1. Which of the following statements is TRUE:

   a) If $f$ is a differentiable and positive function, then $\frac{d}{dx}[\sqrt{f(x)}] = \frac{f'(x)}{2\sqrt{f(x)}}$

   b) If $y = \sin^2 x$, then $y'' = 2 \sin x \cos x$

   c) If $y = e^x$, then $y' = 2e$

   d) $\frac{d}{dx} \ln(10) = \frac{1}{10}$

   e) $\frac{d}{dx}(|x^2 + x|) = |2x + 1|$

2. If $y = \frac{4 \sin x}{2x + \cos x}$, then $y' =$

3. $\lim_{h \to 0} \frac{\sin(2x + h) - \sin(2x)}{h} =$

4. A particle with position function $s(t) = t^3 - 3t^2 - 9t$, $t \in [0, 7]$, moves in the positive direction when $t \in (a, b)$. Then $a + b =$
5. An equation of the tangent line to the curve \( y = \frac{\ln x}{x} \) at \((1, 0)\) is 

6. The slope of the tangent line to the curve \( x^2 + x^2 y^2 + \tan^{-1} y = 1 \) at the point \((-1, 0)\) is 

7. If \( h(2) = 4 \) and \( h'(2) = -3 \), then \( \frac{d}{dx} \left( \frac{h(x)}{x} \right) \bigg|_{x=2} \) is equal to: 

8. \( \lim_{x \to \pi} \frac{\sin(\sin x)}{\tan x} = \) 

9. Let \( f(x) = x^n e^x \), where \( n \) is a positive integer. Then, \( f^{(n)}(x) \) at \( x = 0 \) is 

10. If \( f(x) = x g(x) \), where \( f \) and \( g \) are differentiable functions, \( f(2) = -6 \), and \( f'(2) = -5 \). The equation of the normal line to the curve \( y = g(x) \) at \( x = 2 \) is 

11. Given that \( y = \frac{e^x \cos(\pi x)}{\sqrt{x}} + e^x \), then \( y'(1) = \)
12. If \( f(t) = g(t\, g(t^2)) \) such that

\[
\begin{array}{c|ccc}
 t & 2 & 4 & 8 \\
 g(t) & 2 & 4 & 3 \\
g'(t) & 1 & 2 & 2 \\
\end{array}
\]

then \( f'(2) = \)

13. \[
\frac{d}{dx} \left[ \lim_{n \to \infty} \left( 1 + \frac{x}{5n} \right)^n \right] =
\]

14. Let \( g(x) = \begin{cases} \sqrt{x} e^x & \text{when } x \geq 0 \\ \log_3(-x) & \text{when } x < 0 \end{cases} \). The value of \( g'(1) + g'\left(\frac{-1}{\ln 3}\right) \) equals to

15. Let \( f(x) = c \, x^2 + c \ln(|\cos x|) + 3 \), where \( c \) is some constant. The value of \( c \) making \( f'(\pi) = \frac{3\pi}{2} \) is

16. If \( f(x) = 5x + 3 \, e^{7x} \), then \((f^{-1})'(3) = \)
17. A glass window has a shape of square with a semicircle on its top. Suppose that the area of the square is changing at the rate of \( \frac{2}{\pi} \) cm\(^2\)/min. Then the area of the semicircle will be changing at the rate of \( R \) cm\(^2\)/min where \( R = \)

18. If \( y = x \sin^{-1} x + \sqrt{1 - x^2} \), then \( \frac{dy}{dx} \) at \( x = 1 \) equals to

19. If \( f(x) = (\pi x)^{e^x} \), then \( f' \left( \frac{1}{\pi} \right) = \)

20. \( \frac{d^{19}}{dx^{19}} (x \sin x) = \)

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