

$$\int_2^5 (x+1)^2 dx, \quad \text{let } u=x+1, \therefore dx=du$$

Method 1 - Transform Limits

Substitute $x=2$ and $x=5$ into u equation

$$u=2+1=3 \quad u=5+1=6$$

$$\therefore \int_2^5 (x+1)^2 dx = \int_3^6 u^2 du$$

$$= \left[\frac{1}{3} u^3 \right]_3^6$$

$$= \left[\frac{1}{3} 6^3 - \frac{1}{3} 3^3 \right]$$

$$= 72 - 9$$

$$= 63$$

Method 2 - Re-substitute

Drop the limits of integration

$$\therefore \int (x+1)^2 dx = \int u^2 du$$

$$= \left[\frac{1}{3} u^3 \right]$$

Resubstitute the u -equation and evaluate with original x limits

$$= \left[\frac{1}{3} (x+1)^3 \right]_2^5$$

$$= \left[\frac{1}{3} 6^3 - \frac{1}{3} 3^3 \right]$$

$$= 72 - 9$$

$$= 63$$