

Math 130 – Fall 2014 – Boyle –Exam 2

- NO CALCULATORS OR ELECTRONIC DEVICES ALLOWED.
- Where a calculator would be used, give your answer as an expression a calculator could evaluate.
- Use a separate answer sheet for each question.
- Give your pledge on page 1 only, covering the whole test.
- Draw a box around a final answer to a problem.

1. (11 points)

(a) (6 pts) The trachea is contracted during a cough to produce a more effective cough. The Tuchinsky model for the velocity V of air flowing through the trachea during a cough is $V = C(R_0 - R)R^2$, where C and R_0 are positive constants and R is the radius of the windpipe during the cough.

Find the value of R that maximizes the velocity.

(b) (5 pts) Given $f(x) = \ln(6x^2 - 5x)$, compute $f'(x)$.

2. (12 points)

(a) (7 pts) Find the equation of the tangent line to the graph of $f(x) = \sqrt{x^2 + 9}$ at $x = 4$.

(b) (5 pts) Given $f(x) = \ln(\sqrt{x + 4})$, compute $f'(x)$.

3. (10 points)

For each of the following functions, find the formula for y' .

(a) (5 pts) $y = 3^{5x}$.

(b) (5 pts) $y = \log_{10}(1 - x)$.

4. (11 points)

(a) (7 pts) Given $y = e^{x^2} \cos x$, find the formula for y' .

(b) (4 pts) Given $y = \sin(3x + 2)$, find the formula for y' .

5. (16 points)

For each function below, find all inputs x at which $f(x)$ assumes a local maximum, and all inputs x at which $f(x)$ assumes a local minimum.

(a) (8 pts) $f(x) = x^3 e^x$.

(b) (8 pts) $f(x) = 2x - 9x^{2/3}$, with domain = $[0, \infty)$.

6. (12 points)

(a) (8 pts) Suppose the concentration of a drug in the blood of a patient t minutes after injection is described by the function $K(t) = 5t/(t^2 + 1)$. Over which intervals is $K(t)$ decreasing / increasing ?

(b) (4 pts) Given $y = \cos^7 x$, find a formula for y' .

7. (14 points) Consider the function $f(x) = 2x + \frac{8}{x}$.

(a) (3 pts) Find all asymptotes for f .

(b) (4 pts) Find the intervals on which f is increasing/decreasing.

(c) (3 pts) Find the intervals on which f is concave up/down.

(d) (4 pts) Graph f .

8. (14 points) Consider the function $f(x) = xe^{-x}$.

(a) (2 pts) Find all asymptotes for f .

(b) (4 pts) Find the intervals on which f is increasing/decreasing.

(c) (4 pts) Find the intervals on which f is concave up/down.

(d) (4 pts) Graph f .