

8. The table shows the position $s(t)$ of a particle that moves along a straight line at several times t , where t is measured in seconds and s is measured in meters.

t	2.0	2.7	3.2	3.8
$s(t)$	5.2	7.8	10.6	12.2

Which of the following best estimates the velocity of the particle at $t = 3$?

- (A) 3.7 m/sec (B) 3.9 m/sec
(C) 5.6 m/sec (D) 7.8 m/sec
9. If $2y^3 - 3xy + x^2 = 4$, then $\frac{dy}{dx} =$
- (A) $-\frac{2x}{6y^2 - 3}$ (B) $\frac{2x - 3y}{3x - 6y^2}$
(C) $\frac{2x - 3}{6y^2}$ (D) $-\frac{2x}{6y^2 - 3x}$
10. The volume of a cylinder with radius r and height h is given by $V = \pi r^2 h$. The radius of the cylinder is increasing at a rate of $\frac{1}{3}$ centimeter per second and the height of the cylinder is increasing at a rate of $\frac{1}{2}$ centimeter per second. At what rate, in cubic centimeters per second, is the volume of the cylinder increasing when its height is 9 centimeters and its radius is 4 centimeters?
- (A) $\frac{4\pi}{3}$ (B) $\frac{8\pi}{3}$
(C) 6π (D) 32π

Section 1, Part B, Multiple Choice, Technology Permitted

11. Two roads intersect at right angles. You are standing 25 meters north of the intersection on one of the roads. You are watching a car traveling west at 30 meters per second. At how many meters per second is the car traveling away from you 3 seconds after it passes through the intersection?
- (A) 23.047 (B) 28.906
(C) 29.032 (D) 30
12. The position $s(t)$ of a particle moving along the x -axis at time t is given by
- $$s(t) = -t^3 + 2t^2 + \frac{3}{2}$$
- where s is measured in meters and t is measured in seconds. When is the instantaneous velocity of the particle equal to its average velocity on the interval $[0, 4]$?
- (A) 1.097 seconds (B) 2 seconds
(C) 2.333 seconds (D) 2.431 seconds

Section 2, Part A, Free Response, Technology Permitted

13. A particle moves along the x -axis so that at any time $t \geq 0$, its velocity is given by

$$v(t) = 2 + 3.5 \cos(0.7t).$$

- (a) Find $v'(t)$. What does $v'(t)$ represent?
(b) What is the acceleration of the particle at time $t = 5$?

Section 2, Part B, Free Response, No Technology

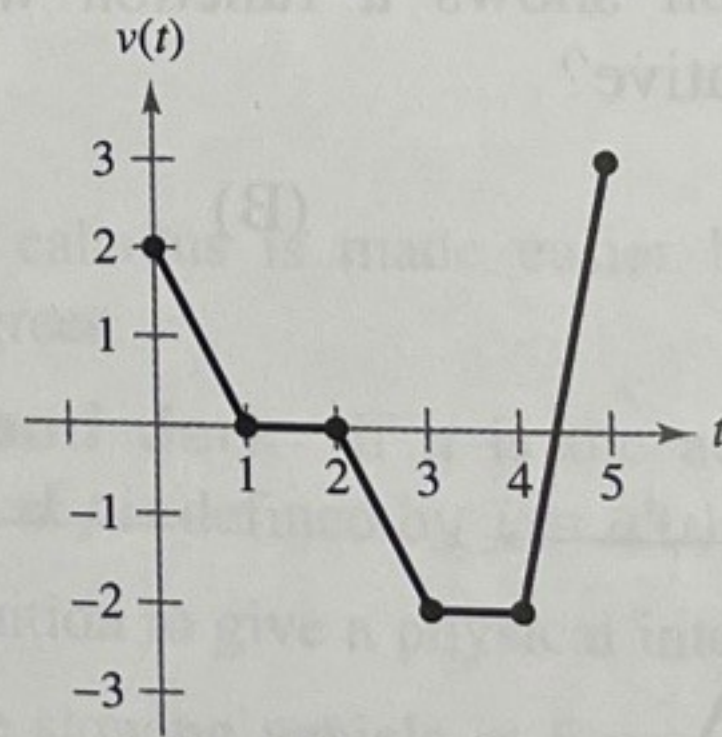
14. Evaluate each limit analytically.

(a) $\lim_{h \rightarrow 0} \frac{\sqrt{16+h} - 4}{h}$ (b) $\lim_{h \rightarrow 0} \frac{\frac{1}{5+h} - \frac{1}{5}}{h}$

15. Given:

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
2	-3	1	5	-2
5	4	7	-1	2

- (a) If $h(x) = \frac{f(x)}{g(x)}$, find $h'(2)$.
(b) If $j(x) = f(g(x))$, find $j'(2)$.
(c) If $k(x) = \sqrt{f(x)}$, find $k'(5)$.
16. The figure shows the graph of the velocity, in feet per second, for a particle moving along the line $x = 4$.



- (a) Find all open intervals where the particle is (i) moving upward, (ii) moving downward, and (iii) at rest. Explain your reasoning.
(b) What is the acceleration of the particle at (i) $t = 0.75$ and (ii) $t = 4.2$? Be sure to include units.
17. Consider $g(x) = f(x) \tan x + kx$, where k is a real number, f is differentiable for all x , $f(\pi/4) = 4$, and $f'(\pi/4) = -2$.
- (a) For what values of x , if any, in the interval $0 < x < 2\pi$ will the derivative of g fail to exist? Justify your answer.
(b) Given $g'(\pi/4) = 6$, find the value of k .