

MATH 135 – Calculus 1
Trigonometric Derivatives
October 31, 2016

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:

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

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) $g(x) = \cot(x) = \frac{\cos(x)}{\sin(x)}$. 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).