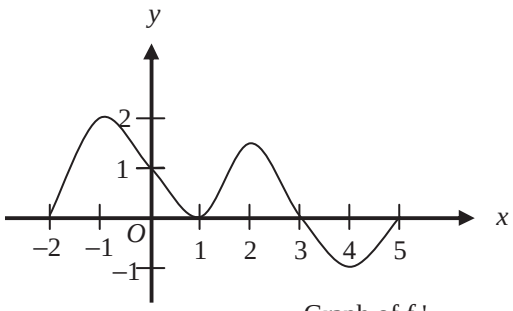



Graph of $f'$

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

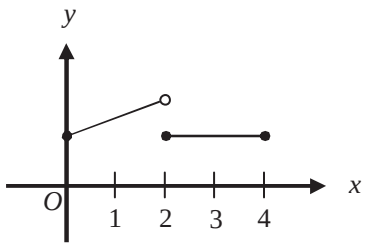
(A) $[-2, 1]$ only

(B) $[-2, 3]$

(C) $[3, 5]$ only

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

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




Graph of $f$

77. The figure above shows the graph of a function $f$ with domain $0 \le x \le 4$. Which of the following statements are true?

I. $\lim_{x \to 2^-} f(x)$ exists.

II. $\lim_{x \to 2^+} f(x)$ exists.

III. $\lim_{x \to 2} f(x)$ exists.

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

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

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

(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 $1.691 \le x \le 2$

79. If $\int_{-5}^{2} f(x)\,dx = -17$ and $\int_{5}^{2} f(x)\,dx = -4,$ what is the value of $\int_{-5}^{5} f(x)\,dx$?

(A) $-21$ (B) $-13$ (C) 0 (D) 13 (E) 21

---

80. The derivative of the function $f$ is given by $f'(x) = x^2 \cos(x^2)$. How many points of inflection does the graph of $f$ have on the open interval $(-2, 2)$?

(A) One (B) Two (C) Three (D) Four (E) Five

81. If $G(x)$ is an antiderivative for $f(x)$ and $G(2)=-7,$ then $G(4)=$

(A) $f'(4)$

(B) $-7+f'(4)$

(C) $\int_2^4 f(t)\,dt$

(D) $\int_2^4 \left(-7+f(t)\right)dt$

(E) $-7+\int_2^4 f(t)\,dt$

---

82. A particle moves along a straight line with velocity given by $v(t)=7-(1.01)^{-t^2}$ at time $t\geq 0.$ What is the acceleration of the particle at time $t=3$?

(A) $-0.914$ (B) 0.055 (C) 5.486 (D) 6.086 (E) 18.087

83. What is the area enclosed by the curves $y = x^3 - 8x^2 + 18x - 5$ and $y = x + 5$?

(A) 10.667

(B) 11.833

(C) 14.583

(D) 21.333

(E) 32

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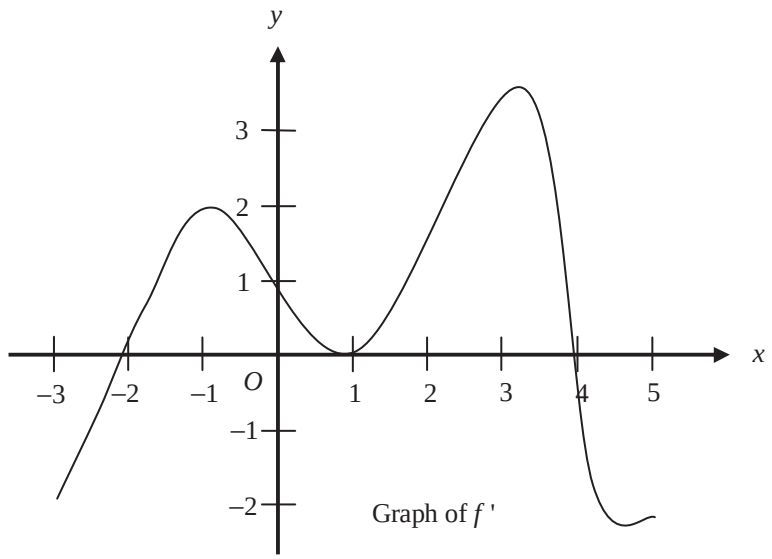


Graph of $f'$

84. 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

| $x$ | –4 | –3 | –2 | –1 |
|---|---|---|---|---|
| $f(x)$ | 0.75 | –1.5 | –2.25 | –1.5 |
| $f'(x)$ | –3 | –1.5 | 0 | 1.5 |

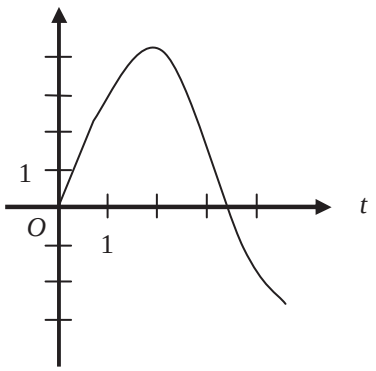
85. The table above gives values of a function $f$ and its derivative at selected values of $x$. If $f'$ is continuous on the interval $[-4, -1]$, what is the value of $\int_{-4}^{-1} f'(x)\,dx$?

