Spring Break Extra Credit MC (Non-Calculators) **Part 1 (30 Questions, 60 mins)**

(Show work on test. Make corrections in different color ink (or use highlighter)

1) Find the value of $\lim_{x \to 2^-} \frac{2x}{x-2}$

(A) $-\infty$

(B) $\frac{1}{2}$

(C) 1

(D) 2

(E) ∞

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2) Evaluate $\lim_{x \to -1} \frac{x^2 - 5x - 6}{x^2 - 1}$

(A) 1

(B) 3

(C) $\frac{7}{2}$

(D) 12

(E) indeterminate

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3) $\lim_{x \to 2} \frac{2 - x}{x^2 - 4} =$

(A) $-\frac{1}{2}$

(B) $-\frac{1}{4}$

(C) $\frac{1}{4}$

(D) $\frac{1}{2}$

(E) does not exist

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4) $f(x) = 2x^3 - 6x^2 + 6x - 1$ has a point of inflection located at

(A) $(0, -1)$

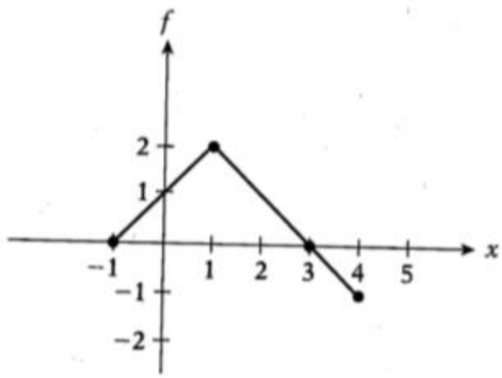
(B) $(1, 1)$

(C) $(2, 3)$

(D) $(1, 0)$

(E) $(-1, 1)$

5) Find the average value of $f(x)$ on the interval $[-1, 4]$ in the figure shown.



(A) $-\frac{1}{5}$

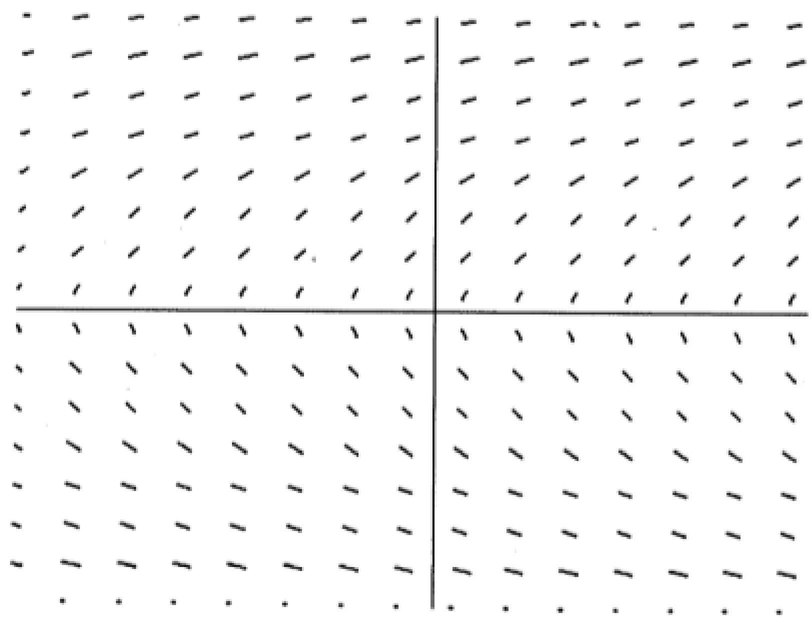
(B) $\frac{7}{10}$

(C) $\frac{9}{10}$

(D) $\frac{7}{2}$

(E) $\frac{35}{2}$

6) Which equation has the slope field shown below?



