

MATH 190, Lab 9: Nov 6 and 8, 2018

In this lab, you will be reviewing your midterm exam and reflect on your errors. When you have completed the problems (to the satisfactory of the facilitators) you can spend the rest of the lab working on the Homework 4 problems posted on Canvas.

1. Reflect on the solution (Problem 2 of the midterm)

Read the solution to Problem 2 of the midterm and answer the questions about the solution.

(a) Evaluate the following two quantities

$$\sin\left(-\frac{\pi}{3}\right) \quad \text{and} \quad \cos\left(-\frac{\pi}{3}\right)$$

Solution:

We note that the angle $-\frac{\pi}{3}$ is in the 4th quadrant so

$$\sin\left(-\frac{\pi}{3}\right) = -\frac{\sqrt{3}}{2}$$

$$\cos\left(-\frac{\pi}{3}\right) = \frac{1}{2}$$

how do we know that the angle in the 4th quad?

why is sine + and cosine - ?

(b) Find the equation of the tangent line to

$$f(x) = \ln(\cos x)$$

at the point $x = -\frac{\pi}{3}$.

Solution:

Why should we compute the derivative?

$$f'(x) = \frac{1}{\cos x}(-\sin x) = -\frac{\sin x}{\cos x}.$$

where does this come from?

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Now

$$f'\left(-\frac{\pi}{3}\right) = -\frac{\sin\left(-\frac{\pi}{3}\right)}{\cos\left(-\frac{\pi}{3}\right)} = -\frac{-\frac{\sqrt{3}}{2}}{\frac{1}{2}} = \sqrt{3}$$

Why are we evaluating this?

We also have

$$y_0 = f\left(-\frac{\pi}{3}\right) = \ln\left(\cos\left(-\frac{\pi}{3}\right)\right) = \ln\left(\frac{1}{2}\right)$$

why do we need this?

All together the equation of the desired tangent line is

$$y - \ln\left(\frac{1}{2}\right) = \sqrt{3} \left(x + \frac{\pi}{3}\right) \implies y = \sqrt{3} x + \ln\left(\frac{1}{2}\right) + \frac{\pi\sqrt{3}}{3}.$$

where did this come from?