(A) –4.5 (B) –2.25 (C) 0 (D) 2.25 (E) 4.5

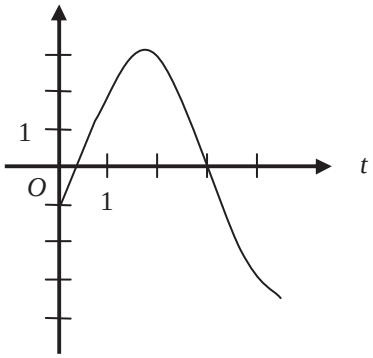
| $t$ | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| $v(t)$ | –1 | 2 | 3 | 0 | –4 |

86. The table gives selected values of the velocity, $v(t)$, of a particle moving along the $x$-axis. At time $t = 0$, the particle is at the origin. Which of the following could be the graph of the position, $x(t)$, of the particle for $0 \le t \le 4$?

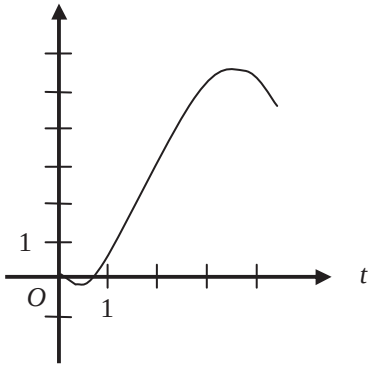
(A) $x(t)$



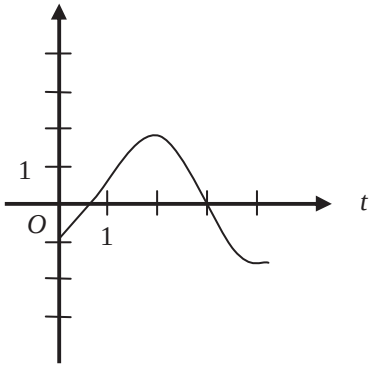

(B) $x(t)$



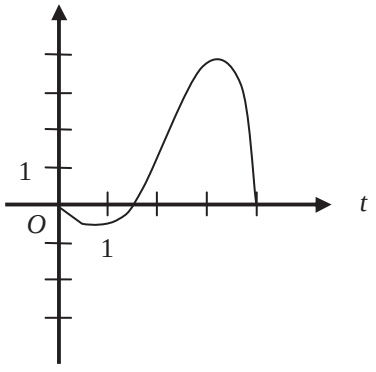

(C) $x(t)$




(D) $x(t)$




(E) $x(t)$



87. An object traveling in a straight line has position $x(t)$ at time $t$. If the initial position is $x(0)=2$ and the velocity of the object is $v(t)=\sqrt[3]{1+t^2}$, what is the position of the object at time $t=3$?

(A) 0.431 (B) 2.154 (C) 4.512 (D) 6.512 (E) 17.408

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88. The radius of a sphere is decreasing at a rate of 2 centimeters per second. At the instant when the radius of the sphere is 3 centimeters, what is the rate of change, in square centimeters per second, of the surface area of the sphere? (The surface area $S$ of a sphere with radius $r$ is $S=4\pi r^2$)

(A) $-108\pi$ (B) $-72\pi$ (C) $-48\pi$ (D) $-24\pi$ (E) $-16\pi$

89. The function $f$ is continuous for $-2 \le x \le 2$ and $f(-2) = f(2) = 0$. If there is no $c$, where $-2 < c < 2$, for which $f'(c) = 0$, which of the following statements must be true?

(A) For $-2 < k < 2$, $f'(k) > 0$.

(B) For $-2 < k < 2$, $f'(k) < 0$.

(C) For $-2 < k < 2$, $f'(k)$ exists.

(D) For $-2 < k < 2$, $f'(k)$ exists, but $f'$ is not continuous.

(E) For some $k$, where $-2 < k < 2$, $f'(k)$ does not exist.

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90. The function $f$ is continuous on the closed interval [2, 4] and twice differentiable on the open interval (2, 4). If $f'(3) = 2$ and $f''(x) < 0$ on the open interval $(2, 4)$, which of the following could be a table of values for $f$?

(A)

| $x$ | $f(x)$ |
|---|---|
| 2 | 2.5 |
| 3 | 5 |
| 4 | 6.5 |

(B)

| $x$ | $f(x)$ |
|---|---|
| 2 | 2.5 |
| 3 | 5 |
| 4 | 7 |

(C)

| $x$ | $f(x)$ |
|---|---|
| 2 | 3 |
| 3 | 5 |
| 4 | 6.5 |

(D)

| $x$ | $f(x)$ |
|---|---|
| 2 | 3 |
| 3 | 5 |
| 4 | 7 |

(E)

| $x$ | $f(x)$ |
|---|---|
| 2 | 3.5 |
| 3 | 5 |
| 4 | 7.5 |

91. What is the average value of $y = \dfrac{\cos x}{x^2 + x + 2}$ on the closed interval $[-1, 3]$?

(A) −0.085 (B) 0.090 (C) 0.183 (D) 0.244 (E) 0.732

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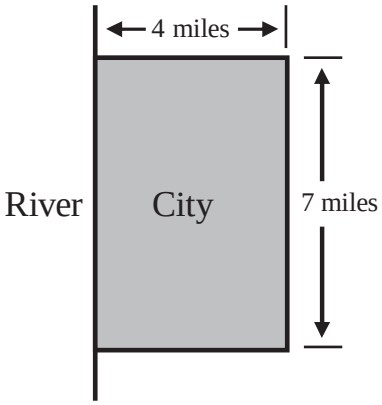


92. A city located beside a river has a rectangular boundary as shown in the figure above. The population density of the city at any point along a strip $x$ miles from the river's edge is $f(x)$ persons per square mile. Which of the following expressions gives the population of the city?

(A) $\int_0^4 f(x)\,dx$

(B) $7\int_0^4 f(x)\,dx$

(C) $28\int_0^4 f(x)\,dx$

(D) $\int_0^7 f(x)\,dx$

(E) $4\int_0^7 f(x)\,dx$