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16/ENG07/1016

PETROLEUM ENGINEERING

ENG 281 (ENGINEERING MATHS)

ASSIGNMENT III

(1). Solution

$$P = \frac{E^2}{R}$$

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

but $P = E^2 R^{-1}$

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

$E = 200$ volts

$R = 8\Omega$

$\delta E = -5$ volts

$\delta R = 0.2$

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

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

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

$$\delta P = -375 \text{ watts}$$

(2) $$y = \frac{k\omega\partial^4}{t^3}$$

$$y = f(k\omega\partial t)$$

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

but $y = k\omega\partial^4 t^{-3}$

$$\frac{\partial y}{\partial \omega} = k\partial^4 t^{-3} \; ; \quad \frac{\partial y}{\partial \partial} = 4k\omega\partial^3 t^{-3} \; , \quad \frac{\partial y}{\partial t} = -3k\omega\partial^4 t^{-4}$$

$$\delta\omega = \frac{3}{100}\%\,\omega \; , \quad \delta\partial = \frac{2.5}{100}\%\,\partial \; ; \quad \delta t = \frac{4}{100}\%\,t$$

$$\delta y = \frac{k\partial^4}{t^3}\left(\frac{3}{100}\right)(\omega) + \frac{k\omega 4\partial^3}{t^3}\cdot\left(\frac{2.5}{100}\right)(\partial) + \left(\frac{-3k\omega\partial^4}{t^4}\right)\left(\frac{4}{100}\right)t$$

$$\delta y = \frac{3k\omega\partial^4}{100t^3} + \frac{10k\omega\partial^4}{100t^3} - \frac{12k\omega\partial^4}{100t^3}$$

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

$= y\,(1/100)$ percent

$\therefore$ y increases by 1%