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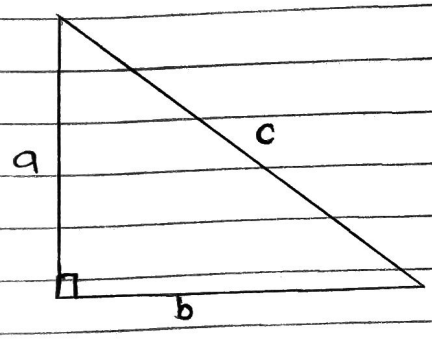
17/ENG04/1057
ELECTRICAL ELECTRONICS ENGINEERING.
ENGINEERING MATHEMATICS.

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 $\pm 1.5\%$, find the maximum possible error in calculating:

a) The area of the triangle, a
b) The length of the hypotenuse.

Solution:



a) The area;

Whereas Area of a triangle $= \frac{1}{2}bh$.

$\therefore$ Let Area $= A$

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

$\therefore$ Using the Formula; $\delta A = \frac{\partial A}{\partial a} \cdot \delta a + \frac{\partial A}{\partial b} \cdot \delta b$.

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

$\frac{\partial A}{\partial a} = \frac{b}{2}$, $\frac{\partial A}{\partial b} = \frac{a}{2}$

$\delta a = 1.5\%$ of a, $\delta b = 1.5\%$ of b

$\therefore \delta A = \frac{b}{2} \times \frac{1.5}{100} \times a + \frac{a}{2} \times \frac{1.5}{100} \times b$

$\delta A = \frac{1.5}{100} \times \frac{ab}{2} + \frac{1.5}{100} \times \frac{ab}{2}$.

$\delta A = \pm \frac{ab}{2} \left[\frac{1.5}{100} + \frac{1.5}{100} \right]$

$\delta A = \frac{ab}{2} \times \left[\frac{3}{100} \right]$

$\delta A = \frac{3}{100} \times \frac{ab}{2}$

$\delta A = \frac{3}{100} \times C$

$\delta A = 3\%$ of C

$\delta A = \pm 3\%$ of C

2 Hypotenuse;

Where Length of hypotenus $\Rightarrow C$

$\therefore C^2 = a^2 + b^2$

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

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

$\delta a = 1.5\%$ of a $\quad \delta b = 1.5\%$ of b

Using the formula;

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

$\delta c = \frac{1}{2}(2a)(\sqrt{a^2+b^2})^{-1} \cdot \frac{1.5}{100} \times a + \frac{1}{2}(2b)(\sqrt{a^2+b^2})^{-1} \times \frac{1.5}{100} \times b$

$= \frac{1.5a^2}{100} \cdot (\sqrt{a^2+b^2})^{-1} + \frac{1.5b^2}{100} \cdot (\sqrt{a^2+b^2})^{-1}$

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

$= \frac{1.5}{100} \times \frac{(a^2+b^2)}{\sqrt{a^2+b^2}}$

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

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

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

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

$= \frac{1.5}{100} \times C$

$= 1.5\%$ of C