

Fall 2009 Math 151

Night Before Drill for Exam III

courtesy: David J. Manuel

(covering 4.3 - 6.2)

1 Section 4.3

1. Evaluate $\log_5 10 + \log_5 20 - 3 \log_5 2$.
2. Solve for x : $\log(3 - x) + \log(x + 4) = 1$.
3. Compute $\lim_{x \rightarrow \pi/2^-} \ln(\cos x)$.

2 Section 4.4

1. Given $f(x) = x^3 \ln x$, find $f'(e)$
2. Find and simplify the derivative of $f(x) = \sqrt{x} \ln x$
3. Use logarithmic differentiation to find the derivative of $f(x) = \frac{(x^3 + 1)^4 \sin^2 x}{\sqrt[3]{x}}$.

3 Section 4.5

1. Money is invested in an account which earns interest compounded continuously. Twenty years later, the investment has tripled in value. Find the interest rate.
2. A tank contains 500 liters of salt solution with 10kg of salt. Pure water enters the tank at a rate of 20 liters per minute, and the solution is completely mixed before leaving the tank at the same rate. When will the solution have only 1 kg of salt remaining?

4 Section 4.6

1. Find the value of $\sin^{-1} \left(\sin \left(\frac{7\pi}{6} \right) \right)$.

2. Compute $\lim_{x \rightarrow -\infty} \cos^{-1} \left(\frac{e^x + \sqrt{3}e^{-x}}{2e^x + 2e^{-x}} \right)$.

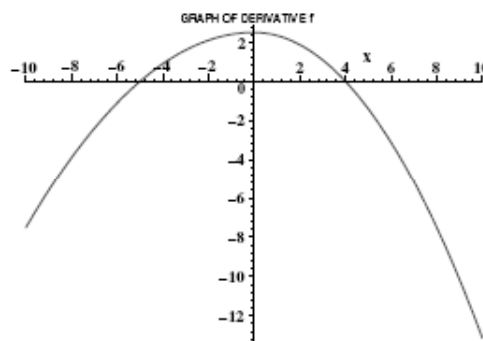
3. Find and simplify the derivative of $f(x) = \arccos \left(\frac{6}{x} \right)$.

5 Section 4.8

1. Compute $\lim_{x \rightarrow 0} \frac{\sin x - x}{x^3}$.
2. Compute $\lim_{x \rightarrow 0} \tan(4x) \cot(7x)$.
3. Compute $\lim_{x \rightarrow \infty} \left(1 + \frac{2}{x} \right)^x$.

6 Section 5.1

1. The graph of the **DERIVATIVE** of a function is shown below. On which interval(s) is the original function $f \dots$
 - (a) decreasing?
 - (b) concave down?



2. Sketch a graph with the following properties:
 - $f'(x) > 0$ when $x < 1$; $f'(x) < 0$ when $x > 1$
 - $f''(x) > 0$ when $x < -2$ and $x > 2$, $f''(x) < 0$ when $-2 < x < 2$
 - $\lim_{x \rightarrow -\infty} f(x) = -2$, $\lim_{x \rightarrow \infty} f(x) = 0$

7 Section 5.2

1. Find the critical numbers of $f(x) = x(x - 1)^{1/3}$.
2. Find the absolute maximum and absolute minimum of $f(x) = \sin x + \cos x$ on the interval $[0, \pi]$

8 Section 5.3

1. Find the x -coordinates of the inflection points of $f(x) = x^5 + 10x^4$.
2. Determine the intervals where $f(x) = e^{(-1/2)x^2}$ is increasing or decreasing and concave up or concave down.

9 Section 5.5

1. Find the x -coordinate of the point on the line $y = 2x$ which is closest to the point $(3, 7)$.
2. A wire 30cm long is to be cut into at most 2 pieces. The first piece is bent into a square; the second piece is bent into an equilateral triangle. How should the wire be divided so that the total area enclosed by the figures is a maximum?
3. A right circular cylinder is inscribed in a sphere of radius 3 cm. Find the volume of the largest possible cylinder.

10 Section 5.7

1. Find the most general antiderivative of $f(x) = 2\sqrt{x} + \frac{1}{x^2}$.
2. Given $f'(x) = \frac{2}{1+x^2}$ and $f(1) = 0$, find $f(x)$.
3. The acceleration of a particle is given by $\mathbf{a}(t) = (1 + e^t)\mathbf{i} + (\cos t)\mathbf{j}$. If the initial velocity is \mathbf{i} and the initial position is \mathbf{j} , find the position of the particle at any time t .

11 Section 6.1

1. Compute $\sum_{i=1}^4 (i + 2)$.
2. Use the formulas on p367 to calculate $\lim_{n \rightarrow \infty} \frac{2}{n} \sum_{i=1}^n \left[\left(1 + \frac{2i}{n}\right)^2 - 1 \right]$.

12 Section 6.2

1. Approximate the area under the graph of $f(x) = 16 - x^2$ between $x = 0$ and $x = 4$ using a partition $P = \{0, 2, 3, 4\}$ and taking $x_i^* =$ left endpoint. Graph the function and illustrate your approximation on the graph.
2. Approximate the area under the graph of $f(x) = \ln x$ between $x = 1$ and $x = 7$ using 3 equal subintervals and taking $x_i^* =$ midpoint.
3. Find the exact area under the graph of $f(x) = x^2 - 1$ between $x = 1$ and $x = 3$ using n equal subintervals ($n \rightarrow \infty$) and taking $x_i^* =$ right endpoint.