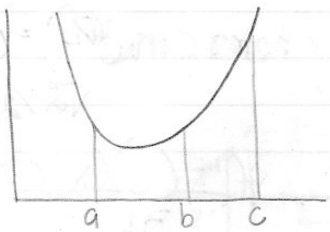
9.30-09



find max & min values of
$x^3-9x+8 \quad [-3,1]$

$f(x)=x^3-9x+8$
$f'(x)=3x^2-9$
$=3(x^2-3)$
$f'(x)=0$ at $x \pm \sqrt{3}$
point in $[-3,1]$ is at $x=\sqrt{3}$)

ep $\rightarrow f(-3)=-27+27+8=8$
$\rightarrow f(-\sqrt{3})=-3\sqrt{3}+9\sqrt{3}+=8+6\sqrt{3}$
ep $\rightarrow f(1)=1-9+8=0$
max $\rightarrow 8+6\sqrt{3}$, min $=0$

differential Equation

simple eqn

$$\left\{\begin{array}{l} y'=x^2+1 \Rightarrow \frac{dy}{dx}=x^2+1 \\ y=\int(x^2+1)\,dx \\ y=\frac{x^3}{3}+x+C \end{array}\right\}$$

$\rightarrow$ Seperate so all y one side all x other

differential

$$\frac{dy}{dx}=\frac{(3x+1)^2\sqrt{2-y^2}}{y}$$

$\int \frac{y\,dy}{\sqrt{2-y^2}} \quad \int(3x+1)^2\,dx$

integrate by subsitit.

$\int \frac{y\,dy}{\sqrt{2-y^2}}$

$u=2-y^2$
$du=-2y\,dy$

$-\int \frac{du}{2\sqrt{u}}$
$-\sqrt{u}$
$-\sqrt{2-y^2}$

Taylor Series

$f(x) = \sin(x)$ at $c = x/4$

note: $\sin(\pi/4) = \cos(\pi/4) = \sqrt{2}/2$

$$f(c) + \frac{f'(c)}{4!}(x-c) + \frac{f''(c)}{2!}(x-c)^2 + \frac{f'''(c)}{3!}(x-c)^3 \ldots$$

$f(x) = \sin x$

$f'(x) = \cos x$

$f''(x) = -\sin x$

$f'''(x) = -\cos x$

$f''''(x) = \sin x$

$$\sum_{i0}^{\infty} = \sin\frac{\pi}{4} + \cos\frac{\pi}{4} \cdot \left(x - \frac{\pi}{4}\right) - \sin\frac{\pi}{4} \cdot \frac{1}{2!}\left(x - \frac{\pi}{4}\right)^2$$

$$- \cos\frac{\pi}{4} \cdot \frac{1}{3!}\left(x - \frac{\pi}{4}\right)^3 + \sin\frac{\pi}{4} \cdot \frac{1}{4!}\left(x - \frac{\pi}{4}\right)^4$$

Maclaurin Series → special case of taylor around point $C = 0$

$f(x)$ is $1 - 9x + 16x^2 - 25x^3$ $\quad f^{(3)}(0) = ?$

$$-25 = \frac{f'''(0)}{3!} \rightarrow \boxed{f'''(0) = -150}$$

$$f(x) \sim f(0) + \frac{f'(0)}{1!}x + \frac{f''(0)}{2!}x^2 + \frac{f'''(0)}{3!}x^3$$