

Review Problems for Midterm II

Sections to be covered: from 2.2 up to 4.4

Review Session: Monday., March 27, 6:00-8:00pm in ESS 001

1. Differentiate the following functions:

(a) $f(x) = 4x^3 - 3x^2 + 12x + 5$

(b) $f(x) = \sqrt{x}$

(c) $f(x) = 3x + 3^x + \frac{3}{x}$

(d) $f(x) = e^{-0.2x} + e^{x^2}$

(e) $f(x) = \ln(x + 5)$

(f) $f(x) = (1 + \ln x)^3$

(g) $f(x) = (x^2 - 3x + 1)(x^3 - 27)$

(h) $f(x) = x(x^2 + 4)^2 e^x$

(i) $f(x) = \frac{x^2+2}{x-1}$

(j) $f(x) = (\ln(e^x + 3))^3$

2. For $f(x) = xe^x$ compute the following first, second, and the third derivative. Guess a formula for the n -th derivative of the function.

3. For the function graphed on problem 9 page 105, answer the following questions:

(a) What are the x -coordinates of the critical points?

(b) On what intervals is $\frac{dy}{dx} \geq 0$?

(c) What are the inflection points?

(d) On what interval is $\frac{d^2y}{dx^2} \leq 0$?

4. For a function $f(x)$, whose DERIVATIVE $f'(x)$ is given by the graph from problem 11 page 105, say if the following statements are TRUE or FALSE:

(a) f is increasing on the interval $(-2, -1)$.

(b) f has a local maximum at $x = 1$.

(c) f has an inflection point at $x = 1$.

(d) $f(0) < f(3)$

(e) f is concave up on the interval $(-1, 1)$.

(f) $x = 4$ is a local minimum of f .

5. Problems 9, 12 page 105.

6. Answer the following questions about the function $f(x) = 2x^3 + 3x^2 - 12x + 1$ on the interval $-3 \leq x \leq 3$.

(a) What is $f'(x) = ?$

(b) Where are the critical points of f ?

(c) List all local maximums of f (include endpoints).

(d) Where is the global maximum of f on this interval?

(e) What is the maximum value of f on this interval?

(f) Where is the inflection point of f ?

7. Problem 16 page 170.
8. For $f(x) = x - \ln x$, and $0.1 \leq x \leq 2$, answer the following questions:
- (a) What are the critical points?
 - (b) On what interval is $f(x)$ increasing/ decreasing?
 - (c) Does $f(x)$ have a inflection point, if yes what are its coordinates?
 - (d) What is the concavity of the function?
9. A ball is thrown into the air. Its height at time t (in seconds) is $s(t) = -16t^2 + 8t$ (feet).
- (a) Find the velocity of the ball at time t . Include units.
 - (b) When the ball reaches the highest point, the velocity will be 0. Use this fact and part (a) to find the time when the ball reaches its highest point.
 - (c) From (b) and the formula for $s(t)$, find the maximum height reached by the ball.
 - (d) Find the acceleration function of the ball. Explain why that is a reasonable answer.
10. Problems 3, 14 page 187.