

## 3.8 EXERCISES

For the following exercises, use implicit differentiation to find  $\frac{dy}{dx}$ .

300.  $x^2 - y^2 = 4$

301.  $6x^2 + 3y^2 = 12$

302.  $x^2y = y - 7$

303.  $3x^3 + 9xy^2 = 5x^3$

304.  $xy - \cos(xy) = 1$

305.  $y\sqrt{x+4} = xy + 8$

306.  $-xy - 2 = \frac{x}{7}$

307.  $y \sin(xy) = y^2 + 2$

308.  $(xy)^2 + 3x = y^2$

309.  $x^3y + xy^3 = -8$

For the following exercises, find the equation of the tangent line to the graph of the given equation at the indicated point. Use a calculator or computer software to graph the function and the tangent line.

310. [T]  $x^4y - xy^3 = -2$ ,  $(-1, -1)$

311. [T]  $x^2y^2 + 5xy = 14$ ,  $(2, 1)$

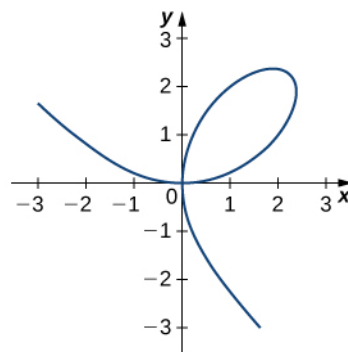
312. [T]  $\tan(xy) = y$ ,  $(\frac{\pi}{4}, 1)$

313. [T]  $xy^2 + \sin(\pi y) - 2x^2 = 10$ ,  $(2, -3)$

314. [T]  $\frac{x}{y} + 5x - 7 = -\frac{3}{4}y$ ,  $(1, 2)$

315. [T]  $xy + \sin(x) = 1$ ,  $(\frac{\pi}{2}, 0)$

316. [T] The graph of a folium of Descartes with equation  $2x^3 + 2y^3 - 9xy = 0$  is given in the following graph.



- Find the equation of the tangent line at the point  $(2, 1)$ . Graph the tangent line along with the folium.
- Find the equation of the normal line to the tangent line in a. at the point  $(2, 1)$ .

317. For the equation  $x^2 + 2xy - 3y^2 = 0$ ,

- Find the equation of the normal to the tangent line at the point  $(1, 1)$ .
- At what other point does the normal line in a. intersect the graph of the equation?

318. Find all points on the graph of  $y^3 - 27y = x^2 - 90$  at which the tangent line is vertical.

319. For the equation  $x^2 + xy + y^2 = 7$ ,

- Find the  $x$ -intercept(s).
- Find the slope of the tangent line(s) at the  $x$ -intercept(s).
- What does the value(s) in b. indicate about the tangent line(s)?

320. Find the equation of the tangent line to the graph of the equation  $\sin^{-1}x + \sin^{-1}y = \frac{\pi}{6}$  at the point  $(0, \frac{1}{2})$ .

321. Find the equation of the tangent line to the graph of the equation  $\tan^{-1}(x+y) = x^2 + \frac{\pi}{4}$  at the point  $(0, 1)$ .

322. Find  $y'$  and  $y''$  for  $x^2 + 6xy - 2y^2 = 3$ .

323. **[T]** The number of cell phones produced when  $x$  dollars is spent on labor and  $y$  dollars is spent on capital invested by a manufacturer can be modeled by the equation  $60x^{3/4}y^{1/4} = 3240$ .

- Find  $\frac{dy}{dx}$  and evaluate at the point  $(81, 16)$ .
- Interpret the result of a.

324. **[T]** The number of cars produced when  $x$  dollars is spent on labor and  $y$  dollars is spent on capital invested by a manufacturer can be modeled by the equation  $30x^{1/3}y^{2/3} = 360$ . (Both  $x$  and  $y$  are measured in thousands of dollars.)

- Find  $\frac{dy}{dx}$  and evaluate at the point  $(27, 8)$ .
- Interpret the result of a.

325. The volume of a right circular cone of radius  $x$  and height  $y$  is given by  $V = \frac{1}{3}\pi x^2 y$ . Suppose that the volume of the cone is  $85\pi \text{ cm}^3$ . Find  $\frac{dy}{dx}$  when  $x = 4$  and  $y = 16$ .

For the following exercises, consider a closed rectangular box with a square base with side  $x$  and height  $y$ .

326. Find an equation for the surface area of the rectangular box,  $S(x, y)$ .

327. If the surface area of the rectangular box is 78 square feet, find  $\frac{dy}{dx}$  when  $x = 3$  feet and  $y = 5$  feet.

For the following exercises, use implicit differentiation to determine  $y'$ . Does the answer agree with the formulas we have previously determined?

328.  $x = \sin y$

329.  $x = \cos y$

330.  $x = \tan y$