

## Lösungen zu den Übungen zu linearer Substitution

$$1. \int_0^3 (5x - 1)^3 dx = \frac{1}{5} \cdot \left[ \frac{1}{4} \cdot x^4 \right]_{-1}^{14} = \frac{1}{20} \cdot 14^4 - \frac{1}{20} \cdot (-1)^4 = 1920,75$$

$$2. \int_2^4 (-7 - 3x)^5 dx = -\frac{1}{3} \cdot \left[ \frac{1}{6} \cdot x^6 \right]_{-13}^{-19} = -\frac{1}{18} \cdot (-19)^6 - \left( -\frac{1}{18} \cdot (-13)^6 \right) = -2345504$$

$$3. \int_{-1}^3 2 \cdot \left(-x + \frac{2}{3}\right)^6 dx = (-1) \cdot \left[ \frac{2}{7} \cdot x^7 \right]_{\frac{5}{3}}^{\frac{7}{3}} = -\frac{2}{7} \cdot \left(-\frac{7}{3}\right)^7 - \left(-\frac{2}{7} \cdot \left(\frac{5}{3}\right)^7\right) = 117,796$$

$$4. \int_2^3 (ax - b)^7 dx = \frac{1}{a} \cdot \left[ \frac{1}{8} \cdot x^8 \right]_{2a-b}^{3a-b} = \frac{1}{8a} \cdot (3a - b)^8 - \frac{1}{8a} \cdot (2a - b)^8$$

$$5. \int_0^2 \sqrt{2x + 8} dx = \frac{1}{2} \cdot \left[ \frac{1}{1,5} \cdot x^{1,5} \right]_8^{12} = \frac{1}{3} \cdot 12^{1,5} - \frac{1}{3} \cdot 8^{1,5} \approx 6,3139$$

$$6. \int_{-4}^1 \sqrt{20 - 4x} dx = -\frac{1}{4} \cdot \left[ \frac{1}{1,5} \cdot x^{1,5} \right]_{36}^{16} = -\frac{1}{6} \cdot (16)^{1,5} - \left( -\frac{1}{6} \cdot (36)^{1,5} \right) = 25,3$$

$$7. \int_3^5 \sqrt[3]{5x - 10} dx = \frac{1}{5} \cdot \left[ \frac{3}{4} \cdot x^{\frac{4}{3}} \right]_5^{15} = \frac{3}{20} \cdot 15^{\frac{4}{3}} - \frac{3}{20} \cdot 5^{\frac{4}{3}} \approx 4,2665$$

$$8. \int_{-1}^3 \sqrt[4]{12 + 10x} dx = \frac{1}{10} \cdot \left[ \frac{4}{5} \cdot x^{\frac{5}{4}} \right]_2^{42} = \frac{2}{25} \cdot 42^{\frac{5}{4}} - \frac{2}{25} \cdot 2^{\frac{5}{4}} \approx 8,3634$$

$$9. \int_{-3}^3 e^{3x+6} dx = \frac{1}{3} \cdot [e^x]_{-3}^{15} = \frac{1}{3} \cdot e^{15} - \frac{1}{3} \cdot e^{-3} \approx 1089672$$

$$10. \int_{-2}^1 (-3) \cdot e^{-0,5x+2} dx = \frac{-3}{-0,5} \cdot [e^x]_3^{1,5} = 6 \cdot e^{1,5} - 6 \cdot e^3 \approx -93,623$$

$$11. \int_1^2 \frac{1}{e^{-2x-8}} dx = \int_1^2 e^{2x+8} dx = \frac{1}{2} \cdot [e^x]_{10}^{12} = \frac{1}{2} \cdot e^{12} - \frac{1}{2} \cdot e^{10} \approx 70364,2$$

$$12. \int_a^b 4 \cdot e^{kx} dx = \frac{4}{k} \cdot [e^x]_{ka}^{kb} = \frac{4}{k} \cdot e^{kb} - \frac{4}{k} \cdot e^{ka}$$

$$13. \int_0^\pi \sin(6x) dx = \frac{1}{6} \cdot [-\cos(x)]_0^{6\pi} = \frac{1}{6} \cdot (-\cos(6\pi)) - \frac{1}{6} \cdot (-\cos(0)) = 0$$

$$14. \int_{0,5}^{1,5} -6 \cdot \cos(-4x + 1) dx = \frac{-6}{-4} \cdot [\sin(x)]_{-1}^{-5} = 1,5 \cdot \sin(-5) - 1,5 \cdot \sin(-1) \approx 2,7$$

$$15. \int_0^2 \sin(2 \cdot (4x - 3)) dx = \int_0^2 \sin(8x - 6) dx$$

$$= \frac{1}{8} \cdot [-\cos(x)]_{-6}^{10} = \frac{1}{8} \cdot (-\cos(10)) - \frac{1}{8} \cdot (-\cos(-6)) \approx 0,225$$

$$16. \int_{-2}^5 \sin(ax^2 + b) da = \frac{1}{x^2} \cdot [-\cos(x)]_{-2x^2+b}^{5x^2+b}$$

$$= \frac{1}{x^2} \cdot (-\cos(5x^2 + b)) - \frac{1}{x^2} \cdot (-\cos(-2x^2 + b)) = -\frac{1}{x^2} \cdot \cos(5x^2 + b) + \frac{1}{x^2} \cdot \cos(-2x^2 + b)$$