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Q31: Error Mechanical Engineering

Prac No: 17/ENGG01075

Area of Triangle

Recall

$$A = \frac{1}{2} b \cdot d$$

$$dA = \frac{dA}{db} \cdot db + \frac{dA}{dd} \cdot dd$$

$$= \frac{b}{2} \cdot dd + \frac{1}{2} b \cdot db$$

$$db = \pm \frac{1.5}{100} \cdot 10$$

$$dd = \pm \frac{1.5}{100}$$

$$\therefore dA = \pm \frac{b}{2} \left(\frac{1.5}{100} \right) + \frac{1}{2} \left(\frac{1.5}{100} \right) b$$

$$\frac{db}{2} \left(\frac{1.5}{100} + \frac{1.5}{100} \right)$$

$$dA = \frac{0.5}{2} \left(\frac{3}{100} \right)$$

$$dA = A \left(\frac{3}{100} \right)$$

\therefore The maximum error is 3%

Length of h

Recall

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

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

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

$$\text{Let } u = a^2 + b^2$$

$$\therefore h = u^{1/2}$$

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

$$\frac{dh}{du} = \frac{1}{2} \frac{1}{\sqrt{a^2 + b^2}}$$

$$\frac{dh}{da} = \frac{1}{2} \frac{1}{\sqrt{a^2 + b^2}} \times \frac{du}{da}$$

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

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

$$\frac{dh}{da} = \frac{1}{2} a^{-1/2} \times 2a$$

$$\frac{dh}{da} = \frac{1}{\sqrt{a}} \cdot a$$

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

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

$$\frac{dh}{db} = \frac{dh}{dv} \times \frac{dv}{db}$$

$$\frac{dh}{db} = \frac{1}{2} a^{-1/2} \cdot 2b$$

$$\frac{dh}{db} = \frac{1}{\sqrt{a}} \cdot b$$

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

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

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

$$dh = \frac{a}{\sqrt{a^2+b^2}} \cdot 1.5 \frac{a}{100} + \frac{b}{\sqrt{a^2+b^2}} \cdot \frac{1.5}{100} b$$

$$dh = \frac{a^2 + b^2}{\sqrt{a^2+b^2}} \cdot \frac{1.5}{100}$$

$$dh = \frac{1}{\sqrt{a^2+b^2}} \left[\frac{1.5a^2}{100} + \frac{1.5b^2}{100} \right]$$

$$dh = \frac{1}{\sqrt{a^2+b^2}} \left[\frac{1.5(a^2+b^2)}{100} \right]$$

$$\frac{1.5}{100} \sqrt{a^2+b^2} \cdot \sqrt{a^2+b^2} \cdot \frac{1}{2}$$

$$\frac{1.5}{100} (a^2+b^2)^{1/2}$$

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

$$dh = \frac{1.5}{100} \cdot 17$$

$$dh = 1.5\% \text{ of } 17$$