logarithm properties

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|---|---|
| $\log(a) = b \Leftrightarrow 10^b = a$ | $\ln(a) = b \Leftrightarrow e^b = a$ |
| $a \uparrow \rightarrow \log(a) \uparrow$ | $a \uparrow \rightarrow \ln(a) \uparrow$ |
| $10^{\log a} = a$ | $e^{\ln a} = a$ |
| $\log(10^a) = a$ | $\ln(e^a) = a$ |
| $\log(10) = 1$ | $\ln(e) = 1$ |
| $\log(1) = 0$ | $\ln(1) = 0$ |
| $\log(a)$ is undefined for $a \le 0$ | $\ln(a)$ is undefined for $a \le 0$ |
| $\log(ab) = \log a + \log b$ | $\ln(ab) = \ln a + \ln b$ |
| $\log\left(\frac{a}{b}\right) = \log a - \log b$ | $\ln\left(\frac{a}{b}\right) = \ln a - \ln b$ |
| $\log(a^b) = b \log a$ | $\ln(a^b) = b \ln a$ |