University of California, San Diego
Department of Mathematics

Instructions

1. **Write your *Name*, *PID*, *Section*, and *Exam Version* on the front of your Blue Book.**
2. **No calculators or other electronic devices are allowed during this exam.**
3. **If you are caught talking or looking at notes, you will receive a grade of zero for this exam.**
4. **You may use one page of notes, but no books or other assistance during this exam.**
5. **Read each question carefully, and answer each question completely.**
6. **Write your solutions clearly in your Blue Book.**
   (a) **Carefully indicate the number and letter of each question and question part.**
   (b) **Present your answers in the same order they appear in the exam.**
   (c) **Start each problem on a new page.**
7. **Show all of your work. No credit will be given for unsupported answers, even if correct.**
8. **Turn in your exam paper with your Blue Book.**

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(0) [1 point] Carefully read and complete the instructions at the top of this exam sheet and any additional instructions written on the chalkboard during the exam.

(This exam is worth 48 points.)

(1) [3 points] Find the equation of the line tangent to $x\cos(y) + 2x^2 + 2xy = 3$ at (1,0).

(2) [4 points] Calculate the following limits or state that they do not exist (DNE).

$$(a)\ \lim_{x\to-\infty} xe^x \qquad\qquad (b)\ \lim_{x\to\infty} x^{1/x}$$

(3) [6 points] Consider the function $f(x) = 2^x$ on $[0, 6]$.

(a) Compute the right endpoint approximation R_3 to $\int_0^6 f(x)dx$.

(b) Write down the most accurate phrase in your blue book:

"The correct answer to Part (a) is **less than** $\int_0^6 f(x)dx$."
"The correct answer to Part (a) is **greater than** $\int_0^6 f(x)dx$."
"The correct answer to Part (a) is **equal to** $\int_0^6 f(x)dx$."

(4) [6 points] A farmer has 24 feet of fencing and wishes to fence off a rectangular field that boarders a straight river. He needs no fence along the river. What are the dimensions of the field that has the largest area?

(5) [6 points] (a) Use linear approximation and the fact that $\sqrt{64} = 8$ to estimate $\sqrt{65}$.

(b) Write down the most accurate phrase in your blue book:

"The correct answer to Part (a) is **less than** $\sqrt{65}$."
"The correct answer to Part (a) is **greater than** $\sqrt{65}$."
"The correct answer to Part (a) is **equal to** $\sqrt{65}$."

(6) [6 points] Calculate the following integrals.

$$(a)\ \int \frac{x^{2/3} + x^{1/2}}{x^{3/2}}dx \qquad (b)\ \int \frac{1}{x^2} + \sec(2x)\tan(2x)dx \qquad (c)\ \int_0^{\pi/2} \sin(2x)dx$$

(7) [6 points] Calculate the derivatives of the following functions.

$$(a)\ \ f(x) = \sin(x)^{\cos(x)} \qquad (b)\ \ g(x) = \cos(\ln(x^2+1)) \qquad (c)\ \ h(x) = \int_1^{2/x} \tan(t^2)dt$$

(8) [10 points] Let $f(x) = \frac{1}{3}x^3 + \frac{1}{2}x^2 - 2x + 3$.

(a) Find the x-coordinates of all critical points of $f(x)$.

(b) Find the intervals of increase and decrease of $f(x)$.

(c) Classify all critical points of $f(x)$ as local maxima, local minima, or neither.

(d) Find the x-coordinates of all points of inflection of $f(x)$.

(e) Find the intervals of concavity of $f(x)$.