(A) $\frac{dy}{dx} = \frac{5}{y}$ (B) $\frac{dy}{dx} = \frac{5}{x}$ (C) $\frac{dy}{dx} = \frac{x}{y}$

(D) $\frac{dy}{dx} = 5y$ (E) $\frac{dy}{dx} = x + y$

7) An object moving in a straight line has velocity given by the equation $v(t) = 4t + e^{t-2}$. At time $t = 2$ the object's position, $y(t)$, is given by $y(2) = 3$. The function, $y(t)$, describing the object's position for any time $t > 0$ is

(A) $y(t) = 9t - 15$

(B) $y(t) = 2t^2 + e^{t-2} + 9$

(C) $y(t) = 9t + 9$

(D) $y(t) = 2t^2 + e^{t-2} - 6$

(E) $y(t) = 9t - 6$

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8) Consider a continuous function f with the properties that f is concave up on the interval $[-1, 3]$ and concave down on the interval $[3, 5]$. Which of the following statements is true?

(A) $f''(2) > 0$ and $f''(4) < 0$.

(B) $f''(2) < 0$ and $f''(4) > 0$.

(C) $f''(3) > 0$ and $x = 3$ is a point of inflection of f.

(D) Both (A) and (C)

(E) Both (B) and (C)

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9) A spherical balloon is being filled with water so that its volume increases at a rate of 100 cm^3/s. How fast is the radius of the balloon increasing when the diameter is 50 cm? The volume of a sphere of radius r is $\frac{4}{3}\pi r^3$.

(A) $\frac{1}{100\pi}$ cm/s

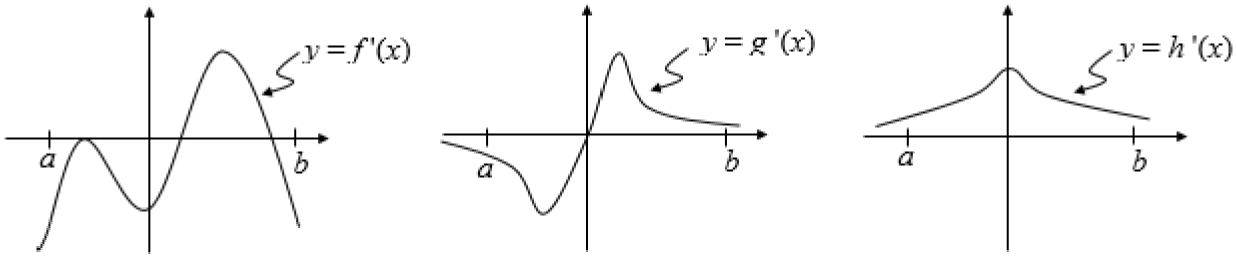
(B) $\frac{1}{25\pi}$ cm/s

(C) $\frac{1}{50\pi}$ cm/s

(D) $\frac{1}{75\pi}$ cm/s

(E) There is not enough information to determine the answer.

10)



The graphs of the derivatives of 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

11)

__________ Find the derivative of $f(x) = \dfrac{3x^2}{x-7}$

a) $\dfrac{42x-3x^2}{(x-7)^2}$ b) $\dfrac{9x^2-42x}{(x-7)^2}$ c) $6x$ d) $\dfrac{3x(x-14)}{(x-7)^2}$ e) none of these

12)

__________ Find $\dfrac{dy}{dx}$ for the following: $y^2 - 3xy + 7x = 2$

a) $\dfrac{dy}{dx} = \dfrac{3y-5}{2y-3x}$ b) $\dfrac{dy}{dx} = \dfrac{3y-7}{2y-3}$ c) $\dfrac{dy}{dx} = \dfrac{3y-5}{2y-3}$ d) $\dfrac{dy}{dx} = \dfrac{3y-7}{2y-3x}$

e) none of these

13) An equation of the line tangent to $y = x^3 + 3x^2 + 2$ at its point of inflection is

a) $y = -6x - 6$ b) $y = -3x + 1$ c) $y = 2x + 10$ d) $y = 3x - 1$ e) $y = 4x + 1$

