

01

10. If $x^4 - 3x^2y^2 + 4y^2 = 5$, then the value of $\frac{dy}{dx}$ at (1, 2) is

- (A) -1 (B) 1 (C) 3 (D) 5 (E) undefined

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17. The curve $3y^2 - 3xy + 2x^3 = 7$ has vertical tangents when

- (A) $x = y$ (B) $2x = y$ (C) $x = 2y$ (D) $3x = y$ (E) $x = 3y$

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13. If $3x + xy + 4y = 8$, the value of $\frac{d^2y}{dx^2}$ at the point (1, 1) is

- (A) 0 (B) $\frac{8}{25}$ (C) $\frac{8}{5}$ (D) $\frac{64}{25}$ (E) $\frac{64}{5}$

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15. There are two lines that pass through the origin and are tangent to the curve $4x^2 + y^2 - 20x + 5 = 0$. Find the equations of both lines.

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11. The equation of the line tangent to the curve $y^2 - 2x - 4y = 1$ at (-2, 1) is

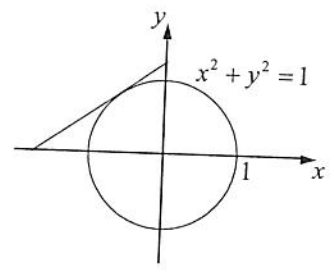
- (A) $y = -x - 1$ (B) $-y = -x - 3$
(C) $3y = -x + 1$ (D) $5y = -x + 3$
(E) none of the above

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20. One of the lines that can be drawn normal to the curve $x^2 - y^2 = 5$ and parallel to the line $2x + 3y = 10$ is

- (A) $2x + 3y = 6$ (B) $2x + 3y = 8$
(C) $2x + 3y = 12$ (D) $2x + 3y = 14$
(E) $2x + 3y = 16$

31. ⁹⁷



The circle $x^2 + y^2 = 1$ has a line segment drawn tangent to it in the second quadrant. The endpoints of the line segment are on the x - and y -axes. If the slope of this line segment is $\frac{3}{4}$, what is its length?

⁴⁶

9. If $5x^2 + 2xy - 3y^5 = 4$, then the value of $\frac{dy}{dx}$ at $(1, 1)$ is

- (A) 0 (B) $\frac{4}{5}$ (C) $\frac{12}{13}$ (D) $\frac{14}{15}$ (E) 1

⁹⁵

14. If $xy + x^2 - y^2 = 1$, then the value of $\frac{d^2y}{dx^2}$ at the point $(1, 1)$ is

- (A) -10 (B) -5 (C) 3 (D) 5 (E) 10

⁴⁵

30. Assuming that the function $y = \log_x y$ ($x > 0, y > 0$) is differentiable, the slope of the tangent line to the curve at $y = \frac{1}{2}$ is

- (A) 1 (B) $\frac{1}{1 + \ln 2}$
 (C) $\frac{2}{1 + 2 \ln 2}$ (D) $\frac{1}{1 - \ln 2}$
 (E) $\frac{1}{\ln 2 - 1}$

⁹⁴

10. If $x^2 - 3xy - y = 5$, then the value of $\frac{dy}{dx}$ at $x = -1$ is

- (A) -4 (B) -2 (C) 2 (D) 4
 (E) non-existent

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31. A particle is moving clockwise on the ellipse $16x^2 + 9y^2 = 400$. What are the coordinates of particle's position in the first quadrant where the y -coordinate is decreasing at the same rate as the x -coordinate is increasing?

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22. Given $y = 1 + xe^y$, express $\frac{dy}{dx}$ in terms of y only.

91

15. A curve is defined by the equation $x^2 + y^2 = 25$ for $x \leq 4$ and by the equation $y = ax^2 + bx + \frac{29}{3}$ for $x > 4$. For what values of a and b will the relation be differentiable at the point $(4, 3)$?

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20. If $x^2 - 2y^2 = 2$, then $\frac{d^2y}{dx^2}$ can be expressed in the form ay^b , where a and b are rational numbers in simplest form. Find a and b .

99

12. For which of the following curves in the xy -plane the slope of the tangent line at every point equals $-\frac{2x}{y}$?

- (A) straight line
- (B) circle
- (C) ellipse
- (D) hyperbola
- (E) parabola

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15. Find the points on the curve $xy + 4x - 3y^2 = 27$ where the tangents to the curve are vertical lines.

87

13. For the curve $x^3 - 2xy + y^2 = 5$, the slope of the tangent to the curve at $(2, 3)$ is

- (A) -3
- (B) $-\frac{3}{5}$
- (C) 0
- (D) $\frac{3}{5}$
- (E) 3

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24. Find the area of the region bounded by the line tangent to the hyperbola $x^2 - y^2 = 16$ at $(5, 3)$ and the two asymptotes, $y = \pm x$, of the hyperbola.

83

12. The slope of the line normal to the curve $xy + x - 2y + 2 = 0$ at the point where $x = 4$ is

- (A) -2 (B) -1 (C) 0 (D) $\frac{1}{2}$ (E) 1

85

31. A particle is moving clockwise on the ellipse $16x^2 + 4y^2 = 45$. Find all points on the ellipse where $\frac{dy}{dt} = -\frac{dx}{dt}$.

87

11. The slope of the tangent to the curve $3x^2y + y^3 - x^2 = 75$ at the point where $x = 1$ is

- (A) $-\frac{2}{3}$ (B) $-\frac{22}{51}$ (C) $\frac{22}{51}$ (D) $\frac{2}{3}$
 (E) none of the above

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27. A circle with the center at $(3, 0)$ passes through the point $(-3, 8)$. An equation of the line tangent to the circle at the point $(-3, 8)$ is

- (A) $4y + 3x = 41$ (B) $4y - 3x = 41$
 (C) $3y - 4x = 36$ (D) $3y + 4x = 36$
 (E) none of the above

83

22. If $x^y = y^x$, then $\frac{dy}{dx} =$

- (A) $\frac{xe^y - y}{ye^x - x}$ (B) $\frac{y^x \ln y}{x^y \ln x}$
 (C) $\frac{y(\ln y) - x}{x(\ln x) - y}$ (D) $\frac{\ln y - \frac{y}{x}}{\ln x - \frac{x}{y}}$
 (E) none of the above

24. ⁸³ Find the coordinates of all points where the curve of $x^2 - xy + y^2 = 1$ has vertical tangents.
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10. ⁸² Which of the following is the equation of the normal to the curve $x^3 + y^2 + 2x - 6 = 0$ at the point where $y = 3$?

- (A) $(y+1) = \frac{6}{5}(x-3)$ (B) $(y-3) = -\frac{5}{6}(x+1)$
(C) $(y+1) = -\frac{5}{6}(x-3)$ (D) $y = \frac{6}{5}x - \frac{23}{5}$
(E) none of the above