

## CHAIN RULE EXPLANATION

This handout is a step-by-step explanation of the chain rule. The purpose of providing this information is to allow teachers and students to have a scaffolding for making sense of which parts of the derivative are  $u$  and which parts are  $u'$ .

1. Find the derivative of  $y = \sqrt{1 - x^2}$

$$y = \sqrt{1 - x^2}$$

First, let  $y = f(u)$

**Notice that this function is a composition of two functions:  $f(u) = \sqrt{u}$ , where  $u = 1 - x^2$**

The derivative of a composite function  $y = f(u)$  is  $y' = f'(u) \cdot u'$

**If  $y = f(u)$ , then  $f(u) = \sqrt{u}$**

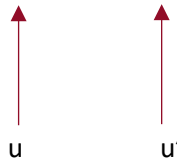
**Therefore, by the chain rule,  $f'(u) = \frac{1}{2}(u)^{-\frac{1}{2}} \cdot u'$**

Because  $u = 1 - x^2$ , then  $u' = -2x$

Substituting  $u$  and  $u'$  into the derivative, we get  $y' = \frac{1}{2}(1 - x^2)^{-\frac{1}{2}} \cdot (-2x)$

Leaving this derivative unsimplified, we can now clearly label the parts of the derivative with  $u$  and  $u'$ .

$$y' = \frac{1}{2}(1 - x^2)^{-\frac{1}{2}} \cdot (-2x)$$

  
 $u$                        $u'$