Section 5.7: Antiderivatives

Definition We call $F(x)$ an antiderivative of $f(x)$ if $F'(x) = f(x)$.

Table of Antiderivatives:

Function	Antiderivative
k	$kx + c$
x^n, if $n \neq -1$	$\dfrac{x^{n+1}}{n+1} + c$
x^{-1}	$\ln\|x\| + c$
e^x	$e^x + c$
a^x	$\dfrac{a^x}{\ln a} + c$
$\cos x$	$\sin x + c$
$\sin x$	$-\cos x + c$
$\sec x \tan x$	$\sec x + c$
$\sec^2 x$	$\tan x + c$
$\csc^2 x$	$-\cot x + c$
$\csc x \cot x$	$-\csc x + c$
$\dfrac{1}{x^2+1}$	$\arctan x + c$
$\dfrac{1}{\sqrt{1-x^2}}$	$\arcsin x + c$

EXAMPLE 1: Find the most general antiderivative.

(i) $f(x) = x^3 - 4x^2 + 17$

(ii) $f(x) = \sqrt[3]{x^2} - \sqrt{x^3}$

(iii) $f(x) = \dfrac{x + x^2 - 1}{x^3}$

(iv) $f(x) = e^x + \dfrac{4}{\sqrt{1 - x^2}}$

EXAMPLE 2: Find $f(x)$ given that $f''(x) = 3e^x + 4\sin x$, $f(0) = 1$ and $f'(0) = 2$.

EXAMPLE 3: A particle is moving according to acceleration $a(t) = 3t + 8$. Find the position, $s(t)$, of the object at time t if we know $s(0) = 1$ and $v(0) = -2$.

EXAMPLE 4: A stone is thrown downward from a 450 m tall building at a speed of 5 meters per second. Derive a formula for the distance of the stone above ground level.

EXAMPLE 5: A car braked with a constant deceleration of 40 feet per second squared, producing skid marks measuring 160 feet before coming to a stop. How fast was the car traveling when the brakes were first applied?