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Course Title: Engineering Mathematics
Course Code: ENG 235

1) $P = \frac{E^2}{R} = E^2R^{-1}$

$$\delta P = \frac{\partial P}{\partial E} \cdot \delta E + \frac{\partial P}{\partial R} \cdot \delta R$$

$$\frac{\partial P}{\partial E} = 2ER^{-1} = \frac{2E}{R} = \frac{2(200)}{8} = 50$$

$$\frac{\partial P}{\partial R} = -E^2R^{-2} = \frac{-E^2}{R^2} = -\frac{(200)^2}{8^2} = -625$$

$$\delta P = \frac{\partial P}{\partial E} \cdot \delta E + \frac{\partial P}{\partial R} \cdot \delta R$$

$$\delta P = 50(-5) + (-625)(0.2)$$

$$\delta P = -250 - 125$$

$$\delta P = -375w.$$

2) $y = \frac{kwd^4}{t^3} = kwd^4t^{-3}$

$$\delta y = \frac{\partial y}{\partial w} \cdot \delta w + \frac{\partial y}{\partial d} + \delta d + \frac{\partial y}{\partial t} \cdot \delta t$$

$$\frac{\partial y}{\partial w} = kd^4t^{-3} = \frac{kd^4}{t^3}$$

$$\frac{\partial y}{\partial d} = 4kwd^3t^{-3} = \frac{4kwd^3}{t^3}$$

$$\frac{\partial y}{\partial t} = -3kwd^4t^{-4} = -\frac{3kwd^4}{t^4}$$

$$\delta w = \frac{3}{100} \text{ of } w = \frac{3w}{100}$$

$$\delta d = \frac{2.5}{100} \text{ of } d = \frac{2.5d}{100}$$

$$\delta t = \frac{4}{100} \text{ of } t = \frac{4t}{100}$$

$$\delta y = \frac{dy}{dw} \cdot \delta w + \frac{dy}{dd} \cdot \delta d + \frac{dy}{dt} \cdot \delta t$$

$$\delta y = \frac{kd^4}{t^3}\left(\frac{3w}{100}\right) + \frac{4kwd^3}{t^3}\left(\frac{2.5d}{100}\right) + \left(\frac{-3kwd^4}{t^4}\right)\left(\frac{4t}{100}\right)$$

$$\delta y = \frac{kwd^4}{t^3}\left(\frac{3}{100}\right) + \frac{kwd^4}{t^3}\left(\frac{10}{100}\right) - \frac{kwd^4}{t^3}\left(\frac{12}{100}\right)$$

$$\delta y = \frac{kwd^4}{t^3}\left(\frac{3}{100} + \frac{10}{100} - \frac{12}{100}\right)$$

$$\delta y = \frac{kwd^4}{t^3}\left(\frac{1}{100}\right)$$

Recall that

$$\frac{kwd^4}{t^3} = y$$

$$\delta y = y\left(\frac{1}{100}\right) = 1\% \text{ of } y$$