» Primitives

Over the last few weeks we have been learning how to *differentiate* various functions to find their *derivative*. The next topic will be looking at how to *anti-differentiate* (a process also called *integrating*) functions to find their *primitive.* They are called 'primitives' because they are where the derivative 'comes from'.

Here is some important notation to learn:

$\frac{d}{dx}\text{function}(x) = \text{derivative}(x)$

$\int \text{function}(x)\, dx = \text{primitive}(x)$

Notice the integral sign (it looks like a stretched-out letter s), as well as the appearance of the *dx* in the different places.

» Exercises

1. Remind yourself of the rules of differentiation by finding the derivatives of the following functions:
   a. $\sin(7x+4)$
   b. $\tan(3x^2 - 7x + 2)$
   c. $\cos\left(\frac{1}{x}\right)$
   d. $\cos x \ln x$
   e. $\frac{e^x}{\tan x}$
   f. $\frac{1}{\cos x + \sin x}$
   g. $e^{\sin x}$
   h. $\sin^{10} x$

2. Consider the following functions $f(x)$, and write down each one's primitive $p(x)$. Test whether $p(x)$ really is the primitive by differentiating it: if you have chosen $p(x)$ correctly, then $p'(x) = f(x)$.
   a. $f(x) = 2x$
   b. $f(x) = 4x^2$
   c. $f(x) = \cos x$
   d. $f(x) = 3\sin x$
   e. $f(x) = \frac{1}{x}$
   f. $f(x) = \cos 4x$
   g. $f(x) = 2e^x$
   h. $f(x) = e^{2x}$
   i. $f(x) = \tan x$
   j. $f(x) = 6(3\text{x} + 2)^5$

3. Recall that as a general rule, $\frac{d}{dx}x^a = ax^{a-1}$. See if you can come up with a general rule for the value of $\int x^n\, dx$.

4. Do the same for the following functions:
   a. $\int e^{ax}\, dx$
   b. $\int \cos(ax)\, dx$
   c. $\int \sin(ax)\, dx$
   d. $\int \sec^2(ax)\, dx$