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MECHANICAL
ENG 281

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

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

$$\frac{\partial P}{\partial E} \; 2 E R^{-1} = \frac{2E}{R} \;, \quad \frac{\partial P}{\partial R} = -E^2 R^{-2} = \frac{-E^2}{R^2}$$

$$\delta P = \frac{2E}{R} \delta E + \frac{(E^2)}{R^2} \cdot \delta R$$

$$\delta P = \frac{2 \times 200}{8} \cdot (-5) + \frac{-(200)^2}{8^2} \cdot 0.2$$

$$\delta P = \frac{-2000}{8} - \frac{8000}{64} = -250 - 125$$

$$= -125$$

$$\therefore \delta P (\text{change in } P) = -375 \text{ watts}$$

② $y = \frac{K w d^4}{b}$; $y = K w d^4 \cdot b^{-1}$

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

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

$\frac{\partial y}{\partial k} = \frac{wd^4}{t^3}$ $\frac{\partial y}{\partial w} = \frac{kd^4}{t^3}$ $\frac{\partial y}{\partial d} = \frac{4d^3kw}{t^3}$

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

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

$\delta d = 5/2 \div 100$ of $d = 5/2 \times \frac{1}{100} = 5/200 = \frac{\delta d}{500}$

$\delta t = 4/100$ of $t = 4 \times 1/100$

$\delta y = 0 + \frac{kd^4}{t^3} \times \frac{3w}{100} + \frac{4d^3kw}{t^3} \times \frac{5d}{200} + \frac{-3kwd^4}{t^4} \times \frac{4t}{100}$

$$\delta y = \frac{k d^4 w}{t^3} \times \frac{3}{100} + \frac{d^4 k w}{t^3} \times \left(\frac{20}{200}\right) - \frac{k w d^4}{t^3} \times \left(\frac{12}{100}\right)$$

$$\delta y = \frac{k w d^4}{t^3}\left(\frac{3}{100} + \frac{20}{200} - \frac{12}{100}\right)$$

$$\delta y = \frac{k w d^4}{t^3}\left(\frac{2}{200}\right) = \frac{k w d^4}{t^3}\left(\frac{1}{100}\right)$$

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

Percentage change in $y = \pm 1$ percent