14) If $y = \cos^2 x - \sin^2 x$, then $y' =$

(A) -1

(B) 0

(C) $-2(\cos x + \sin x)$

(D) $2(\cos x + \sin x)$

(E) $-4(\cos x)(\sin x)$

15) $\int \frac{x-2}{x-1}\, dx =$

(A) $-\ln|x-1| + C$

(B) $x + \ln|x-1| + C$

(C) $x - \ln|x-1| + C$

(D) $x + \sqrt{x-1} + C$

(E) $x - \sqrt{x-1} + C$

16)

If $\int_2^4 f(x)\,dx = 6$, then $\int_2^4 (f(x)+3)\,dx =$

(A) 3

(B) 6

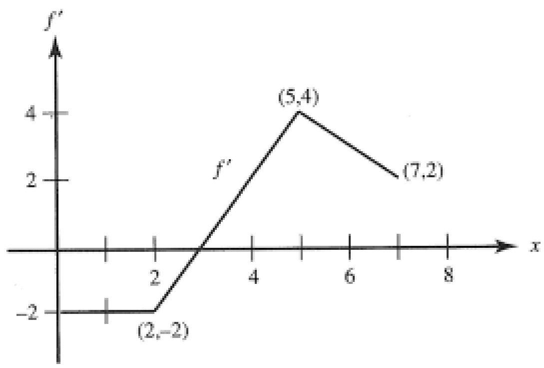
(C) 9

(D) 12

(E) 15

17)

The graph of f' is shown below. If $f(7) = 3$ then $f(1) =$



(A) −10 (B) −4 (C) −3 (D) 10 (E) 16

18) Using the substitution $u = x^2 - 3$, $\int_{-1}^{4} x\left(x^2 - 3\right)^5\,dx$ is equal to which of the following?

(A) $2\int_{-2}^{13} u^5\,du$

(B) $\int_{-2}^{13} u^5\,du$

(C) $\frac{1}{2}\int_{-2}^{13} u^5\,du$

(D) $\int_{-1}^{4} u^5\,du$

(E) $\frac{1}{2}\int_{-1}^{4} u^5\,du$

19)

x	2	3	5	8	13
$f(x)$	6	-2	-1	3	9

The function f is continuous on the closed interval $[2, 13]$ and has values as shown in the table above. Using the intervals $[2, 3]$, $[3, 5]$, $[5, 8]$, and $[8, 13]$, what is the approximation of $\int_2^{13} f(x)\,dx$ obtained from a left Riemann sum?

(A) 6 (B) 14 (C) 28 (D) 32 (E) 50

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20)

The graph of $y = 3x^4 - 16x^3 + 24x^2 + 48$ is concave down for

(A) $x < 0$

(B) $x > 0$

(C) $x < -2$ or $x > -\frac{2}{3}$

(D) $x < \frac{2}{3}$ or $x > 2$

(E) $\frac{2}{3} < x < 2$

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21)

t (sec)	0	2	4	6
$a(t)$ (ft/sec^2)	5	2	8	3

The data for the acceleration $a(t)$ of a car from 0 to 6 seconds are given in the table above. If the velocity at $t = 0$ is 11 feet per second, the approximate value of the velocity at $t = 6$, computed using a left-hand Riemann sum with three subintervals of equal length, is

(A) 26 ft/sec (B) 30 ft/sec (C) 37 ft/sec (D) 39 ft/sec (E) 41 ft/sec

22)

$$f(x) = \begin{cases} cx + d & \text{for } x \le 2 \\ x^2 - cx & \text{for } x > 2 \end{cases}$$

Let f be the function defined above, where c and d are constants. If f is differentiable at $x = 2$, what is the value of $c + d$?

(A) -4 (B) -2 (C) 0 (D) 2 (E) 4

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23)

$$f(x) = \begin{cases} x + 2 & \text{if } x \le 3 \\ 4x - 7 & \text{if } x > 3 \end{cases}$$

Let f be the function given above. Which of the following statements are true about f ?

