

Complete all the following on notebook paper.

_____ 1.

Population y grows according to the equation $\frac{dy}{dt} = ky$, where k is a constant and t is measured in years. If the population doubles every 10 years, then the value of k is

- (A) 0.069 (B) 0.200 (C) 0.301 (D) 3.322 (E) 5.000

_____ 2.

If $a \neq 0$, then $\lim_{x \rightarrow a} \frac{x^2 - a^2}{x^4 - a^4}$ is

- (A) $\frac{1}{a^2}$ (B) $\frac{1}{2a^2}$ (C) $\frac{1}{6a^2}$ (D) 0 (E) nonexistent

_____ 3.

If f is a continuous function and if $F'(x) = f(x)$ for all real numbers x , then $\int_1^3 f(2x) dx =$

- (A) $2F(3) - 2F(1)$
(B) $\frac{1}{2}F(3) - \frac{1}{2}F(1)$
(C) $2F(6) - 2F(2)$
(D) $F(6) - F(2)$
(E) $\frac{1}{2}F(6) - \frac{1}{2}F(2)$

_____ 4.

Let f be the function given by $f(x) = |x|$. Which of the following statements about f are true?

- I. f is continuous at $x = 0$.
II. f is differentiable at $x = 0$.
III. f has an absolute minimum at $x = 0$.

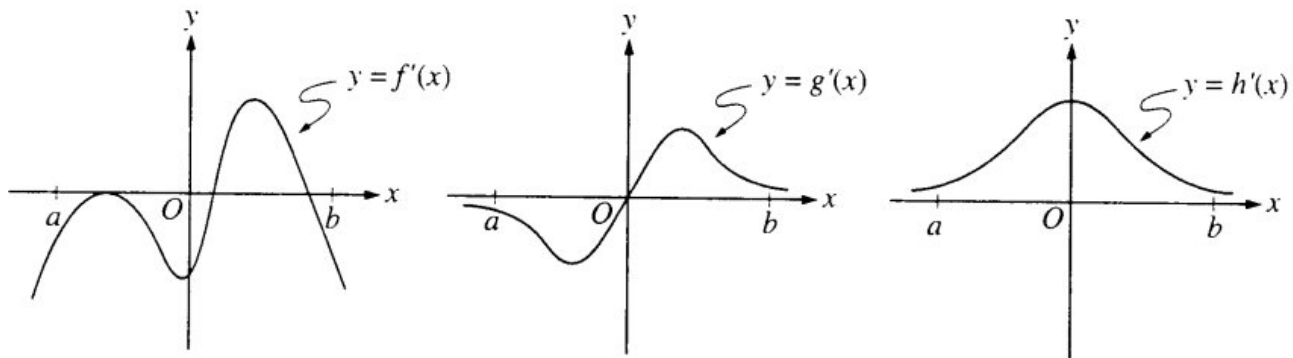
- (A) I only (B) II only (C) III only (D) I and III only (E) II and III only

5.

The first derivative of the function f is given by $f'(x) = \frac{\cos^2 x}{x} - \frac{1}{5}$. How many critical values does f have on the open interval $(0,10)$?

- (A) One
- (B) Three
- (C) Four
- (D) Five
- (E) Seven

6.



The graphs of the derivatives of the functions f , g , and h are shown above. Which of the functions f , g , or h have a relative maximum on the open interval $a < x < b$?

- (A) f only
- (B) g only
- (C) h only
- (D) f and g only
- (E) f , g , and h

7.

The radius of a circle is decreasing at a constant rate of 0.1 centimeter per second. In terms of the circumference C , what is the rate of change of the area of the circle, in square centimeters per second?

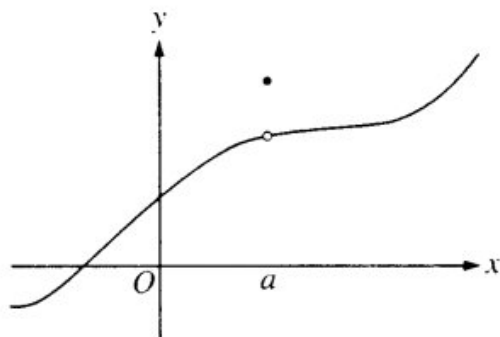
- (A) $-(0.2)\pi C$
- (B) $-(0.1)C$
- (C) $-\frac{(0.1)C}{2\pi}$
- (D) $(0.1)^2 C$
- (E) $(0.1)^2 \pi C$

8.

Let f be the function given by $f(x) = 3e^{2x}$ and let g be the function given by $g(x) = 6x^3$. At what value of x do the graphs of f and g have parallel tangent lines?

