

## Assignment

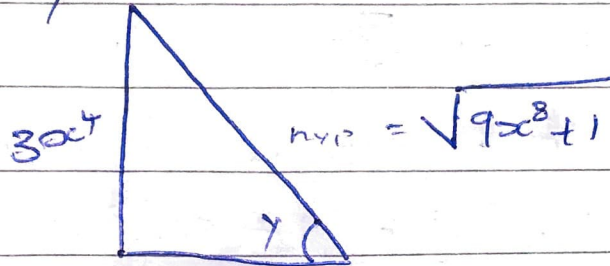
1. Find the differential of  $y = \arctan 3x^4$

Solution

$$y = \tan^{-1} 3x^4$$

$$y = \frac{3x^4}{\tan}$$

$$\tan y = 3x^4$$



$$\text{hyp}^2 = (3x^4)^2 + 1^2$$

$$\text{hyp}^2 = 9x^8 + 1$$

$$\text{hyp} = \sqrt{9x^8 + 1}$$

$$\tan y = 3x^4 \quad \frac{dy}{dx}$$

$$\sec^2 y \frac{dy}{dx} = 12x^3$$

$$\frac{dy}{dx} = \frac{12x^3}{\sec^2 y}$$

$$\sec y = \frac{1}{\cos y}$$

$$\cos y = \frac{1}{\sqrt{9x^8 + 1}}$$

$$\therefore \sec y = \sqrt{9x^8 + 1}$$

$$\text{thus } \sec^2 y = (\sqrt{9x^8 + 1})^2 = 9x^8 + 1$$

$$\text{Finally } \frac{dy}{dx} = \frac{12x^3}{9x^8 + 1}$$

2. Find the derivative of  $u = \arcsin 3k$

Solution

$$u = \sin^{-1} 3k$$

$$u = \frac{3k}{\sin}$$

$$\sin u = 3k \quad \frac{du}{dk}$$

$$\cos u \frac{du}{dk} = 3$$

$$\frac{du}{dk} = \frac{3}{\cos u}$$

recall  $\cos^2 u + \sin^2 u = 1$

$$\cos^2 u = 1 - \sin^2 u$$

$$\cos u = \sqrt{1 - \sin^2 u}$$

also  $\sin u = 3k$

$$\cos u = \sqrt{1 - (3k)^2}$$

$$\cos u = \sqrt{1 - 9k^2}$$

$$\therefore \frac{du}{dk} = \frac{3}{\sqrt{1 - 9k^2}}$$

3. Find the differential of  $\arcsin x^2$

Solution

$$y = \sin^{-1} x^2$$

$$y = \frac{x^2}{\sin}$$

$$\sin y = x^2 \quad \frac{dy}{dx}$$

$$\cos y \frac{dy}{dx} = 2x$$

$$\frac{dy}{dx} = \frac{x}{\cos y}$$

recall  $\cos^2 y + \sin^2 y = 1$

$$\cos^2 y = 1 - \sin^2 y$$

$$\cos y = \sqrt{1 - \sin^2 y}$$

also  $\sin y = x^2$

$$\sin^2 y = (x^2)^2 = x^4$$

$$\therefore \frac{dy}{dx} = \frac{x}{\sqrt{1 - x^4}}$$