Chapter 2 MC Questions

1. A particle moves on the x-axis in such a way that its position at time t is given by $x(t) = 3t^5 - 25t^3 + 60t$. For what values of t is the particle moving to the left?

A) $-2 < t < 1$ only
B) $-2 < t < -1$ and $1 < t < 2$
C) $-1 < t < 1$ and $t > 2$
D) $1 < t < 2$ only
E) $t < -2$, $-1 < t < 1$, and $t > 2$

2. If the line $y = 4x + 3$ is tangent to the curve $y = x^2 + c$, then c is

A) 2 B) 4 C) 7 D) 11 E) 15

3. The volume of an expanding sphere is increasing at a rate of 12 cubic feet per second. When the volume of the sphere is 36π cubic feet, how fast, in square feet per second, is the surface area increasing?

A) 8 B) 6 C) 8π D) $\frac{8\pi}{3}$ E) 10

4. Consider the function $f(x) = \begin{cases} \frac{\sin x}{x} & x \neq 0 \\ k & x = 0 \end{cases}$

In order for $f(x)$ to be continuous at x = 0, the value of k must be

A) 0
B) 1
C) -1
D) π
E) a number greater than 1

5. If $y^2 - 2xy = 21$ then $\frac{dy}{dx}$ at the point (2, -3) is

A) -6/5 B) -3/5 C) -2/5 D) 3/8 E) 3/5

6. If $\sin(xy) = x^2$, then $\frac{dy}{dx} =$

A) $2x\sec(xy)$

B) $\frac{\sec(xy)}{x^2}$

C) $2x\sec(xy) - y$

D) $\frac{2x\sec(xy)}{y}$

E) $\frac{2x\sec(xy) - y}{x}$

7. The equation of the normal line to the curve $y = \sqrt[3]{x^2 - 1}$ at the point where x = 3 is

A) y + 12x = 38
B) y – 4x = 10
C) y + 2x = 4
D) y + 2x = 8
E) y – 2x = -4

8. The table below gives values of a differentiable function f. Estimate $f'(2)$.

X	1.92	1.94	1.96	1.98	2.00
$f(x)$	6.00	5.00	4.40	4.10	4.00

A) -0.10
B) -0.20
C) -5
D) -10
E) -25

9. The equation of the tangent line to the curve $y = \frac{3x+4}{4x-3}$ at the point (1, 7) is

A) y + 25x = 32
B) y – 31x = -24
C) y – 7x = 0
D) y + 5x = 12
E) y – 25x = -18

10. A particle moves along the x-axis so that any time t its position is given by $x(t) = \frac{1}{2}\sin t + \cos(2t)$.

What is the acceleration of the particle at $t = \frac{\pi}{2}$?

A) 0 B) 1/2 C) 3/2 D) 5/2 E) 7/2

11. The table shows the velocity at time t of an object moving along a line. Estimate the acceleration (in ft/sec^2) at t = 6 sec.

t (sec)	0	4	8	10
velocity	18	16	10	0

A) -6 B) -1.8 C) -1.5 D) 1.5 E) 6

12. Two cars are traveling along perpendicular roads, car A at 40 mph, car B at 60 mph. At noon, when car A reaches the intersection, car B is 90 miles away, and moving toward it. At 1 pm, the rate, in miles per hour, at which the distance between the cars is changing is

A) -40 B) 68 C) 4 D) -4 E) 40

13. If $f(x) = \cos x \sin 3x$, then $f'\left(\frac{\pi}{6}\right)$ is equal to

A) $\frac{1}{2}$ B) $-\frac{\sqrt{3}}{2}$ C) 0 D) 1 E) $-\frac{1}{2}$

14. If $f(x) = (x-1)^2 \cos x$, then $f'(0) =$

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

15. If the radius of a sphere is increasing at a rate of 2 inches per second, how fast, in cubic inches per second, is the volume increasing when the radius is 10 inches ?

A) 800π B) 800 C) 3200π D) 40π E) 80π

16. If $f(x) = x^3 - x + 3$ and if c is the only real number such that $f(c) = 0$, then c is between

A) -2 and -1 B) -1 and 0 C) 0 and 1 D) 1 and 2 E) 2 and 3

17. A particle moves along the x-axis so that its position at any time $t \geq 0$ is given by $x(t) = 3t^3 - 15t^2 - 24t$. At which time t is the particle at rest?

A) never B) 0 only C) $\frac{2}{3}$ only D) $\frac{2}{3}$ and 4 E) 0, $\frac{2}{3}$ and 4

18. If $f(x) = x \cdot \sqrt[3]{x}$, then $f'(x) =$

A) $4x^3$ B) $\frac{3}{7}x^{7/3}$ C) $\frac{4}{3}x^{1/3}$ D) $\frac{1}{3}x^{1/3}$ E) $\frac{1}{3}x^{-2/3}$

19. If $f(x)=\dfrac{\sin^2 x}{1-\cos x}$, then $f'(x)=$

$A)\cos x \quad B)\sin x \quad C)-\sin x \quad D)-\cos x \quad E)2\cos x$

20. $\lim\limits_{x\to+\infty}\dfrac{x-\dfrac{1}{2x}}{2x+\dfrac{1}{6x}}$ is

$A)-3 \quad B)-\dfrac{1}{2} \quad C)-\dfrac{1}{3} \quad D)\dfrac{1}{2} \quad E)2$

21. The $\lim\limits_{h\to 0}\dfrac{(x+h)^3-x^3}{h}$ at the point x=2 is

$A)36 \quad B)12 \quad C)8 \quad D)2 \quad E)0$

22. At what point on the curve $x^3 - y^2+x^2 = 0$ is the tangent line vertical?

(A) (0,0) only
(B) (–1, 0) only
(C) $\left(1,\sqrt{2}\right)$ only
(D) (–1, 0) and (0, 0)
(E) The tangent line is never vertical.

