This test has pages 1 – 5. Take a moment to make sure you have them all.
No Calculators Allowed; No Reference Materials; Just You and Your Pencil and Eraser. Show your steps.

1. Let \( g(x) = 24\sqrt[3]{x} + 18\sqrt[3]{x^2} \). Show steps in finding the slope of the line tangent to the graph of \( g \) at the point where \( x = -8 \).

2. Let \( y = \sin(2x) \). Compute the differential \( dy \), and then find the value of \( dy \) when \( x = \pi/2 \) and \( dx = -1/10 \).
3. Use our chapter-three short-cut rules for the following. Use appropriate “lead-ins” so your answers are identifiable.

(a) Let $f(x) = x^2 \ln(x)$. Find $f'(x)$ and $f'(e^3)$. Leave $f'(x)$ in factored form.

(b) Let $g(x) = \frac{\sin(x)}{x}$. Find $g'(x)$ and $g'(\pi/2)$.

(c) Let $f(x) = \arctan(2x)$. Find $f'(x)$ and $f'(\sqrt{2})$. 
4 Use our chapter-three short-cut rules for the following. Use appropriate “lead-ins” so your answers are identifiable.

(a) Let \( G(x) = e^{3x} (x + 3)^2 \). Give \( G'(x) \) in factored form.

(b) Let \( f(x) = 2x \arctan(x) - \ln(1 + x^2) \). Compute \( f'(x) \). Simplify.

(c) Let \( H(x) = e^x \sinh(3x) \). Find \( H'(x) \) and \( H'(0) \).
5. Show steps in computing the value of \( \lim_{x \to 0} \frac{\tan(10x)}{5x} \).

6. Compute the maximum and minimum values of \( f(x) = 2x^3 - 3x^2 - 12x - 1 \) on \([1, 4]\).
7. The point $(1, -2)$ lies on the graph of $y^2 = x^3 + 3x^2$. Find an equation for the line tangent to the curve at that point.

8. At noon, Abercrombie was three miles west of the crossroads and driving toward the crossroads at 40 MPH.
   
   At the same instant, Benson was four miles north of the crossroads and driving northward away from the crossroads at 31 MPH.
   
   Compute the rate at which the distance between Abercrombie and Benson is changing at the instant in question. Explain whether they are drawing closer to each other.