

$$\Leftrightarrow ((\sqrt[3]{x})^3)^4 = 2^{12} ((\sqrt[4]{x})^4)^3$$

$$\Leftrightarrow x^4 = 2^{12} x^3 \quad \Leftrightarrow x^4 - 2^{12} x^3 = 0$$

$$\Leftrightarrow x^3 (x - 2^{12}) = 0 \quad \Leftrightarrow x^3 = 0 \text{ tai } x - 2^{12} = 0$$

$$\Leftrightarrow x = 0 \quad \text{tai} \quad x = 2^{12}$$

Tark. $x = 0 : f(0) = \sqrt[3]{0} - 2 \cdot \sqrt[4]{0} = 0 \%$

$x = 2^{12} : f(2^{12}) = \sqrt[3]{2^{12}} - 2 \cdot \sqrt[4]{2^{12}} = 2^4 - 2 \cdot 2^3 = 0 \%$

Varh. $x = 0$ tai $x = 2^{12} = 4096$

b) $g(x) = \sqrt[4]{x^3} - \sqrt{x^2} = 0$, $\begin{cases} x^3 \geq 0 \\ x^2 \geq 0 \end{cases} \Leftrightarrow \underline{x \geq 0} \quad (x \in [0, \infty[)$

$$\Leftrightarrow \sqrt[4]{x^3} = \sqrt{x^2} \quad |(\)^4$$

$$\Leftrightarrow (\sqrt[4]{x^3})^4 = (\sqrt{x^2})^4$$

$$\Leftrightarrow x^3 = (\underbrace{(\sqrt{x^2})^2}_{x^2})^2 \quad \Leftrightarrow x^3 = (x^2)^2 \quad \Leftrightarrow x^3 = x^4$$

$$\Leftrightarrow x^3 - x^4 = 0 \quad \Leftrightarrow x^3 (1 - x) = 0$$

$$\Leftrightarrow x^3 = 0 \text{ tai } 1 - x = 0$$

$$\Leftrightarrow x = 0 \text{ tai } x = 1$$

Tark. $x = 0 : g(0) = \sqrt[4]{0^3} - \sqrt{0^2} = 0 - 0 = 0 \%$

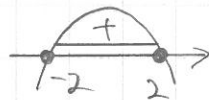
$x = 1 : g(1) = \sqrt[4]{1^3} - \sqrt{1^2} = 1 - 1 = 0 \%$

Varh. $x = 0$ tai $x = 1$

24.16

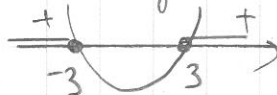
$$\sqrt[4]{4-x^2} + 2x = \sqrt[6]{x^2-9}$$

1^o $4-x^2 \geq 0$; vastaus jätö: $4-x^2=0 \Leftrightarrow 4=x^2 \sqrt{\Leftrightarrow} x = \pm 2$



$$-2 \leq x \leq 2$$

2^o $x^2-9 \geq 0$; vastaus jätö: $x^2-9=0 \Leftrightarrow x^2=9 \sqrt{\Leftrightarrow} x = \pm 3$



$$x \leq -3 \text{ tai } x \geq 3$$

1^o ja 2^o Millään x :n arvo ei tyydytä molempia ehtoa
Varh. ei ratk.