If none of the answers given is correct choose e) Nota.

1. Write the equation of the **normal** to the graph of $y = \sqrt{2x+1}$ at $x = 4$.

a) $x - 3y = -5$ b) $9x + y = 39$ c) $6x + y = 27$ d) $3x + y = 15$ e) Nota

2. If h, g, and f are twice differentiable functions and $h(x) = f(x)g(x)$, then $h''(x) =$

a) $f(x)g'(x) + g(x)f'(x)$ b) $f(x)g''(x) + f'(x)g'(x) + g(x)f''(x) + f''(x)g'(x)$
c) $g''(x)f'(x) + f(x)g'(x) + g(x)f''(x) + f'(x)g'(x)$ d) $f(x)g''(x) + 2f'(x)g'(x) + g(x)f''(x)$
e) Nota

3. $\int[\cos(bx) + e]\,dx =$

a) $\frac{\sin(bx)+ex}{b} + C$ b) $\frac{2\sin(bx)+be^2}{2b} + C$ c) $\frac{\sin(bx)+bex}{b} + C$ d) $\frac{-\sin(bx)}{b} + ex + C$ e) Nota

4. $\lim_{h\to 0} \frac{2^{x^2+2xh+h^2} - 2^{x^2}}{h} =$

a) $2^{x^2} \bullet 2x \bullet \ln 2$ b) $2^{x^2+1} \bullet \ln 2$ c) $2x^3 \bullet 2^{x^2-1}$ d) $2x^3 \bullet 2^{x^2-1} \bullet \ln 2$ e) Nota

5. If f is an even function which of the following is also even?

a) $[f']^3$ b) $f \bullet f'$ c) f'' d) $2 \bullet f'$ e) Nota

6. A point (x,y) is floating at random on a coordinate plane such that $0 \le x \le 70$ and $0 \le y \le 4$. Find the probability that at a given time it is in the region bounded by $x = 1$, $x = e^3$, $y = 0$, and $y = \frac{2}{x}$.

a) $\frac{1}{70}$ b) $\frac{3}{140}$ c) $\frac{\ln 3}{140}$ d) $\frac{e^3}{140}$ e) Nota

7. Find the slope of the line tangent to the curve $y^3 - xy + \sin(xy) = 8$ at $x = 0$.

a) $\frac{-1}{6}$ b) $\frac{1}{12}$ c) $\frac{1}{3}$ d) $\frac{2}{3}$ e) Nota

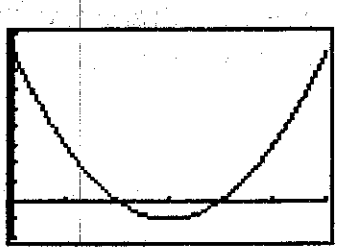
8. $\lim_{x\to 0} \frac{\arctan(x^2)}{7x^2} =$

a) 0 b) $\frac{1}{14}$ c) $\frac{1}{7}$ d) $\frac{2}{3}$ e) Nota

9. To the nearest tenth find the distance form the vertex of the parabola determined by $f(x) = 5x^2 + 10x + 3$ to the line tangent to the graph of $y = e^{2x}$ at $x = \ln 2$.

a) 0.9 b) 1.9 c) 3.4 d) 0.6 e) Nota

10. The graph of the acceleration of a function moving rectilinearly , $t \geq 0$, is given below. Each tick mark represents a unit of 1. Which of the following statements is true?



a) The acceleration is decreasing for $2 < t < 4$.
b) The position reaches a maximum value at $t = 2$.
c) The velocity reaches a minimum at $t = 4$.
d) The position reaches a minimum at $t = 3$. e) Nota

11. A spherical balloon is being inflated so that its volume is increasing at the rate of $6 \frac{m^3}{\text{min}}$. At what rate is the diameter increasing when the diameter is 10 m?

a) $\frac{3}{200\pi}$ b) $\frac{3}{25\pi}$ c) $\frac{12}{25\pi}$ d) $\frac{3}{50\pi}$ e) Nota

12. Find the particular solution of the differential equation determined by the following initial conditions: $\frac{dy}{dx} = \frac{\cos(3x)}{\sin(2y)}$, $y = \frac{\pi}{3}$ *when* $x = \frac{\pi}{2}$.

a) $4\sin(3x) + 6\cos(2y) + 7 = 0$ b) $2\sin(3x) - 3\cos(2y) - 1 = 0$
c) $2\sin(3x) + 6\cos(2y) + 8 = 0$ d) $3\sin(3x) + 2\cos(2y) + 5 = 0$ e) Nota

13. To the nearest thousandth find the absolute maximum value of $y = \frac{e^{\sin(x)}}{x}$ over [3,20].

a) 0.253 b) 0.349 c) 0.384 d) 7.700 e) Nota

14. What relationship must exist between b and c if the graph of $y = x^3 + 2bx^2 + cx + 5$ has no horizontal tangent lines?

