Analysis 1, Summer 2024

Written Assignment 1

1. For each function, *if* it is possible to find the derivative using only algebra, Power Rule, Sum Rule, Product Rule, Constant Multiple Rule, and the derivatives of sin and cos, then give the derivative. If it is not possible to find the derivative using these rules, just write "no". The first two are completed as examples.

   (a) $\dfrac{\sin(x)}{2x^3}$ Answer: $\left(\frac{\sin(x)}{2x^3}\right)' = (\frac{1}{2}x^{-3}\sin x)' = (\frac{-3}{2}x^{-4})\sin x + \frac{1}{2}x^{-3}(\cos x)$

   You do not have to explain why $(\frac{1}{2}x^{-3})' = \frac{-3}{2}x^{-4}$. The work above is enough, although you could write

   $$\begin{aligned}(\tfrac{1}{2}x^{-3}\sin x)' &= (\tfrac{1}{2}x^{-3})'(\sin x) + (\tfrac{1}{2}x^{-3})(\sin x)' \\ &= \tfrac{1}{2}(x^{-3})'\sin x + \tfrac{1}{2}x^{-3}(\cos x) \\ &= \tfrac{1}{2}(-3x^{-4})\sin(x) + \tfrac{1}{2}x^{-3}\cos(x)\end{aligned}$$

   if you want to be more detailed.

   (b) $\sin(2x^3)$ Answer: No.

   (c) $x^9 + \dfrac{x}{9} + \dfrac{9}{x}$

   (d) $\sqrt{(2x)^3}$

   (e) $\dfrac{x+7}{x^3-1}$

   (f) $(2x-7)(8\sqrt{x}+1)$

   (g) $5\sin(x) + \frac{1}{2}\cos(x)$

   (h) $\sqrt{x}\cos(x) + \sin(\frac{\pi}{6})$

   (i) $\dfrac{x^4-1}{x+1}$

   (j) $x^2 + 2^x + 2$

   (k) $2\sin(x)\cos(x)$

2. Fill in the blanks below with the digits of your Student ID:

   $$f(x) = \_\_x^5 + \_\_x^4 + \_\_x^3 + \_\_x^2 + \_\_x + \_\_.$$

   Then find the derivative, $f'(x)$.

3. For the function

   $$f(x) = \tfrac{1}{6}x^3 + 4x^2 + 7,$$

   calculate both $f(2)$ and $f'(2)$.

4. (a) Give the derivative of $x\sin x$.

   (b) Give the derivative of your answer to part (a).

   (c) Give the derivative of your answer to part (b).

   (d) Give the derivative of your answer to part (c).