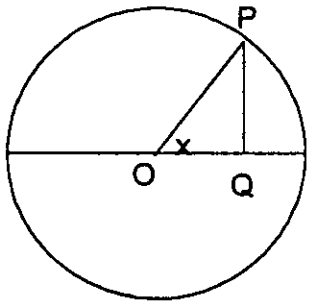
8

1. In the given diagram, x is the measure of angle POQ in radians. Circle O is a unit circle with center O. Find the limit of the ratio of PQ to x as x approaches 0.



a. 0
b. 1
c. PQ
d. x
e. NOTA

2. Given $f(x) = \dfrac{x^2 - 4x + 1}{x - 2 + \sqrt{3}}$ if $x \neq 2 - \sqrt{3}$ and f is continuous at $x = 2 - \sqrt{3}$. Find $f(2 - \sqrt{3})$.

a. $-2\sqrt{3}$ b. $-2 - \sqrt{3}$ c. $2 - \sqrt{3}$ d. $-\sqrt{3}$ e. NOTA

3. For $x \neq -2$, $\dfrac{d}{dx}\ln|x + 2| =$

a. $|x + 2|$ b. $x + 2$ c. $\dfrac{1}{x + 2}$ d. $\dfrac{1}{|x + 2|}$ e. NOTA

4. If $\dfrac{dx}{dt} = f'(t)$ and $\dfrac{dy}{dx} = h(t)$, then $\dfrac{d^2y}{dx^2} =$

a. $\dfrac{h''(t)}{f'(t)}$ b. $\dfrac{h'(t)}{f''(t)}$ c. $\dfrac{h'(t)}{f'(t)}$ d. $f'(t)h'(t)$ e. NOTA

5. If f is a differentiable function at every real number and $f(x) = \begin{cases} 3 + e^{-x}, x > 0 \\ ax + b, x \leq 0 \end{cases}$, find $a + b$.

a. 4 b. 3 c. 2 d. 1 e. NOTA

6. If $f' = 1 + f$, then for all positive integers n, $f^{(n)}$, the nth derivative of f is

a. $n + f$ b. $1 + f$ c. $1 + f^n$ d. $(1 + f)^n$ e. NOTA

7. If $f(x) = x^3 - 2x - 3$ and g is the inverse of f, then $\lim_{x \to 0} \frac{f(g(x)) - \sin x}{x^3} =$

a. 0 b. $\frac{1}{5}$ c. 0.17 d. $\frac{1}{6}$ e. NOTA

8. Let $f(x) = x + \sin^2 x$ for $\frac{\pi}{6} \le x \le \frac{5\pi}{6}$. Find the exact maximum value of f on the given interval.

a. $\frac{5\pi}{6} + \frac{1}{4}$ b. 2.935 c. $\frac{3\pi}{4}$ d. $\frac{3\pi}{2}$ e. NOTA

9. The region in the first quadrant bounded by the axes and the graphs of $\sqrt{x} + \sqrt{y} = 4$ and $x = 4$ is revolved about the x-axis. Find the volume of the solid generated (to the nearest hundredth).

a. 764.04 b. 243.20 c. 92.15 d. 33.51 e. NOTA

10. At time $t = 0$, a cyclist is traveling at 400 meters per minute and is slowing down with a negative acceleration that is directly proportional to the time t. This brings the cyclist to a stop in 8 minutes. What is the total distance traveled by the cyclist in meters?

a. 4000 b. $\frac{4000}{3}$ c. $\frac{16000}{3}$ d. $\frac{12800}{3}$ e. NOTA

11. A tank with rectangular base and rectangular sides is to be open at the top. It is to be constructed so that the width of its base is 6 meters and its volume is 48 cubic meters. If building the tank costs \$12 per square meter for the base and \$8 per square meter for the sides, what is the cost of the least expensive tank to the nearest cent?

a. \$428.30 b. \$450.70 c. \$532.50 d. \$598.30 e. NOTA

12. Given $f(x) = \begin{cases} x \sin\frac{1}{x}, & \text{for } x \neq 0 \\ 0, & \text{for } x = 0 \end{cases}$. Which of the following is correct?

a. f is continuous at 0 but not differentiable at 0.
b. f is continuous and differentiable at 0.
c. $\lim_{x\to 0} f(x) = 1$
d. $\lim_{x\to 0} f(x)$ does not exist
e. NOTA

13. Find the slope of a line tangent to the curve defined by $x^3y^2 = \cos(\pi y)$ at the point $(-1,1)$.

a. undefined b. $\frac{1}{2}$ c. $\frac{3}{2}$ d. 0 e. NOTA

14. If $f(x) = x^3 + x^2 + x - 1$, find the derivative of $f^{-1}(x)$ where $x = 2$ on the graph of f^{-1}.

a. 6 b. 1/5 c. 1/6 d. 1/17 e. NOTA

15. Find the linearization of $f(x) = \sqrt{1+x}$ at $x = 0$. Note: The linearization is the line containing $(0, f(0))$ which most closely matches the graph of f at that point.

