Quick summary of the various rules for integration

Here is a summary for the various integration rules- here is an example for you to use and expand on

$\int x^n dx = \frac{x^{n+1}}{n+1} + C$ $\int ax^n dx = \frac{ax^{n+1}}{n+1} + C$ $\int (x-b)^n dx = \frac{(x-b)^{n+1}}{n+1} + C$ $\int a(kx-b)^n dx = \frac{a(kx-b)^{n+1}}{k(n+1)} + C$	$\int ax^n dx = \frac{ax^{n+1}}{n+1} + c \quad , n \neq -1$ $\int (ax+b)^n dx = \frac{(ax+b)^{n+1}}{a(n+1)} + c \quad ,n \neq -1$
$\int \frac{1}{x} dx = \log_e \lvert x \rvert + C$ $\int \frac{a}{kx} dx = \frac{a}{k} \log_e \lvert x \rvert + C$ $\int \frac{1}{x-b} dx = \log_e \lvert x-b \rvert + C$ $\int \frac{a}{k(x-b)} dx = \frac{a}{k} \log_e \lvert x-b \rvert + C$ $\int \frac{a}{kx-b} dx = \frac{a}{k} \log_e \lvert kx-b \rvert + C$	$\int \frac{1}{ax+b} dx = \frac{1}{a} \log_e (ax+b) = c$
$\int \sin(x) dx = -\cos(x) + C$ $\int a\sin(kx) dx = -\frac{a}{k}\cos(kx) + C$ $\int \sin(x-b) dx = -\cos(x-b) + C$ $\int a\sin k(x-b) dx = -\frac{a}{k}\cos k(x-b) + C$ $\int a\sin(kx-b) dx = -\frac{a}{k}\cos(kx-b) + C$	$\int \cos(x) dx = \sin(x) + C$ $\int a\cos(kx) dx = \frac{a}{k}\sin(kx) + C$ $\int \cos(x-b) dx = \sin(x-b) + C$ $\int a\cos k(x-b) dx = \frac{a}{k}\sin k(x-b) + C$ $\int a\cos(kx-b) dx = \frac{a}{k}\sin(kx-b) + C$
$\int e^x dx = e^x + C$ $\int ae^{kx} dx = \frac{a}{k} e^{kx} + C$ $\int e^{x-b} dx = e^{x-b} + C$ $\int ae^{k(x-b)} dx = \frac{a}{k} e^{k(x-b)} + C$ $\int ae^{kx-b} dx = \frac{a}{k} e^{kx-b} + C$	$\int Af(x) dx = A\int f(x) dx$ $\int (f(x) \pm g(x)) dx = \int f(x) dx \pm \int g(x) dx$ $\int_a^b f(x) dx + \int_b^c f(x) dx = \int_a^c f(x) dx$ $\int_a^b f(x) dx = -\int_b^a f(x) dx$
$\int \frac{f'(x)}{f(x)} dx = \log_e f(x) + c$	

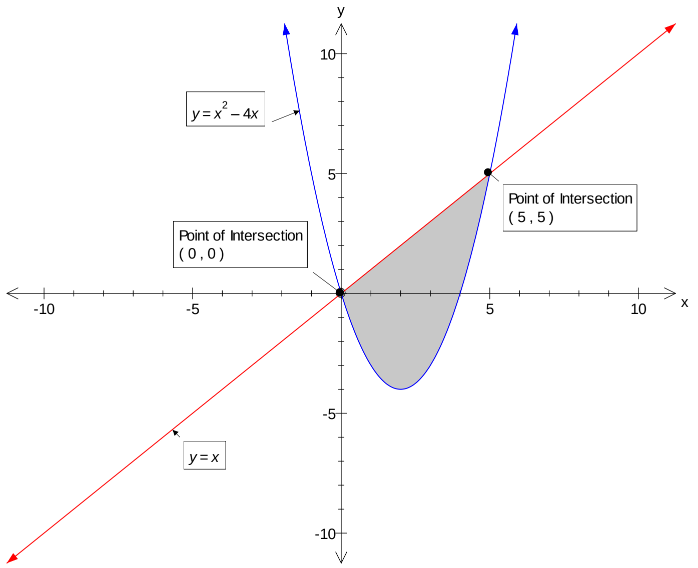
Concept- given the anti-derivative find or evaluate the integral

Solution

These questions ask you to differentiate a function, and then they **require** you to use this answer to work out a different integral. The difficult part is using the answer to do the second part.

Steps	
If $y = x^4 + 2x^3$ find $\frac{dy}{dx}$ and hence find $\int (2x^3 + 3x^2)dx$	
Step 1: First find $\frac{dy}{dx}$	$\frac{dy}{dx} = 4x^3 + 6x^2$
Step 2: We need to re-organise this to start to look like the integral. **Remember that the integral of** $\frac{dy}{dx}$ **is the original function.**	$\int (4x^3 + 6x^2)dx = x^4 + 2x^3 + c$ Now notice if we take out a 2 from the left side it will look like the integral we want $\int 2(2x^3 + 3x^2)dx = x^4 + 2x^3 + c$ Divide the LHS by 2 and do the same to the RHS $\frac{2\int (2x^3 + 3x^2)dx}{2} = \frac{x^4 + 2x^3 + c}{2}$ Thus we finally manage to get it to look like $\int (2x^3 + 3x^2)dx = \frac{x^4}{2} + \frac{2x^3}{2} + c_1$

When we find the area bounded between two graphs it is always the top graph – bottom graph

Find the area bounded by the two graphs $y = x$ and $y = x^2 - 4x$	
Step 1 – Sketch the two graphs and see what they look like	
Now we need to find the area bounded between the two graphs	$\int_0^5 ((x) - (x^2 - 4x))dx$ It is important to work the inside of the integral before actually working out the integral to avoid errors in the subtraction $\int_0^5 (x - x^2 + 4x))dx = \frac{125}{6}$ sq units