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 $f(t) = \dfrac{5\sec t \tan t}{3} - 4\sin t - \dfrac{1}{t} + e^2$

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 $9.8\,\mathrm{m/s^2}$.)

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