

An **antiderivative** of a function  $f(x)$  is a function  $F(x)$  with  $F'(x) = f(x)$ .

If  $F(x)$  is a particular antiderivative of  $f(x)$ , then so is  $F(x) + C$  for any constant  $C$ .

If the domain of  $f(x)$  is an interval, and if  $F(x)$  is a particular antiderivative of  $f(x)$ , then any antiderivative has the form  $F(x) + C$  for some constant  $C$ .

If  $F(x)$  and  $G(x)$  are antiderivatives of  $f(x)$  and  $g(x)$  then

- $aF(x)$  is an antiderivative of  $af(x)$  for any constant  $a$ .
- $F(x) + G(x)$  is an antiderivative of  $f(x) + g(x)$ .

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1. Find a particular antiderivative of  $x - x^2 + 9$ .
  2. Find all antiderivatives of  $x - x^2 + 9$ .
  3. Find an antiderivative of  $1/x^2$ .
  4. If  $F(x)$  is your answer to the previous problem, does every antiderivative of  $1/x^2$  have the form  $F(x) + C$  for some constant  $C$ ?

5. For each of the following functions, find a particular antiderivative.

Function	Antiderivative
$x$	
$x^2$	
$x^3$	
$x^k$ ( $k \neq -1$ )	
$x^{-1}$ for $x > 0$	
$x^{-1}$ for $x < 0$	
$x^{-1}$ for all $x$	

Function	Antiderivative
$\sin(x)$	
$\cos(x)$	
$e^x$	
$1/(1+x^2)$	
$\sec^2(x)$	
$\sec(x) \tan(x)$	
1	

6. Compute three different antiderivatives of  $f(x) = x^{20} + 4x^{10} + 8$

7. Compute an antiderivative of  $f(t) = \frac{5 \sec t \tan t}{3} - 4 \sin t - \frac{1}{t} + e^2$

8. Compute an antiderivative of  $f(x) = \cos(3x)$ .

9. Compute the antiderivative of  $f(t) = t^2$  that equals 5 when  $t = 2$ .
10. A particle moves in a straight line and has acceleration given by  $a(t) = 5 \cos t - 2 \sin t$ . Its initial velocity is  $v(0) = -6$  m/s and its initial position is  $s(0) = 2$  m. Find its position function  $s(t)$ .

11. A stone is dropped from a cliff and hits the ground three seconds later. How high is the cliff? (Acceleration due to gravity is  $9.8 \text{ m/s}^2$ .)

12. What constant acceleration is needed to take a car from 10 mph to 60 mph in 5 seconds?