

Written HW3 – MATH 2501 Fall 2020

**Due by 26 August for timely completion credit**

We saw in class that  $\lim_{x \rightarrow 0} \frac{\sin(x)}{x} = 1$ . A related fact is the following limit, which you are free to use:  $\lim_{x \rightarrow 0} \frac{x}{\sin(x)} = 1$ . For these problems you may also use the formula

$$\lim_{x \rightarrow a} f(x)g(x) = \left( \lim_{x \rightarrow a} f(x) \right) \left( \lim_{x \rightarrow a} g(x) \right),$$

provided the limits on the right-hand side both exist.

In this written homework, you will consider various different similar limits involving other trigonometric functions. If you use a graph to assist your arguments, then include a copy of the graph attached to the problem you're working on (it's ok to sketch it yourself or whatever you prefer).

All you should need to do these problems is the limit above. For other trigonometric functions, you will need to recall basic facts about them (e.g. values on the unit circle, relationships between various trig functions and sine and cosine, etc). For the most part you are allowed to “plug in” the value that  $x$  is approaching into the trig functions, as long as doing so does not result in a  $\frac{0}{0}$  situation (those will be handled by the limit given at the top).

Fully correct answers will contain a completely symbolic derivation of the values of these problems.

1.  $\lim_{x \rightarrow 0} \frac{\sin(5x)}{x}$
2.  $\lim_{x \rightarrow 0} \frac{x}{\sin(2x)}$
3.  $\lim_{x \rightarrow 0} \frac{\sec(x)}{x \csc(x)}$
4.  $\lim_{x \rightarrow 0} \frac{\tan(x)}{x}$
5.  $\lim_{x \rightarrow 0} \frac{\tan(2x)}{x \cos\left(x + \frac{\pi}{6}\right)}$
6.  $\lim_{x \rightarrow 0} \frac{\sin(3x)}{\sin(8x)} \left( \text{hint: } 1 = \frac{x}{x} \right)$