Antiderivatives

Recall

If $f'(x) = x^3$

then $f(x) = 3x^2$

We say the antiderivative of $3x^2$ is x^3.
(going from derivative to $f(x)$)

Notation

$\int 3x^2\,dx = x^3 + C$ ← Integral
↑ constant (could be any value since the derivative of a constant is 0)
family of antiderivatives

In general

$\int x^n = \frac{x^{n+1}}{n+1} + C$

↑ symbol for integral

Common Integrals

fcn	Integral
0	C
1	$x + C$
x	$\frac{x^{n+1}}{n+1} + C$
$\frac{1}{x}$	$\ln\lvert x\rvert + C$
$\cos kx$ $k \neq 0$	$\frac{\sin kx}{k} + C$
$\sin kx$ $k \neq 0$	$-\frac{\cos kx}{k} + C$

* on yellow sheet

Note: $\int dx = x + C$

ex Find the integral

a) $\int (2x^2 - x + 7)\,dx$ ← $7x^0$ ← add 1

add 1 to exp, divide by same → $\frac{2x^3}{3} - \frac{x^2}{2} + 7x + C$

b) $\int (5x^4 - 3x + 11)\,dx$

$\frac{5x^5}{5} - \frac{3x^2}{2} + 11x + C$

$x^5 - \frac{3x^2}{2} + 11x + C$

c) $\int \cos x\,dx - \int \sin x\,dx$

$\sin x - (-\cos x) + C$

$\sin x + \cos x + C$

d) $\int e^{kx}\,dx \quad k \neq 0$ $\int e^x dx = e^x + C$

$\frac{1}{k} e^{kx} + C$

Rules

f and g have antiderivatives
k is a constant

1) $\int k f(x)\,dx = k \int f(x)\,dx$

ie $\int 3x^4\,dx = 3\int x^4\,dx$

2) $\int [f(x) + g(x)]\,dx = \int f(x)\,dx + \int g(x)\,dx$

3) $\int [f(x) - g(x)]\,dx = \int f(x)\,dx - \int g(x)\,dx$

ex 10.1
#1, 4, 5, 6a, 7a,b
8a-e