I. $\lim_{x \to 3} f(x)$ exists.

II. f is continuous at $x = 3$.

III. f is differentiable at $x = 3$.

(A) None

(B) I only

(C) II only

(D) I and II only

(E) I, II, and III

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24)

Which of the following is the solution to the differential equation $\frac{dy}{dx} = \frac{x^2}{y}$ with the initial condition $y(3) = -2$?

(A) $y = 2e^{-9+x^3/3}$

(B) $y = -2e^{-9+x^3/3}$

(C) $y = \sqrt{\frac{2x^3}{3}}$

(D) $y = \sqrt{\frac{2x^3}{3} - 14}$

(E) $y = -\sqrt{\frac{2x^3}{3} - 14}$

25)

$$\frac{d}{dx}\left(\int_0^{x^2} \sin\left(t^3\right) dt\right) =$$

(A) $-\cos\left(x^6\right)$ (B) $\sin\left(x^3\right)$ (C) $\sin\left(x^6\right)$ (D) $2x\sin\left(x^3\right)$ (E) $2x\sin\left(x^6\right)$

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26)

If $y = \left(x^3 + 1\right)^2$, then $\frac{dy}{dx} =$

(A) $\left(3x^2\right)^2$ (B) $2\left(x^3 + 1\right)$ (C) $2\left(3x^2 + 1\right)$ (D) $3x^2\left(x^3 + 1\right)$ (E) $6x^2\left(x^3 + 1\right)$

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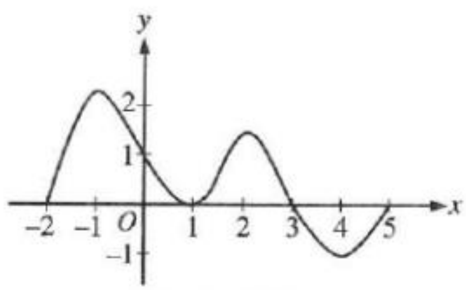
27)



Graph of f'

The graph of f', the derivative of f, is shown above for $-2 \le x \le 5$. On what intervals is f increasing?

(A) $[-2, 1]$ only

(B) $[-2, 3]$

(C) $[3, 5]$ only

(D) $[0, 1.5]$ and $[3, 5]$

(E) $[-2, -1]$, $[1, 2]$, and $[4, 5]$

28)

If $\dfrac{dy}{dx} = (1+\ln x)\,y$ and if $y = 1$ when $x = 1$, then $y =$

(A) $e^{\frac{x^2-1}{x^2}}$

(B) $1+\ln x$

(C) $\ln x$

(D) $e^{2x+x\ln x-2}$

(E) $e^{x\ln x}$

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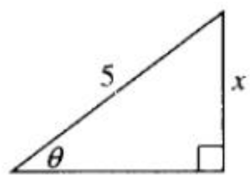
29)



In the triangle shown above, if θ increases at a constant rate of 3 radians per minute, at what rate is x increasing in units per minute when x equals 3 units?

(A) 3 (B) $\dfrac{15}{4}$ (C) 4 (D) 9 (E) 12

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30)

$$\int_1^e \frac{x^2+1}{x}\,dx =$$

(A) $\dfrac{e^2-1}{2}$ (B) $\dfrac{e^2+1}{2}$ (C) $\dfrac{e^2+2}{2}$ (D) $\dfrac{e^2-1}{e^2}$ (E) $\dfrac{2e^2-8e+6}{3e}$

Spring Break Extra Credit MC (Calculator Active) **Part 2(15 Questions, 45 mins)**

(Show work on test. Make corrections in different color ink (or use highlighter)

Calculator section

1)

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

2)

The base of a solid is the region in the first quadrant enclosed by the graph of $y = 2 - x^2$ and the coordinate axes. If every cross section of the solid perpendicular to the y-axis is a square, the volume of the solid is given by

(A) $\pi\int_0^2 (2-y)^2\,dy$

(B) $\int_0^2 (2-y)\,dy$

(C) $\pi\int_0^{\sqrt{2}} \left(2-x^2\right)^2 dx$

(D) $\int_0^{\sqrt{2}} \left(2-x^2\right)^2 dx$

(E) $\int_0^{\sqrt{2}} \left(2-x^2\right) dx$

3)

Let g be the function given by $g(x) = \int_0^x \sin(t^2)dt$ for $-1 \le x \le 3$. On which of the following intervals is g decreasing?

