# Approximate Error

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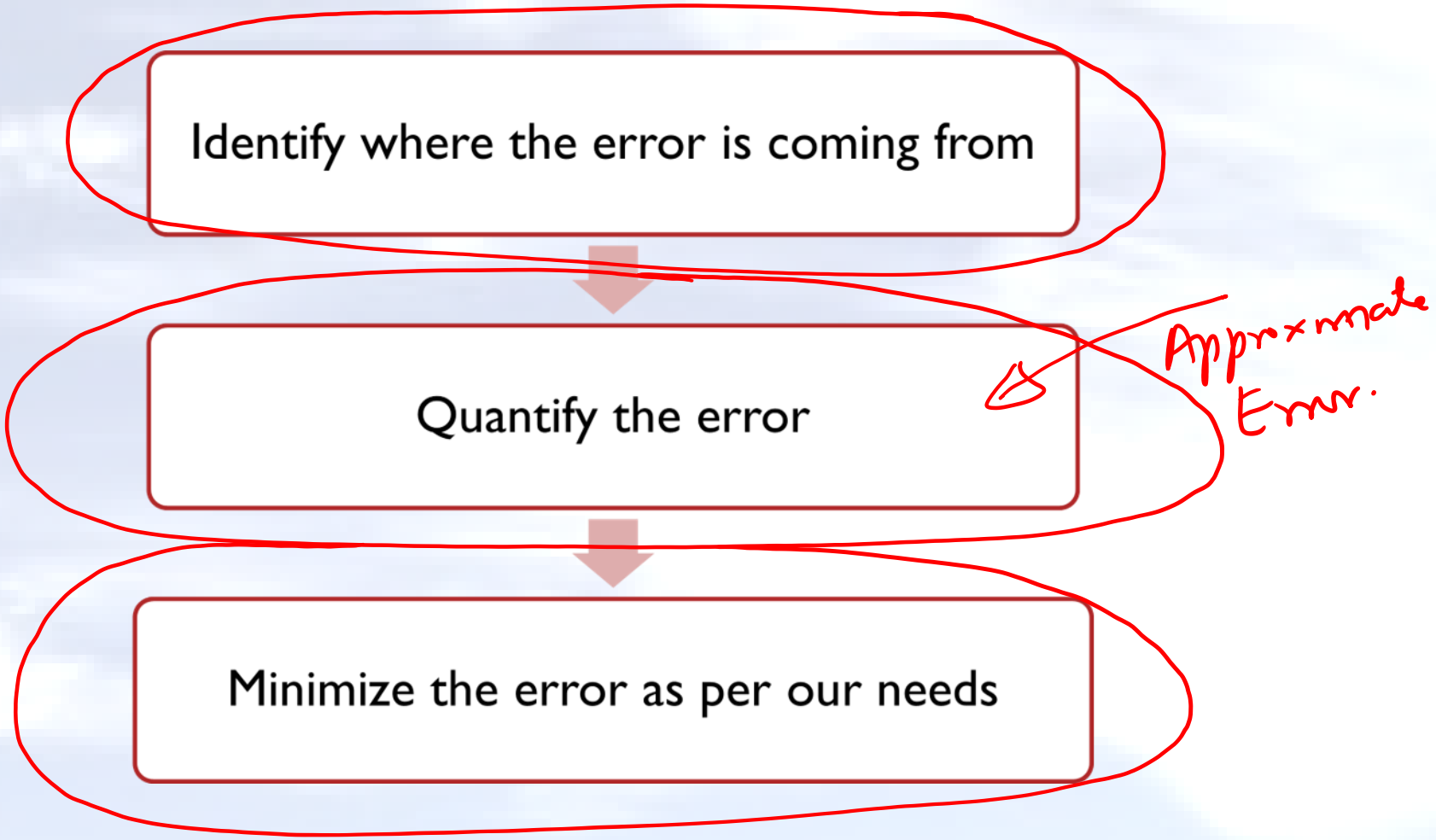
- Click on Quantifying Errors

# How to deal with errors?



Approximate Error ($E_a$)

= Present Approx - Previous Approx.

# Example of approximate error

The derivative of a function $f(x)$ at a particular value of $x$ can be approximately calculated by

$$f'(x) \approx \frac{f(x+h) - f(x)}{h}$$

For $f(x) = 7e^{0.5x}$, find the approximate error in calculating $f'(2)$ using $h = 0.3$ and $h = 0.15$.

Previous appr.

Present appr.

$$f'(x) \simeq \frac{f(x+h) - f(x)}{h}$$

$h = 0.3$, $x = 2$

$$f'(2) = \frac{f(2+0.3) - f(2)}{0.3}$$

$$= \frac{f(2.3) - f(2)}{0.3}$$

$$= \frac{7e^{0.5(2.3)} - 7e^{0.5(2)}}{0.3}$$

$$= 10.263$$ ← Previous Approx.

$$f'(x) \simeq \frac{f(x+h) - f(x)}{h}$$

$x = 2$
$h = 0.15$

$$f'(2) \simeq \frac{f(2+0.15) - f(2)}{0.15}$$

$$= \frac{f(2.15) - f(2)}{0.15}$$

$$= \frac{7e^{0.5(2.15)} - 7e^{0.5(2)}}{0.15}$$

$$= 9.8800$$

Current Approx.

Approximate Error

$E_a$ = Current approx - Previous approx

$= 9.8800 - 10.263$

$= -0.38300$

$f(x) = 7e^{0.5x}$ $\qquad$ $f(x) = \underline{\underline{7 * 10^{-6}}} e^{0.5x}$

$E_a = -0.38300 * 10^{-6}$

Relative Approx. Error

$$\epsilon_a = \frac{E_a}{\text{Current Approx.}}$$

# Example of relative approximate error

The derivative of a function $f(x)$ at a particular value of $x$ can be approximately calculated by

$$f'(x) \approx \frac{f(x+h) - f(x)}{h}$$

For $f(x) = 7e^{0.5x}$, find the relative approximate error in calculating $f'(2)$ using $h = 0.3$ and $h = 0.15$.

$$E_a = 9.8800 - 10.263$$
$$= -0.38300$$

$$\epsilon_a = \frac{E_a}{\text{Current Approx.}}$$

$$= \frac{-0.38300}{9.8800}$$

$$= -0.038765$$

$$\epsilon_a = -0.038765 * 100\%$$

$$= -3.8765\%$$

$$|\epsilon_a| = \underline{0.038765} \text{ or } \underline{3.8765\%}$$

END

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