1. If \( y = e^x + x^2 e^e + 2 \pi^e - e^\pi + 1 \), then \( y' = \)

(a) \( e^x + (e + 2) x^{e+1} \)
(b) \( e^x + (e + 2) x^{e+1} - \pi e^\pi \)
(c) \( e^x + (e + 2) x^{e+1} + 2e \pi^{e-1} \)
(d) \( e^x + 2x^{e+1} \)
(e) \( e^x + e x^{e+1} \)

2. If \( y = x \tan^{-1} x - \ln \sqrt{1 + x^2} \), then \( y'(1) = \)

(a) \( \frac{\pi}{4} \)
(b) \( \frac{\pi}{2} \)
(c) 1
(d) \( \frac{1}{2} \)
(e) \( \frac{\pi}{3} \)
3. Let

\[ y = \sqrt[3]{\frac{(x^2 + 1)^5 \sqrt{x}}{(3x - 1)^2}}. \]

The instantaneous rate of change of \( y \) with respect to \( x \) at \( x = 1 \) is:

(a) \( \frac{5}{3} \)

(b) \( \frac{10}{3} \)

(c) \( \frac{17}{3} \)

(d) 1

(e) \( \frac{1}{3} \)

4. If the line tangent to the parabola \( y = ax^2 + bx \) at the point \( (1, 1) \) is parallel to \( y = 3x - 2 \), then \( a - b = \)

(a) 3

(b) -1

(c) -2

(d) 2

(e) 1
5. If \( f(2) = 10 \) and \( f'(x) = x^2 f(x) \) for all \( x \), then \( f''(2) = \)

(a) 200
(b) 160
(c) 0
(d) does not exist
(e) 240

6. Let \( g(x) = \frac{1 + x f(x)}{\sqrt{x}} \). If \( f \) is differentiable such that \( f(1) = 3 \) and \( f'(1) = 2 \), then \( g'(1) = \)

(a) 3
(b) 2
(c) 1
(d) 0
(e) 5
7. If \( f(x) = \cos(2x) \sin(2x) \), then \( f''(x) = \)

(a) \(-8 \sin(4x)\)
(b) \(8 \cos(4x)\)
(c) \(-16 \sin(2x)\)
(d) \(16 \sin(2x)\)
(e) \(16 \cos(2x) \sin(2x)\)

8. If \( y = e^x \sec x \), then \( y' = \)

(a) \(y(1 + \tan x)\)
(b) \(y(1 + \sec x)\)
(c) \(y(\csc x - \tan x)\)
(d) \(y(1 + \sec^2 x)\)
(e) \(y(\sec x + \tan x)\)
9. \[ \lim_{x \to 0} \frac{2x + \sin 3x}{\sin 5x} = \]

(a) 1  
(b) 0  
(c) 2  
(d) \( \frac{3}{5} \)  
(e) 5  

10. Let the graph of \( f \) as shown and \( g(x) = \sqrt{f(x)} \). Then \( g'(3) = \)

(a) \(-\frac{\sqrt{2}}{6}\)  
(b) \(-2\)  
(c) 2  
(d) \( \frac{\sqrt{2}}{2} \)  
(e) \(-1\)
11. If $y = f(2 - 3 f(4 - 5t))$, $f(4) = -2/3$ and $f'(4) = 1$ then $y'(0) =$

(a) 15
(b) 18
(c) 20
(d) 14
(e) 12

12. Consider the curve given by the equation $\sin (x^2 + y^2) = x + y$. The slope of the tangent line at $P(0,0)$ is:

(a) $-1$
(b) 1
(c) 0
(d) 2
(e) $-2$
13. Let \( f(x) = \left(\sin \frac{\pi x}{2}\right)^{\ln(x)} \), then \( f'(1) = \)

(a) 0  
(b) 1  
(c) \(1/2\)  
(d) \(\pi\)  
(e) does not exist

14. If \( f(x) = x \ln x \) then \( f^{(61)}(1) = \)

(a) \(-59!\)  
(b) \(60!\)  
(c) \(-60!\)  
(d) \(61!\)  
(e) \(58!\)
15. If \( f(6) = 7 \) and \( f'(6) = 3 \), then \( (f^{-1})'(7) = \)

(a) \( \frac{1}{3} \)

(b) \( \frac{1}{6} \)

(c) \( \frac{1}{7} \)

(d) 6

(e) 7

16. The position of a particle is given by

\[ s(t) = 2t^3 - 9t^2 + 12t + 5, \quad t \geq 0, \]

where \( t \) is measured in seconds and \( s \) in meters. The distance in meters traveled during the first 3 seconds is

(a) 11

(b) 20

(c) 15

(d) 9

(e) 10
17. A spotlight on the ground shines on a wall 10 m away. If a man 2 m tall walks from the spotlight towards the building at a speed of 2 m/s. When the man is 4 m from the building, the length of his shadow on the building is:

(a) decreasing at a rate of \( \frac{10}{9} \) m/s
(b) decreasing at a rate of \( \frac{5}{3} \) m/s
(c) increasing at a rate of \( \frac{10}{9} \) m/s
(d) increasing at a rate of \( \frac{5}{2} \) m/s
(e) increasing at a rate of 2 m/s

18. The volume of a cube is increasing at a rate of 10 cm\(^3\)/min. when the length of the edge is 30 m. At that time the surface area is increasing at the rate:

(a) \( \frac{4}{3} \) cm\(^2\)/min
(b) \( \frac{3}{4} \) cm\(^2\)/min
(c) \( \frac{4}{9} \) cm\(^2\)/min
(d) \( \frac{9}{4} \) cm\(^2\)/min
(e) \( \frac{4}{27} \) cm\(^2\)/min
19. \[ \lim_{x \to 1} \frac{xe^x - e}{x - 1} \]

(a) \(2e\)
(b) \(e\)
(c) \(1/e\)
(d) \(-e\)
(e) \(e^2\)

20. The position function of a particle moving in a straight line is given by

\[ f(t) = t^2 e^{-t}, \quad t > 0, \]

where time is measured in seconds. Then the particle is at rest at \(t =\)

(a) 2
(b) 1
(c) \(\frac{1}{2}\)
(d) \(\frac{3}{2}\)
(e) 3
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