

a) Integrationsgrenzen $\hat{=}$ Nullstellen von f

$$f(x) = 3x - \frac{1}{2}x^2 = 0 \Rightarrow x(3 - \frac{1}{2}x) = 0 \Rightarrow x_1 = 0 \vee x_2 = 6$$

$$V = \pi \int_0^6 (3x - \frac{1}{2}x^2)^2 dx = \pi \cdot \int_0^6 (9x^2 - 3x^3 + \frac{1}{4}x^4) dx =$$

$$V = \pi \left[\frac{9x^3}{3} - \frac{3x^4}{4} + \frac{1}{4} \cdot \frac{x^5}{5} \right]_0^6 = \underline{\underline{\pi \cdot \frac{324}{5} \approx 203,575}}$$

b) $f(x) = x^2(x+2)$ Nullstellen $x_1 = 0 \vee x_2 = -2$

$$V = \pi \cdot \int_{-2}^0 (x^3 + 2x^2)^2 dx = \pi \int_{-2}^0 x^6 + 4x^5 + 4x^4 dx$$

$$V = \pi \cdot \left[\frac{x^7}{7} + \frac{4x^6}{6} + \frac{4x^5}{5} \right]_{-2}^0 = \pi \cdot \left[0 - \left\{ \frac{(-2)^7}{7} + \frac{4(-2)^6}{6} + \frac{4(-2)^5}{5} \right\} \right]$$

$$V = \underline{\underline{\pi \cdot \frac{128}{105} \approx 3,830}}$$

c) $f(x) = x \cdot \sqrt{4-x}$ Nullstellen $x_1 = 0 \vee x_2 = 4$

$$V = \pi \cdot \int_0^4 (x \cdot \sqrt{4-x})^2 dx = \pi \int_0^4 x^2 \cdot (4-x) dx = \pi \int_0^4 (4x^2 - x^3) dx$$

$$V = \pi \cdot \left[\frac{4x^3}{3} - \frac{x^4}{4} \right]_0^4 = \underline{\underline{\pi \cdot \frac{64}{3} = 67,021}}$$

d) $f(x) = (e^x - 1) \cdot (4-x)$ Nullstellen $x_1 = 0 \vee x_2 = 4$

$$V = \pi \cdot \int_0^4 ((e^x - 1) \cdot (4-x))^2 dx \approx \pi \cdot 589,93 \approx 1853,320$$