

## Comparing Linear Approximations to Calculator Computations

In lecture, we explored linear approximations to common functions at the point  $x = 0$ . In this worked example, we use the approximations to calculate values of the sine function near  $x = 0$  and compare the answers to those on a scientific calculator.

Find the linear approximation to  $\sin(x)$  at the point  $x = 0$  and use your answer to approximate the values of  $\sin(.01)$ ,  $\sin(.1)$  and  $\sin(1)$ . Check your answer on a calculator.

$$\begin{array}{ll}
 f(x) \approx f(0) + f'(0)x & \sin(.01) \approx 0.01 \\
 f(x) \approx \sin(0) + \cos(0)x & \sin(.1) \approx 0.1 \\
 f(x) \approx x & \sin(1) \approx 1
 \end{array}
 \left. \vphantom{\begin{array}{l} f(x) \approx f(0) + f'(0)x \\ f(x) \approx \sin(0) + \cos(0)x \\ f(x) \approx x \end{array}} \right\} \text{linear approximation at} \\
 \hspace{15em} \text{points close to zero}$$
  

$$\begin{array}{ll}
 \sin(0.01) = 0.009999 & \\
 \sin(0.1) = 0.0998 & \\
 \sin(1) = 0.84147 &
 \end{array}
 \left. \vphantom{\begin{array}{l} \sin(0.01) = 0.009999 \\ \sin(0.1) = 0.0998 \\ \sin(1) = 0.84147 \end{array}} \right\} \text{true value of } f(x) = \sin x$$

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