a) $|b| \geq \frac{\sqrt{3c}}{4}$ b) $|b| < c$ c) $|b| \leq \frac{\sqrt{3c}}{8}$ d) $|b| < \frac{\sqrt{3c}}{2}$ e) Nota

15. To the nearest hundredth find the area bounded by y = tanx and y = 2ln(x+1).

a) 0.16 b) 0.24 c) 0.26 d) 0.64 e) Nota

16. Let f(x) = $x\log_a x$. Determine all real values of a for which the graph of f is concave up.

a) $\left(0, \frac{1}{e}\right) \cup (1, \infty)$ b) $(1, \infty)$ c) (e, ∞) d) $(1, e)$ e) Nota

17. $\int \frac{x}{\sqrt{x^2+7}}\, dx =$

a) $\frac{\sqrt{x^2+7}}{4} + C$ b) $\sqrt{x^2+7} + C$ c) $\frac{-1}{\sqrt{(x^2+7)^3}} + C$ d) $4\sqrt{x^2+7} + C$ e) Nota

18. R and S are two real numbers whose difference is 16 and whose product is as small as possible. Find R + S.

a) -12 b) -16 c) 2 d) 16 e) Nota

19. f(x) = $\sqrt{x}$. The line 4y = x + 4 is tangent to the graph of f. If (x,y) is the point of tangency x + y = ?

a) 1 b) 2 c) 4 d) 6 e) Nota

20. If 0 ≤ a < b and f(x) = x^2, find the average value of f on [a,b].

a) $\frac{a^2+ab+b^2}{3}$ b) $a^2 + ab + b^2$ c) $\frac{a^2-ab+b^2}{3}$ d) $\frac{b^3-a^3}{3}$ e) Nota

21. Find y′ if $y = 3x^2(e^{-4\ln x})(4\ln e^{\sec x})(\cos x)$.

a) $\frac{24}{x}$ b) $\frac{96}{x^3}$ c) $-36x^2$ d) $\frac{-24}{x^3}$ e) Nota

22. The flow of water through a dam is controlled so that the rate F′(t) of flow in tons per hour is given by $F'(t) = 14{,}000\sin\left(\frac{\pi t}{24}\right), 0 \le t \le 24$. To the nearest tenth how many tons of water flow through the dam per day?

a) 68,087.8 b) 28,000.0 c) 213,904.2 d) 49,165.6 e) Nota

23. Which of the following statements is false concerning the graph of $y = \frac{\sqrt{9x^2-1}}{4x^2-3}$.

a) The graph has 3 asymptotes. b) The graph has no absolute maximum value.

c) It is the graph of an even function. d) The graph is concave down on $\left(\frac{-\sqrt{3}}{2}, \frac{\sqrt{3}}{2}\right)$

e) Nota

24. Find the value of c in the interval (0,1) guaranteed by the Mean Value Theorem for $f(x) = -3 + \sqrt{x}$.

a) $\frac{1}{\sqrt{2}}$ b) $\frac{1}{4}$ c) $\frac{1}{2}$ d) $\frac{1}{100}$ e) Nota

25. Let f be a continuous function having the following properties:
$\int_4^{11} f(x)dx = 5$ and $\int_1^{11} f(x)dx = 12$ Find $\int_1^4 [2f(x) - 5]dx$.

a) -1 b) -12 c) 15 d) 33 e) Nota

26. A single cell amoeba doubles every 3 days. To the nearest day how long would it take one amoeba to produce a population of 10,000 amoebae?

a) 1667 b) 333 c) 126 d) 40 e) Nota

27. Given points A(3,1) and B(6,4) on a rectangular coordinate system, find the abscissa to the nearest tenth of the point P on the x-axis such that angle APB has its largest value.

a) 4.6 b) 4.8 c) 5.3 d) 5.5 e) Nota

28. A curve C has parametric equations $x = t^3 - 3t$ and $y = t^2 - 5t - 1$, where $t \in$ Reals. For what value(s) of t is the tangent line horizontal?

a) $t = 1$ or $t = -1$ b) $t = \frac{2}{5}$ c) $t = \frac{-5}{2}$ d) $t = 10$ e) Nota

29. If $f(x) = x^3 + 2x - 1$, find the slope of the tangent line to the graph of f^{-1} at $x = 2$.

a) $\frac{1}{5}$ b) $\frac{1}{2}$ c) $\frac{2}{5}$ d) 5 e) Nota

30. Use differentials to approximate the arclength for the graph of $y = x^2$ from A(2,4) to B(2.1,4.41).

a) $\frac{\sqrt{17}}{10}$ b) $\frac{16\sqrt{17}}{17}$ c) $\frac{8\sqrt{17}}{170}$ d) $\frac{\sqrt{17}}{17}$ e) Nota