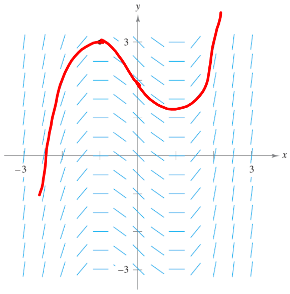
$7 = 9 + c$

$-2 = c$

$\boxed{y = x^2 - 2}$

A **slope field** consists of line segments with slopes given by the differential equation. These line segments give a visual perspective of the slopes of the solutions of the differential equation.

a. Sketch two approximate solutions of the differential equation on the slope field, one of which passes through the point.
b. Use integration to find the particular solution.
(p 256 #50) $\frac{dy}{dx} = x^2 - 1$, $(-1, 3)$
$x \quad y$



$$dx \cdot \frac{dy}{dx} = (x^2 - 1)\,dx$$

$$\int dy = \int (x^2 - 1)\,dx$$

$$y = \int x^2 - 1\,dx$$

$$y = \frac{x^3}{3} - x + c$$

$$3 = \frac{(-1)^3}{3} - (-1) + c$$

$$3 = -\frac{1}{3} + 1 + c$$

$$3 = \frac{2}{3} + c$$

$$\frac{7}{3} = c$$

$$y = \frac{x^3}{3} - x + \frac{7}{3}$$

Solve the differential equation: – Integrate
- anti derivative

$f'(x) = 6x - 8x^3, \quad f(2) = 3$
$(2, 3)$
(x, y)

$$f(x) = \int 6x - 8x^3\,dx$$

$$y = \frac{6x^2}{2} - \frac{8x^4}{4} + c$$

$$y = 3x^2 - 2x^4 + c$$

$$3 = 3(2)^2 - 2(2)^4 + c$$

$$3 = 12 - 32 + c$$

$$3 = -20 + c$$

$$23 = c$$

$$y = 3x^2 - 2x^4 + 23$$

Solve the differential equation:

$f''(x) = x^2$, $f'(0) = 6$, $f(0) = 3$

$\int f''(x) = \int x^2\,dx$

$f'(x) = \frac{x^3}{3} + c$

$6 = \frac{0^3}{3} + c$

$6 = c$

$\int f'(x) = \int \frac{x^3}{3} + 6$

$f(x) = \frac{x^4}{4 \cdot 3} + 6x + c$

$f(x) = \frac{x^4}{12} + 6x + c$

$3 = \frac{0}{12} + 0 + c$

$3 = c$

$f(x) = \frac{x^4}{12} + 6x + 3$

Vertical Motion

A ball is thrown upward from a height of 2m with a velocity of 10m/s.
What is its position function and what is its max height?
Use $a(t) = -9.8\,m/s^2$ as the acceleration due to gravity.

$s''(t) = v'(t) = a(t) = -9.8$

$\int a(t) = \int -9.8$

$v(t) = -9.8t + c$

$v(0) = 10$

$s'(t) = v(t) = -9.8t + c$

$10 = -9.8(0) + c$

$10 = c$

$V(t) = -9.8t + 10$

$\int V(t) = \int -9.8t + 10\,dt$

$S(t) = -\frac{9.8t^2}{2} + 10t + c$

$S(0) = 2$

$S(t) = -4.9t^2 + 10t + c$

$2 = 0 + 0 + c$

$2 = c$

$S(t) = -4.9t^2 + 10t + 2$

$V(t) = -9.8t + 10 = 0$

$10 = 9.8t$

$\frac{10}{9.8} = t$ time when Reaches max height

$S\left(\frac{10}{9.8}\right) = -4.9\left(\frac{10}{9.8}\right)^2 + 10\left(\frac{10}{9.8}\right) + 2$

Stand and Deliver

remember this card from 2.3

2.3

Rate of Change

down derivatives
dy/dx

s(t) = position

v(t) = s'(t) = velocity

a(t) = v'(t) = s''(t) = acceleration

speed = lv(t)l

up integrals

$\int$

now you can start anywhere on the ladder and go up or down