

10.6 Rekenregels voor logaritmen

Opgave 73:

- a. $y_2 = y_3$
- b. $y_2 = y_3$
- c. $y_1 = y_2$

Opgave 74:

- a. ${}^2\log 7 + {}^2\log 6 = {}^2\log 42$
- b. ${}^2\log 15 - {}^2\log 3 = {}^2\log \frac{15}{3} = {}^2\log 5$
- c. $2 \cdot {}^2\log 3 - 3 \cdot {}^2\log 5 = {}^2\log 3^2 - {}^2\log 5^3 = {}^2\log 9 - {}^2\log 125 = {}^2\log \frac{9}{125}$
- d. $3 + {}^2\log 5 = {}^2\log 2^3 + {}^2\log 5 = {}^2\log 8 + {}^2\log 5 = {}^2\log 40$
- e. $-2 \cdot {}^2\log 5 + 3 \cdot {}^2\log 3 = {}^2\log 5^{-2} + {}^2\log 3^3 = {}^2\log \frac{1}{25} + {}^2\log 27 = {}^2\log \frac{27}{25}$
- f. ${}^3\log 50 - 2 \cdot {}^3\log 5 = {}^3\log 50 - {}^3\log 5^2 = {}^3\log 50 - {}^3\log 25 = {}^3\log 2$

Opgave 75:

- a. ${}^2\log a + 3 \cdot {}^2\log b = {}^2\log a + {}^2\log b^3 = {}^2\log ab^3$
- b. $5 \cdot {}^3\log a - 2 \cdot {}^3\log b = {}^3\log a^5 - {}^3\log b^2 = {}^3\log \frac{a^5}{b^2}$
- c. $2 + {}^5\log a = {}^5\log 5^2 + {}^5\log a = {}^5\log 25 + {}^5\log a = {}^5\log 25a$
- d. $2 - {}^3\log a = {}^3\log 3^2 - {}^3\log a = {}^3\log 9 - {}^3\log a = {}^3\log \frac{9}{a}$
- e. ${}^6\log a - 1 = {}^6\log a - {}^6\log 6^1 = {}^6\log a - {}^6\log 6 = {}^6\log \frac{a}{6} = {}^6\log \frac{1}{6} a$
- f. $2 \cdot {}^5\log b + \frac{1}{2} \cdot {}^5\log a = {}^5\log b^2 + {}^5\log a^{\frac{1}{2}} = {}^5\log b^2 + {}^5\log \sqrt{a} = {}^5\log b^2 \sqrt{a}$

Opgave 76:

- a. ${}^5\log x = 3 \cdot {}^5\log 2 - 2 \cdot {}^5\log 3$
 ${}^5\log x = {}^5\log 2^3 - {}^5\log 3^2$
 ${}^5\log x = {}^5\log 8 - {}^5\log 9$
 ${}^5\log x = {}^5\log \frac{8}{9}$
 $x = \frac{8}{9}$
- b. ${}^5\log x = 3 + 4 \cdot {}^5\log 3$
 ${}^5\log x = {}^5\log 5^3 + {}^5\log 3^4$
 ${}^5\log x = {}^5\log 125 + {}^5\log 81$
 ${}^5\log x = {}^5\log 10125$
 $x = 10125$
- c. ${}^2\log x = 9 - {}^2\log 3$
 ${}^2\log x = {}^2\log 2^9 - {}^2\log 3$
 ${}^2\log x = {}^2\log 512 - {}^2\log 3$
 ${}^2\log x = {}^2\log \frac{512}{3}$
 $x = \frac{512}{3} = 170\frac{2}{3}$

$$\begin{aligned}
 \text{d. } & {}^3\log x = 0,5 \cdot {}^3\log 5 + 1 \\
 & {}^3\log x = {}^3\log 5^{0,5} + {}^3\log 3^1 \\
 & {}^3\log x = {}^3\log \sqrt{5} + {}^3\log 3 \\
 & {}^3\log x = {}^3\log 3\sqrt{5}
 \end{aligned}$$

Opgave 77:

$$\begin{aligned}
 \text{a. } & {}^5\log x = {}^5\log 6 - 2 \cdot {}^5\log 4 \\
 & {}^5\log x = {}^5\log 6 - {}^5\log 4^2 \\
 & {}^5\log x = {}^5\log 6 - {}^5\log 16 \\
 & {}^5\log x = {}^5\log \frac{6}{16} \\
 & x = \frac{6}{16} = \frac{3}{8}
 \end{aligned}$$

$$\begin{aligned}
 \text{b. } & {}^4\log x = \frac{1}{2} - {}^4\log 3 \\
 & {}^4\log x = {}^4\log 4^{\frac{1}{2}} - {}^4\log 3 \\
 & {}^4\log x = {}^4\log 2 - {}^4\log 3 \\
 & {}^4\log x = {}^4\log \frac{2}{3} \\
 & x = \frac{2}{3}
 \end{aligned}$$

$$\begin{aligned}
 \text{c. } & {}^2\log x = 5 - 3 \cdot {}^2\log 6 \\
 & {}^2\log x = {}^2\log 2^5 - {}^2\log 6^3 \\
 & {}^2\log x = {}^2\log 32 - {}^2\log 216 \\
 & {}^2\log x = {}^2\log \frac{32}{216} \\
 & x = \frac{32}{216} = \frac{4}{27}
 \end{aligned}$$

