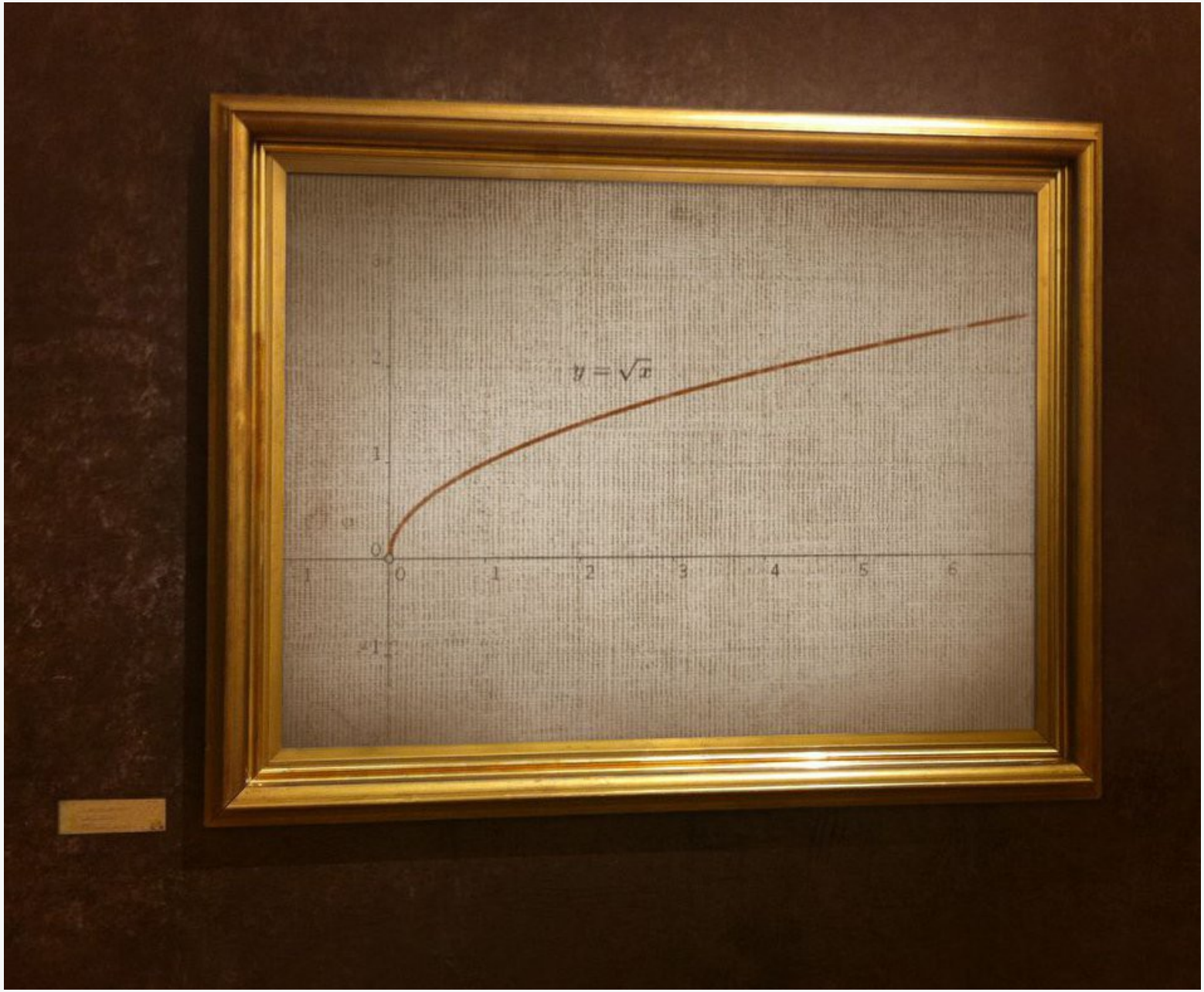

Root functions

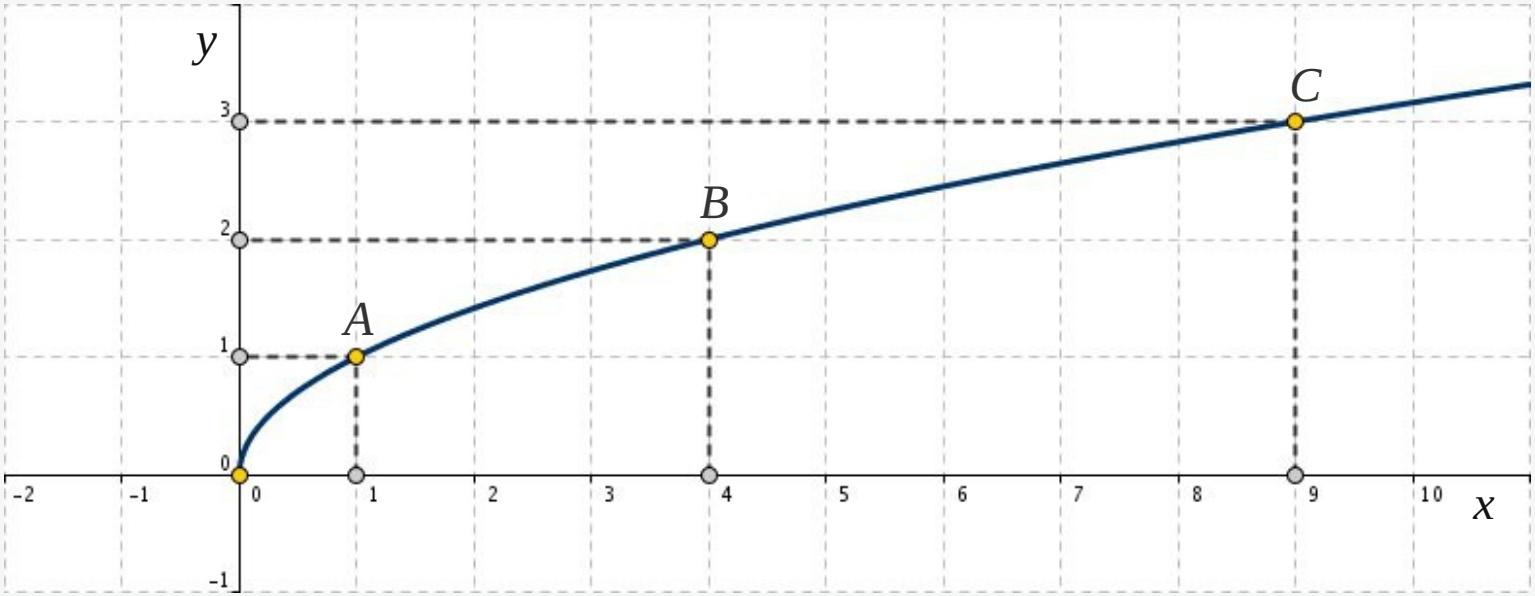

Fig. 1: Root function $f(x) = \sqrt{x}$

The domain (D) and the range (R) of the root function $f(x) = \sqrt{x}$ are

$$D(f) = [0, \infty), \qquad R(f) = [0, \infty).$$

Remember, in the field of the real numbers, roots are only defined for positive radicands