a. $y = 1 + \frac{x}{2}$ b. $y = -\frac{1}{2} + \frac{x}{2}$ c. $y = x + 1$ d. $y = -1 + \frac{x}{2}$ e. NOTA

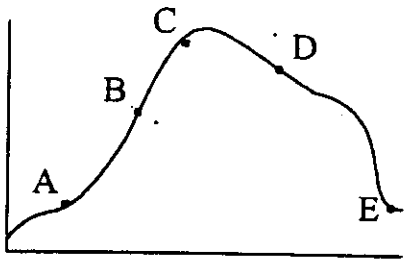
16. How fast in cm/sec does the water level drop when a cylindrical tank of radius r is drained at the constant rate of 1000 cm^3/sec?

a. $\frac{1000}{\pi}$ b. $\frac{1000}{\pi r^2}$ c. $1000\pi r^2$ d. $\frac{1000\pi}{r^2}$ e. NOTA

17. Find the <u>range</u> of the function $f(x) = x^3 - 5x^2 + x + 8$ on the interval $[-2,4]$. (Answer to the nearest hundredth.)

a. $[-22, -4]$ b. $[-7.24, 8.05]$ c. $[-22, 8.05]$ d. $[-7.24, -4]$ e. NOTA

18. Between which pair of consecutive points does the average rate of change of *f*, the function whose graph is shown, have the least value?



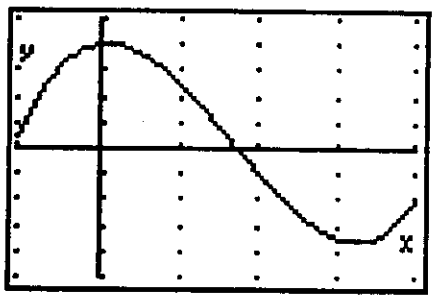
a. A and B
b. B and C
c. C and D
d. D and E
e. NOTA

19. Using the table of values for the function *f*, what is the best estimate for $f'(1.8)$?

x	1	1.4	1.6	1.8	2.0	2.2
f(x)	3	3.9	3.7	4.2	4.7	4.4

a. 0.4 b. 2.5 c. 1.4 d. 0.5 e. NOTA

20. How many values of *c* on $(-1,4)$ will satisfy the conclusion of the Mean Value Theorem for the continuous, differentiable function whose graph is shown.



a. 0
b. 1
c. 2
d. 3
e. NOTA

21. Find the slope of the tangent line to the graph of $y = x^{\frac{2}{3}}$ at $x = 0$.

a. 0 b. 2/3 c. 1/3 d. $-1/3$ e. NOTA

22. The cost per meter to dig a tunnel is given by $C = 100 + 0.06x^2$ where x is the number of meters from the entrance to the tunnel. Find the total cost to dig from the entrance to 100 meters from the entrance.

a. \$700 b. \$20000 c. \$30000 d. \$40000 e. NOTA

23. $\frac{d}{dx}(x \sin^{-1} x + \sqrt{1-x^2}) =$

a. $\sin^{-1} x$ b. $\frac{1}{1-x^2}$ c. $\frac{x}{1-x^2}$ d. 0 e. NOTA

24. Evaluate $\lim_{h\to 0}\dfrac{e^{2h+2}-e^2}{h}$.

a. $2e^2$ b. 14.7 c. e^2 d. $2e$ e. NOTA

25. At what angle to the nearest degree does the curve $y=\dfrac{2}{x}-1$ cut the positive x-axis?

a. 145 b. 150 c. 152 d. 153 e. NOTA

26. If $f(t)=\cot(t\sin t)$, find $f'(t)$.

a. $-(t\sin t+\cos t)\csc^2(t\sin t)$
b. $-(\sin t+t\cos t)\csc^2(t\sin t)$
c. $-\csc^2(t\sin t)\cos t$
d. $\csc^2(t\sin t)$
e. NOTA

27. If $f'(x)=x^x$, for $x>0$, and $g(x)=f(x^2)$, which of the following is $g'(x)$?

a. x^{2x^2} b. $2x^{2x^2+1}$ c. x^{x^2+1} d. $2x^{x+1}(1+\ln x)$ e. NOTA

28. The part of the parabola $y=9-x^2$ from $x=0$ to $x=3$ is rotated about the y-axis to form a surface. A cone is inscribed in the resulting paraboloid with its vertex at the origin and its base touching the paraboloid. What is the maximum volume of the inscribed cone to the nearest thousandth?

a. 2.121 b. 4.500 c. 6.75 d. 21.206 e. NOTA

29. Find the derivative function for the function defined by $y=(\ln e^{-2x})(\ln e^{5x})$

a. $-10x^2$ b. $-20x$ c. e^{-3x} d. -10 e. NOTA

30. If $f(x)=\sqrt{1-x^2}$, find the domain of $f'(x)$.

a. $(-1,1)$ b. $[0,1)$ c. $[-1,1]$ d. $[0,1]$ e. NOTA