

Logarithms

$$a = b^x \iff \log_b(a) = x$$

base result power

only take log from positive numbers!

$$a = \log_b(c) \quad | b^{} \\ b^a = c$$

$$\log_a(x) = \frac{\log_b(x)}{\log_b(a)}$$

$$\log_a(x \cdot y) = \log_a(x) + \log_a(y)$$

$$\log_a\left(\frac{x}{y}\right) = \log_a(x) - \log_a(y)$$

$$\log_a(x^m) = m \cdot \log_a x$$

(a, x, y > 0)

$$\log_e(x) = \ln(x) \quad \rightarrow \text{natural logarithm}$$

$$e^{\ln(a)} = \ln(e^a) = a$$

Functions

$$f(x) = x^2 + 3$$

$$f: x \mapsto x^2 + 3$$

$$y = x^2 + 3$$

~~sqrt~~ ~~*~~ ~~log(-1)~~

x → domain (Definitionsbereich)

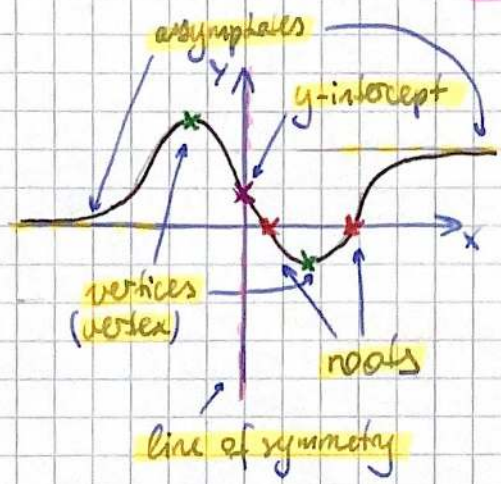
y → range (Wertebereich)

f^{-1}

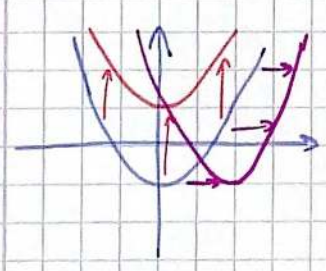
inverse function

→ x & y swapped

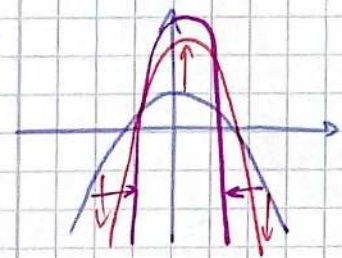
→ reflected on $y=x$



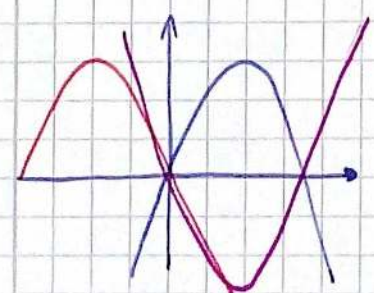
Transformations of graphs



vertical
horizontal } translation $\left\{ \begin{array}{l} f(x) + b \\ f(x+c) \end{array} \right.$



vertical
horizontal } stretch $\left\{ \begin{array}{l} p \cdot f(x) \\ f(q \cdot x) \end{array} \right.$



reflection on $\left\{ \begin{array}{l} x\text{-axis} - f(x) \\ y\text{-axis} - f(-x) \end{array} \right.$