$$A = (1, 1), \qquad B = (4, 2), \qquad C = (9, 3)$$

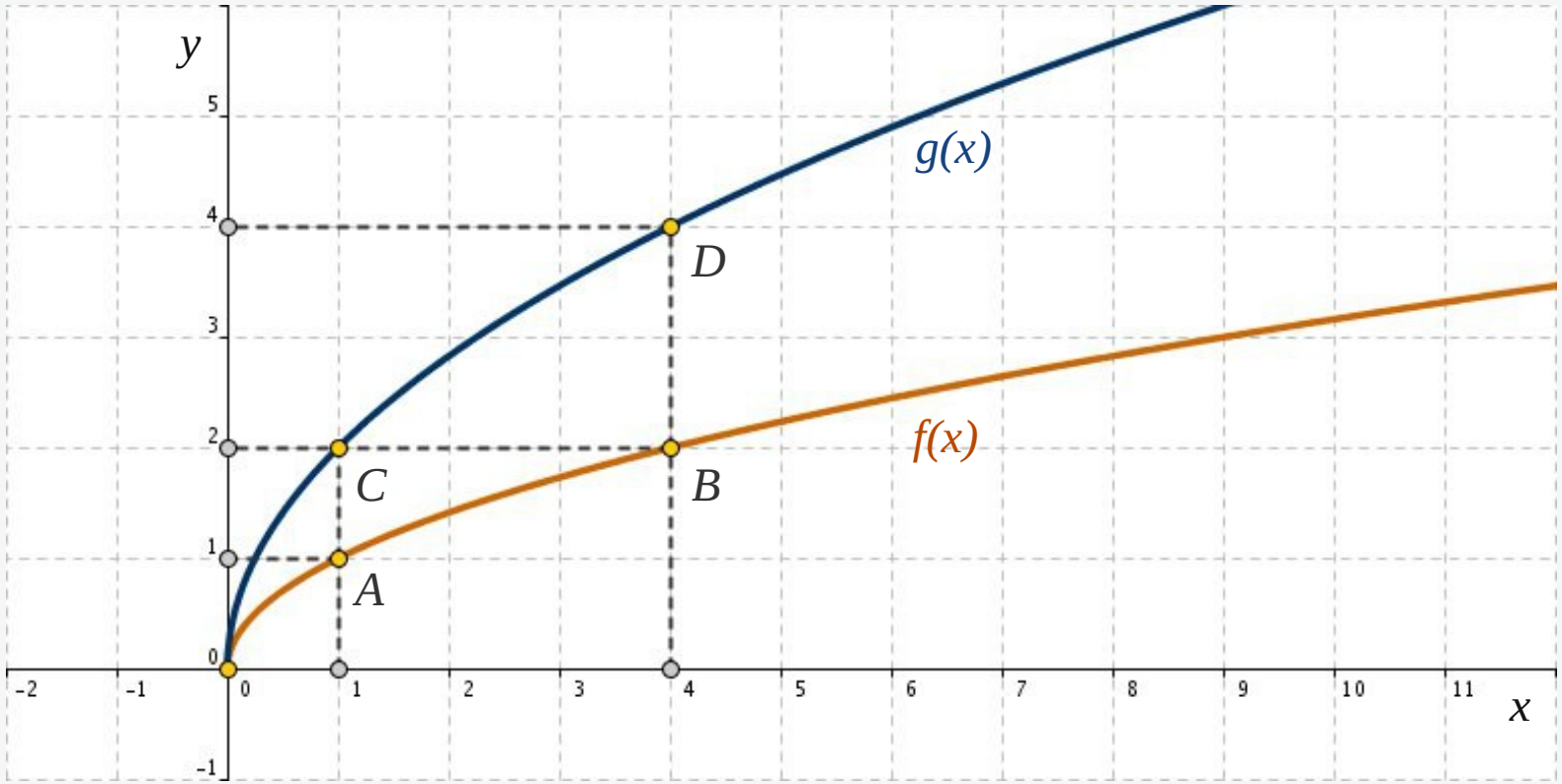

Fig. 2: Root functions $f(x)$ and $g(x)$

$$f(x) = \sqrt{x}\ , \qquad g(x) = 2\sqrt{x}$$

$$A = (1,\ 1)\,, \quad B = (4,\ 2)\,, \quad C = (1,\ 2)\,, \quad D = (4,\ 4)$$

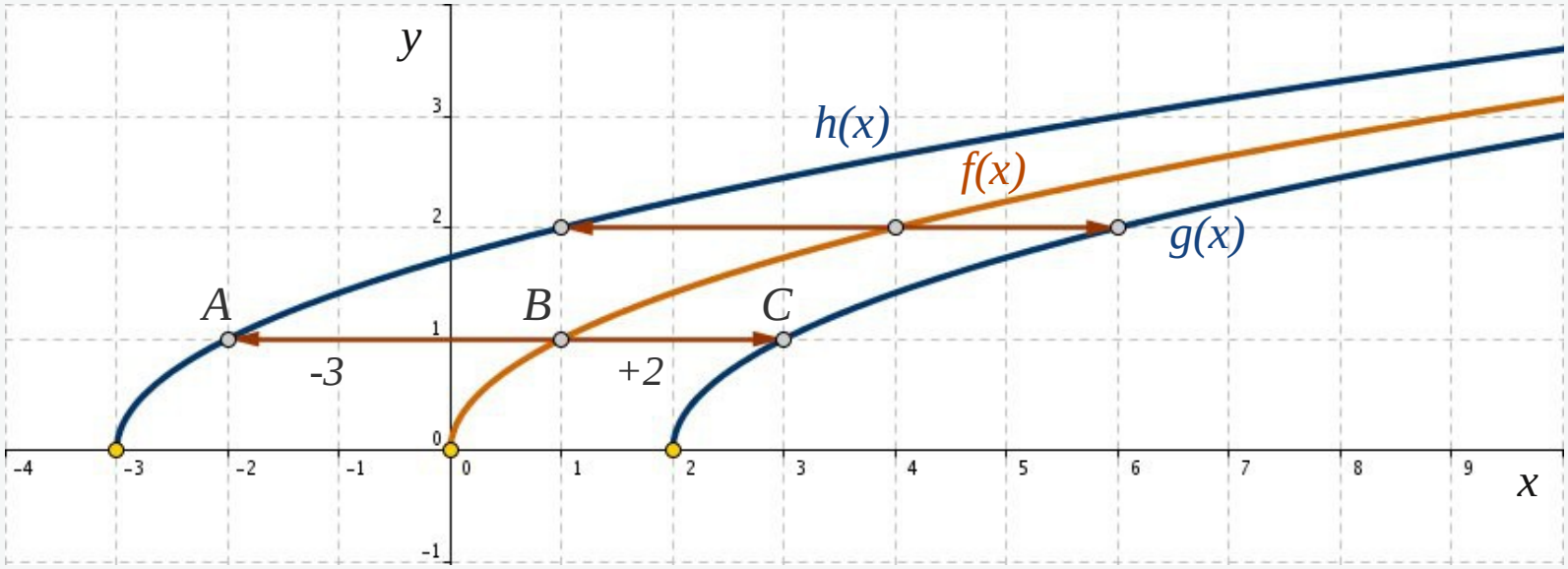

Fig. 3: Root functions $f(x)$, $g(x)$ and $h(x)$

$$f(x) = \sqrt{x}\ , \qquad g(x) = \sqrt{x-2}\ , \qquad h(x) = \sqrt{x+3}$$

$$A = (-2,\ 1)\,, \qquad B = (1,\ 1)\,, \qquad C = (3,\ 1)$$

