

“WEIRD U-SUB”

Don't worry, if AP asks a “weird u-sub”, then they will give you what to use for the “u”!

Example 1: ✓

$$\int x\sqrt{2x-1} dx$$

$$= \int \frac{1}{2}(u+1)u^{\frac{1}{2}} \left(\frac{1}{2}\right) du$$
$$= \frac{1}{4} \int [u^{\frac{3}{2}} + u^{\frac{1}{2}}] du$$

$$\text{Let } u = 2x - 1$$

$$du = 2 dx$$
$$\frac{1}{2} du = dx$$

$$u = 2x - 1$$
$$u + 1 = 2x$$
$$\frac{1}{2}(u + 1) = x$$

Example 2:

$$\int_3^8 \frac{dx}{2x\sqrt{x+1}}$$

$$= \int_3^8 \left(\frac{1}{x}\right) \left(\frac{1}{2\sqrt{x+1}}\right) dx$$

$$= \int_2^3 \frac{1}{u^2 - 1} du$$

$$\text{Let } u = \sqrt{x+1}$$

$$du = \frac{1}{2\sqrt{x+1}} dx$$

$$u = \sqrt{x+1}$$

$$u^2 = x + 1$$

$$u^2 - 1 = x \quad \checkmark$$

$$u(3) = 2 \quad \checkmark$$

$$u(8) = 3 \quad \checkmark$$

← Hey “u”!

Example 3:

$$\int \underbrace{x} \sqrt{\underbrace{2x+1}} \underbrace{dx}$$

$$= \int \frac{1}{2}(u-1)(u^{\frac{1}{2}}) \left(\frac{1}{2} du\right)$$

$$= \frac{1}{4} \int (u^{\frac{3}{2}} - u^{\frac{1}{2}}) du$$

Let $u = 2x+1$

$$du = 2 dx$$

$$\frac{1}{2} du = dx$$

$$u = 2x+1$$

$$u-1 = 2x$$

$$\frac{1}{2}(u-1) = x$$

“U” try!

$$\int \underbrace{x^2} \sqrt{\underbrace{1-x}} \underbrace{dx}$$

$$= - \int (1-u)^2 (u^{\frac{1}{2}}) du$$

$$u = 1-x$$

$$du = -dx$$

$$-du = dx$$

$$u = 1-x$$

$$x = 1-u$$

$$x^2 = (1-u)^2$$