23. If $x+y=xy$, then $\dfrac{dy}{dx}$ is

(A) $\dfrac{1}{x-1}$
(B) $\dfrac{y-1}{x-1}$
(C) $\dfrac{1-y}{x-1}$
(D) $x+y-1$
(E) $\dfrac{2-xy}{y}$

24. Suppose that f is a continuous function defined for all real numbers x and $f(-5)=3$ and $f(-1)=-2$.
If $f(x)=0$ for one and only one value of x, then which of the following could be x?

(A) –7
(B) –2
(C) 0
(D) 1
(E) 2

25. If $f(x) = (2 + 3z)^4$, then the fourth derivative of f is

(A) 0
(B) $4!(3)$
(C) $4!(3^4)$
(D) $4!(3^5)$
(E) $4!(2+3x)$

26. What is the 50^{th} derivative of $\cos x$?

(A) $-\cos x$
(B) $\cos x$
(C) $\sin x$
(D) $-\sin x$
(E) 0

27. Let f and g be differentiable functions such that

$f(1) = 4,\ g(1) = 3,\ f'(3) = -5$

$f'(1) = -4,\ g'(1) = -3,\ g'(3) = 2$

If $h(x) = f(g(x))$, then $h'(1) =$

(A) -9
(B) 15
(C) 0
(D) -5
(E) -12

28. A particle moves along the x-axis in such a way that its position at time t is given by $x(t) = \dfrac{1-t}{1+t}$. What is the acceleration of the particle at time $t = 0$?

(A) $-\dfrac{3}{5}$
(B) -4
(C) 4
(D) 2
(E) -2

29. The equation of the tangent line to the curve $x^2 + y^2 = 169$ at the point $(5, -12)$ is

(A) $5y - 12x = -120$
(B) $5y - 12x = 119$
(C) $5x - 12y = 169$
(D) $12x + 5y = 0$
(E) $12x + 5y = 169$

30. If $f(x)=\sqrt{4\sin x+2}$, then $f'(0)=$

(A) -2
(B) 0
(C) $\sqrt{2}$
(D) $\frac{\sqrt{2}}{2}$
(E) 1

31. The graph of which function has y = –1 as an asymptote?

(A) $y=e^{-x}$
(B) $y=\frac{-x}{1-x}$
(C) $y=\ln(x+1)$
(D) $y=\frac{x}{x+1}$
(E) $y=\frac{x}{1-x}$

32. If $f(x)=\begin{cases}x^2+2, & x\le 1\\ 2x+1, & x>1\end{cases}$, then $f'(1)$ is

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

33. If f is a function such that $\lim_{x\to a}\frac{f(x)-f(a)}{x-a}=0$, which of the following must be true?

(A) $\lim_{x\to a} f(x)$ does not exist
(B) $f(a)$ does not exist
(C) $f'(a)=0$
(D) $f(a)=0$
(E) $f(x)$ is continuous at $x=0$

34. The $\lim_{h\to 0}\frac{|x+h|-|x|}{h}$ at $x=3$ is

(A) 0
(B) 1
(C) 3
(D) -1
(E) nonexistent

35. $\lim_{h\to 0}\dfrac{\tan 2(x+h)-\tan(2x)}{h}$ is

(A) 0
(B) $2\cot(2x)$
(C) $\sec^2(2x)$
(D) $2\sec^2(2x)$
(E) nonexistent

36. $\lim_{x\to\infty}\dfrac{10^8x^5+10^6x^4+10^4x^2}{10^9x^6+10^7x^5+10^5x^3}$ is

(A) 0
(B) 1
(C) -1
(D) $\dfrac{1}{10}$
(E) $-\dfrac{1}{10}$

37. If $f(x)=\dfrac{x^2-9}{x+3}$ is continuous at $x=-3$, then $f(-3)=$

(A) 3
(B) -3
(C) 0
(D) 6
(E) -6

38. The equation of the line tangent to the curve $y=\dfrac{kx+8}{k+x}$ at $x=-2$ is $y=x+4$. What is the value of k?

(A) -3
(B) -1
(C) 1
(D) 3
(E) 4

39. If $x^2y+yx^2=6$, then $\dfrac{d^2y}{dx^2}$ at the point $(1,3)$ is

(A) -18
(B) -6
(C) 6
(D) 12
(E) 18

40. Which of the following are the equations of all horizontal and vertical asymptotes for the curve $y = \dfrac{x}{x(x^2-4)}$?

	Horizontal Asymptote	Vertical Asymptote
(A)	$y = 1$	$x = -2$ and $x = 2$
(B)	$y = 0$	$x = -2$, $x = 0$, and $x = 2$
(C)	$y = 0$	$x = -2$ and $x = 2$
(D)	$y = 1$	$x = -2$, $x = 0$, and $x = 2$
(E)	None	$x = -2$ and $x = 2$