Chapter 2 Multiple Choice Questions

1. The position of a particle on the x-axis, $x(t)$, is given at one second intervals by the following table for $0 \le t \le 4$.

t	0	1	2	3	4
$x(t)$	10	15	11	2	-2

The average velocity for the particle over this time interval is

(A) -4 (B) -3 (C) 1.6 (D) 3 (E) 4

2. Among the following choices, the largest value of h which ensures that $3x + 1$ is within 0.5 of 7 when x is within h of 2 is $h =$

(A) 0.01 (B) 0.05 (C) 0.1 (D) 0.2 (E) 0.25

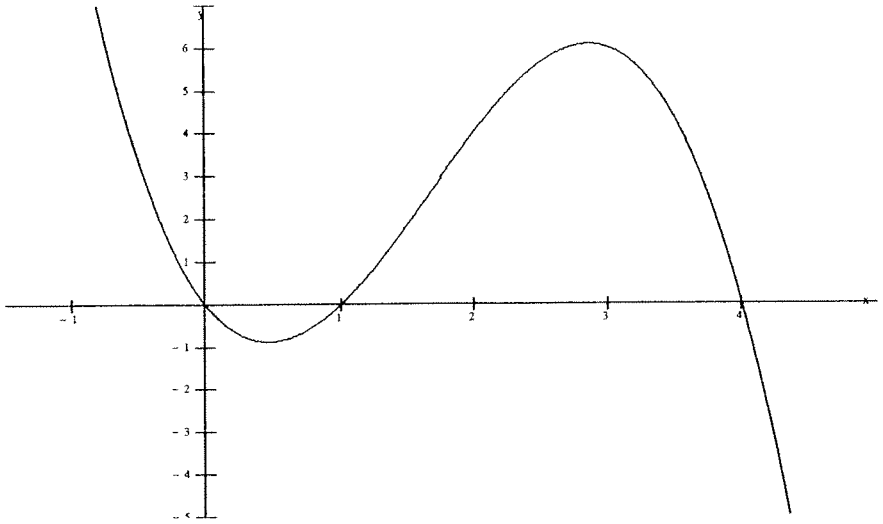
3. Let $f(x) = \begin{cases} x^2 - 4 & \text{for } x < 3 \\ 7 & \text{for } x = 3 \\ 2x + 4 & \text{for } x > 3 \end{cases}$

Then $\lim_{x \to 3^+} f(x) =$

(A) 2 (B) 5 (C) 7 (D) 10 (E) Does not exist

4. $\lim_{x \to \infty} \dfrac{x^2 + 3x + 5}{2x^2 - 7x + 6} =$

(A) 0 (B) $\frac{1}{2}$ (C) $\frac{5}{6}$ (D) 1 (E) ∞



5. The graph above is the graph of $y = f(x)$. At which of the following points is $f'(x)$ the greatest?

(A) $x = -1$ (B) $x = 0$ (C) $x = 2$ (D) $x = 3$ (E) $x = 4$

6. $\lim_{x \to \infty} \frac{5e^{-x} + 10}{6e^{x} - 1} =$

(A) $-\infty$ (B) -10 (C) 0 (D) $\frac{5}{6}$ (E) ∞

7. If $f(x) = \frac{x^2 - 4}{x^2 - x - 2}$, then which of the following is true?

(A) The lines x = -1 and x = 2 are vertical asymptotes

(B) The lines x = -2 and x = 2 are vertical asymptotes

(C) The line x = 1 is the only vertical asymptote

(D) The line y = 1 is the only vertical asymptote

(E) The line x = -1 is the only vertical asymptote

8. If $V(t)$ represents the number of thousands of gallons of water in a tank t hours after midnight on a fixed day, then which of the following pairs of equations can be used to express the statement, "At 3 PM there were 9000 gallons of water in the tank, and the amount of water in the tank was decreasing at the rate of 200 gallons per hour."?

(A) $V(3) = 9000$ and $V'(3) = -200$

(B) $V(3) = 9$ and $V'(3) = 200$

(C) $V(15) = 9000$ and $V'(15) = -200$

(D) $V(15) = 9$ and $V'(15) = -0.2$

(E) $V(15) = 9$ and $V'(15) = 0.2$

9. If $P(t)$ is the population, in millions, of a country t years after 1900, then what does the equation $(P^{-1})'(60) = 10$ mean?

(A) In 1960, the population was growing at rate of 10 million people per year.

(B) In 1910, the population was growing at rate of 60 million people per year.

(C) In 1960, the population was growing at the rate of $\frac{1}{10}$ million people per year.

(D) When the population was 60 million, it was growing at the rate of 10 million people per year.

(E) When the population was 60 million, it was growing at the rate of $\frac{1}{10}$ million people per year.

