

Name: \_\_\_\_\_

Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page. **SHOW ALL YOUR WORK.**  
**WRITE NEATLY AND LARGE. CIRCLE FINAL ANSWER.**

1. Express the given quantity as a single logarithm.

(a) (5 points)  $a \ln x - b \ln y$

(b) (5 points)  $\ln(\sin(x)) - \ln(\cos(x))$

2. (10 points) Find a formula for the inverse of the function.

$$f(x) = \sqrt{1 - 3x}$$

3. (10 points) Solve the equation for  $x$ .

$$e^{2x+3} - 8 = 0$$

4. (10 points) Eliminate the parameter to find a Cartesian equation of the curve.

$$x = 3 \cos(\theta)$$

$$y = 2 \sin(\theta)$$

5. (5 points) Say we throw a ball into the air with an initial velocity of 30 m/s. We can give the height of the ball by the function  $h(t) = 30t - 9t^2$ . Determine the instantaneous velocity by using its definition. Verify  $v(0) = 30$ .

6. For the following piecewise function, state the value of the each quantity, if it exists. If it does not exist, explain why.

$$f(x) = \begin{cases} 2 - x & x < -1 \\ e^x & -1 \leq x \leq 1 \\ (x - 1)^2 & x > 1 \end{cases}$$

(a) (5 points)  $\lim_{x \rightarrow -1^-} f(x)$

(b) (5 points)  $\lim_{x \rightarrow 1} f(x)$

(c) (5 points)  $\lim_{x \rightarrow -1} f(x)$

7. Evaluate the limit, if it exists.

(a) (10 points)  $\lim_{x \rightarrow 3} \frac{x^2 - 5x + 6}{x - 3}$

(b) (10 points)  $\lim_{s \rightarrow \infty} \frac{s^4 + 2}{s^{-5} + s^3 - 1}$

8. (10 points) Use the Intermediate Value Theorem to show that  $f(x) = x^2$  achieves the value 2.

9. (10 points) Use the definition of the derivative to determine  $f'(a)$  given the following function.

$$f(t) = 1 - t^2$$

10. **Bonus:** (5 Points) Suppose you know that  $\lim_{h \rightarrow 0} e^h$  is identical to  $\lim_{t \rightarrow 0} 1 + t$ , use this, and the definition of the derivative, to evaluate  $f'(x)$  for  $f(x) = e^x$ .