23. If $F(x) = \int_4^{x^2} \sqrt{t}\, dt$ for all real numbers $x > 0$, then $F'(x) =$

(A) $-\frac{1}{2x}$ (B) $\sqrt{x}$ (C) x (D) $2x^2$ (E) $\frac{2x^3 - 16}{3}$

26. Let g be the function defined by $g(x) = \int_{-1}^{x} \frac{t^3 - t^2 - 6t}{\sqrt{t^2 + 7}}\, dt$. On which of the following intervals is g decreasing?

(A) $x \le -2$ and $0 \le x \le 3$

(B) $x \le -2$ and $x \ge 3$

(C) $-2 \le x \le 0$ and $x \ge 3$

(D) $-2 \le x \le 3$

(E) $x \le -1$

28. Let g be a continuously differentiable function with $g(1) = 6$ and $g'(1) = 3$. What is $\lim_{x \to 1} \frac{\int_1^x g(t)\, dt}{g(x) - 6}$?

(A) 0 (B) $\frac{1}{2}$ (C) 1 (D) 2 (E) The limit does not exist.

x	0	1	2	3
$f(x)$	5	2	3	6
$f'(x)$	−3	1	3	4

80. The derivative of the function f is continuous on the closed interval $[0, 4]$. Values of f and f' for selected values of x are given in the table above. If $\int_0^4 f'(t)\, dt = 8$, then $f(4) =$

(A) 0 (B) 3 (C) 5 (D) 10 (E) 13

25. $\lim_{h \to 0} \frac{\sin\left(\frac{\pi}{3} + h\right) - \sin\left(\frac{\pi}{3}\right)}{h}$ is

(A) 0 (B) $\frac{1}{2}$ (C) 1 (D) $\frac{\sqrt{3}}{2}$ (E) nonexistent

Question 1

There is no snow on Janet's driveway when snow begins to fall at midnight. From midnight to 9 A.M., snow accumulates on the driveway at a rate modeled by $f(t) = 7te^{\cos t}$ cubic feet per hour, where t is measured in hours since midnight. Janet starts removing snow at 6 A.M. $(t = 6)$. The rate $g(t)$, in cubic feet per hour, at which Janet removes snow from the driveway at time t hours after midnight is modeled by

$$g(t) = \begin{cases} 0 & \text{for } 0 \le t < 6 \\ 125 & \text{for } 6 \le t < 7 \\ 108 & \text{for } 7 \le t \le 9. \end{cases}$$

(a) How many cubic feet of snow have accumulated on the driveway by 6 A.M.?

(b) Find the rate of change of the volume of snow on the driveway at 8 A.M.

(c) Let $h(t)$ represent the total amount of snow, in cubic feet, that Janet has removed from the driveway at time t hours after midnight. Express h as a piecewise-defined function with domain $0 \le t \le 9$.

(d) How many cubic feet of snow are on the driveway at 9 A.M.?