MATH 133 – Calculus with Fundamentals 1
Trigonometric Derivatives
November 5, 2015

Background

In today's video, we saw how the addition formulas for $\sin(x)$ and $\cos(x)$, combined with some trigonometric limits we saw back in Chapter 2 of the text lead to the derivative formulas:

$$\frac{d}{dx}\sin(x) = \cos(x) \qquad \text{and} \qquad \frac{d}{dx}\cos(x) = -\sin(x).$$

Questions

(1) For each function, use the appropriate short-cut rules to find the first derivative, and then differentiate again to get the second derivative:

   (a) $f(x) = 3\sin(x) + 4\cos(x)$.

   (b) $g(x) = \cot(x) = \dfrac{\cos(x)}{\sin(x)}$. Your life will be a lot easier here if you simplify the first derivative *before differentiating again* to get $g''(x)$.

   (c) $h(x) = \sin(x)e^x$. Also find the third derivative $h'''(x)$ for this one.

(2) Consider the graph $y = x - \sin(x)$.

   (a) Do the tangent lines to this graph ever have a negative slope? Why or why not?

   (b) Do the tangent lines ever have zero slope? Where does that happen?

   (c) Where do the tangent lines have the steepest positive slope? For which x does that happen?

   (d) Sketch the graph $y = x - \sin(x)$ and check your work with a graphing calculator if you have one (or if one of your classmates can share theirs).