7. Administrators at Massachusetts General Hospital believe that the hospital's expenditures $E(B)$, measured in dollars, are a function of how many beds B are in use with

$$E(B) = 14000 + (B+1)^2.$$

On the other hand, the number of beds B is a function of time t, measured in days, and it is estimated that

$$B(t) = 20\sin\left(\frac{t}{10}\right) + 50.$$

At what rate are the expenditures decreasing when $t = 100$?

(A) 120 dollars/day

(B) 125 dollars/day

(C) 130 dollars/day

(D) 135 dollars/day

(E) 140 dollars/day

If $\frac{d}{dx}[f(x)] = g(x)$ and $\frac{d}{dx}[g(x)] = f(3x)$, then $\frac{d^2}{dx^2}[f(x^2)]$ is

(A) $4x^2 f(3x^2) + 2g(x^2)$

(B) $f(3x^2)$

C) $f(x^4)$

(D) $2x f(3x^2) + 2g(x^2)$

(E) $2x f(3x^2)$

6. If $f(x) = 2x + \sin x$ and the function g is the inverse of f, then $g'(2) =$

(A) 0.324
(B) 0.342
(C) 0.360
(D) 0.378
(E) 0.396

If $g(x) = \sqrt[3]{x-1}$ and f is the inverse function of g, then $f'(x) =$

(A) $3x^2$

(B) $3(x-1)^2$

(C) $-\frac{1}{3}(x-1)^{-4/3}$

(D) $\frac{1}{3}(x-1)^{2/3}$

(E) does not exist

12. Let $f(x) = \dfrac{\ln e^{2x}}{x-1}$ for $x > 1$. If g is the inverse of f, then $g'(3) =$

(A) 2 (B) 1 (C) 0 (D) –1 (E) –2

5. If $y = u + 2e^u$ and $u = 1 + \ln x$, find $\frac{dy}{dx}$ when $x = \frac{1}{e}$

(A) e (B) $2e$ (C) $3e$ (D) $\frac{2}{e}$ (E) $\frac{3}{e}$

If $y = \sin u$, $u = v - \frac{1}{v}$, and $v = \ln x$, then value of $\frac{dy}{dx}$ at $x = e$ is

(A) 0

(B) 1

(C) $\frac{1}{e}$

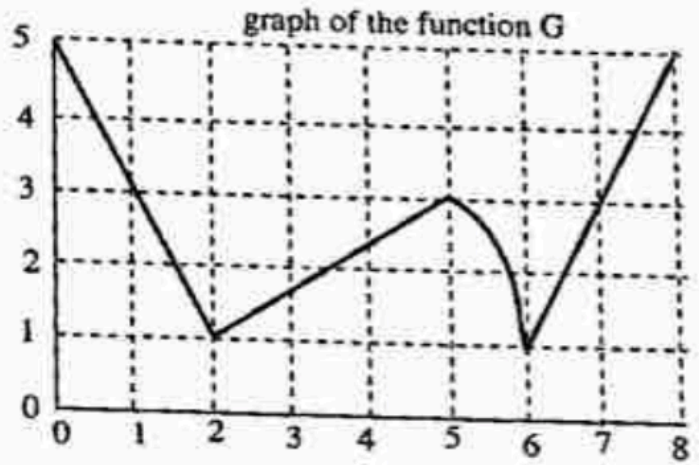
(D) $\frac{2}{e}$

(E) $\cos e$

3. The function F is defined by

$$F(x) = G[x + G(x)]$$

where the graph of the function G is shown at the right.



The approximate value of $F'(1)$ is

(A) $\frac{7}{3}$

(B) $\frac{2}{3}$

(C) -2

(D) -1

(E) $-\frac{2}{3}$

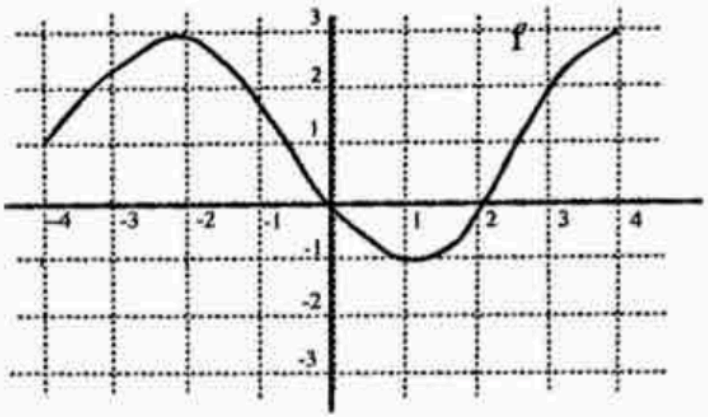
Ans

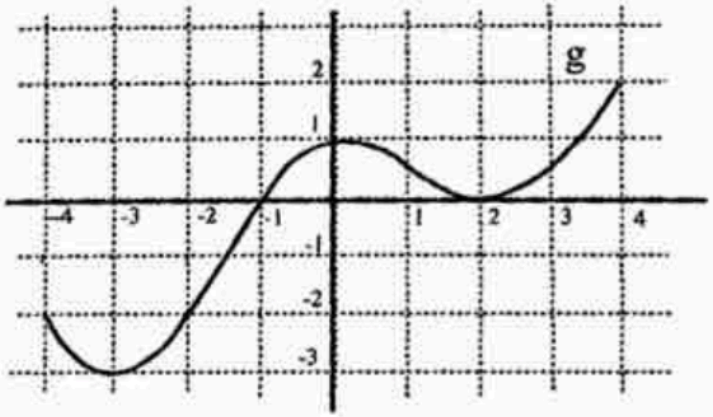
19. Suppose that g is a function with the following two properties: $g(-x) = g(x)$ for all x, and $g'(a)$ exists. Which of the following must necessarily be equal to $g'(-a)$?

(A) $g'(a)$ (B) $-g'(a)$ (C) $\frac{1}{g'(a)}$ (D) $-\frac{1}{g'(a)}$ (E) none

Ans

17. The composite function h is defined by $h(x) = f[g(x)]$, where f and g are functions whose graphs are shown below. The graph of f has horizontal tangents at $x = -2$ and $x = 1$. The graph of g has horizontal tangents at $x = -3$, 0 and 2.





The number of points on the graph of h where there are horizontal tangent lines is

(A) 3 (B) 4 (C) 5 (D) 6 (E) 7

Ans