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17/ENG06/001
MECHANICAL ENGINEERING

ENG 221

MATHS QUIZ

(i a) Area of a triangle

$$A = \frac{1}{2} ab$$

$$\delta A = \frac{\delta A}{\delta a} \cdot \delta a + \frac{\delta A}{\delta b} \cdot \delta b$$

$$\therefore = \frac{b}{2} \delta a + \frac{a}{2} \cdot \delta b$$

$$\delta a = \pm \frac{0.5}{100} a \quad , \quad \delta b = \pm \frac{0.5}{100} b$$

$$\therefore = \frac{b}{2} \cdot \left(\frac{\pm 0.5a}{100} \right) + \frac{a}{2} \left(\frac{\pm 0.5b}{100} \right)$$

Factorizing Out $ab/2$

Therefore; $\frac{ab}{2} \pm \left(\frac{1}{100} \right)$

But Area = $ab/2$

$$\therefore \pm A = \frac{1}{100}$$

② The length of hypotenus coal length

Recall; $h = \sqrt{a^2 + b^2}$

$\delta h = \frac{\delta h}{\delta a} \cdot \delta a + \frac{\delta h}{\delta b} \cdot \delta b$

Let $h = \sqrt{u}$, where $u = a^2 + b^2$

$\frac{\delta u}{\delta a} = 2a$ $\qquad$ $\frac{\delta u}{\delta b} = 2b$

$\frac{\delta h}{\delta u} = \frac{1}{2} u^{-1/2}$, $\qquad \frac{\delta h}{\delta a} = \frac{\delta u}{\delta a} \times \frac{dh}{\delta u}$

i) $\frac{\delta h}{\delta a} = \frac{1}{2} u^{-1/2} \times 2a$

$= a u^{-1/2}$

$\therefore \frac{\delta h}{\delta a} = \frac{a}{\sqrt{u}}$

Since $u = a^2 + b^2$

$\therefore \frac{\delta h}{\delta a} = \frac{a}{\sqrt{a^2 + b^2}}$

ii) $\frac{\delta h}{\delta b} = \frac{\delta h}{\delta u} \times \frac{\delta u}{\delta b}$

$= \frac{1}{2} u^{-1/2} \times 2b$

$\frac{\delta h}{\delta b} = \frac{b}{\sqrt{u}}$ $\qquad$ Recall, $u = a^2 + b^2$

$\therefore \frac{\delta h}{\delta b} = \frac{b}{\sqrt{a^2 + b^2}}$

$\delta a = \pm \frac{1.5}{100} a$ $\qquad$ $\delta b = \pm \frac{1.5}{100} b$

$\delta h = \frac{\delta h}{\delta a} \cdot \delta a + \frac{\delta h}{\delta b} \times \delta b$

$$\delta h = \frac{a}{\sqrt{a^2+b^2}}\left(\frac{\pm 1.5}{100}a\right) + \frac{b}{\sqrt{a^2+b^2}}\left(\frac{\pm 1.5}{100}b\right)$$

~~By factorizing,~~ ~~$\frac{\pm 1.5}{100}(a$~~

$$\frac{\pm 1.5\, a^2}{100\sqrt{a^2+b^2}} + \frac{\pm 1.5\, b^2}{100\sqrt{a^2+b^2}}$$

$$\therefore \frac{\pm 3}{100}\left(\frac{a^2+b^2}{\sqrt{a^2+b^2}}\right) \Rightarrow \frac{\pm 3}{100}\left(\sqrt{a^2+b^2}\right)$$

Recall that $h = \sqrt{a^2+b^2}$

$$\therefore \delta h = \frac{\pm 3}{100}(h)$$

∴ The change in h is ±3% when there's a change of ±1.5% in the lengths 'a and b'