

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

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

(c) Let  $\mathbf{H}(x) = e^x \sinh(3x)$ . Find  $\mathbf{H}'(x)$  and  $\mathbf{H}'(0)$ .

5 Show steps in computing the value of  $\lim_{x \rightarrow 0} \frac{\tan(10x)}{5x}$

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.