1. The slope of the tangent line to the curve
$y = x^3 - x^2$ at $x = -1$ is

(a) 5

(b) 1

(c) 0

(d) 2

(e) -4

2. An equation of the normal line to the curve $y = \dfrac{2}{(x-2)^3}$ at the point $(3, 2)$ is

(a) $6y - x = 9$

(b) $y + 6x = 5$

(c) $y = -6x + 8$

(d) $x = 6y - 7$

(e) $6y - 3x = 11$

3. If $y = \dfrac{e^x}{x}$, then y' is equal to

(a) $\dfrac{(x-1)e^x}{x^2}$

(b) $\dfrac{e^x}{x^2}$

(c) 0

(d) e^x

(e) $\dfrac{x^2e^x - 1}{x^2}$

4. At time $t > 0$, the position of a particle moving along the $s-$axis is $S(t) = t^3 - 6t^2$. The acceleration of the particle when the velocity is zero is

(a) 12

(b) 6

(c) 0

(d) 4

(e) 10

5. If $f(x) = x^2 \cos x - 2x \sin x - 2 \cos x$, then $f'\left(\frac{3\pi}{2}\right)$ is

(a) $\frac{9\pi^2}{4}$

(b) 0

(c) $\frac{-9\pi^2}{4}$

(d) $\frac{-3\pi}{2}$

(e) $\frac{3\pi}{2}$

6. If $y = u^2 - 1$ and $u = e^{2x} + \ln x$, then $\frac{dy}{dx}$ at $x = 1$ is equal to

(a) $4e^4 + 2e^2$

(b) $2e^4 + e^2$

(c) $4e^4 - 2e^2$

(d) $2e^4 - e^2$

(e) $e^4 + 4e^2$

7. If $y = \left(1 + \frac{1}{x}\right)^3 + \left(1 - \frac{1}{x}\right)^3$, then $y' =$

(a) $\dfrac{-12}{x^3}$

(b) $\dfrac{-9}{x}$

(c) $\dfrac{-3}{x^2}$

(d) $\dfrac{-6}{x^3}$

(e) $\dfrac{3}{x^4}$

8. Let $f(x) = \begin{cases} x - 1 & \text{if} \quad x < 0 \\ \sin x & \text{if} \quad x \geq 0 \end{cases}$, then $f'(0)$

(a) Does not exist

(b) is equal to 1

(c) is equal to 0

(d) is equal to -1

(e) is equal to 2

9. Let $h(x) = 2g(x) + f(\sqrt{g(x)})$ and $h'(-1) = 7$, $f'(3) = 18$, $g(-1) = 9$, then $g'(-1)$ is equal to

(a) $\frac{7}{5}$

(b) 2

(c) 0

(d) $\frac{1}{7}$

(e) 5

10. The slope of the tangent line to the graph of $x^2y + y^4 = 4 + 2x$ at the point $(-1, 1)$ is equal to

(a) $\frac{4}{5}$

(b) -1

(c) 1

(d) 0

(e) $\frac{4}{3}$

11. Given $y = x(x+1)(x+2)$, then by using logarithmic differentiation y' is equal to

(a) $3x^2 + 6x + 2$

(b) $3x^2 - 6x + 2$

(c) $3x^2 - 6x - 2$

(d) $-3x^2 + 6x + 2$

(e) $-3x^2 - 6x + 2$

12. If $y = \ln(\ln x)$, then $(x \ln x)y'' + y' =$

(a) $\dfrac{-1}{x}$

(b) $\dfrac{1}{x\ \ln x}$

(c) $\dfrac{\ln x}{x}$

(d) 0

(e) $\dfrac{-x}{1 + \ln x}$

13. If the radius r of a circle is measured with a possible percentage error of $\pm 2\%$, then the estimated percentage error in calculating the area of the circle is

(a) $\pm 4\%$

(b) $\pm 2\pi\%$

(c) $\pm 2\%$

(d) $\pm \frac{\pi}{r}\%$

(e) $\pm \frac{4}{r}\%$

14. The linearization $L(x)$ of $f(x) = e^{x-1}$ at $x = 1$ is

(a) $L(x) = x$

(b) $L(x) = -x$

(c) $L(x) = x + 1$

(d) $L(x) = 1 - x$

(e) $L(x) = 2x$

15. Suppose that x and y are differentiable functions of t and are related by the equation $x^2y^3 = \frac{4}{27}$. If $\frac{dy}{dt} = \frac{1}{2}$, then the value of $\frac{dx}{dt}$ at $x = 2$ is

(a) $-\frac{9}{2}$

(b) $\frac{-5}{2}$

(c) -1

(d) $\frac{9}{4}$

(e) 0

16. For $t > 0$, $\frac{d}{dt}\left[\sin^{-1}\left(\frac{t-4}{t+4}\right)\right] =$

(a) $\frac{2\sqrt{t}}{t(t+4)}$

(b) $\frac{8\sqrt{t}}{t+4}$

(c) $\frac{4\sqrt{t}}{t}$

(d) $\frac{8}{1+\sqrt{t}}$

(e) $(t+4)\sqrt{t}$

17. If $f(x) = \ln(x^2+4) - x\tan^{-1}\left(\frac{x}{2}\right)$, then $f'(2) =$

(a) $\dfrac{-\pi}{4}$

(b) $\dfrac{\pi}{4}$

(c) 0

(d) Does not exist

(e) -1

18. If $y = (1+\sqrt{x})^x$, then $y'(1) =$

(a) $\dfrac{1}{2} + 2\ln 2$

(b) $1 + 2\ln 2$

(c) $1 + \ln 2$

(d) $\dfrac{1}{2} + \ln 2$

(e) $\dfrac{1}{4} + 2\ln 2$

19. The coordinates of a particle in the xy-plane are differentiable functions of time t with $\frac{dx}{dt} = -1\ m/sec$ and $\frac{dy}{dt} = -5\ m/sec$. How fast is the particle's distance from the origin changing as it passes through the point $(5, 12)$

(a) -5

(b) $\frac{2}{13}$

(c) $\frac{-3}{7}$

(d) $\frac{-5}{13}$

(e) 4

20. The equations of two lines through the origin tangent to the curve of $x^2 - 4x + y^2 + 2 = 0$ are given by

(a) $y = x,\ y = -x$

(b) $y = 2x,\ y = -x$

(c) $y = x + 1,\ y = -x + 2$

(d) $y = 3x,\ y = 2x$

(e) $y = -2x,\ y = -x$