

PAUL STONER 11/10/11

MECHANICAL ENGINEERING

U.S. (11/10/11)

Stoner

Calculus

$$A = \pi r^2 \quad \text{for } r = 100 \quad \text{and } \Delta r = \frac{100 \Delta A}{A}$$

$$\frac{dA}{dr} = 2\pi r \quad \frac{dA}{A} = \frac{2\pi r}{\pi r^2} dr$$

$$\frac{dA}{A} = \frac{2}{r} dr \quad \frac{dA}{A} = \frac{2}{100} \Delta r$$

$$\frac{\Delta A}{A} = \frac{2}{100} \Delta r \quad \Delta A = \frac{2}{100} \Delta r A$$

$$\Delta A = 1.5\% \quad (1/2 \cdot 100) \Delta r$$

$$\Delta r = 1.5\% / 50$$

$$\frac{\Delta A}{A} = \left( \frac{2}{100} \Delta r \right) = \frac{2}{100} \left( \frac{1.5\%}{50} \right)$$

$$\Delta A = \frac{2}{100} \left( \frac{1.5\%}{50} \right) A$$

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$$\Delta A = 1.5\% \cdot (1 + (1.5\% + 1.5\%))$$

$$c = \sqrt{a^2 + b^2} \quad d(a^2 + b^2)^{1/2}$$

$$\frac{dc}{da} = \frac{1}{2}(a^2 + b^2)^{-1/2} \cdot 2a \left( \frac{da}{da} + \frac{db}{db} \right)$$

$u = a^2 + b^2$ $\frac{du}{da} = 2a \quad \frac{dc}{du} = \frac{u^{-1/2}}{2}$ $\frac{dc}{da} = \frac{1}{2}(a^2 + b^2)^{-1/2} \cdot 2a$
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$$\frac{dc}{db} = \frac{1}{2}(a^2 + b^2)^{-1/2} \cdot 2b = \frac{b}{\sqrt{a^2 + b^2}}$$

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

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

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

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

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

$$= \frac{3}{200} \cdot \left( \frac{c^2}{c} \right)$$

$$= \frac{3}{200} (c)$$

$$dc = 1.5\% \text{ of } c$$