$$f(x) = \sqrt{x} \quad \overset{\overrightarrow{BC}}{\longrightarrow} \quad g(x) = \sqrt{x-2}$$

$$f(x) = \sqrt{x} \quad \overset{\overrightarrow{BA}}{\longrightarrow} \quad h(x) = \sqrt{x+3}$$

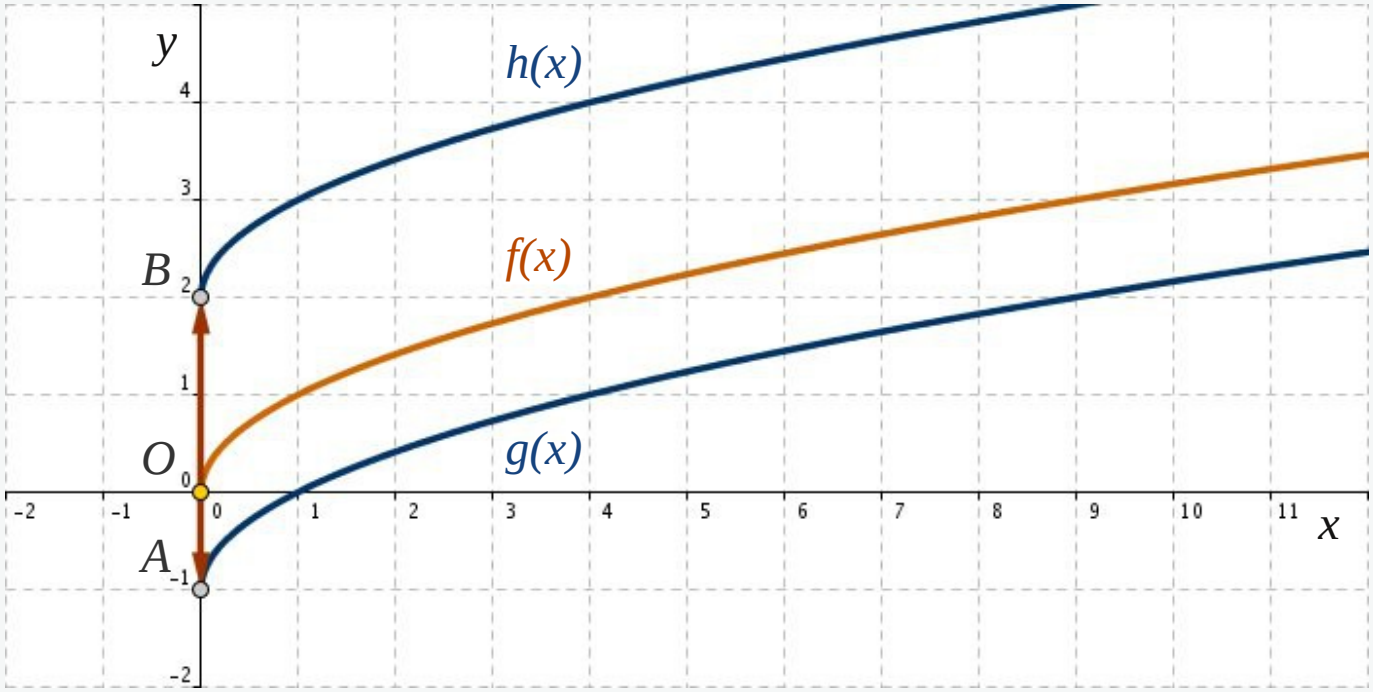

Fig. 4: Root functions $f(x)$, $g(x)$ and $h(x)$

$$f(x) = \sqrt{x}\,, \qquad g(x) = \sqrt{x} - 1, \qquad h(x) = \sqrt{x} + 2$$

$$f(x) = \sqrt{x} \quad \overset{\overbrace{\vec{OA}}}{\rightarrow} \quad g(x) = \sqrt{x} - 1$$

$$f(x) = \sqrt{x} \quad \overset{\overbrace{\vec{OB}}}{\rightarrow} \quad h(x) = \sqrt{x} + 2$$

