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. (10 points) Find the linearization $L(x)$ of $f(x) = \sin(x)$ at $a = \pi$.

2. (15 points) Car A is traveling west at 40 mi/h and car B is traveling north at 30 mi/h. Both are headed for a collision at the intersection of the two roads. At what rate are the cars approaching each other when car A is 4 mi and car B is 3 mi from the intersection?

3. (10 points) Find the critical number(s) of the function $z(y) = y \ln y$.

4. (15 points) Find the absolute maximum value of f on the given interval.

$$f(t) = \frac{1}{t^2 - 1}, \qquad -1 < t < 1$$

5. (15 points) Find all local maximum and minimum values (and classify each) for

$$d(x) = x^2 e^x$$

6. (10 points) Find the limit. Use L'Hospital's Rule where appropriate. If L'Hospital's Rule can not be applied, explain why.

$$\lim_{x \to 0^+} x^{(-x^2)}$$

7. (15 points) Find a positive number such that the sum of the number and its reciprocal is as small as possible.

8. (10 points) Perform one step of Newton's method to find an approximation for the angle near π radians such that the sine of the angle is the same as the cosine of the angle.

9. **Bonus:** (10 Points) Explain why Newton's method fails when applied to $\sqrt[3]{x} = 0$ for any initial guess $x_1 \neq 0$.