For this homework, we will review some of the things from the first few weeks of the course, and explore derivatives: the concept of what they are and the limit definition we use to find them.

Problems from the textbook are denoted as “Section XX, #XX.”

**Problem 1:** For these problems, we are asking you to work with both the unit circle and triangle definition of the trigonometric functions.

(a) If $0 < \theta < \frac{\pi}{2}$ and $\cos \theta = \frac{1}{2}$, what is $\sin \theta$?

(b) If $\frac{\pi}{2} < \theta < \pi$ and $\tan \theta = -1$, what is $\cos \theta$?

(c) If $0 < \theta < \frac{\pi}{2}$ and $\cos \theta = \frac{1}{3}$, what is $\sin \theta$?

(d) If $\frac{3\pi}{2} < \theta < 2\pi$ and $\sin \theta = \frac{4}{5}$, what is $\tan \theta$?

(e) If $0 < \theta < \frac{\pi}{2}$ and $\tan \theta = x$, what is $\sin \theta$?

**Problem 2:** It can be shown that $\sin x \leq x \leq \tan x$ for $x$ positive and near 0. Use this fact to evaluate $\lim_{x \to 0^+} \frac{\sin x}{x}$.

*Hint: It would help to rewrite $\tan x$ in terms of $\sin x$ and $\cos x$. It might also be useful to remember that if $a \leq b$ then $\frac{1}{a} \geq \frac{1}{b}$.*

**Problem 3:** Solve for $t$: $7 \cdot 3^t = 5 \cdot 2^t$.

**Problem 4:** Section 2.1, #20

**Problem 5:** Section 2.1, #26

**Problem 6:** Section 2.2, #22

*Hint: if $f(-x) = f(x)$, then we say that $f$ is an even function – think of $x^2$ or $x^4$. For this problem, you’ll want to think about what that means about the graph of the function $f$.*

**Problem 7:** Section 2.2, #40

**Problem 8:** Section 2.2, #50

[More on next page]
For problems 9-12, determine the requested limit or state that it does not exist. If the limit does not exist, describe the behavior of the function near that point (for example, show that $\lim_{x \to a} f(x) = \pm \infty$)

**Problem 9:**

(a) $\lim_{x \to 0^-} \frac{x^2 - 4x + 4}{x^3 + 5x^2 - 14x}$

(b) $\lim_{x \to 0^+} \frac{x^2 - 4x + 4}{x^3 + 5x^2 - 14x}$

**Problem 10:** $\lim_{x \to \infty} e^{1/x} \cos \left( \frac{1}{x} \right)$

**Problem 11:** $\lim_{x \to -\infty} \sqrt{\frac{x^2 + 9}{9x^2 + 1}}$

**Problem 12:** $\lim_{x \to 0} \frac{e^{2x} - 1}{e^x - 1}$