Name: Thankgod Clinton
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Department: Mechanical Engineering.

(a) The power P dissipated in a resistor is given as equation (1) $P = E^2/R$. If E = 200 volts and R = 8 ohms, find the change in P resulting from a drop of 5 volts in E and an increase of 0.2 ohm in R.

(2) The deflection y at the centre of a circular plate suspended at the edge and uniformly loaded is given in equation (2); $y = kwd^4/t^3$
Where W = total load, d = diameter of plate, t = thickness and k is constant.
Calculate the approximate percentage change in y if w is increased by 2½ percent and t is increased by 4 percent.

solution.

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

$\delta E = 5V$, $\delta R = 0.2\Omega$, $E = 200V$, $R = 8\Omega$

$\delta P = \frac{dP}{dE}\delta E + \frac{dP}{dR}\delta R$

$\frac{dP}{dE} = \frac{2E}{R}$ $\quad \frac{dP}{dR} = \frac{-E^2}{R^2}$

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

$\delta P = \frac{2(200)(-5)}{8} + \left[\frac{-(200)^2(0.2)}{64}\right]$

$\delta P = \frac{-2000}{8} + \left[\frac{-8000}{64}\right]$

$\delta P = -250 - 125$

$\delta P = -375$

(2) $\delta y = k\left(\frac{dy}{dw}\delta w + \frac{dy}{dd}\delta d + \frac{dy}{dt}\delta t\right)$

$\frac{dy}{dw} = \frac{d^4}{t^3}$, $\frac{dy}{dd} = \frac{4wd^3}{t^3}$, $\frac{dy}{dt} = \frac{3wd^4}{t^3}$

$\delta w = \frac{3w}{100}$, $\delta d = \frac{5d}{200}$ $\delta t = \frac{4t}{100}$

$\delta y = \left(\frac{kd^4}{t^3}\left(\frac{300}{100}\right) + \frac{k4wd^3}{t^3}\left(\frac{5d}{200}\right) - \frac{kwd^4}{t^4}\left(\frac{4t}{100}\right)\right)$

$\delta y = \frac{3kwd^4}{100t^3} + \frac{20wd^4k}{200t^3} - \frac{12kwd^4}{100t^3}$

$\delta y = \frac{1}{100}\left(\frac{3kwd^4}{t^3} + \frac{10kwd^4}{t^3} - \frac{12kwd^4}{t^3}\right)$

$\delta y = \frac{1}{100}(3y + 10y - 12y)$

$\delta = 1/100(12y)$

$\delta y = 1/100\, y$

y increases by $1/100$ percent.