10. $\lim_{h \to 0} \frac{3^2 - (3+h)^2}{h}$ is

(A) -9 (B) -6 (C) 0 (D) 6 (E) undefined

11. If $f(p) = q$ means that, at a price of p dollars, a sandwich shop can sell q thousand sandwiches per week, then the equations $f(4.5) = 1.2$, $f'(4.5) = -0.1$ mean

(A) When the price of a sandwich is \$4.50, the shop can sell 1200 sandwiches per week and the profit is decreasing at \$100 per week.

(B) The graph of f is a straight line going through (4.5, 1.2) with slope -1.

(C) When the price of a sandwich is \$1.20, the shop can sell 4500 sandwiches per week, but the shop loses \$100 per week.

(D) When the price of a sandwich is \$4.50, the shop can sell 1200 sandwiches per week and the price is decreasing at 10 cents per sandwich.

(E) None of the above.

12. If $f(x) \cdot f'(x) \cdot f''(x) > 0$, then which of the following is possible?

(A) The graph is in the second quadrant and is decreasing and concave up.

(B) The graph is in the second quadrant and is decreasing and concave down.

(C) The graph is in the first quadrant and is increasing and concave down.

(D) The graph is in the third quadrant and is increasing and concave up.

(E) The graph is in the fourth quadrant and is decreasing and concave down.

13. If the graph of f goes through the points (2,5), (4,12), and (8,22), and if neither $f'(x)$ nor $f''(x)$ changes sign on the interval (2,8), then the graph must be

(A) increasing and concave up

(B) increasing and concave down

(C) decreasing and concave up

(D) decreasing and concave down

(E) none of the above.

14. If the graph of f goes through the points (1,4), (2,6), and (3,10) then on the interval (1,3) the graph of f must be

(A) increasing and concave up

(B) increasing and concave down

(C) decreasing and concave up

(D) decreasing and concave down

(E) none of the above

15. If $\lim_{h\to 0}\frac{f(3+h)-15}{h}=4$, then which of the following must be true?

I. $\lim_{x\to 3} f(x)=15$
II. $f(3)=15$
III. $f'(3)=4$

(A) I only (B) I and II only (C) II and III only

(D) I and III only (E) I, II, and III

16. If $\lim_{h\to 0}\frac{f(2+h)-f(2)}{h}=1$, then which of the following must be true?

I. $\lim_{x\to 2} f(x)=1$
II. f is continuous at $x=2$
III. $f'(2)=1$

(A) I only (B) II only (C) III only

(D) II and III only (E) I, II, and III

17. If $\lim_{h\to 0}\frac{f(4+h)-f(4)}{h}$ does not exist, then which of the following must be true?

I. $\lim_{x\to 4} f(x)$ does not exist
II. f is not continuous at $x = 4$
III. f is not differentiable at $x = 4$

(A) I only (B) II only (C) III only

(D) II and III only (E) I, II, and III

18. If $f(x)=\begin{cases}2x, & \text{if } x\geq 0\\ -x, & \text{if } x<0\end{cases}$, then $f'(0)$ is

(A) -1 (B) 0 (C) 1 (D) 2 (E) undefined

19. If $f(x)=\begin{cases}\frac{\sin x}{x}, & \text{if } x\neq 0\\ 1, & \text{if } x=0\end{cases}$, then which of the following is true?

I. f is continuous at $x = 0$.
II. The line $x = 0$ is a vertical asymptote.
III. The line $y = 0$ is a horizontal asymptote.

(A) None (B) I only (C) II only

(D) I and III only (E) II and III only

20. $\lim_{h\to 0}\frac{(4+h)^2-16}{h}$ is

(A) -16 (B) 0 (C) 8 (D) 16 (E) undefined

21. If $f(2)=7, f'(2)=4,$ and $f''(2)=8$, which of the following must be true?

I. $\lim_{x\to 2} f(x)=7$ II. $\lim_{x\to 2} f'(x)=4$ III. $\lim_{x\to 2} f''(x)=8$

(A) None (B) I only (C) II only

(D) I and II only (E) I, II, and III

22. $\lim_{x\to\frac{\pi}{2}} \frac{\sin(x)}{x}$ is

(A) 0 (B) $\frac{2}{\pi}$ (C) 1 (D) $\frac{\pi}{2}$ (E) undefined

23. If $f(x)=\begin{cases} 3x+1, & \text{if } x<2 \\ 9, & \text{if } x=2 \\ 6x-4, & \text{if } x>2 \end{cases}$, then $\lim_{x\to 2^+} f(x)$ is

(A) 6 (B) 7 (C) 8 (D) 9 (E) undefined

24. If $f(x)=\begin{cases} 6x+1, & \text{if } x<2 \\ 9, & \text{if } x=2 \\ 6x-4, & \text{if } x>2 \end{cases}$, then $f'(2)$ is

(A) 0 (B) 6 (C) 9 (D) 12 (E) undefined

25. If $f(x)=\begin{cases} \frac{x^2-9}{x-3}, & \text{if } x\neq 3 \\ 6, & \text{if } x=3 \end{cases}$, then $f'(3)$ is

(A) 0 (B) 1 (C) 3 (D) 6 (E) undefined