

## 3.7 Implicit Differentiation

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### Implicit Differentiation Process

- (1) Differentiate both sides of the equation with respect to  $x$
  - (2) Collect the terms with  $\frac{dy}{dx}$  on one side of the equation
  - (3) Factor out  $\frac{dy}{dx}$
  - (4) Solve for  $\frac{dy}{dx}$
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For problems 1 – 5, assume that the equation determines a differentiable function  $f$  such that  $y = f(x)$ , and find  $y'$

1.  $y = 5\sqrt{3x^{-\frac{1}{3}} + 2}$

2.  $2x - \sqrt{xy} + y^3 = 16$

3.  $\sin^2(3y) = x + y - 1$

4.  $y^2 + 1 = x^2 \sec y$

5.  $y = \csc(xy)$

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6. Use implicit differentiation to find  $\frac{dy}{dx}$  and  $\frac{d^2y}{dx^2}$  for  $3x^2 + 4y^2 = 4$

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7. Find the equation of the tangent line for  $x^2y + \sin y = 2\pi$  at the point  $(1, 2\pi)$

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8. Find the equation of the normal line for  $(x^2 + y^2)^2 = 4xy$  at the point  $(1, 1)$