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Course:- ENGINEERING MATHEMATICS I

The hypotenus of a right-angled trainagle is denoted as C and the other two sides are denoted as a and b. If the possible error of measuring each of a and b is ± 1.5%. Find the maximum possible error in calculating

a.) The area of the triangle

b.) The length of the triangle

Solution

a.) $A = \frac{1}{2}bh \qquad A = \frac{1}{2}a \times b \qquad A = \frac{ab}{2}$

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

$$\delta A = \pm\frac{ab}{2}(0.15) + \frac{ab}{2}(0.15)$$

$$\delta A = \pm A(0.30) = \pm 30\% A$$

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

$$\frac{\partial C}{\partial a} = \frac{2a}{2\times\sqrt{a^2+b^2}} = \frac{a}{\sqrt{a^2+b^2}}$$

$$\frac{\partial C}{\partial b} = \frac{2b}{2\times\sqrt{a^2+b^2}} = \frac{b}{\sqrt{a^2+b^2}}$$

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

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

$$\delta C = \sqrt{a^2+b^2}\,(\pm 1.5\%)$$

$$\delta C = \pm 1.5\% C$$