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13/ENG 01025

Mechanical Engineering

$$\textcircled{1} x^2 + y^2 = 4 \quad \text{--- (I)}$$

$$5x^2 + y^2 = 4 \quad \text{--- (II)}$$

Subtract

$$y^2 = 5(1 - x^2) \quad \text{--- (III)}$$

Sub for  $y^2$  in equation (I)

$$x^2 + 5 - 5x^2 = 4$$

$$x^2 - 5x^2 = -1$$

$$-4x^2 = -1$$

$$x^2 = \frac{1}{4}$$

$$x^2 = \frac{1}{4}$$

$$x = \pm \frac{1}{2}$$

$$x = \frac{1}{2}$$

Sub  $x = \frac{1}{2}$  into eqn (I)

$$\left(\frac{1}{2}\right)^2 + y^2 = 4$$

$$\frac{1}{4} + y^2 = 4$$

$$y^2 = 4 - \frac{1}{4}$$

$$y^2 = \frac{15}{4}$$

$$y = \pm \sqrt{\frac{15}{4}}$$

$$\textcircled{2} 5x^2 - y^2 = 5$$

Differentiate using implicit differentiation

$$10x + 2y \frac{dy}{dx} = 0$$

$$2y \left(\frac{dy}{dx}\right) = \frac{-10x}{2y}$$

$$\frac{dy}{dx} = \frac{-10\left(\frac{1}{2}\right)}{2\sqrt{\frac{15}{4}}}$$

$$\frac{dy}{dx} = \frac{-5}{\sqrt{15}}$$

$$\frac{dy}{dx} = \tan \theta$$

$$\theta = \tan^{-1} \left( \frac{-5}{\sqrt{15}} \right)$$

$$\theta = -52.24^\circ$$

$$g(x) := \sqrt{4 - x^2}$$

$$f(x) := \sqrt{5 - 5x^2}$$