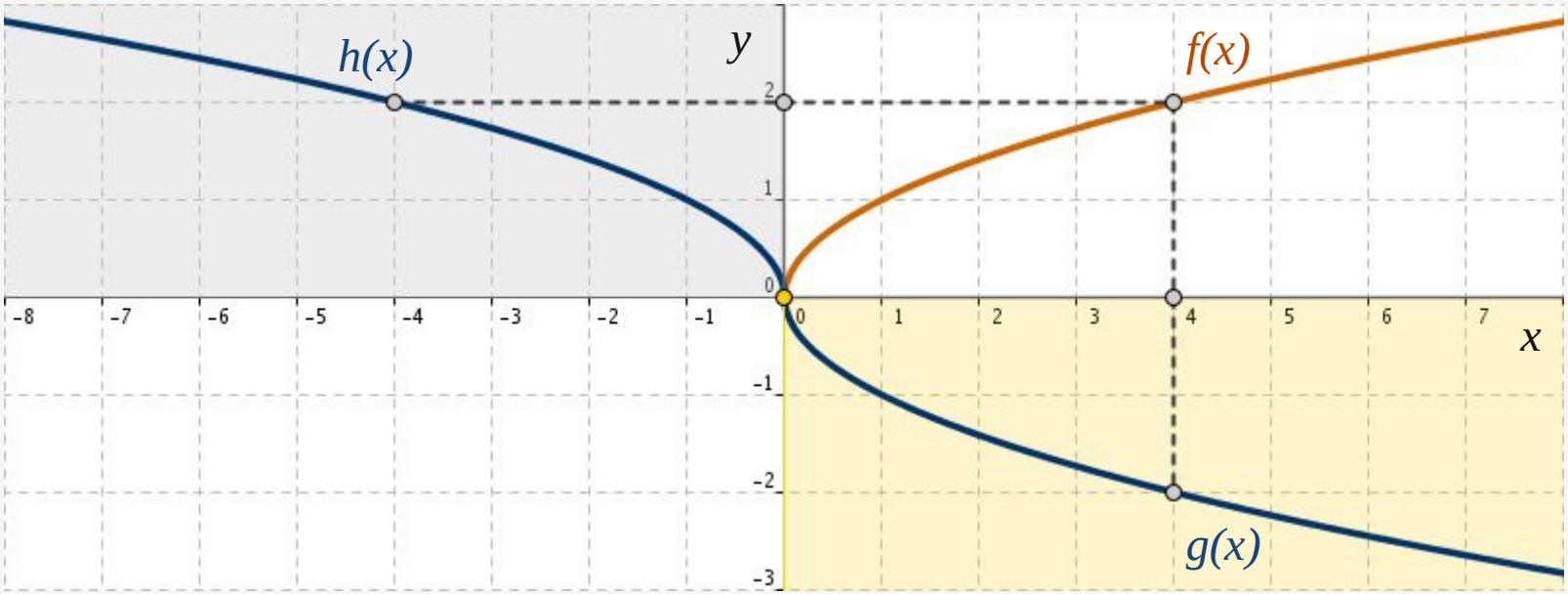

Fig. 5: Root functions $f(x)$, $g(x)$ and $h(x)$

$$f(x) = \sqrt{x}\ , \qquad g(x) = -\sqrt{x}\ , \qquad h(x) = \sqrt{-x}$$

$$f(x) = \sqrt{x} \quad \overset{x-\text{Achse}}{\rightarrow} \quad g(x) = -\sqrt{x}$$

$$f(x) = \sqrt{x} \quad \overset{y-\text{Achse}}{\rightarrow} \quad h(x) = \sqrt{-x}$$

