

**Example** Calculate  $\int_{-8}^{-3} x\sqrt{1-x} dx$

If you use the mnemonic it suggests that we use for  $u = 1 - x$ , the expression inside the square root expression. Then differential gives us  $du = -dx$  or  $-du = dx$ . So re-writing our integral with this substitution gives

$$\int_{-8}^{-3} x\sqrt{1-x} dx = \int_9^4 x\sqrt{u}(-du)$$

Houston we got a problem? We have said before that after the substitution we want NO  $x$  left over's inside the new one. We wanted to see the new variable  $u$  only. Yet the integral on the right hand side has  $x$  in it! Question is how do we turn  $x$  into a "u"? For this you need to use your substitution  $u = 1 - x$ , and solve it for  $x$ ,  $x = 1 - u$ . Then replace  $x$  with this expression on the right hand side integral above

$$\begin{aligned} \int_{-8}^{-3} x\sqrt{1-x} dx &= \int_9^4 (u-1)\sqrt{u}(-du) \\ &= \int_4^9 (u^{1/2} - u^{3/2}) du \\ &= \left[ \frac{2}{3}u^{3/2} - \frac{2}{5}u^{5/2} \right]_4^9 = -\frac{1076}{15} \end{aligned}$$