(A) $-1 \le x \le 0$

(B) $0 \le x \le 1.772$

(C) $1.253 \le x \le 2.171$

(D) $1.772 \le x \le 2.507$

(E) $2.802 \le x \le 3$

4)

The first derivative of the function f is defined by $f'(x) = \sin(x^3 - x)$ for $0 \le x \le 2$. On what intervals is f increasing?

(A) $1 \le x \le 1.445$ only

(B) $1 \le x \le 1.691$

(C) $1.445 \le x \le 1.875$

(D) $0.577 \le x \le 1.445$ and $1.875 \le x \le 2$

(E) $0 \le x \le 1$ and $1.691 \le x \le 2$

5)

x	0	1	2	3
$f''(x)$	5	0	−7	4

The polynomial function f has selected values of its second derivative f'' given in the table above. Which of the following statements must be true?

(A) f is increasing on the interval $(0, 2)$.

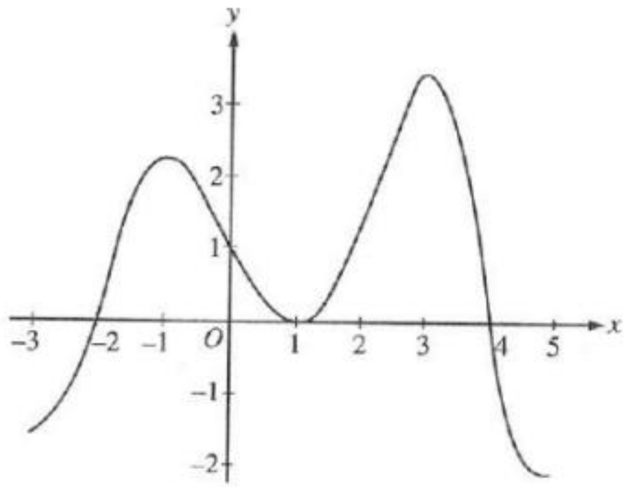
(B) f is decreasing on the interval $(0, 2)$.

(C) f has a local maximum at $x = 1$.

(D) The graph of f has a point of inflection at $x = 1$.

(E) The graph of f changes concavity in the interval $(0, 2)$.

6)

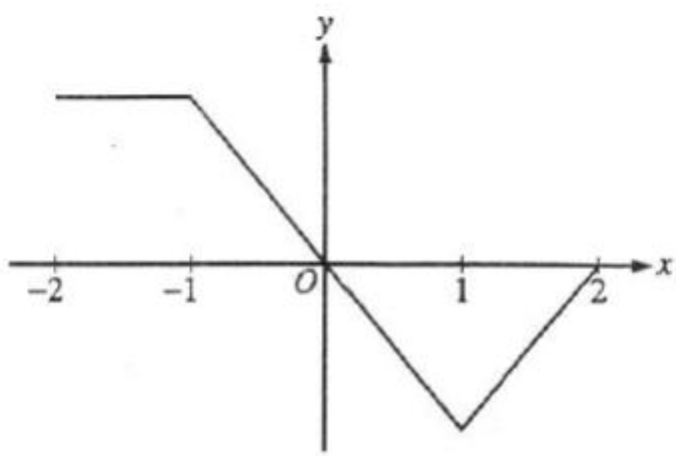


Graph of f'

The graph of the derivative of a function f is shown in the figure above. The graph has horizontal tangent lines at $x = -1$, $x = 1$, and $x = 3$. At which of the following values of x does f have a relative maximum?

(A) -2 only (B) 1 only (C) 4 only (D) -1 and 3 only (E) -2, 1, and 4

7)



Graph of f'

The graph of f', the derivative of the function f, is shown above. Which of the following statements is tru about f ?

(A) f is decreasing for $-1 \le x \le 1$.