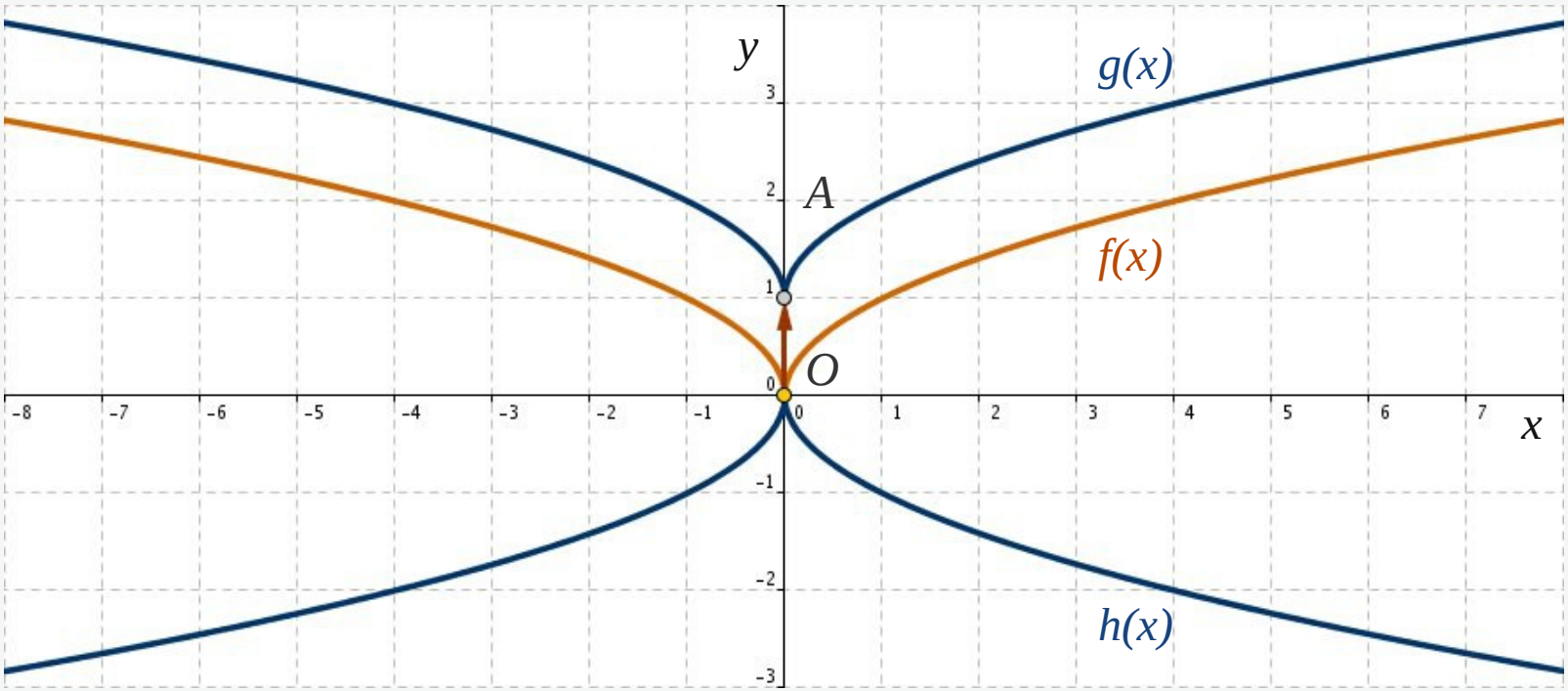

Fig. 6: Root functions $f(x)$, $g(x)$ and $h(x)$

$$f(x) = \sqrt{|x|}\,, \qquad g(x) = \sqrt{|x|} + 1, \qquad h(x) = -\sqrt{|x|}$$

$$f(x) = \sqrt{|x|} \overset{x-Achse}{\longrightarrow} h(x) = -\sqrt{|x|}$$

$$f(x) = \sqrt{|x|} \overset{\vec{OA}}{\longrightarrow} g(x) = \sqrt{|x|} + 1$$

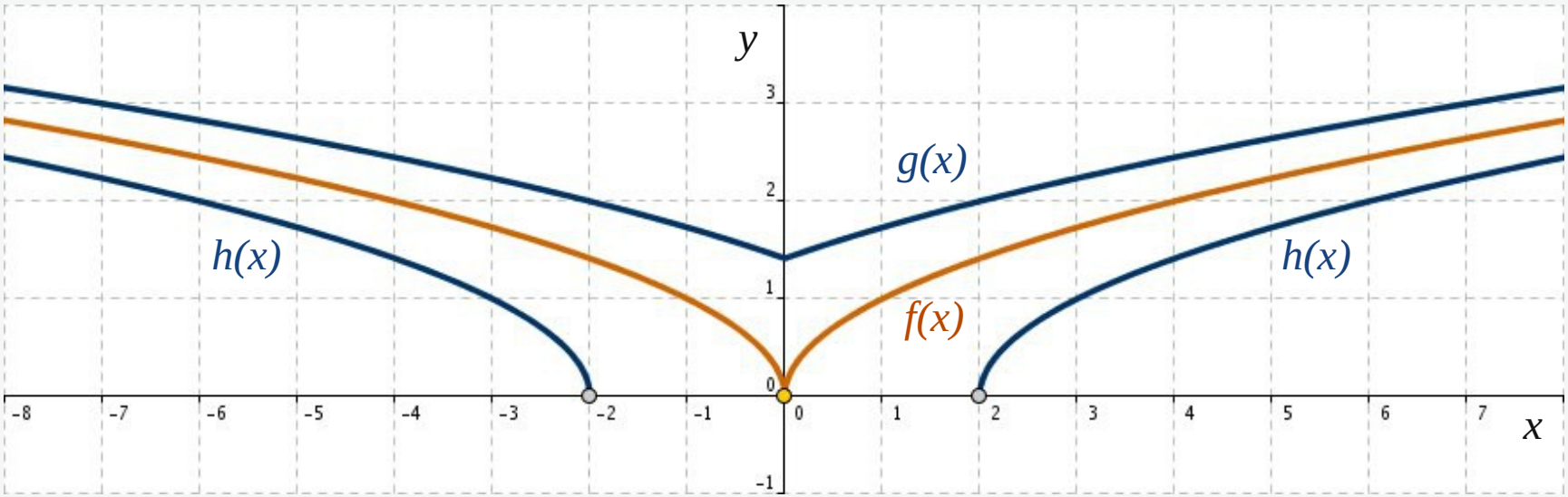

Fig. 7: Root functions f(x), g(x) and h(x)

$$f(x) = \sqrt{|x|}\,, \qquad g(x) = \sqrt{|x| + 2}\,, \qquad h(x) = \sqrt{|x| - 2}$$

$$D(f(x)) = D(g(x)) = \mathbb{R}\,, \qquad D(h(x)) = (-\infty, -2] \cup [2, \infty)$$

Exercise 1:

Describe how the graph of the function $f(x)$ is transformed to that of $g(x)$

$a)\quad f(x) = \sqrt{x}\ , \qquad g(x) = \sqrt{x+3} + 1$

$b)\quad f(x) = \sqrt{x}\ , \qquad g(x) = 1.5\sqrt{x+3}$

Exercise 2:

