2. If $y = \sin^{-1}(3x-1)$, show that $\frac{dy}{dx} = \frac{3}{\sqrt{6x-9x^2}}$.

$f(x) \rightarrow f'(x)$

$\sin^{-1}\left(\frac{x}{a}\right) \rightarrow \frac{1}{\sqrt{a^2-x^2}}$

CHAIN RULE

$a=1$

$y = \sin^{-1}(3x-1) = \sin^{-1}\left(\frac{3x-1}{1}\right)$

$$\frac{dy}{dx} = \underbrace{\left(\frac{1}{\sqrt{1-(3x-1)^2}}\right)}\cdot\underbrace{(3)}$$

$$= \frac{3}{\sqrt{1-(9x^2-6x+1)}}$$

$$= \frac{3}{\sqrt{6x-9x^2}}$$

11. If $y = \tan^{-1}x$, show that $\frac{d^2y}{dx^2}(1+x^2) + 2x\frac{dy}{dx} = 0$.

$f(x) \rightarrow f'(x)$

$\tan^{-1}\left(\frac{x}{a}\right) \rightarrow \frac{a}{a^2+x^2}$

$a=1$

$y = \tan^{-1}x = \tan^{-1}\left(\frac{x}{1}\right)$

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

Chain Rule

$$\frac{d^2y}{dx^2} = -1(1+x^2)^{-2}\cdot(2x)$$

$$= \frac{-2x}{(1+x^2)^2}$$

Show that...

$$\frac{-2x}{\cancel{(1+x^2)^2}}\cancel{(1+x^2)} + 2x\cancel{\left(\frac{1}{1+x^2}\right)}$$

$$= 0$$