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17/ENG03/050

CIVIL ENGINEERING

ENG 281 (Engineering maths)

Quiz

(1) a) Area of a triangle

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

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

$$\therefore = b/2 \delta a + a/2 \cdot \delta b$$

$$\delta a = \frac{1}{100} \cdot 0.5 a$$

$$\delta b = \frac{0.5 b}{100}$$

$$\therefore = b/2 \cdot \left(\frac{1 \cdot 0.5 a}{100} \right) + a/2 \cdot \left(\frac{0.5 b}{100} \right)$$

Factorizing out $ab/2$

Therefore, $\frac{ab}{2} \cdot \left(\frac{1}{100} \right)$

$$\text{Area} = \frac{ab}{2}$$

$$\therefore A = \frac{1}{100} \underline{\underline{ab}}$$

2) The length of hypotenuse and length

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

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

Let $h = \sqrt{u}$

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

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

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

$$\frac{dh}{du} = \frac{1}{2} u^{-1/2}$$

$$\frac{dh}{da} = \frac{du}{da} \times \frac{dh}{du}$$

$$i) \frac{dh}{da} = \frac{1}{2} u^{-1/2} \times 2a = au^{-1/2}$$

$$\frac{dh}{da} = \frac{a}{\sqrt{u}}$$

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

$$\frac{dh}{da} = \frac{a}{\sqrt{a^2 + b^2}}$$

$$ii) \frac{dh}{db} = \frac{dh}{du} \times \frac{du}{db}$$

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

$$\frac{dh}{db} = \frac{b}{\sqrt{u}}$$

$$\therefore \frac{dh}{db} = \frac{b}{\sqrt{a^2 + b^2}}$$

$$da = \pm \frac{1.5}{100} a$$

$$db = \pm \frac{1.5}{100} b$$

$$\frac{dh}{h} = \frac{dh}{da} da + \frac{dh}{db} db$$

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

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

$$\therefore \frac{\pm 1.5}{100} \left(\frac{a^2 + b^2}{\sqrt{a^2 + b^2}} \right) \Rightarrow \frac{\pm 1.5}{100} \left(\sqrt{a^2 + b^2} \right)$$

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

$$\Delta h = \frac{\pm 1.5}{100} (h) \quad \text{7/10/2007}$$

\therefore The change in h is $\pm 1.5\%$ when there's a change in the lengths 'a and b'