

Name \_\_\_\_\_ Period \_\_\_\_\_ Date \_\_\_\_\_

## NON-CALCULATOR Section

Vocabulary: **Directions** – Define each word *and* give an example.

1. Right-Hand Derivative
2. Quotient Rule (derivatives)
3. Velocity

Short Answer

4. Describe each of the ways a function can fail to be differentiable at a point.
5. What is the difference between displacement and position?
6. Describe how to determine when a particle in motion along a line is moving to the right.

Review

7. Calculate the limit:  $\lim_{x \rightarrow 4} \frac{-x^2 + 11x - 28}{x^2 - 4x}$

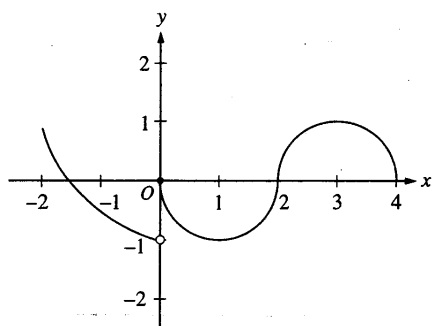
8. Determine any point(s) of discontinuity for the function  $f(x) = \frac{|x|}{x}$ . Then tell which type of continuity it is.

Unit Two Problems

**Directions:** Show all work completed to obtain your final answers. Partial credit may be given for incorrect answers. No credit may be given for problems without work if it is required to obtain the answer. Circle or box in your final answers.

9. What is the maximum acceleration attained on the interval  $0 \leq t \leq 3$  by the particle whose velocity is given by  $v(t) = t^3 - 3t^2 + 12t + 4$ ?

10. The graph of the function  $f$  shown in the figure below has a vertical tangent at the point  $(2, 0)$  and horizontal tangents at the points  $(1, -1)$  and  $(3, 1)$ .



For what value(s) of  $x$ ,  $-2 < x < 4$ , is  $f$  not differentiable?

11. Use the definition of the derivative to find the derivative of  $f(x) = x^2 - 2x + 3$  at  $x = 2$ . Show your work.

12. A particle moves along a line so that its position at any time  $t \geq 0$  is given by the function  $s(t) = 2t^3 - 5t - 3$ , where  $s$  is measured in feet and  $t$  is measured in seconds.

a) Find the displacement during the first 5 seconds.

b) Find the average velocity during the first 5 seconds.

c) Find the instantaneous velocity when  $t = 5$ .

d) Find the acceleration of the particle when  $t = 5$ .

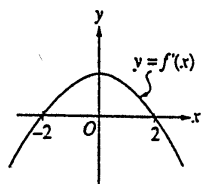
e) At what value(s) of  $t$  does the particle change direction?

Multiple Choice Questions: **Circle the best answer.**

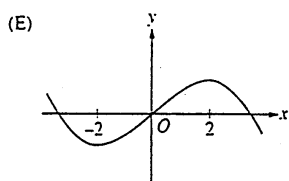
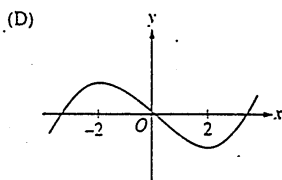
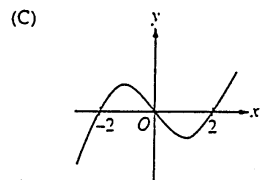
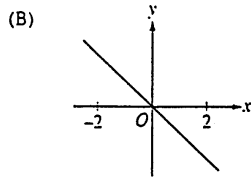
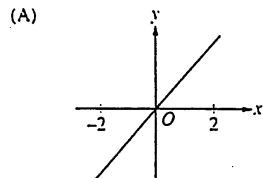
13. What is the instantaneous rate of change at  $x = 2$  for the function  $f$  given by  $f(x) = \frac{x^2 - 2}{x - 1}$ ?

- (A)  $-2$                       (B)  $\frac{1}{6}$                       (C)  $\frac{1}{2}$                       (D)  $2$                       (E)  $6$

14. The graph of the derivative of  $f$  is shown in the figure below.



Which of the following could be the graph of  $f$ ?



15. Let  $f$  and  $g$  be differentiable functions with the following properties:

(i)  $g(x) > 0$  for all  $x$

(ii)  $f(0) = 1$

If  $h(x) = f(x)g(x)$  and  $h'(x) = f(x)g'(x)$ , then  $f'(x) =$

- (A)  $f'(x)$                       (B)  $g(x)$                       (C)  $x$                       (D)  $0$                       (E)  $1$

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## CALCULATOR Section

16. Let  $f$  be a function such that  $\lim_{h \rightarrow 0} \frac{f(2+h) - f(2)}{h} = 5$ . Which of the following must be true?

- I.  $f$  is continuous at  $x = 2$ .
- II.  $f$  is differentiable at  $x = 2$ .
- III. The derivative of  $f$  is continuous at  $x = 2$ .

(A) I only      (B) II only      (C) I and II only      (D) I and III only      (E) II and III only

17. Let  $f$  be the function given by  $f(x) = 2e^{4x^2}$ . For what value of  $x$  is the slope of the line tangent to the graph of  $f$  at  $(x, f(x))$  equal to 3?

(A) 0.168      (B) 0.276      (C) 0.318      (D) 0.342      (E) 0.551

18. Suppose that  $u$  and  $v$  are differentiable at  $x = 5$  and  $u(5) = 2$ ,  $v(5) = 2$ ,  $u'(5) = -3$ , and

$v'(5) = 6$ . Find  $\frac{d}{dx}(v - 3uv)$  at  $x = 5$ .