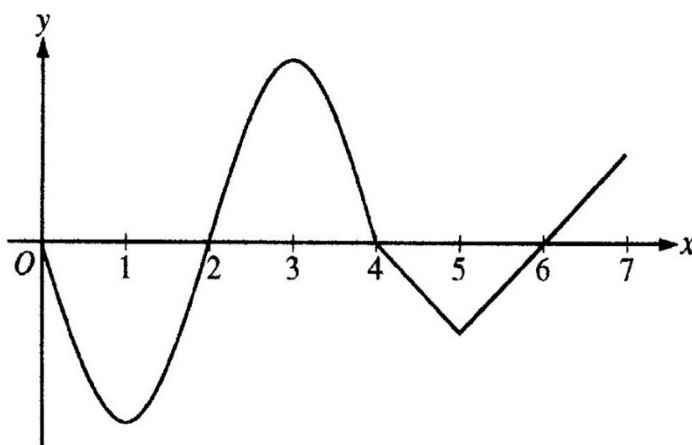


Name \_\_\_\_\_ DUE DATE: \_\_\_\_\_

**Directions:**

- Read each problem carefully and use your knowledge of calculus to determine your answer.
- In order to receive FULL CREDIT you must either SHOW ALL WORK or EXPLAIN how you got your answer!! PLEASE NOTE: A multiple choice answer alone without any work will only receive half credit.

1)

Graph of  $f'$ 

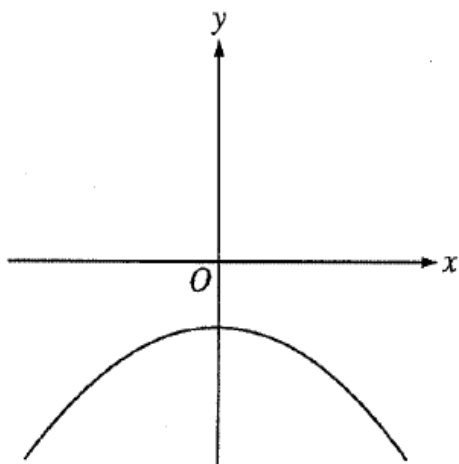
The graph of  $f'$ , the derivative of the function  $f$ , is shown above. On which of the following intervals is  $f$  decreasing?

- (A)  $[2, 4]$  only
- (B)  $[3, 5]$  only
- (C)  $[0, 1]$  and  $[3, 5]$
- (D)  $[2, 4]$  and  $[6, 7]$
- (E)  $[0, 2]$  and  $[4, 6]$

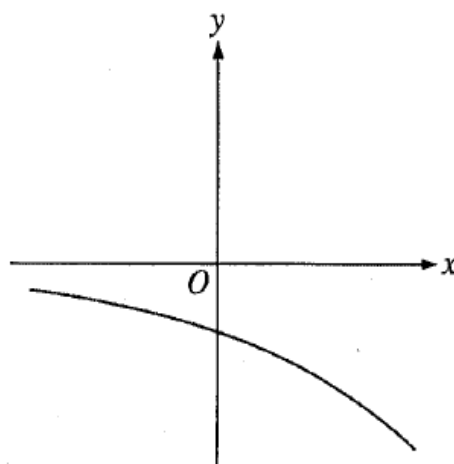
2) Evaluate:  $\int t \cos(2t)^2 dt$

3) The function  $f$  has the property that  $f(x)$ ,  $f'(x)$ , and  $f''(x)$  are negative for all real values  $x$ . Which of the following could be the graph of  $f$ ?

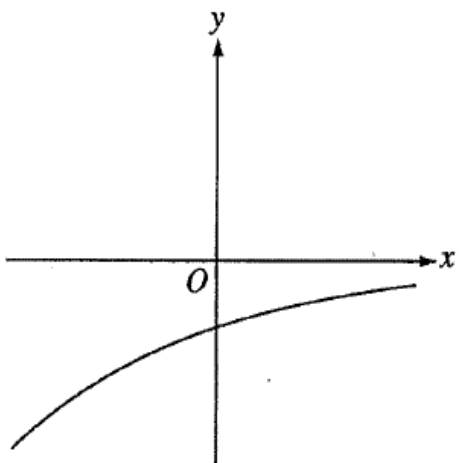
(A)



