Nr. 14) $u(x) = 2x - 1$; $v(x) = -x + 2$; $w(x) = 3x - 2$

a) $u(v(x)) = 2\cdot(-x+2) - 1 = -2x + 4 - 1 = \underline{\underline{-2x + 3}}$

$v(u(x)) = -(2x-1) + 2 = -2x + 1 + 2 = \underline{\underline{-2x+3}}$

$u(w(x)) = 2\cdot(3x-2) - 1 = 6x - 4 - 1 = \underline{\underline{6x - 5}}$

$w(u(x)) = 3\cdot(2x-1) - 2 = 6x - 3 - 2 = \underline{\underline{6x - 5}}$

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b) $\underbrace{m_1 x + c_1}_{u(x)}$; $\underbrace{m_2 x + c_2}_{v(x)}$

$u(v(x)) = m_1\cdot(m_2 x + c_2) + c_1 = \underbrace{m_1 m_2}_{} x + \underbrace{m_1 c_2 + c_1}_{}$

$= \underline{\underline{m_3 x + c_3}}$

$\Rightarrow u(v(x))$ ist eine lineare Funktion

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c) $(f\circ g)(x) = (g\circ f)(x)$; $f(x) = 9x + 2$; $g(x) = 3x + a$

$9(3x + a) + 2 = 3\cdot(9x + 2) + a$

$\cancel{27x} + 9a + 2 = \cancel{27x} + 6 + a \quad | -a - 2$

$8a = 4$

$\underline{\underline{a = \frac{1}{2}}}$ Für $a = \frac{1}{2}$ gilt $f\circ g = g\circ f$

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d) $u(x) = m_1\cdot x + c_1$; $v(x) = m_2 x + c_2$

$u(v(x)) = v(u(x))$

$m_1(m_2 x + c_2) + c_1 = m_2(m_1 x + c_1) + c_2$

$\cancel{m_1 m_2 x} + m_1 c_2 + c_1 = \cancel{m_2\cdot m_1 x} + m_2\cdot c_1 + c_2 \quad | -c_2 - c_1$

$m_1 c_2 - c_2 = m_2 c_1 - c_1$

$c_2(m_1 - 1) = c_1(m_2 - 1) \quad | \cdot \frac{1}{(m_2-1)\cdot c_2}$

Für $\underline{\underline{\frac{m_1 - 1}{m_2 - 1} = \frac{c_1}{c_2}}}$ ist $u\circ v = v\circ u$

O. Fell