1993 Semester 1 Multiple Choice

1. If $f(x)=x^{\frac{3}{2}}$, then $f'(4)=$

(A) –6 (B) –3 (C) 3 (D) 6 (E) 8

3. $\lim_{n\to\infty}\frac{3n^3-5n}{n^3-2n^2+1}$ is

(A) –5 (B) –2 (C) 1 (D) 3 (E) nonexistent

4. If $x^3+3xy+2y^3=17$, then in terms of x and y, $\frac{dy}{dx}=$

(A) $-\frac{x^2+y}{x+2y^2}$

(B) $-\frac{x^2+y}{x+y^2}$

(C) $-\frac{x^2+y}{x+2y}$

(D) $-\frac{x^2+y}{2y^2}$

(E) $\frac{-x^2}{1+2y^2}$

7. An equation of the line tangent to the graph of $y=\frac{2x+3}{3x-2}$ at the point $(1,5)$ is

(A) $13x-y=8$ (B) $13x+y=18$ (C) $x-13y=64$

(D) $x+13y=66$ (E) $-2x+3y=13$

8. If $y=\tan x-\cot x$, then $\frac{dy}{dx}=$

(A) $\sec x\csc x$ (B) $\sec x-\csc x$ (C) $\sec x+\csc x$ (D) $\sec^2 x-\csc^2 x$ (E) $\sec^2 x+\csc^2 x$

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

(A) –2 (B) –1 (C) 0 (D) 1 (E) 2

15. For what value of x does the function $f(x)=(x-2)(x-3)^2$ have a relative maximum?

(A) –3 (B) $-\frac{7}{3}$ (C) $-\frac{5}{2}$ (D) $\frac{7}{3}$ (E) $\frac{5}{2}$

16. The slope of the line normal to the graph of $y=2\ln(\sec x)$ at $x=\frac{\pi}{4}$ is

(A) –2

(B) $-\frac{1}{2}$

(C) $\frac{1}{2}$

(D) 2

(E) nonexistent

18. If $f(x)=\sin\left(\frac{x}{2}\right)$, then there exists a number c in the interval $\frac{\pi}{2}<x<\frac{3\pi}{2}$ that satisfies the conclusion of the Mean Value Theorem. Which of the following could be c ?

(A) $\frac{2\pi}{3}$ (B) $\frac{3\pi}{4}$ (C) $\frac{5\pi}{6}$ (D) π (E) $\frac{3\pi}{2}$

19. Let f be the function defined by $f(x)=\begin{cases}x^3 & \text{for } x\le 0,\\ x & \text{for } x>0.\end{cases}$ Which of the following statements about f is true?

(A) f is an odd function.

(B) f is discontinuous at $x=0$.

(C) f has a relative maximum.

(D) $f'(0)=0$

(E) $f'(x)>0$ for $x\neq 0$

23. How many critical points does the function $f(x)=(x+2)^5(x-3)^4$ have?

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

24. If $f(x)=(x^2-2x-1)^{\frac{2}{3}}$, then $f'(0)$ is

(A) $\frac{4}{3}$ (B) 0 (C) $-\frac{2}{3}$ (D) $-\frac{4}{3}$ (E) -2

25. $\frac{d}{dx}\left(2^x\right)=$

(A) 2^{x-1} (B) $(2^{x-1})x$ (C) $(2^x)\ln 2$ (D) $(2^{x-1})\ln 2$ (E) $\frac{2x}{\ln 2}$

26. A particle moves along a line so that at time t, where $0\le t\le \pi$, its position is given by $s(t)=-4\cos t-\frac{t^2}{2}+10$. What is the velocity of the particle when its acceleration is zero?

(A) –5.19 (B) 0.74 (C) 1.32 (D) 2.55 (E) 8.13

27. The function f given by $f(x)=x^3+12x-24$ is

(A) increasing for $x<-2$, decreasing for $-2<x<2$, increasing for $x>2$
(B) decreasing for $x<0$, increasing for $x>0$
(C) increasing for all x
(D) decreasing for all x
(E) decreasing for $x<-2$, increasing for $-2<x<2$, decreasing for $x>2$

31. If $f(x)=e^{3\ln(x^2)}$, then $f'(x)=$

(A) $e^{3\ln(x^2)}$ (B) $\frac{3}{x^2}e^{3\ln(x^2)}$ (C) $6(\ln x)e^{3\ln(x^2)}$ (D) $5x^4$ (E) $6x^5$

34. The top of a 25-foot ladder is sliding down a vertical wall at a constant rate of 3 feet per minute. When the top of the ladder is 7 feet from the ground, what is the rate of change of the distance between the bottom of the ladder and the wall?

(A) $-\frac{7}{8}$ feet per minute
(B) $-\frac{7}{24}$ feet per minute
(C) $\frac{7}{24}$ feet per minute
(D) $\frac{7}{8}$ feet per minute
(E) $\frac{21}{25}$ feet per minute

35. If the graph of $y=\frac{ax+b}{x+c}$ has a horizontal asymptote $y=2$ and a vertical asymptote $x=-3$, then $a+c=$

(A) –5 (B) –1 (C) 0 (D) 1 (E) 5

37. If f is a differentiable function, then $f'(a)$ is given by which of the following?

I. $\lim_{h\to 0}\frac{f(a+h)-f(a)}{h}$
II. $\lim_{x\to a}\frac{f(x)-f(a)}{x-a}$
III. $\lim_{x\to a}\frac{f(x+h)-f(x)}{h}$

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

39. The radius of a circle is increasing at a nonzero rate, and at a certain instant, the rate of increase in the area of the circle is numerically equal to the rate of increase in its circumference. At this instant, the radius of the circle is

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

44. What is the minimum value of $f(x)=x\ln x$?

(A) $-e$ (B) –1 (C) $-\frac{1}{e}$ (D) 0 (E) $f(x)$ has no minimum value.