Sample Exam (50 points)
September 26, 2019   Name: _____

> No notes, calculators, or other aids are allowed. Read all directions carefully and write your answers in the space provided. To receive full credit, you must show all of your work.

Math mode is used to display mathematical content in LaTeX, and there are two main forms of math mode: *display mode* and *inline mode*. Question 1 uses *display mode*, which centers the math content on its own line. Question 2 uses *inline mode* to render the math content within a line of text.

1. (10 points) Find an equation for the tangent line to the following curve at the point (0,1).

$$2xy^3 + y^4 = 1 + x^3 y$$

2. (10 points) Use the linearization of $f(x) = \sqrt[3]{x}$ at $x = 8$ to approximate $\sqrt[3]{8.24}$.

3. Evaluate each expression.

   (a) (5 points) $\displaystyle \lim_{x \to \infty} \left(1 + \frac{1}{x}\right)^x$

   (b) (5 points) $\displaystyle \frac{d}{dx}\left[\frac{\sin^2(\pi x)}{\sqrt{3x+1}}\right]$

   (c) (5 points) $\displaystyle \int_1^{e^2} t \ln t \; dt$

4. Using the *displaystyle* command (as in each part of question 3) forces fractions, limits, integrals, etc. to be displayed larger and more clearly even when using inline mode. Without *displaystyle*, those math expressions will be shrunk when using inline mode, like so:

   (a) (5 points) $\lim_{x \to \infty} \left(1 + \frac{1}{x}\right)^x$

   (b) (5 points) $\frac{d}{dx}\left[\frac{\sin^2(\pi x)}{\sqrt{3x+1}}\right]$

   (c) (5 points) $\int_1^{e^2} t \ln t \; dt$