

# Assignment 6 - Derivatives II

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1. Using the formula  $\cos(a + b) = \cos(a)\cos(b) - \sin(a)\sin(b)$  show that

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

2. Let  $f(x) = \tan(x) = \sin(x)/\cos(x)$ . Find  $f'(a)$ .

3. Show that

$$\frac{d}{dx} \left( \frac{1}{x} \right) = -\frac{1}{x^2}$$

Prove any theorem that you use.

4. State Chain rule. Using Chain rule and the above problem, show that if  $g$  is differentiable and nonzero at  $a$ , show that  $\frac{1}{g}$  is differentiable at  $a$  and

$$\left( \frac{1}{g} \right)' (a) = -\frac{g'(a)}{g(a)^2}.$$

5. Using  $\epsilon, \delta$  argument, show that if  $g$  is continuous at  $a$  and  $f$  is continuous at  $g(a)$ , then  $f \circ g$  is continuous at  $a$ .
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6. <sup>1</sup> Let  $c \in [0, 1)$  be a real number. Show that the sequence  $(x_n)$  is convergent where

$$x_n := 1 + c + c^2 + \cdots + c^n.$$

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<sup>1</sup>The starred problems will not be asked in quiz