$$\begin{aligned}
 \text{d. } & {}^3\log x = 5 \cdot {}^3\log 2 - 3 \cdot {}^3\log 4 \\
 & {}^3\log x = {}^3\log 2^5 - {}^3\log 4^3 \\
 & {}^3\log x = {}^3\log 32 - {}^3\log 64 \\
 & {}^3\log x = {}^3\log \frac{32}{64} \\
 & x = \frac{32}{64} = \frac{1}{2}
 \end{aligned}$$

$$\begin{aligned}
 \text{e. } & {}^3\log(x+7) - {}^3\log(x-1) = 2 \\
 & {}^3\log(x+7) = {}^3\log 3^2 + {}^3\log(x-1) \\
 & {}^3\log(x+7) = {}^3\log 9 + {}^3\log(x-1) \\
 & {}^3\log(x+7) = {}^3\log 9(x-1) \\
 & x+7 = 9(x-1) \\
 & x+7 = 9x-9 \\
 & -8x = -16 \\
 & x = 2
 \end{aligned}$$

$$\begin{aligned}
 \text{f. } & \log(x+98) = \log(x-1) + 2 \\
 & \log(x+98) = \log(x-1) + \log 10^2 \\
 & \log(x+98) = \log(x-1) + \log 100 \\
 & \log(x+98) = \log 100(x-1) \\
 & x+98 = 100(x-1) \\
 & x+98 = 100x-100
 \end{aligned}$$

$$-99x = -198$$

$$x = 2$$

Opgave 78:

a. ${}^3\log y = p$

$$y = 3^p$$

b. ${}^2\log y = t + 5$

$$y = 2^{t+5}$$

c. $\log y = q$

$$y = 10^q$$

Opgave 79:

a. $\log y = 1,3 - 0,6x$

$$y = 10^{1,3-0,6x}$$

$$y = 10^{1,3} \cdot 10^{-0,6x}$$

$$y = 20 \cdot (10^{-0,6})^x$$

$$y = 20 \cdot 0,25^x$$

b. $3 \cdot \log P = 8 - 4t$

$$\log P = \frac{8}{3} - \frac{4}{3}t$$

$$P = 10^{\frac{8}{3} - \frac{4}{3}t}$$

$$P = 10^{\frac{8}{3}} \cdot 10^{-\frac{4}{3}t}$$

$$P = 464 \cdot (10^{-\frac{4}{3}})^t$$

$$P = 460 \cdot 0,046^t$$

c. ${}^2\log A = 1,7 - 0,3t$

$$A = 2^{1,7-0,3t}$$

$$A = 2^{1,7} \cdot 2^{-0,3t}$$

$$A = 3 \cdot (2^{-0,3})^t$$

$$A = 3 \cdot 0,81^t$$

Opgave 80:

a. $N = 280 \cdot 1,7^t$

$$\log N = \log(280 \cdot 1,7^t)$$

$$\log N = \log 280 + \log 1,7^t$$

$$\log N = 2,45 + t \cdot \log 1,7$$

$$\log N = 0,23t + 2,45$$

b. $N = 20 \cdot 0,4^{3t-2}$

$$\log N = \log(20 \cdot 0,4^{3t-2})$$

$$\log N = \log 20 + \log 0,4^{3t-2}$$

$$\log N = 1,30 + (3t - 2) \cdot \log 0,4$$

$$\log N = 1,30 + (3t - 2) \cdot -0,40$$

$$\log N = 1,30 - 1,19t + 0,80$$

$$\log N = -1,19t + 2,10$$

Opgave 81:

a. $20 \cdot \log A = 5 - 100x$

$$\log A = 0,25 - 5x$$

$$A = 10^{0,25-5x}$$

$$A = 10^{0,25} \cdot 10^{-5x}$$

$$A = 1,8 \cdot (10^{-5})^x$$

$$A = 1,8 \cdot 0,00001^x$$

b. $-5 \cdot \log y = 20 - 10x^2$

$$\log y = -40 + 2x^2$$

$$y = 10^{-40+2x^2}$$

$$y = 10^{2x^2-40}$$

c. $0,5 \cdot \log N + 3 = 5 - 2x$

$$0,5 \cdot \log N = 2 - 2x$$

$$\log N = 4 - 4x$$

$$N = 10^{4-4x}$$

$$N = 10^4 \cdot 10^{-4x}$$

$$N = 10000 \cdot (10^{-4})^x$$

$$N = 10000 \cdot 0,0001^x$$

Opgave 82:

a. $\log W = \log 2,4 + 0,008 \cdot 130 = 1,42$

$$W = 26 \text{ kg}$$

b. $\log 23,5 = \log 2,4 + 0,008h$

$$1,37 = 0,38 + 0,008h$$

$$0,99 = 0,008h$$

$$h = 124 \text{ cm}$$

c. $\log W = \log 2,4 + 0,008h$

$$W = 10^{\log 2,4 + 0,008h}$$

$$W = 10^{\log 2,4} \cdot 10^{0,008h}$$

$$W = 2,4 \cdot (10^{0,008})^h$$

$$W = 2,4 \cdot 1,0186^h$$