

1) Calculator Allowed

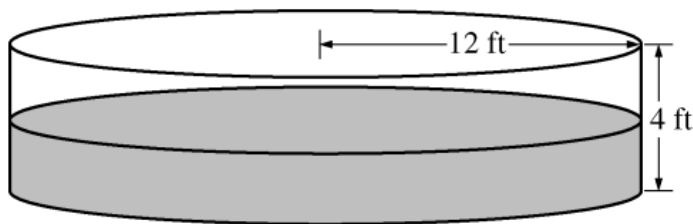
A particle moves along a straight line. For $0 \leq t \leq 5$, the velocity of the particle is given by

$v(t) = -2 + (t^2 + 3t)^{6/5} - t^3$, and the position of the particle is given by $s(t)$. It is known that $s(0) = 10$.

- (a) Find all values of t in the interval $2 \leq t \leq 4$ for which the speed of the particle is 2.
- (b) Write an expression involving an integral that gives the position $s(t)$. Use this expression to find the position of the particle at time $t = 5$.
- (c) Find all times t in the interval $0 \leq t \leq 5$ at which the particle changes direction. Justify your answer.
- (d) Is the speed of the particle increasing or decreasing at time $t = 4$? Give a reason for your answer.

2) Calculator Allowed

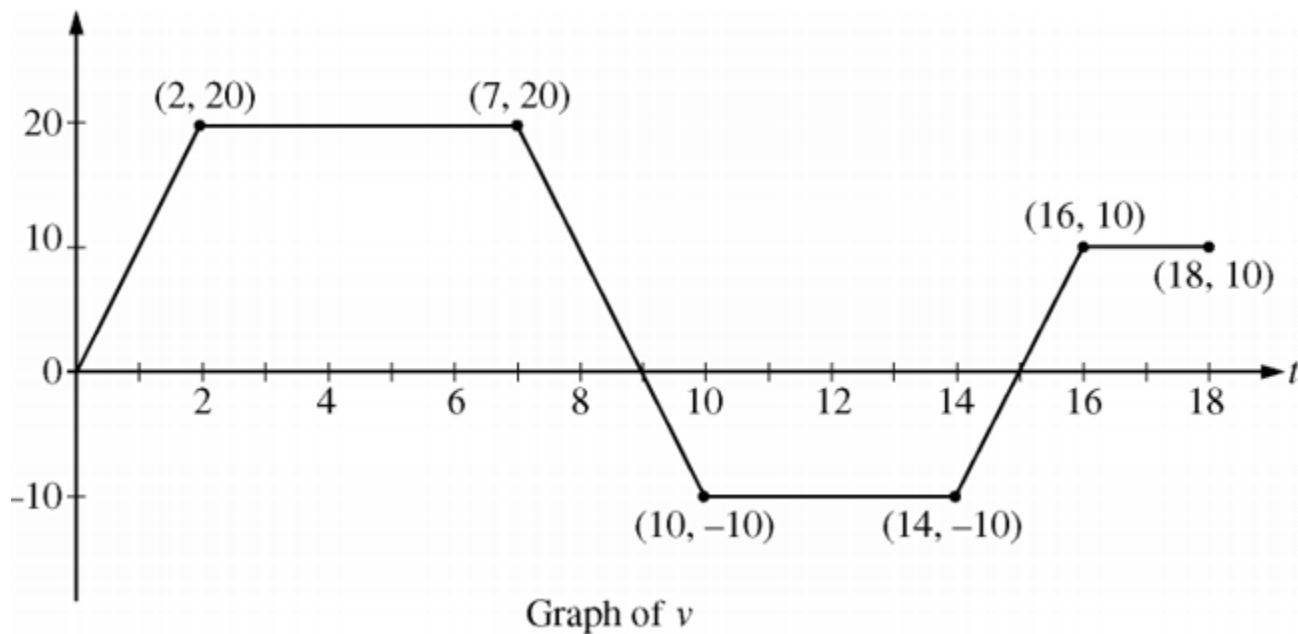
t	0	2	4	6	8	10	12
$P(t)$	0	46	53	57	60	62	63



The figure above shows an aboveground swimming pool in the shape of a cylinder with a radius of 12 feet and a height of 4 feet. The pool contains 1000 cubic feet of water at time $t = 0$. During the time interval $0 \leq t \leq 12$ hours, water is pumped into the pool at the rate $P(t)$ cubic feet per hour. The table above gives values of $P(t)$ for selected values of t . During the same time interval, water is leaking from the pool at the rate $R(t)$ cubic feet per hour, where $R(t) = 25e^{-0.05t}$. (Note: The volume V of a cylinder with radius r and height h is given by $V = \pi r^2 h$.)

