MA 16010 Lesson 7: Basic rules of differentiation

**Recall:** The derivative of y = f(x) at x is defined via limits as:

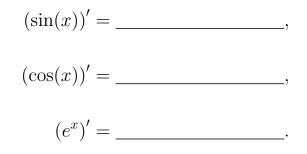
(other notation for derivatives:

Today we look at practical rules for computing derivatives.

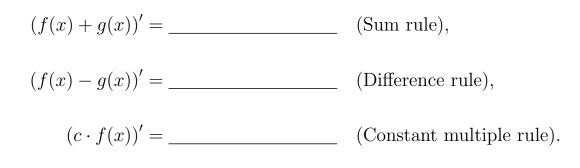
- **0. Constant rule:** If f(x) = c is a constant function, then f'(x) =\_\_\_\_\_. *Justification:*
- **1. Power rule:** We have  $(x^n)' = Examples:$ 
  - $f(x) = x^0 =$ \_\_\_\_:
  - $f(x) = x^1 = x$ :
  - $f(x) = x^2$ :

Note: The rule works not only for n from non-negative integers, but for all exponents, including negative, rational, irrational, ... numbers. *Examples:* 

## 2. Trig and exponential functions: We have



**3.** Sum, difference, constant multiple rules: If f(x), g(x) are functions and c is a constant (i.e. a number), we have:



**Exercise:** Find f'(x) when 1.  $f(x) = 2x^5 - 3x^2 + 7$ :

2. 
$$f(x) = \frac{\sqrt[3]{x^2 - 4x^{-1/5}}}{\sqrt{x}} + 2\sin(x)$$
 :

**Exercise:** Compute  $\frac{dy}{dx}\Big|_{x=2}$  when  $y = \frac{2}{x^3} + 7e^x + 10e^2$ .

**Exercise:** Find the equation of the tangent line to the graph of  $f(x) = 4 + 2\cos(x)$  at  $x = \pi/3$ :