- (A) -0.701
- (B) -0.567
- (C) -0.391
- (D) -0.302
- (E) -0.258

9.



The graph of a function f is shown above. Which of the following statements about f is false?

- (A) f is continuous at $x = a$.
- (B) f has a relative maximum at $x = a$.
- (C) $x = a$ is in the domain of f .
- (D) $\lim_{x \rightarrow a^+} f(x)$ is equal to $\lim_{x \rightarrow a^-} f(x)$.
- (E) $\lim_{x \rightarrow a} f(x)$ exists.

10.

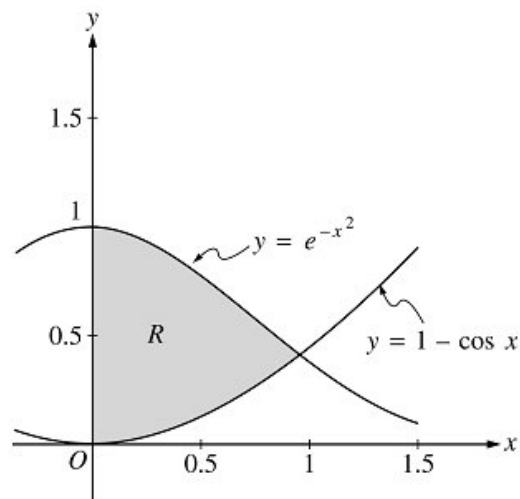
x	2	5	7	8
$f(x)$	10	30	40	20

The function f is continuous on the closed interval $[2, 8]$ and has values that are given in the table above. Using the subintervals $[2, 5]$, $[5, 7]$, and $[7, 8]$, what is the trapezoidal approximation of

$$\int_2^8 f(x) dx?$$

- (A) 110
- (B) 130
- (C) 160
- (D) 190
- (E) 210

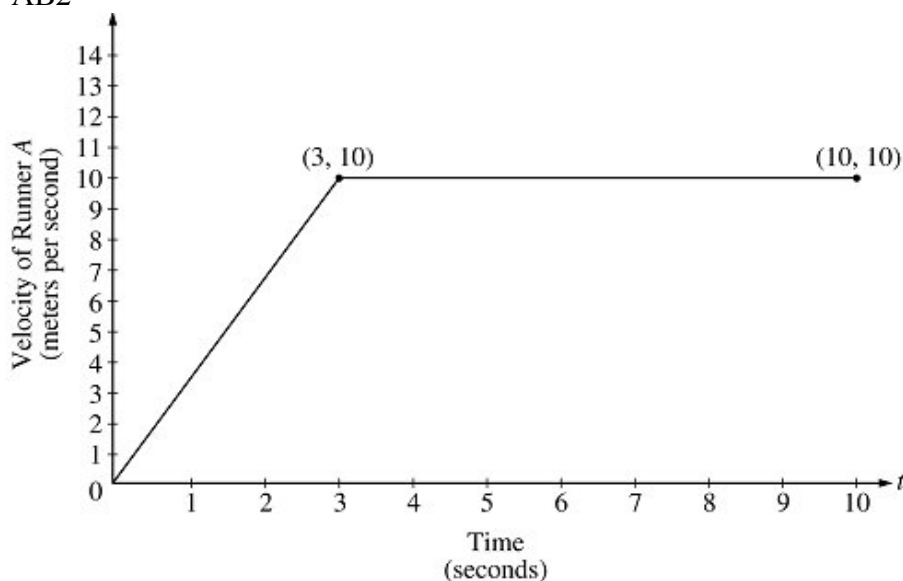
11. 2000—AB1



Let R be the shaded region in the first quadrant enclosed by the graphs of $y = e^{-x^2}$, $y = 1 - \cos x$, and the y -axis, as shown in the figure above.

- Find the area of the region R .
- Find the volume of the solid generated when the region R is revolved about the x -axis.
- The region R is the base of a solid. For this solid, each cross section perpendicular to the x -axis is a square. Find the volume of this solid.

12. 2000—AB2



Two runners, A and B , run on a straight racetrack for $0 \leq t \leq 10$ seconds. The graph above, which consists of two line segments, shows the velocity, in meters per second, of Runner A . The velocity, in meters per second, of Runner B is given by the function v defined by $v(t) = \frac{24t}{2t+3}$.

- Find the velocity of Runner A and the velocity of Runner B at time $t = 2$ seconds. Indicate units of measure.
- Find the acceleration of Runner A and the acceleration of Runner B at time $t = 2$ seconds. Indicate units of measure.
- Find the total distance run by Runner A and the total distance run by Runner B over the time interval $0 \leq t \leq 10$ seconds. Indicate units of measure.