- Use a midpoint Riemann sum with three subintervals of equal length to approximate the total amount of water that was pumped into the pool during the time interval $0 \leq t \leq 12$ hours. Show the computations that lead to your answer.
- Calculate the total amount of water that leaked out of the pool during the time interval $0 \leq t \leq 12$ hours.
- Use the results from parts (a) and (b) to approximate the volume of water in the pool at time $t = 12$ hours. Round your answer to the nearest cubic foot.

3) NO CALCULATOR ALLOWED FOR THIS PROBLEM



4. A squirrel starts at building A at time $t = 0$ and travels along a straight, horizontal wire connected to building B . For $0 \leq t \leq 18$, the squirrel's velocity is modeled by the piecewise-linear function defined by the graph above.
- (a) At what times in the interval $0 < t < 18$, if any, does the squirrel change direction? Give a reason for your answer.
 - (b) At what time in the interval $0 \leq t \leq 18$ is the squirrel farthest from building A ? How far from building A is the squirrel at that time?
 - (c) Find the total distance the squirrel travels during the time interval $0 \leq t \leq 18$.

4) AP MULTIPLE CHOICE EXAMPLES

- 1)** A particle moves in a straight line with velocity $v(t) = t^2$. How far does the particle move between times $t = 1$ and $t = 2$?

(A) $\frac{1}{3}$ (B) $\frac{7}{3}$ (C) 3 (D) 7 (E) 8

- 2) At $t = 0$ a particle starts at rest and moves along a line in such a way that at time t its acceleration is $24t^2$ feet per second per second. Through how many feet does the particle move during the first 2 seconds?

(A) 32 (B) 48 (C) 64 (D) 96 (E) 192

3) Graphing Calculator Allowed

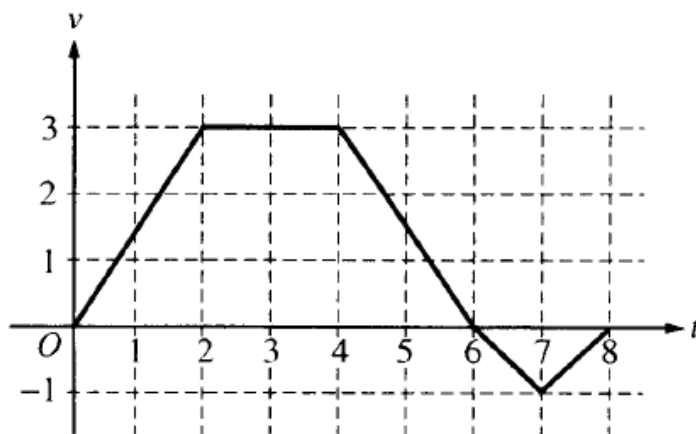
The number of bacteria in a culture is growing at a rate of $3000e^{\frac{2t}{5}}$ per unit of time t . At $t = 0$, the number of bacteria present was 7,500. Find the number present at $t = 5$.

(A) $1,200e^2$ (B) $3,000e^2$ (C) $7,500e^2$ (D) $7,500e^5$ (E) $\frac{15,000}{7}e^7$

- 4) A point moves in a straight line so that its distance at time t from a fixed point of the line is $8t - 3t^2$. What is the *total* distance covered by the point between $t = 1$ and $t = 2$?

(A) 1 (B) $\frac{4}{3}$ (C) $\frac{5}{3}$ (D) 2 (E) 5

5)



A bug begins to crawl up a vertical wire at time $t = 0$. The velocity v of the bug at time t , $0 \leq t \leq 8$, is given by the function whose graph is shown above.

What is the total distance the bug traveled from $t = 0$ to $t = 8$?

(A) 14 (B) 13 (C) 11 (D) 8 (E) 6

6) **Graphing Calculator Allowed**

A particle moves along the x -axis so that its acceleration at any time t is $a(t) = 2t - 7$. If the initial velocity of the particle is 6, at what time t during the interval $0 \leq t \leq 4$ is the particle farthest to the right?

(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

7) Graphing Calculator Allowed

Let g be a differentiable function such that $g(4) = 0.325$ and $g'(x) = \frac{1}{x}e^{-x}\left(\cos\left(\frac{x}{100}\right)\right)$. What is the value of $g(1)$?

(A) 0.109

(B) 0.216

(C) 0.541

(D) 0.688