Practice Midterm 2
MAT 131

Midterm 2 will cover material from sections 2.7-3.7 and 3.9

1. Calculate the derivatives of the following functions:

(a) $f(x) = 3x^3 + 4x^2 + 5x + \frac{6}{x}$

(b) $f(x) = \sin^{10} x$

(c) $f(x) = \frac{x^2+1}{x+5}$

(d) $f(x) = 3^x \log_3(x+3)$

(e) $f(x) = \arctan(x^2+1)$

(f) $f(x) = x^{\sin x}$

(g) $f(x) = \frac{x^3(x+2)^{3/4}}{(x-1)^{3/2}(x+3)^{5/2}}$

2. (a) Find the linear function that best approximates $\tan x$ at the point $x = \frac{\pi}{4}$

(b) Use (a) to find an approximate value of $\tan(\frac{\pi}{4} + 0.02)$.

3. Find the tangent line to the curve at the point a:

(a) $\sqrt[3]{x} + \sqrt[3]{y} = 1, a = (8, -1)$

(b) $x^2 - xy + y^2 = 4, a = (2, 2)$

4. Suppose f and g are differentiable. Write the derivative of the function $F(x) = \frac{f(x)g(x)}{f(x)+g(x)}$ in terms of f, g, f', and g'.

5. Let $f(x) = \frac{x^2+1}{x^2-1}$.
  (a) Compute $f'(x), f''(x)$.
  (b) For which values of x is f increasing? decreasing? concave up? down?
  (c) Use the information above to sketch the graph of $f(x)$. Clearly mark maximums/minimums, inflection points, and asymptotes (if any). Do not forget to mark the units on the axes.

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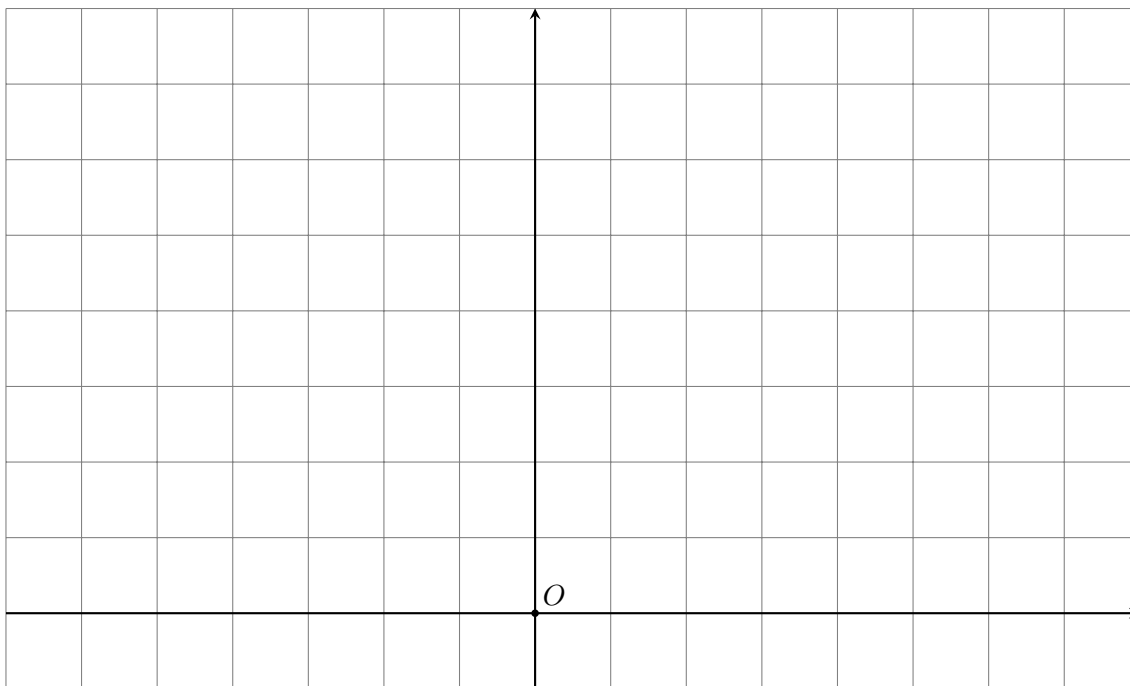
6. Let $f(x) = \sin x + \cos x$.

    (a) Calculate $f'(x)$.

    (b) Calculate the 101st derivative of $f(x)$.

7. Match each graph of a function (first column) with the graph of its derivative (second column), by writing next to each graph of a function the corresponding letter.

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a.

b.

c.

d.

e.