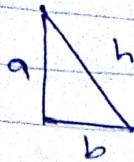


OYUGBO ESTHER VALERIE

17/ENG06/072

MECHANICAL ENGINEERING

ENG MATH ENG 283



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

$$\begin{aligned} a) \quad \delta A &= \frac{\delta A}{\delta a} \cdot \delta a + \frac{\delta A}{\delta b} \cdot \delta b \\ &= \frac{b}{2} \cdot \delta a + \frac{a}{2} \cdot \delta b \end{aligned}$$

$$\delta a = \pm 0.5 \text{ of } a$$

100

$$\delta b = \pm 0.5 \text{ of } b$$

100

$$= \frac{\pm 0.5}{100} a = \frac{3a}{200}$$

$$= \frac{3b}{200}$$

$$\therefore \delta A = \frac{b}{2} \cdot \frac{3a}{200} + \frac{a}{2} \cdot \frac{3b}{200}$$

$$= \frac{ab}{2} \left(\frac{3}{200} \right) + \frac{ab}{2} \left(\frac{3}{200} \right)$$

$$= \frac{ab}{2} \left(\frac{3 + 3}{200} \right)$$

$$= \frac{ab}{2} \left(\frac{6}{200} \right)$$

$$= \frac{ab}{2} \left(\frac{3}{100} \right)$$

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

$$\therefore \delta A = 3\% \text{ of } A$$

i.e. A is increasing or decreasing by 3%

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

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

$$h = (a^2 + b^2)^{1/2} \therefore h = u^{1/2}$$

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

$$\begin{aligned} \frac{\delta h}{\delta a} &= \frac{\delta h}{\delta u} \times \frac{\delta u}{\delta a} \\ &= \frac{1}{2} u^{-1/2} \times 2a \\ &= \frac{1}{2} (a^2 + b^2)^{-1/2} \times 2a \\ &= \frac{a}{\sqrt{a^2 + b^2}} \end{aligned}$$

$$\begin{aligned} \frac{\delta h}{\delta b} &= \frac{\delta h}{\delta u} \times \frac{\delta u}{\delta b} \\ &= \frac{1}{2} u^{-1/2} \times 2b \\ &= \frac{1}{2} (a^2 + b^2)^{-1/2} \times 2b \\ &= \frac{b}{\sqrt{a^2 + b^2}} \end{aligned}$$

$$\delta a = \frac{3a}{200} \quad \text{and} \quad \delta b = \frac{3b}{200}$$

$$\therefore \delta h = \frac{a}{\sqrt{a^2 + b^2}} \cdot \frac{3a}{200} + \frac{b}{\sqrt{a^2 + b^2}} \cdot \frac{3b}{200}$$

$$= \frac{a^2}{\sqrt{a^2 + b^2}} \left(\frac{3}{200} \right) + \frac{b^2}{\sqrt{a^2 + b^2}} \left(\frac{3}{200} \right)$$

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

then

$$= \frac{a^2}{h} \left(\frac{3}{200} \right) + \frac{b^2}{h} \left(\frac{3}{200} \right)$$

$$= \frac{a^2 + b^2}{h} \left(\frac{3}{200} \right)$$

also note that $h^2 = a^2 + b^2$

then

$$= \frac{h^2}{h} \left(\frac{3}{200} \right)$$

$$S_h = \frac{h}{200} \left(\frac{3}{200} \right)$$

h of 3% 0.015%

$\therefore h$ is increasing or decreasing by 0.015%