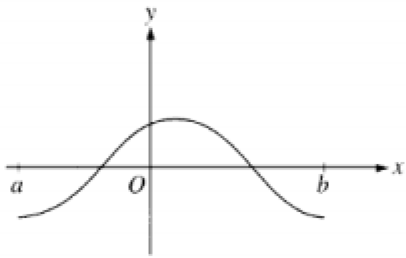
(B) f is increasing for $-2 \le x \le 0$.

(C) f is increasing for $1 \le x \le 2$.

(D) f has a local minimum at $x = 0$.

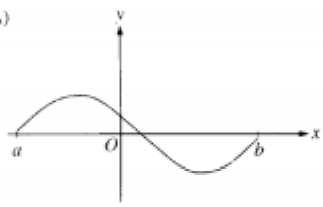
(E) f is not differentiable at $x = -1$ and $x = 1$.

8)

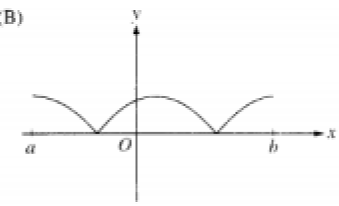


The graph of f is shown in the figure above. Which of the following could be the graph of the derivative of f?

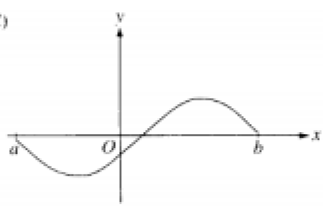
(A)



(B)



(C)



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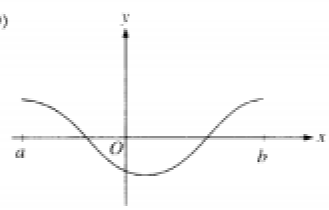
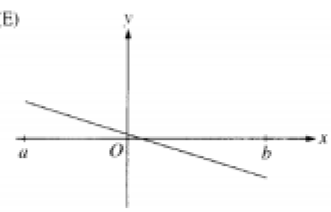


(E)



9)

Let f be a differentiable function such that $f(3) = 15$, $f(6) = 3$, $f'(3) = -8$, and $f'(6) = -2$. The function g is differentiable and $g(x) = f^{-1}(x)$ for all x. What is the value of $g'(3)$?

(A) $-\frac{1}{2}$

(B) $-\frac{1}{8}$

(C) $\frac{1}{6}$

(D) $\frac{1}{3}$

(E) The value of $g'(3)$ cannot be determined from the information given.

10)

The region enclosed by the graphs of $y = x^{2/3}$, $y = 4$, and the y-axis is rotated about the line $y = 4$. The volume of the solid generated can be represented by the integral

(A) $2\pi \int_0^8 (4 - x^{2/3})^2\, dx$

(B) $\pi \int_0^8 (4 - x^{2/3})^2\, dx$

(C) $2\pi \int_0^4 (4 - x^{2/3})^2\, dx$

(D) $\pi \int_0^4 (16 - x^{4/3})\, dx$

(E) $\pi \int_0^8 (16 - x^{4/3})\, dx$

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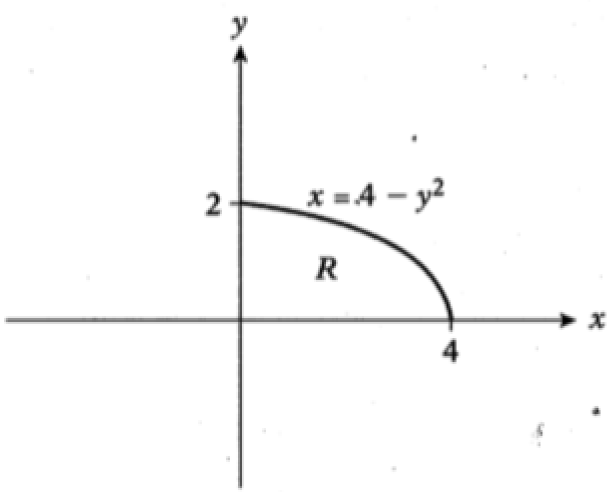
11)

