• Sit in your assigned seat (circled below).
• Circle your TA discussion section.
• Do not open this test booklet until I say START.
• Turn off all electronic devices and put away all items except a pen/pencil and an eraser.
• Remove hats and sunglasses.
• You must show sufficient work to justify each answer.
• While the test is in progress, we will not answer questions concerning the test material.
• Do not leave early unless you are at the end of a row.
• Quit working and close this test booklet when I say STOP.
• Quickly turn in your test to me or a TA and show your Student ID.

▷ AD1, TR 9:00-10:50, Nick Andersen  ▷ ADH, TR 3:00-3:50, Nathan Rehfuss
▷ AD2, TR 1:00-2:50, Sarah Loeb  ▷ ADJ, TR 9:00-9:50, Dan Schultz
▷ ADA, TR 8:00-8:50, Lisa Hickok  ▷ ADK, TR 10:00-10:50, Dan Schultz
▷ ADB, TR 9:00-9:50, Sneha Chaubey  ▷ ADL, TR 11:00-11:50, Derrek Yager
▷ ADC, TR 10:00-10:50, Sneha Chaubey  ▷ ADM, TR 12:00-12:50, Derrek Yager
▷ ADD, TR 11:00-11:50, Tom Mahoney  ▷ ADN, TR 1:00-1:50, Ben Fulan
▷ ADE, TR 12:00-12:50, Tom Mahoney  ▷ ADO, TR 2:00-2:50, Ben Fulan
▷ ADF, TR 1:00-1:50, Lisa Hickok  ▷ ADP, TR 3:00-3:50, Mahmood Etedadi Aliabadi
▷ ADG, TR 2:00-2:50, Nathan Rehfuss  ▷ ADQ, TR 4:00-4:50, Mahmood Etedadi Aliabadi
1. (5 points) Find $f'(x)$ given that $f(x) = 5x^4 + 2 \sec x - 4 \cot x + 2e^x + 4 \ln x$

2. (5 points) Find $f'(x)$ given that $f(x) = \cos (x^3 + 2)$

3. (5 points) Find $f'(x)$ given that $f(x) = \frac{e^{5x}}{x^3}$

4. (5 points) Find $f'(x)$ given that $f(x) = x^5 \arctan x$
5. (5 points) Find $f'(x)$ given that $f(x) = \tan(\ln(\sin(3x)))$

6. (12 points) Find $\frac{dy}{dx}$ given that $x^5y^2 = 6x + 4y$
7. (12 points) Find the equation of the line tangent to the curve \( f(x) = 5x^2 + 2x + 3 \) at \( x = 1 \). Write your simplified answer in the form \( y = mx + b \).

8. (12 points) Solve the following differential equations given that the graph of each solution goes through the point \((p, w) = (1, 8)\). You must use the given variables.

(a) \( \frac{dw}{dp} = 6p \)

(b) \( \frac{dw}{dp} = 6w \)
9. (4 points each) Circle the correct limit. No partial credit. You do not need to show any work.

(a) \( \lim_{{x \to \infty}} \frac{2 \ln x}{\sqrt{x}} \)

(a) \(-\infty\)  (b) \(-2\)  (c) \(-1\)  (d) 0  (e) 1  (f) 2  (g) \(\infty\)

(b) \( \lim_{{x \to 0}} \frac{e^{10x} - 1}{5x} \)

(a) \(-\infty\)  (b) \(-2\)  (c) \(-1\)  (d) 0  (e) 1  (f) 2  (g) \(\infty\)

(c) \( \lim_{{x \to \infty}} \frac{e^{10x} - 1}{5x} \)

(a) \(-\infty\)  (b) \(-2\)  (c) \(-1\)  (d) 0  (e) 1  (f) 2  (g) \(\infty\)

(d) \( \lim_{{x \to \pi}} \frac{2 \cos x}{(\pi - x)^2} \)

(a) \(-\infty\)  (b) \(-2\)  (c) \(-1\)  (d) 0  (e) 1  (f) 2  (g) \(\infty\)

(e) \( \lim_{{x \to 3}} \frac{e^{x-3} + 1}{2x - 5} \)

(a) \(-\infty\)  (b) \(-2\)  (c) \(-1\)  (d) 0  (e) 1  (f) 2  (g) \(\infty\)
10. (10 points) State the interval upon which the graph of \( f(x) = \ln(x - 4) + \ln(10 - x) \) is increasing and the interval upon which it is decreasing.
11. (9 points) For each $x > 0$, a line goes through the point $(0, 0)$ and a point on the curve $y = x^4 e^{-8x}$. Which value of $x$ gives the line with largest slope?
1. (5 points) __________________

2. (5 points) __________________

3. (5 points) __________________

4. (5 points) __________________

5. (5 points) __________________

6. (12 points) __________________

7. (12 points) __________________

8. (12 points) __________________

9. (20 points) __________________

10. (10 points) __________________

11. (9 points) __________________

**Total (100 points) ______________**