Precalc15.2

Find derivatives and antiderivatives of polynomial functions

function   slope

inverse function

derivative

antiderivative

C   constant

Quiz 15.2 Tomorrow

Use the derivative rules to find the derivative of each function.

6. $f(x) = 2x^2 - 3x + 5x^0$

$$4x^1 - 3$$
$$4x + 3.$$

Find the derivative of:

$x^3 = 3x^2$

$x^3 + 5 = 3x^2 + 0$

$x^3 + 13 = 3x^2 + 0$

$x^3 - 7 = 3x^2 + 0$

$x^3 - 1,000,000 = 3x^2 + 0$

$$x^3 \quad\longrightarrow\quad 3x^2 + ? ? ?$$

$$x^3 + C$$

So if I tell you $3x^2$ ...

$$x^3 \leftarrow 3x^2$$

$$3x^2$$

$$x^3 + C$$

Can I ever know what the constant might have been????

What is the pattern?

term	previous
$f'(x)$	anti $f'(x)$
$3x^2$	$x^3 + c$
$4x^3$	$x^4 + c$
$8x^7$	$x^8 + c$
$\dfrac{8x^3}{4}$	$2x^4 + c$
$\dfrac{12x^5}{\text{number}}$	$2x^6 + c$
$\dfrac{x^{n+1}}{n}$	$6 \cdot (\ ) = 12$

f'	anti
ax^n	$\dfrac{a\, x^{n+1}}{n+1} + c$

4 Find the antiderivative of the function $f'(x) = 2x$.

$$anti$$

$$x^2$$

$$F' = x^2 + c$$

What is 2x the derivative of?

F

Was there a constant?
Can I ever know what it was?

5 Find the antiderivative of each function.

a. $f(x) = 3x^7$

$$F = \frac{3x^8}{8} + C$$

indefinite...could it have been +7? -3?   +1,000,000?...
Can I ever know???
Might as well admit it...

As with derivatives, there are rules for finding antiderivatives.

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Power Rule:	If $f(x) = x^n$, where n is a rational number other than -1, the antiderivative is $F(x) = \frac{1}{n+1} x^{n+1} + C.$
Constant Multiple of a Power Rule:	If $f(x) = kx^n$, where n is a rational number other than -1 and k is a constant, the antiderivative is $F(x) = k \cdot \frac{1}{n+1} x^{n+1} + C.$
Sum and Difference Rule:	If the antiderivatives of $f(x)$ and $g(x)$ are $F(x)$ and $G(x)$, respectively, then the antiderivative of $f(x) \pm g(x)$ is $F(x) \pm G(x).$

Why C?

b. $f(x) = 4x^2 - 7x + 5$

$$F(x) = 4\frac{x^3}{3} - \frac{7x^2}{2} + \frac{5x^1}{1} + C$$

$$\frac{(\quad)^{n+1}}{n+1}$$

distributive property

c. $f(x) = x(x^2 + 2)$ $= x^3 + 2x$

$$F(x) = \frac{x^4}{4} + \frac{2x^2}{2} = \frac{x^4}{4} + x^2 + C$$

$$\downarrow$$

$$\frac{\cancel{4}x^3}{\cancel{4}}$$

Find the antiderivative of each function.

10. $f(x) = x^2$ $\qquad$ $F(x) = \dfrac{x^3}{3} + C = \dfrac{1}{3}x^3 + C$

11. $f(x) = x^3 + 4x^2 - x - 3$

12. $f(x) = 5x^5 + 2x^3 - x^2 + 4$

$\longrightarrow F(x) = \dfrac{1}{4}x^4 + \dfrac{4}{3}x^3 - \dfrac{1}{2}x^2 - 3x + C$

$F(x) = \dfrac{5}{6}x^6 + \dfrac{1}{2}x^4 - \dfrac{1}{3}x^3 + 4x + C$

Physics:

$F =$ Position

$f =$ Velocity $\quad x$

$f' =$ Acceleration

$f'' =$ Impulse

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