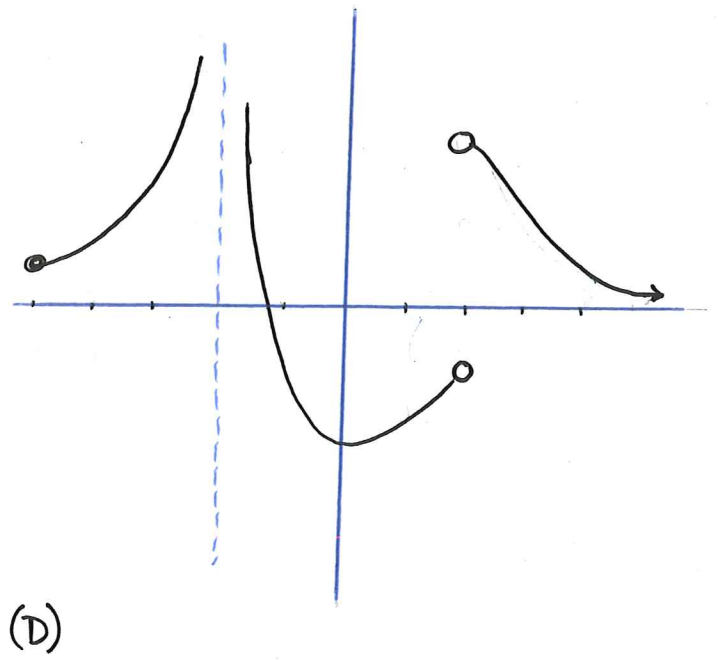
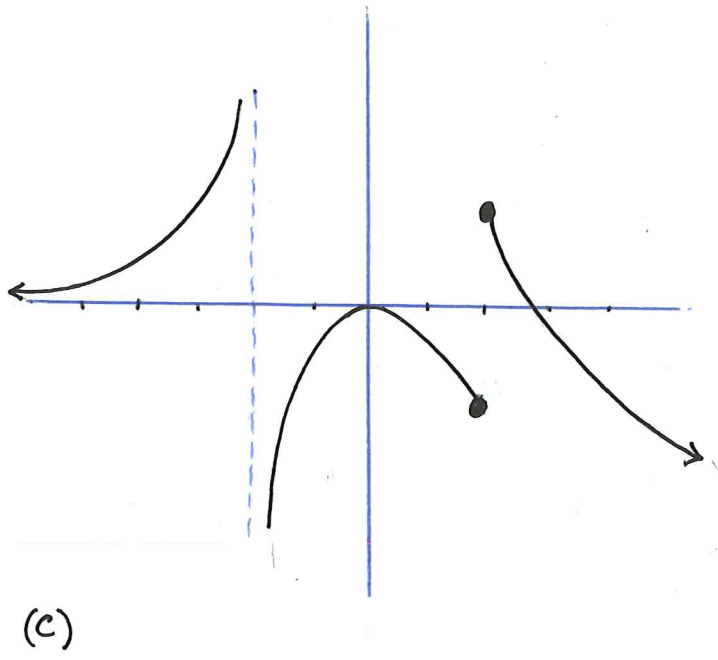
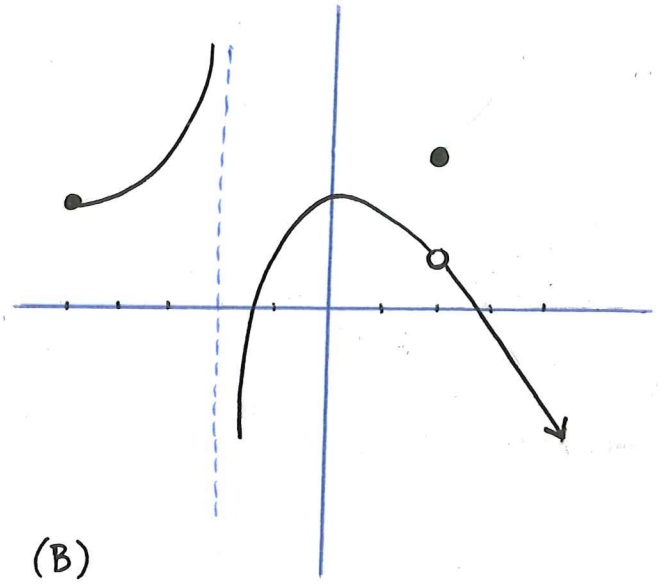
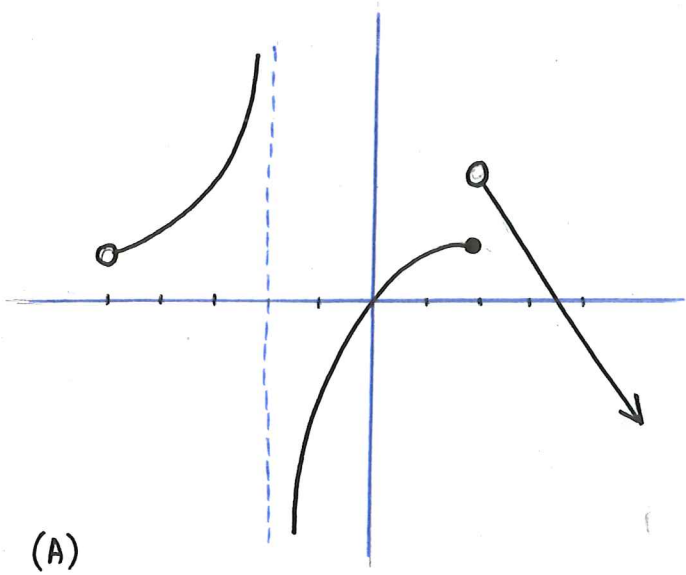
2. **Reflect on your errors** (Problem 7 of the midterm)

Check your answer to the following question and, if you have not received a full credit, explain how/why your graph does not satisfy one or more of the given conditions, then correct your answer.

Sketch the graph of a function satisfying **all** the following properties:

- The domain of $f(x)$ is $[-5, -2) \cup (-2, \infty)$
- $f(x)$ has a vertical asymptote at $x = -2$
- $\lim_{x \rightarrow 2} f(x)$ does not exist
- $\lim_{x \rightarrow \infty} f(x) = -\infty$
- $f'(-3) > 0$
- $f'(0) = 0$
- $f'(3) < 0$

The graphs on the next page have been chosen from your answers to this question which illustrate some common mistakes you have made. Check each graph and find the mistake(s) and explain how the given graph violates one or more of the given conditions.



3. Correct your answer

Review your answer to Problem 1 in the midterm and find your mistakes, if any. Explain why your answer is incorrect and what concept/skill is missing, then correct your answer.

Compute the derivatives of the following functions

(a) $f(x) = x^{2018} + \frac{2}{\sqrt[3]{x}} + \frac{x^2x^6}{x} - 7e^x + \pi^e$

(b) $g(x) = 5^x \cdot \ln(3x^2 + x)$

4. Solve

Redo questions 3 and 4 of the exam.