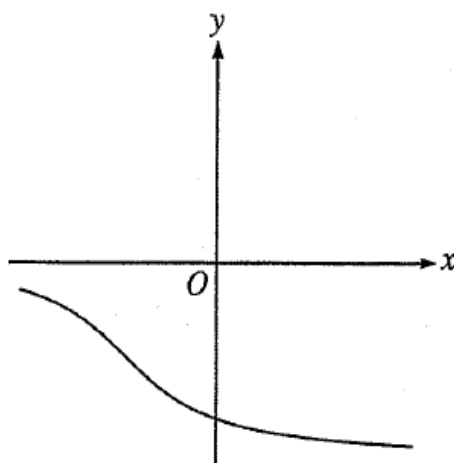
(B)



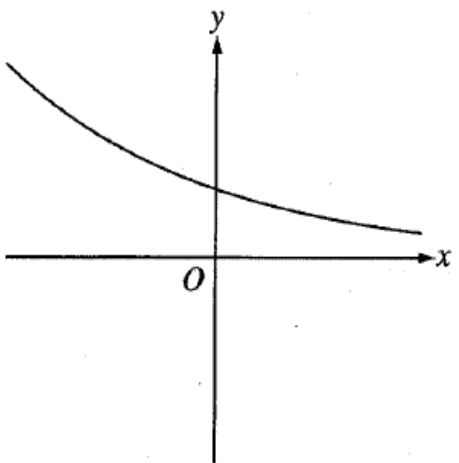
(C)



(D)



(E)



- 4) If  $y = xy + x^2 + 1$ , then when  $x = -1$ ,  $\frac{dy}{dx}$  is
- (A)  $\frac{1}{2}$       (B)  $-\frac{1}{2}$       (C)  $-1$       (D)  $-2$       (E) nonexistent

- 5) The top of a 25-foot ladder is sliding down a vertical wall at a constant rate of 3 feet per minute. When the top of the ladder is 7 feet from the ground, what is the rate of change, in feet per minute, of the distance between the bottom of the ladder and the wall?
- (A)  $-\frac{7}{8}$       (B)  $-\frac{7}{24}$       (C)  $\frac{7}{24}$       (D)  $\frac{7}{8}$       (E)  $\frac{21}{25}$

- 6) The slope of the tangent line to the graph of  $4x^2 + cx - 2e^y = -2$  at  $x = 0$  is 4. Find the value of  $c$ .

- 7)
- |        |   |     |     |     |     |
|--------|---|-----|-----|-----|-----|
| $x$    | 0 | 0.5 | 1.0 | 1.5 | 2.0 |
| $f(x)$ | 3 | 3   | 5   | 8   | 13  |
- A table of values for a continuous function  $f$  is shown above. If four equal subintervals of  $[0, 2]$  are used, which of the following is the trapezoidal approximation of  $\int_0^2 f(x) dx$ ?
- (A) 8      (B) 12      (C) 16      (D) 24      (E) 32

8) Find the derivative of  $f(x) = \int_0^{x^2} \ln(t^2 + 1)dt$

9) If  $f(x) = \begin{cases} 8 - x^2 & \text{for } -2 \leq x \leq 2 \\ x^2 & \text{elsewhere} \end{cases}$  then find  $\int_{-1}^3 f(x)dx$ .

10) What is the average value of the function  $g(x) = (2x + 3)^2$  on the interval from  $x = -3$  to  $x = -1$ ?

- 11) A particle moves along the  $x$ -axis in such a way that at time  $t > 0$  its position coordinate is  $x = \sin(e^t)$ .
- (a) Find the velocity and acceleration of the particle at time  $t$ .
  - (b) At what time does the particle first have zero velocity?
  - (c) What is the acceleration of the particle at the time determined in part (b)?

- 12) The tide moves sand from Sandy Point Beach at a rate modeled by the function  $R$ , given by  $R(t) = 2 + 5 \sin\left(\frac{4\pi}{25}t\right)$ . A pumping station adds sand to the beach at a rate modeled by the function  $S$ , given by  $S(t) = \frac{15t}{1+3t}$ . Both  $R(t)$  and  $S(t)$  have units of cubic yards per hour and  $t$  is measured in hours for  $0 \leq t \leq 6$ . At time  $t = 0$ , the beach contains 2500 cubic yards of sand.
- How much sand will the tide remove from the beach during this 6-hour period? Indicate units of measure.
  - Write an expression for  $Y(t)$ , the total number of cubic yards of sand on the beach at time  $t$ .
  - Find the rate at which the total amount of sand on the beach is changing at time  $t = 4$ .
  - For  $0 \leq t \leq 6$ , at what time  $t$  is the amount of sand on the beach a minimum? What is the minimum value? Justify your answers.

