EXAM 2 # TMath 124 Spring 2023

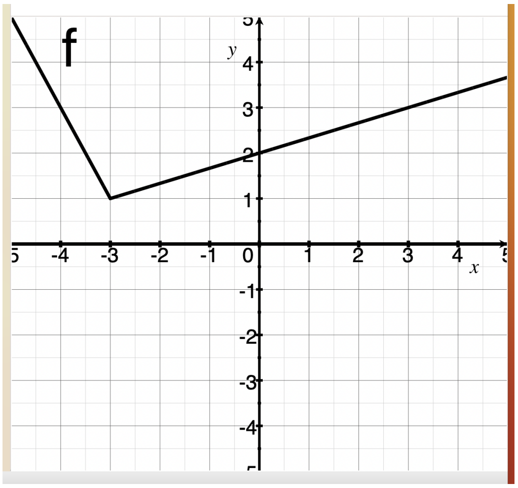
Show *all* your work (numerically, algebraically, or geometrically) for the following problems. Supporting work is needed to earn credit.

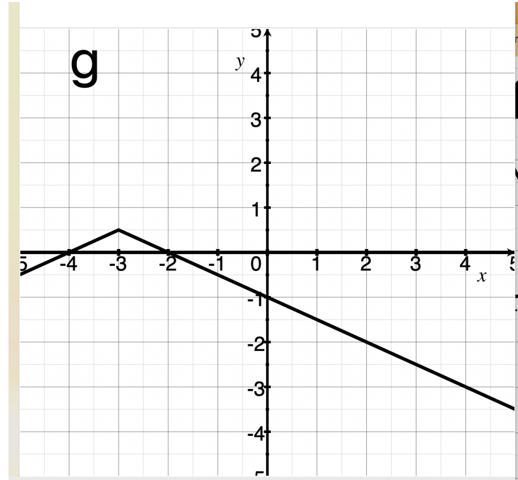
1. [2] (TrigAcitvity#2) Find $\lim_{x \to 0} \dfrac{\sin(4x)}{6x}$

2. Identify which derivative rule(s) you can use to find $\frac{dy}{dx}$. Do *not* find $\frac{dy}{dx}$!!

	Derivative Rule(s)
[2] (ImpExpActivity#5) $y = \sqrt{\frac{x-1}{x^4+1}}$	
[2] (§3.5 #24) $y + x4^y = x^9$	
[2] (WebHW8 #9) $y = e^{x^3-5x}$	
[2] (WebHW10 #13) $y = (\tan(x))^x$	

3. Use the graphs of f and g below for the following questions.





(a) [2] (ProductActivity#1) Find an x so that $g'(x)$ does not exist.

(b) [3] (WebHW8#7) Estimate $\frac{d}{dx}(f(x)g(x))|_{x=0}$

(c) [3] (Quiz3#1) If $c(x) = f(g(x))$, then estimate $c'(4)$.

(d) [3] (§3.4#72) If $h(x) = g(3x - 1)$, then estimate $h'(2)$.

4. The differentiable functions f and g are defined for all real numbers. Values for f, f', g, and g' for various x values are given in the table.

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	3	4	2	6
2	1	5	8	7
3	7	7	2	9

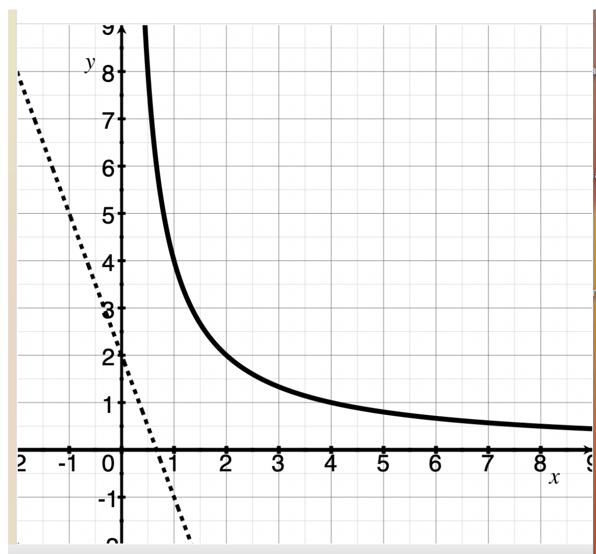
(a) [4] (PracticeExam#4) Given that $h(x) = \frac{f(x)}{2x+g(x)}$, find $h'(1)$.

(b) [3] (§3.10 #52) Find the linearization of f at $x = 2$.

(c) [2] (§3.10 #52) Use the linearization of f to approximate $f(2.05)$.

5. A particle moves along a hyperbola $xy = 4$ when $x > 0$. The graph is shown below with a solid curve. The dotted line is of a dust particle moving along a straight line.

(a) [4] (§3.2 #56) Find the point that the particle's movement is parallel to a dust particle moving along the dotted straight line graphed.



(b) [4] (WebHW11#5) When the particle reaches an x value of 1, the y-coordinate is decreasing at a rate of 3 cm/s. How fast is the x-coordinate of the point changing at that instant?

6. (WordProblems#9) If C is the cost ($ out) a company incurs by producing x units of their commodity, the marginal cost MC is equal to $\lim_{\Delta x \to 0} \dfrac{\Delta C}{\Delta x} = \dfrac{dC}{dx}$. Similarly, if R is the revenue ($ in) a company gathers by producing x units on their commodity, the marginal revenue MR is equal to $\frac{dR}{dx}$. Also if P is profit ($), the marginal profit, MP, is $\frac{dP}{dx}$. Note that Profit=($ in)-($ out)=Revenue-Cost.

(a) [2] A company sells each product for $450 dollars. Write down the revenue function for the company selling x units.

(b) [3] The same company has a cost function of $C(x) = 10,000 + 3x^2$. Find the number x units that should be produced to maximize profit.

(c) [2] Explain why economics care when $MP = 0$.