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① The hypotenuse of a right angled triangle 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%.
a). the area of the triangle
b) the length of the hypotenuse

Soln

a) Recall, area of triangle = $\frac{1}{2} b \times h$

$\therefore = \frac{1}{2} b \times a$

$\Rightarrow \frac{a \cdot b}{2}$

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

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

$\delta a = \pm \frac{3a}{200}$; $\delta b = \pm \frac{3b}{200}$

$= \pm \frac{ab}{2} \left[\frac{3}{200} + \frac{3}{200} \right] = \pm A \cdot \frac{3}{100}$

$\Rightarrow \delta A = 3\%$ of A

b) $C = \sqrt{a^2+b^2} = (a^2+b^2)^{1/2}$

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

$\frac{\delta C}{\delta a} = \frac{1}{2}(a^2+b^2)^{-1/2}(2a) = \frac{a}{\sqrt{a^2+b^2}}$; $\frac{\delta c}{\delta b} = \frac{1}{2}(a^2+b^2)^{-1/2}(2b)$

$\delta a = \pm 3a/200$, $b/\sqrt{a^2+b^2}$ $\therefore \delta b = \pm 3b/200$

$\therefore \delta C = a/\sqrt{a^2+b^2} \cdot \pm 3b/200 + b/\sqrt{a^2+b^2} \cdot \pm 3/200$

$= \pm \frac{3}{200} \cdot \frac{a^2+b^2}{\sqrt{a^2+b^2}} = \pm \frac{3}{200} \sqrt{a^2+b^2} = \pm \frac{3}{200}(c)$

$\delta C = 0.015\%$ of C