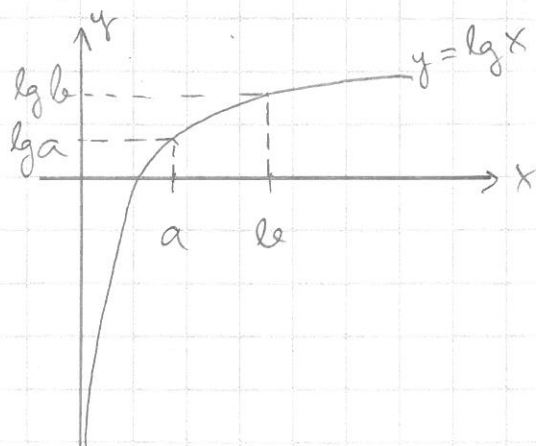


2° Logaritmin ottaminen epäytölö



$$a < b \quad | \lg$$

$$\Leftrightarrow \lg a < \lg b$$

$\lg x$ on aidosti kasvava funktio
 $\rightarrow$ järjestys säilyy ts. epäytölö-
 merkki säilyy

14.2, 4, 7

14.2 a) $5^x = \frac{1}{25} \Leftrightarrow 5^x = \frac{1}{5^2} \Leftrightarrow 5^x = 5^{-2} \Leftrightarrow \underline{x = -2}$

b) $8^x = \frac{1}{16} \Leftrightarrow (2^3)^x = \frac{1}{2^4} \Leftrightarrow 2^{3x} = 2^{-4}$

$$\Leftrightarrow 3x = -4 \quad | :3 \quad \Leftrightarrow \underline{x = -\frac{4}{3}}$$

c) $\underbrace{9^x}_{>0} = -\frac{1}{81} \quad \downarrow \text{ei mahdollista}$

14.4 a) $3^x - 6 = 0 \Leftrightarrow 3^x = 6 \Leftrightarrow x = \log_3 6 \approx 1,631$

$$\begin{aligned} \lceil 3^x = 6 \quad | \lg \quad \Leftrightarrow \lg 3^x = \lg 6 \quad \Leftrightarrow x \lg 3 = \lg 6 \quad | : \lg 3 \\ \Leftrightarrow x = \frac{\lg 6}{\lg 3} \approx 1,631 \end{aligned}$$

b) $90 = 120 - 7^x \Leftrightarrow 7^x = 30 \Leftrightarrow \underline{x = \log_7 30 \approx 1,748}$

14.7 a) $3 + 5^{x+3} = 21 \Leftrightarrow 5^{x+3} = 18 \Leftrightarrow x+3 = \log_5 18$
 $\Leftrightarrow \underline{x = \log_5 18 - 3 \approx -1,2}$

b) $\frac{3^x}{2} - 98 = 0 \quad | \cdot 2 \quad \Leftrightarrow 3^x - 196 = 0 \quad \Leftrightarrow 3^x = 196$
 $\Leftrightarrow \underline{x = \log_3 196 \approx 4,8}$

14.10 $4 \cdot 18^x = 6 \cdot 9^x \quad | : (9^x \cdot 4) \quad \Leftrightarrow \frac{18^x}{9^x} = \frac{6}{4}$

$$\Leftrightarrow \left(\frac{18}{9}\right)^x = \frac{3}{2} \quad \Leftrightarrow 2^x = \frac{3}{2} \quad \Leftrightarrow x = \log_2 \frac{3}{2} \approx 0,585$$

$\lceil \text{T41: } 4 \cdot 18^x = 6 \cdot 9^x \quad \Leftrightarrow 4 \cdot (2 \cdot 9)^x = 6 \cdot 9^x$

$$\begin{aligned} \lceil \frac{6^3}{2^3} &= \left(\frac{6}{2}\right)^3 \\ \Leftrightarrow 27 &= 27 \end{aligned}$$