

Logaritmi

- logaritmillä ratkaistaan eksponentti

Vertaa:

$$a) \quad x^3 = 15 \quad || \sqrt[3]{}$$

$$x = \sqrt[3]{15} \approx 2.466$$

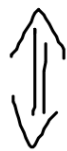
$$b) \quad 3^x = 15 \quad || \log$$

$$x = \frac{\log 15}{\log 3} \approx 2.466$$

$$- \quad a^x = b \quad || \log_a \quad a > 0, b > 0$$

$$\Leftrightarrow x = \log_a b = \text{"a-kantainen logaritmi b:stä"}$$

Esim. a) $x = \log_2 7$



$$2^x = 7$$

MAOL

$$\parallel \log_{10} = \log = \lg$$

$$x = \frac{\log 7}{\log 2}$$

Laskinetta

$$\boxed{\text{LOG}} = \boxed{\text{LG}} = \log_{10}$$

$$\boxed{\text{LN}} = \log_e$$

b) Lause 5 7:n potenssina.

Tapa 1

$$\text{MAOL: } 5 = 7^{\log_7 5}$$

Tapa 2

$$7^x = 5 \parallel \lg$$

$$x = \frac{\lg 5}{\lg 7} \rightarrow \text{V: } 5 = 7^{\frac{\lg 5}{\lg 7}}$$

Esim Kumpi suurempi?

1999^{1998}

Vai

1998^{1999}

↑
vertaa
elkop.

$$10^1 = 10$$

$$10^2 = 100$$

$$10^5 = 100000$$

$$\left(1998^{\log_{1998} 1999} \right)^{1998} =$$

$$1998^{1998 \cdot \log_{1998} 1999}$$

$$1998 \cdot \log_{1998} 1999 \approx 1998,13$$

$$10^x \Rightarrow x+1 \text{ numeroa } V: 1998^{1999}$$

S. 86

701. a) $3^x = 10 \quad || \log$

$$\left(\begin{array}{l} \log 3^x = \log 10 \\ x \cdot \log 3 = \log 10 \quad || : \log 3 \end{array} \right)$$

$$x = \frac{\log 10}{\log 3} = \frac{1}{\log 3} \approx 2,096$$

703. a) $\lg 10000 = \lg_{10} 10000 = \overset{4}{\lg_{10} 10^4} = 4 \lg_{10} 10 = 4 \cdot 1 = 4$

704. a) $\log_3 81 = \log_3 9 \cdot 9 = \log_3 3^2 \cdot 3^2 = \overset{4}{\log_3 3^4} = 4 \cdot \log_3 3 = 4 \cdot 1 = 4$

705. a) $\log_{27} 3 = x \Leftrightarrow 27^x = 3 \Rightarrow \sqrt[3]{27} = 27^{\frac{1}{3}}$

$\nwarrow$ askin

$$x = \frac{\log 3}{\log 27} = \frac{1}{3}$$

$x = \frac{1}{3}$

$$706. \text{ a) } \lg 13 - \lg 130 = \lg \left(\frac{13}{130} \right) = \lg \left(\frac{1}{10} \right) \\ = \overbrace{\lg_{10} 10}^{-2} = -2 \lg_{10} 10 = -2$$

$$\text{b) } \underbrace{\lg 25 + \lg 12}_{\text{summa-kaava}} - \lg 3$$

$$= \lg (25 \cdot 12) - \lg 3$$

$$= \underbrace{\lg 300 - \lg 3}_{\text{erotus-kaava}}$$

$$= \lg \frac{300}{3} = \lg 100 = \overbrace{\lg_{10} 10}^{2} = 2 \lg_{10} 10 = \underline{\underline{2}}$$

710.

$$a) \quad \lg a + \lg \left(\frac{a+b}{a-b} \right) + \lg \left(\frac{a-b}{ab} \right) + \lg b, \quad \begin{matrix} a > b \\ b > 0 \end{matrix}$$

Samankant. log. summa

$$= \lg \left(a \cdot \frac{a+b}{a-b} \cdot \frac{a-b}{ab} \cdot b \right) = \lg (a+b)$$

$$b) \quad 2 \cdot \ln \sqrt{x^2-1} + \ln \frac{1}{x+1}, \quad x > 1$$

$$= \ln (\sqrt{x^2-1})^2 + \ln \frac{1}{x+1}$$

$$= \ln x^2 - 1 + \ln \frac{1}{x+1}$$

$$= \ln \left(\frac{x^2-1}{x+1} \right) = \ln \frac{(x-1)(x+1)}{x+1} = \ln (x-1)$$

S. 88: 701, 703
706, 707, 710