Notes 2.1 **Antiderivatives (Indefinite Integrals)**

- Reversing the operation of finding a derivative is called antiderivative.

$f(x) = x^2 + 3$ and $f'(x) = 2x$ In words, the antiderivative of 2x is $x^2 + C$

- We use the integral sign $\int$ for this operation called integration.

$\int 2x\ dx = x^2 + C$

$\int x^n\ dx = \frac{x^{n+1}}{n+1} + C$	increase the exponent by 1, then divide by the new exponent.
$\int x^{-1}\ dx = \ln\lvert x\rvert + C$	$\int \sin ax\ dx = -\frac{1}{a}\cos ax + C$
$\int \cos ax\ dx = \frac{1}{a}\sin ax + C$	$\int e^{ax}\ dx = \frac{1}{a}e^{ax} + C$

Find the following indefinite integrals by Integrating.

* Check by taking the derivative of your answer -- it should equal original problem

1. $\int x\ dx$ $\boxed{\frac{x^2}{2} + C}$

2. $\int 6x\ dx$ $\frac{6x^2}{2} = \boxed{3x^2 + C}$

3. $\int 5\ dx$ $\boxed{5x + C}$

4. $\int 8x^5\ dx$ $\frac{8x^6}{6} = \boxed{\frac{4}{3}x^6 + C}$

5. $\int \frac{1}{x^3}\ dx = x^{-3}$

$\boxed{\frac{x^{-2}}{-2} + C}$ OR $-\frac{1}{2x^2} + C$

6. $\int x^{-1}\ dx$ $\frac{x^0}{0} \to$ hmmm..

see form. above

$\boxed{\ln\lvert x\rvert + C}$

7. $\int (12u^2 - 8u + 5)\ du$

$\int 12u^2 - \int 8u + \int 5$

$\frac{12u^3}{3} - \frac{8u^2}{2} + \frac{5u}{1} + C$

$\boxed{4u^3 - 4u^2 + 5u + C}$

** can use 'u' subst., but haven't learned it yet.

8. $\int (3t + 5)^2\ dt$

$(3t+5)(3t+5)$

$\int 9t^2 + 30t + 25$

$\frac{9t^3}{3} + \frac{30t^2}{2} + \frac{25t}{1} + C$

$\boxed{3t^3 + 15t^2 + 25t + C}$

$\int \sin ax \, dx = -\frac{1}{a}\cos ax + C$

$\int \cos ax \, dx = \frac{1}{a}\sin ax + C$ $\int e^{ax} \, dx = \frac{1}{a}e^{ax} + C$

* Again, take derivative of your answer to double check.

9. $\int \sin 3x \, dx$

$a = 3$

$\boxed{-\frac{1}{3}\cos 3x + C}$

10. $\int \cos 5x \, dx$

$a = 5$

$\boxed{\frac{1}{5}\sin 5x + C}$

11. $\int e^{3t} \, dt$

$a = 3$

$\boxed{\frac{1}{3}e^{3t} + C}$