

Write your questions
and thoughts here!

Notation	1 st Derivative	2 nd Derivative	3 rd Derivative	n^{th} Derivative
y	y'	y''	y'''	
$f(x)$	$f'(x)$	$f''(x)$	$f'''(x)$	
y	$\frac{dy}{dx}$	$\frac{d^2y}{dx^2}$	$\frac{d^3y}{dx^3}$	

Finding the 2nd derivative

$$f(x) = x^6 - 2x^4 + 5x^2 - 3x + 9$$

$$f'(x) =$$

$$f''(x) =$$

$$f'''(x) =$$

$$f^{(4)}(x) =$$

$$y = \sqrt{x} + x^{-2}$$

$$\frac{dy}{dx} =$$

$$\frac{d^2y}{dx^2} =$$

2nd Derivative with Implicit DifferentiationFind $\frac{d^2y}{dx^2}$ for $\sin y = x + y$

3.6 Calculating Higher-Order Derivatives

Practice

Calculus

Find $\frac{d^2y}{dx^2}$ based on the given information.

1. $y = \sin x + \ln(5x)$

2. $y = e^x x$

3. $y = \sin^2 x$

$$5. \frac{dy}{dx} = y^2 + 2x - 1$$

$$6. \frac{dy}{dx} = \frac{1}{y} - 3x$$

$$7. \frac{dy}{dx} = xy^2$$

$$8. \sin(x + y) = 2x$$

$$9. e^x = y^3 + 1$$

$$10. \ln(y) = 5x + 3$$

Evaluate the 2nd derivative at the given point.

11. If $f(x) = -3x^3 + 4x^{-2}$, find $f''(-2)$.

12. If $f(x) = x \ln x$, find $f''(1)$.

13. If $f(x) = 3\sqrt{x} - \frac{32}{x}$, find $f''(4)$.

14. If $\frac{dy}{dx} = 3 \cos y + 5x$, find $\frac{d^2y}{dx^2}$ at $(2, \frac{\pi}{2})$

15. If $\frac{dy}{dx} = \frac{4-x}{2y-3}$, find $\frac{d^2y}{dx^2}$ at $(-1, 2)$

16. If $\frac{dy}{dx} = \ln x e^y$, find $\frac{d^2y}{dx^2}$ at $(e, 1)$

Find the derivatives of the following.

17. $f(x) = 3x^7 - 4x^3 + 5x$

$f'(x) =$

$f''(x) =$

$f'''(x) =$

$f^{(4)}(x) =$

18. $y = 4\sqrt{x}$

$\frac{dy}{dx} =$

$\frac{d^2y}{dx^2} =$

19. $y = \frac{1}{x^3} - \frac{1}{2}x^4$

$y' =$

$y'' =$

$y''' =$

Given $f(x) = 3x^2 - x + 2$, $g(x) = \frac{1}{x^3}$, and $h(x) = \sqrt{x}$, find the following.

20. $f''(2) =$

21. $g'''(-3) =$

22. $2h''(4) =$

3.6 Calculating Higher-Order Derivatives

23. If $f(x) = \left(1 + \frac{x}{20}\right)^5$, find $f''(40)$.

- (A) 0.068
- (B) 1.350
- (C) 5.400
- (D) 6.750
- (E) 540.000

24. A curve given by the equation $x^3 + xy = 8$ has slope given by $\frac{dy}{dx} = \frac{-3x^2 - y}{x}$. The value of $\frac{d^2y}{dx^2}$ at the point where $x = 2$ is

- (A) -6
- (B) -3
- (C) 0
- (D) 4
- (E) undefined

25. If $y = xe^x$, then $\frac{d^ny}{dx^n} =$

- (A) e^x
- (B) e^{nx}
- (C) $(x + n)e^x$
- (D) $x^n e^x$
- (E) $(x + n^2)e^x$

26. Let g be the function given by $g(x) = \cos(-x) - \sin x + 6$. Which of the following statements is true for $y = g(x)$?

- (A) $y - 6 = \frac{d^4y}{dx^4}$
- (B) $g^{(4)}(x) = (g''(x))^2$
- (C) $g''(x) - 6 = g(x)$
- (D) $y'' = \cos(-x) - \sin x$