

Math 1300 Homework 2

Due July 17, 2023 at the beginning of class

Collaboration and use of external sources are permitted, but must be fully acknowledged and cited. You will get most out of the problems if you tackle them on your own. All writing must be done individually.

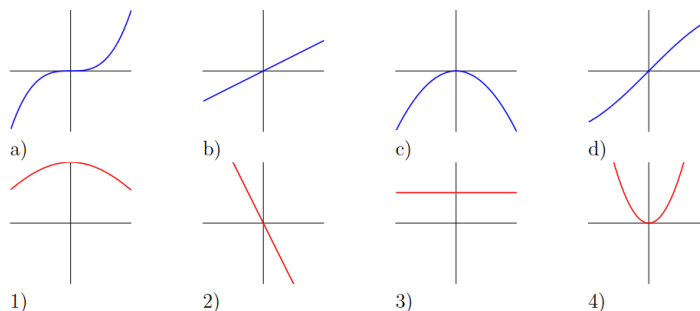
1. Compute the derivatives of the following functions:

(a) $f(x) = x^{10}$ at $x = 2$.

(b) $f(x) = x \sin x$ at $x = \pi/3$.

(c) $f(x) = 2^x$ at $x = 4$.

2. Match the following functions (blue) with their derivatives (red) and explain your reasoning.



3. Following the example of computing the derivative of \sqrt{x} that was done in class, compute the derivative of $\sqrt[3]{x}$ for $x > 0$. (Hint: use the multiply-and-divide trick we've seen many times for re-writing limits; in particular, you will need the algebraic identity $(a^3 - b^3) = (a - b)(a^2 + ab + b^2)$.)
4. Compute the derivatives of the following functions, then evaluate at $x = 0$:
 - (a) $\cos(20x) \tan(23x)$
 - (b) $\cos^3(x)/(1+x)^2$
 - (c) $\sin(x)/x$.
5. Using the chain rule, compute the derivatives of the following functions:

- (a) $f(x) = \sin(\cos(x))$
 - (b) $f(x) = e^{\sin(22x)}$
 - (c) $f(x) = \cos(e^x)$
6. Given that $\sin(\pi xy) = \pi(x + y)$, find y' (alternatively denoted by $\frac{dy}{dx}$) at $(1, -1)$ by implicit differentiation.
7. Using the formulas for derivatives of inverse trigonometric functions, compute the following:
- (a) $f'(4)$ for $f(x) = \arccos(2\sqrt{x})$
 - (b) $f'(8)$ for $f(x) = \arctan(x^2)$
 - (c) $f'(1)$ for $f(x) = \arcsin(\log(x))$
8. There are two different lines tangent to the parabola $y = x^2$ that pass through the point $(0, -1)$. Find their equations.