

Please read the following instructions carefully:

- There are **three problems** in this quiz.
- The point distribution is given in the table below.
- Please write each solution on a separate page.
- This is a group quiz. Feel free to discuss the problems with your teammates. **You must, however, write and turn in your own work.**
- Upload your work to Gradescope.

Question:	1	2	3	Total
Points:	2	4	4	10

1. (2 points) Simplify the following expression:

$$\frac{(x^5)(2x^2)(5x)}{2x^2}$$

2. (4 points) Find the equation of the tangent line to $y = x^3 + x + 1$ when $x = 1$.
3. (4 points) Calculate the derivative of $f(x) = (6x^2 + 2x + 1)^4$. Don't simplify the answer.

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Question:	1	2	Total
Points:	5	5	10

1. (5 points) If you hire x workers for a project, your total cost (in dollars) is given by

$$C(x) = 3x^2 - 12x + 60$$

What value of x minimizes your cost? Confirm that the value of x you find is actually a relative minimum.

2. (5 points) Consider the function

$$f(x) = x^3 - 3x + 1$$

Find all critical points and inflection points of the function. Plot the graph of the function using calculus.

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Question:	1	2	3	Total
Points:	2	4	4	10

1. (2 points) Solve for x in the following equation:

$$\frac{2^{-3x+2}}{2^{x-5}} = 2^x$$

2. (4 points) Find the critical points of

$$y = x^2 e^{3x}$$

3. (4 points) Find the derivative of

$$f(x) = \ln(x^4(4x - 2)^3)$$

Once you've taken the derivative, you do not need to simplify further.

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Question:	1	2	Total
Points:	5	5	10

1. (5 points) Evaluate the following integrals:

(a)

$$\int (e^{5x} + x^4 + (2x + 1)^{10}) dx$$

(b)

$$\int_0^1 \left(4x + \frac{5}{x}\right) dx$$

2. (5 points) Write down the integral that computes area enclosed by the curves $y = x$ and $y = 2x^2 + 5x$ between their points of intersection. Do **NOT** evaluate the integral.

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Question:	1	2	Total
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1. Solve the following question:

(a) (3 points) Find a so that

$$f(x) = \frac{3x^2}{8}$$

is a probability density function for $0 \leq x \leq a$.

(b) (2 points) In a factory, the average time between accidents has a probability density functions

$$f(t) = 0.1e^{-0.1t}, \quad 0 \leq t < \infty$$

What is the probability that the next accident happens between 5 and 10 days from now on. Your answer may contain exponentials.

2. Solve the following questions:

(a) (3 points) Consider the function

$$f(x, y) = 5x^3y^2 + e^x + \ln(y)$$

Calculate $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{\partial y}$ and $\frac{\partial^2 f}{\partial x \partial y}$.

(b) (2 points) Let $f(x, y)$ is a function of x and y . Assume we know that

$$f(100, 250) = 3, \quad \frac{\partial f}{\partial x}(100, 250) = 7, \quad \frac{\partial f}{\partial y}(100, 250) = -5.$$

Estimate the value of $f(97, 250)$.