# MATH 122
Exam 2 Review

Exam 2 will be selected from the combinations of problems/parts of the graded and ungraded homeworks on WileyPlus. Problems may be slightly modified, i.e. values in the problem changed, the names or context changed, parts added or removed, plots changed, etc. The problems below represent a sample of what an exam resulting from this process could resemble.

Problem 1. Consider the function $f(x)$ plotted below.
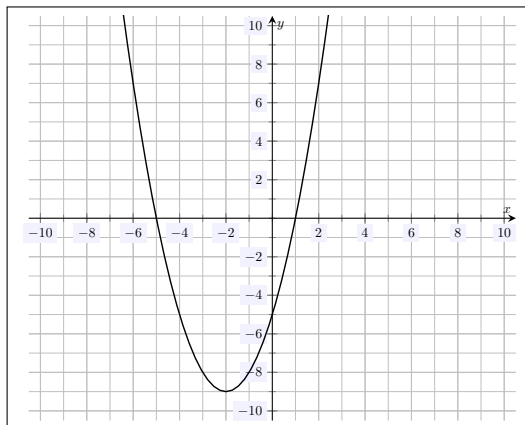

(a) When is $f'(x) > 0$? When is $f'(x) < 0$? Explain.

(b) When is $f''(x) > 0$? When is $f''(x) < 0$? Explain.

(c) List any critical values for $f(x)$. Classify them as maxima or minima.

(d) Are there any points of inflection? Explain.

(e) Determine whether the following values are positive, negative, or zero:

- $f(-6)$
- $f'(1)$
- $f''(-3)$
- $f'(-2)$

(f) Sketch the tangent line to $f(x)$ at $x = -5$.

Problem 2. Showing all your work, compute the following derivatives:

(a) $\dfrac{d}{dx}\left(5x^4 - 7x + 2\sqrt[3]{x} - \pi^2\right)$

(b) $\dfrac{d}{dx}\left(3x^4 \log_5 x\right)$

(c) $\dfrac{d}{dx}(e^x - 4)^8$

(d) $\dfrac{d}{dx}\left(\dfrac{5x - 1}{2x + 4}\right)$

Problem 3. Below is a plot of the derivative, $f'(x)$, of some function $f(x)$. Based on this plot, answer the questions below.
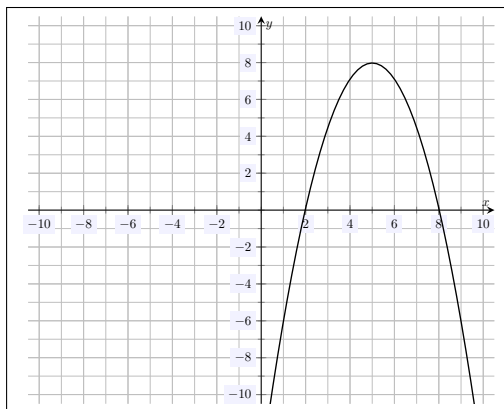
(a) Where is $f(x)$ increasing? Where is $f(x)$ decreasing?

(b) Find and classify any local maxima and minima for $f(x)$.

(c) Where is $f(x)$ concave up? Where is $f(x)$ concave down?

(d) Does $f(x)$ have any points of inflection? Explain.

Problem 4. Showing all your work, compute the following derivatives:

(a) $\dfrac{d}{dx}\left(x^6 4^{-x}\log_2(3x)\right)$

(b) $\dfrac{d}{dx}(x9^{\sqrt{x}} - 5)^6$

(c) $\dfrac{d}{dx}\left(\dfrac{3^x \ln x}{5x-4}\right)$

Problem 5. Suppose that the total cost, C, of producing q items is given by $C(q) = 3q^2 + 150$.

(a) Use the definition of the derivative to approximate $C'(2)$.

(b) What is the marginal cost when $q = 2$?

(c) Find the tangent line to $C(q)$ when $q = 2$.

(d) Use the previous part to estimate $C(2.2)$.

(e) Knowing that $C''(2) = 6 > 0$, is your answer in (d) an overestimate or underestimate?

Problem 6. Suppose that $f(x) = 2x^3 + 3x^2 - 120x$.

(a) Where is $f(x)$ increasing? Where is $f(x)$ decreasing?

(b) Where is $f(x)$ concave up? Where is $f(x)$ concave down?

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(c) Does $f(x)$ have any points of inflection?

(d) Find and classify any local maxima and local minima.

(e) Find the global maxima and global minima for $f(x)$ on $[-2, 4]$.