

$$h(y) = \int 2y + 1 dy = y^2 + y + k$$

You'll note that we included the constant of integration,  $k$ , here. It will turn out however that this will end up getting absorbed into another constant so we can drop it in general.

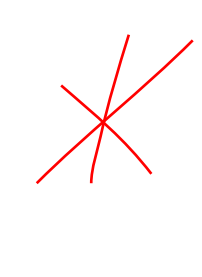
So, we can now write down  $\Psi(x, y)$ .

$$\Psi(x, y) = x^2 y - 3x^3 + y^2 + y + k = y^2 + (x^2 + 1)y - 3x^3 + k$$

With the exception of the  $k$  this is identical to the function that we used in the first example. We can now go straight to the implicit solution using (4).

$$y^2 + (x^2 + 1)y - 3x^3 + k = c$$

We'll now take care of the  $k$ . Since both  $k$  and  $c$  are unknown constants all we need to do is subtract one from both sides and combine and we still have an unknown constant.

$$\begin{aligned} y^2 + (x^2 + 1)y - 3x^3 &= c - k \\ y^2 + (x^2 + 1)y - 3x^3 &= c \end{aligned}$$


Therefore, we'll not include the  $k$  in anymore problems.

This is where we left off in the first example. Let's now apply the initial condition to find  $c$ .

$$(-3)^2 + (0 + 1)(-3) - 3(0)^3 = c \quad \Rightarrow \quad c = 6$$

The implicit solution is then.

$$y^2 + (x^2 + 1)y - 3x^3 - 6 = 0$$

Now, as we saw in the separable differential equation section, this is quadratic in  $y$  and so we can solve for  $y(x)$  by using the quadratic