Homework 01

Math 140-002: Calculus I (Spring 2026)
Week 1 (Jan 12–Jan 16, 2026)

Relevant topics: Functions, inverse functions, trigonometric review, exponential and logarithmic expressions
Due: Wednesday, Jan 21, 2026.
Instructions: Show your work clearly. Problems 1–6 emphasize computational fluency; Problems 7–12 emphasize concepts and communication.

1. Simplify: $\dfrac{1-\cos^2(x)}{\sin(x)}$ (assume $\sin(x) \neq 0$).
2. Given $\tan(x) = \dfrac{3}{4}$ with x in Quadrant I, find $\sec(x)$.
3. Evaluate exactly: $\sin(\arctan(3/4))$.
4. Evaluate exactly: $\cos(\arcsin(5/13))$.
5. Solve for x: $\sin(x) = \frac{\sqrt{2}}{2}$ on $[0, 2\pi)$.
6. Find all x such that $\cos^2(x) = \dfrac{1}{4}$ on $[0, 2\pi)$.
7. Simplify using log rules: $\ln\left(\frac{e^3 x^2 \sqrt{y}}{(x-1)^5}\right)$ (assume $x > 1$, $y > 0$).
8. Rewrite as a single logarithm: $2\log_3 x - \frac{1}{2}\log_3 y + \log_3(9)$ (assume $x > 0$, $y > 0$).
9. Solve for x: $\ln(x-2) + \ln(x+2) = \ln 15$.
10. Solve for x: $e^{2x} - 5e^x + 6 = 0$.
11. Explain (3–5 sentences) why $\arcsin(\sin(x)) \neq x$ for all real x, and state precisely when equality holds.
12. A function satisfies $f(1) = 10$ but $\lim_{x\to 1} f(x) = 3$. Give an explicit example of such a function and briefly verify both conditions.