

MAT – 112: Calculus I and Modeling

Solution 7

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Other Problems

Problem 1. We will use the following linear approximation formula

$$f(x + \Delta x) \approx f(x) + \Delta x f'(x).$$

- Let $f(x) = \sin(x)$, $x = 120^\circ = \frac{2\pi}{3}$, and $\Delta x = 2^\circ = \frac{\pi}{90}$. Then

$$\begin{aligned}\sin 122^\circ &\approx \sin(2\pi/3) + \frac{\pi}{90} \cos(2\pi/3) \\ &= \frac{\sqrt{3}}{2} - \frac{\pi}{180} \\ &\approx 0.848572.\end{aligned}$$

The error in this approximation is 0.00052.

- Let $f(x) = \cos(x)$, $x = 135^\circ = \frac{3\pi}{4}$, and $\Delta x = 2^\circ = \frac{\pi}{90}$. Then

$$\begin{aligned}\cos 137^\circ &\approx \cos(3\pi/4) - \frac{\pi}{90} \sin(3\pi/4) \\ &= -\frac{\sqrt{2}}{2} - \frac{\pi\sqrt{2}}{180} \\ &\approx -0.731789.\end{aligned}$$

The error in this approximation is 0.00044.