Learning the Anti-differentiation Process

GroupWork

Look at the following table and try and fill in the missing functions. Do you notice any patterns?

$g'(x)$	$g(x)$
	$\cos(3x)$
$\sin(2x)$	
$\sin(7x)$	
$\sin(\frac{1}{6}x)$	
$\sin(Ax)$	
$\sin(Ax+B)$	
$\cos(2x)$	
$\cos(Ax+B)$	
$(Ax+B)^{25}$	
$f(x)$	$\int f(x)dx$

The anti-derivatives on the other side can all be calculated by the "Guess and Check" Method. That is, given a function $f(x)$ you are supposed to anti-differentiate, you pick a function $F(x)$ that when you differentiate you get something which looks very close to $f(x)$.

In the examples in the table, all the functions looked like $f(Ax+B)$. In fact, they really looked like $g'(Ax+B)$. Can you use your experience from the table to evaluate the following integral?

$$\int g'(Ax+B)\ dx =$$

Let us check the answer by differentiating our guess.

Q: What DERIVATIVE rule do we have to use?

Derivative of a Composite Function

Suppose $h(x) = g(p(x))$. Then

$$\frac{dh}{dx} = h'(x) = g'(p(x)) \cdot p'(x).$$

The derivative of a composite function $h(x)$ is the product of the derivatives of the outside and inside functions. The derivative of the outside function must be evaluated at the inside function.

ANTI-Derivative of a Composite Function

We can use The Chain Rule combined with the Fundamental Theorem of Calculus to evaluate the following integrals

1. $\int g'(p(x))p'(x)dx$

2. $\int \sin(x^2)2xdx$

3. $\int \cos(e^x)e^x dx$

4. $\int \cos(e^x)dx$