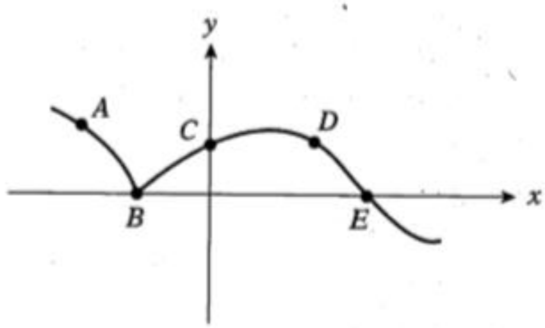
A solid is formed that has the region R as its base and cross sections perpendicular to the x-axis that are squares. Find the value of k so that the volume of the solid on the interval $[0, k]$ is half the total volume of the solid.

(A) 0.568
(B) 1.172
(C) 2.201
(D) 3.2
(E) 3.567



12)

In the graph shown, at which point is $\frac{dy}{dx} > 0$ and $\frac{d^2y}{dx^2} < 0$?



(A) A
(B) B
(C) C
(D) D
(E) E

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13)

If $f'(x) = \sqrt{1+x^3}$ and $f(1) = 0.5$, then $f(4) =$

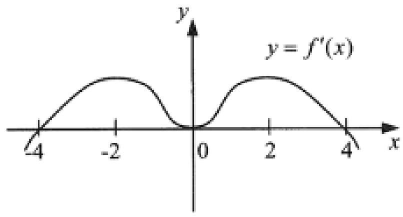
(A) 7.562 (B) 8.062 (C) 12.871 (D) 13.371 (E) 17.871

14)

If the region enclosed by the y-axis and the graph of $x = 4 - y^2$ is revolved about the y-axis, the volume of the solid generated is

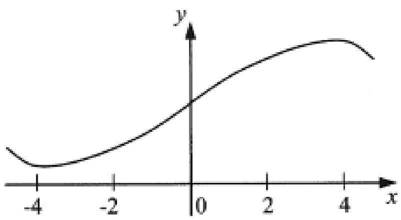
(A) 25.133 (B) 33.510 (C) 53.617 (D) 107.233 (E) 214.466

15)

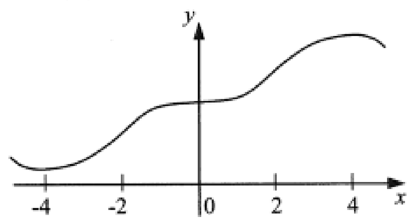


The graph of the derivative of f is shown in the figure above. Which of the following could be the graph of f?

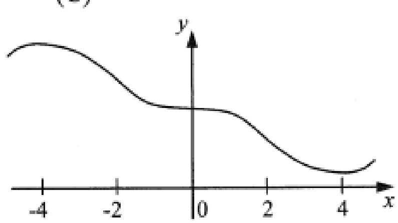
(A)



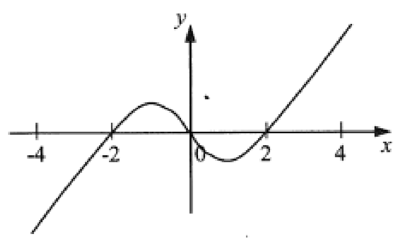
(B)



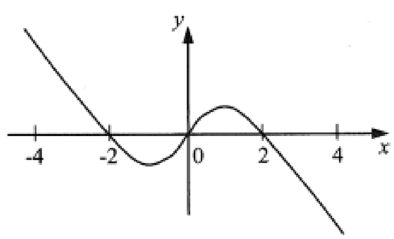
(C)



(D)



(E)



16)

At how many points on the interval $[0,\pi]$ does $f(x) = 2\sin x + \sin 4x$ satisfy the Mean Value Theorem?

(A) none **(B)** 1 **(C)** 2 **(D)** 3 **(E)** 4