3.9 Differentials

WCID? I can compute the propagated error of measurements using differentials

A. Differential- the amount of error in measurements in applications of mathematics

1. Scientists approximate this error by the symbol ΔV, where the blank space is filled by a symbol indicating the quantity measured

   Ex: ΔV for the error in Volume

2. To find this error…think:

$$dx\left(\frac{dy}{dx} = f'(x)\right)dx$$

$$dy = f'(x)\,dx$$

diff diff

**We now let dy be approximately the same as Δy

3. Set up the derivative, and then fill in the blanks

Ex: Let $y = x^2$. Find dy when $x = 1$ and $dx = 0.01$

$dy = f'(x)dx$

$dy = 2x \cdot dx$

$dy = 2(1)(.01)$

$dy = .02$

Ex. Let $y = x^3$. Find dy when $x = 4$ and $dx = 0.02$

$dy = f'(x)dx$

$dy = 3x^2 dx$

$dy = 3(4)^2(.02) = .96$

B. This is also called error propagation

1. dx can be used to indicated the acceptable amount of error

Ex: The radius of a ball bearing is measured to be 0.07 in., with allowable error of 0.01 in. Find the propagated error in the Volume of the ball bearing.

$V = \frac{4}{3}\pi r^3$

$dV = 4\pi r^2 dr$

$= 4\pi(.07)^2(.01)$

$= .000196\pi$

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