

Print Name _____

APPM 1350

Final Exam

Summer 2016

On the front of your bluebook, please write: a grading key, your name, student ID, your lecture number and instructor. This exam is worth 100 points and has 5 questions on both sides of this paper.

- Submit this exam sheet with your bluebook. However, nothing on this exam sheet will be graded. Make sure all of your work is in your bluebook.
 - **Show all work and simplify your answers!** Answers with no justification will receive no points.
 - Please begin each problem on a new page.
 - No notes or papers, calculators, cell phones, or electronic devices are permitted.
-

1. Evaluate the following integrals. Show all work to justify your answer and make sure to simplify as much as possible.

(a) (6 pts) $\int \frac{x+2}{\sqrt{x^2+4x}} dx$

(b) (6 pts) $\int \frac{\sinh x}{e^x} dx$

(c) (6 pts) If f is continuous and $\int_0^9 f(x) dx = 4$, find $\int_0^3 xf(x^2) dx$.

2. Find $\frac{dy}{dx}$ for the following. Show all work to justify your answer and make sure to simplify as much as possible.

(a) (6 pts) $y = (\sin x)^x$

(b) (6 pts) $ye^{x^2} = \cos^{-1}(e^y)$

(c) (6 pts) $y = \int_e^{e^x} t^{\ln t} dt$

3. Answer the following.

Given $f(x) = \frac{e^x}{x}$ with $f'(x) = \frac{e^x(x-1)}{x^2}$ and $f''(x) = \frac{e^x(x^2-2x+2)}{x^3}$, find the following for f .

Make sure to state any rules or theorems you utilize.

- (a) (3 pts) State the domain of f .
- (b) (8 pts) Find all asymptote(s) for f . Justify your answer(s) using the appropriate limits.
- (c) (5 pts) Find the intervals of increase and decrease for the function f . Justify your answer(s).
- (d) (5 pts) Find the local maximum and minimum values for the function f . Justify your answer(s).
- (e) (6 pts) Find the intervals of concavity and the inflection points for the function f . Justify your answer(s).
- (f) (7 pts) Use parts (a) - (e) to sketch the graph of f . LABEL the asymptote(s), maximum(s), minimum(s), and inflection point(s) on your graph.

| |
|----------------------------|
| TWO MORE ON THE OTHER SIDE |
|----------------------------|

4. (12 pts) Sketch a function $y = f(x)$ that satisfies **all** of the following conditions. No explanation is necessary. Clearly label all important features of the graph.

(a) $f(-x) = -f(x)$ (b) $f(-1) = 1$ (c) $\lim_{h \rightarrow 0} \frac{f(2+h) - f(2)}{h} > 0$

(d) $\lim_{x \rightarrow -\infty} f(x) = 2$ (e) $\lim_{x \rightarrow -1} f(x) = 3$

5. Some unrelated questions:

- (a) (6 pts) Find the linearization of $f(x) = \sqrt{1-x}$ at $a = -3$ and use the linearization to approximate $\sqrt{5}$. Show all work to justify your answer and make sure to simplify as much as possible.
- (b) (6 pts) Suppose a rectangle is entirely contained in the first quadrant of the xy -plane. The rectangle borders the x -axis and y -axis and its upper right corner touches the curve $y = \frac{2}{x}$. What dimensions minimize the perimeter of the rectangle? Show all work to justify your answer and make sure to simplify as much as possible.
- (c) (6 pts) **True or False:** $\int_{-1}^1 \frac{\sin x}{1+x^2} dx = 0$. Justify your answer for full credit.

END