



Calculus 2 Workbook Solutions

U-substitution

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MATH

U-SUBSTITUTION IN DEFINITE INTEGRALS

- 1. Use u-substitution to evaluate the integral.

$$\int_2^4 8x^3 \sqrt{7+x^4} \, dx$$

Solution:

Let

$$u = 7 + x^4$$

$$du = 4x^3 \, dx, \text{ so } dx = \frac{du}{4x^3}$$

Substitute.

$$\int_{x=2}^{x=4} 8x^3 \sqrt{u} \left(\frac{du}{4x^3} \right)$$

$$\frac{8}{4} \int_{x=2}^{x=4} \sqrt{u} \, du$$

$$2 \int_{x=2}^{x=4} u^{\frac{1}{2}} \, du$$

Integrate and back-substitute.



$$2 \cdot \frac{2}{3} u^{\frac{3}{2}} \bigg|_{x=2}^{x=4}$$

$$\frac{4}{3} u^{\frac{3}{2}} \bigg|_{x=2}^{x=4}$$

$$\frac{4}{3} (7 + x^4)^{\frac{3}{2}} \bigg|_2^4$$

Evaluate over the interval.

$$\frac{4}{3} (7 + 4^4)^{\frac{3}{2}} - \left(\frac{4}{3} (7 + 2^4)^{\frac{3}{2}} \right)$$

$$\frac{4}{3} (263)^{\frac{3}{2}} - \frac{4}{3} (23)^{\frac{3}{2}}$$

$$\frac{1,052}{3} \sqrt{263} - \frac{92}{3} \sqrt{23}$$

$$\frac{1,052\sqrt{263} - 92\sqrt{23}}{3}$$



