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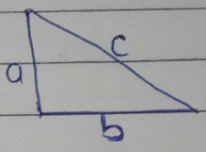
17/Engo1/025
Chemical Engineering

1) The hypotenuse of a right angled triangle is denoted by 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, and
b) the length of the hypotenuse

Solution



a) $A = \frac{a \times b}{2}$ $\quad dA = \frac{dA}{da} da + \frac{dA}{db} db$

$\frac{dA}{da} = \frac{b}{2}$, $\frac{dA}{db} = \frac{a}{2}$ $\quad da = \pm \frac{3a}{200}$ $\quad db = \pm \frac{3b}{200}$

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

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

$= \frac{a.b}{2}\left(\frac{3}{100}\right)$

$dA = 3\%$ of A

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

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

$\frac{dh}{da} = \frac{2a}{2}(a^2+b^2)^{-1/2} = \frac{a}{\sqrt{a^2+b^2}}$

$\frac{dh}{db} = \frac{2b}{2}(a^2+b^2)^{-1/2} = \frac{b}{\sqrt{a^2+b^2}}$

$da = \pm \frac{3a}{200}$

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

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

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

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

$dh = 1.5\%$ of h