Plot the following functions

$f(x) = \sqrt{2-x}\ , \qquad g(x) = \sqrt{x+2} + 1$

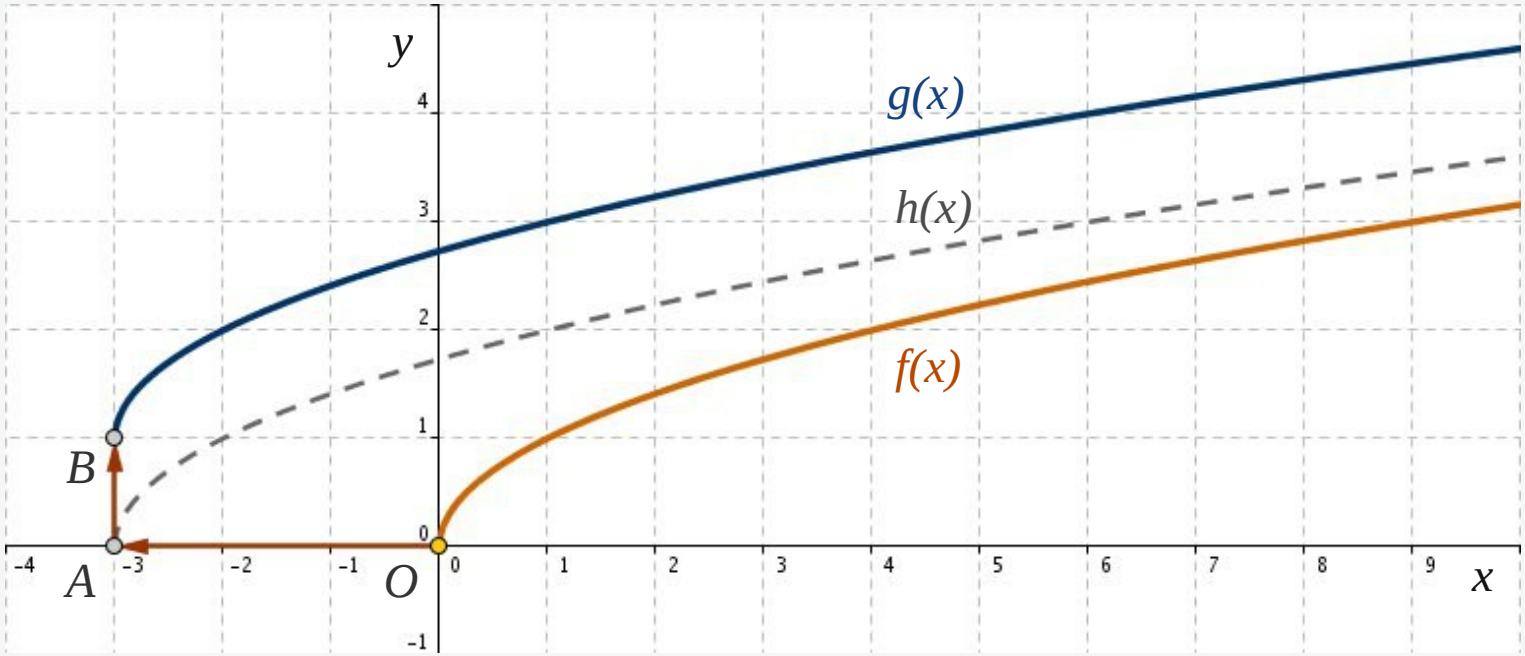

Fig. 8-1: Root functions f(x), g(x) and h(x)

$$f(x) = \sqrt{x} \quad \overset{\vec{OA}}{\rightarrow} \quad h(x) = \sqrt{x+3} \quad \overset{\vec{AB}}{\rightarrow} \quad g(x) = \sqrt{x+3} + 1$$

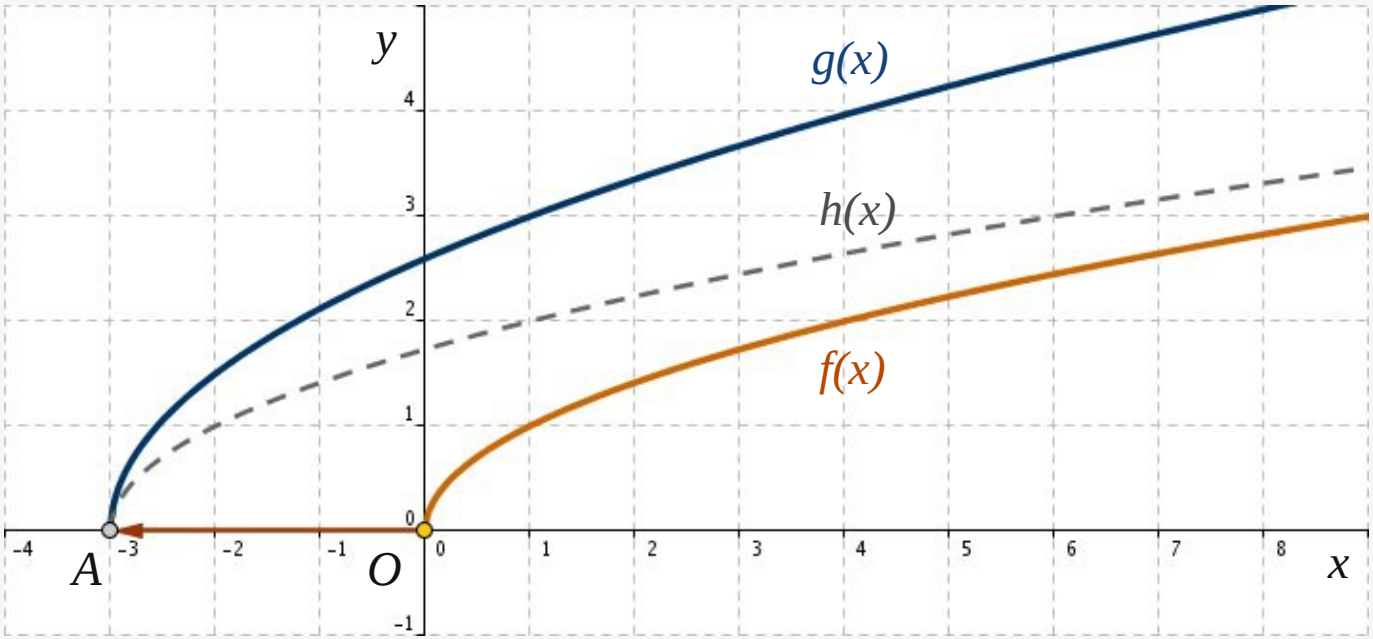

Fig. 8-2: Root functions $f(x)$, $g(x)$ and $h(x)$

$$f(x) = \sqrt{x} \quad \overset{\vec{OA}}{\rightarrow} \quad h(x) = \sqrt{x+3} \quad \overset{\times 1.5}{\rightarrow} \quad g(x) = 1.5\sqrt{x+3}$$

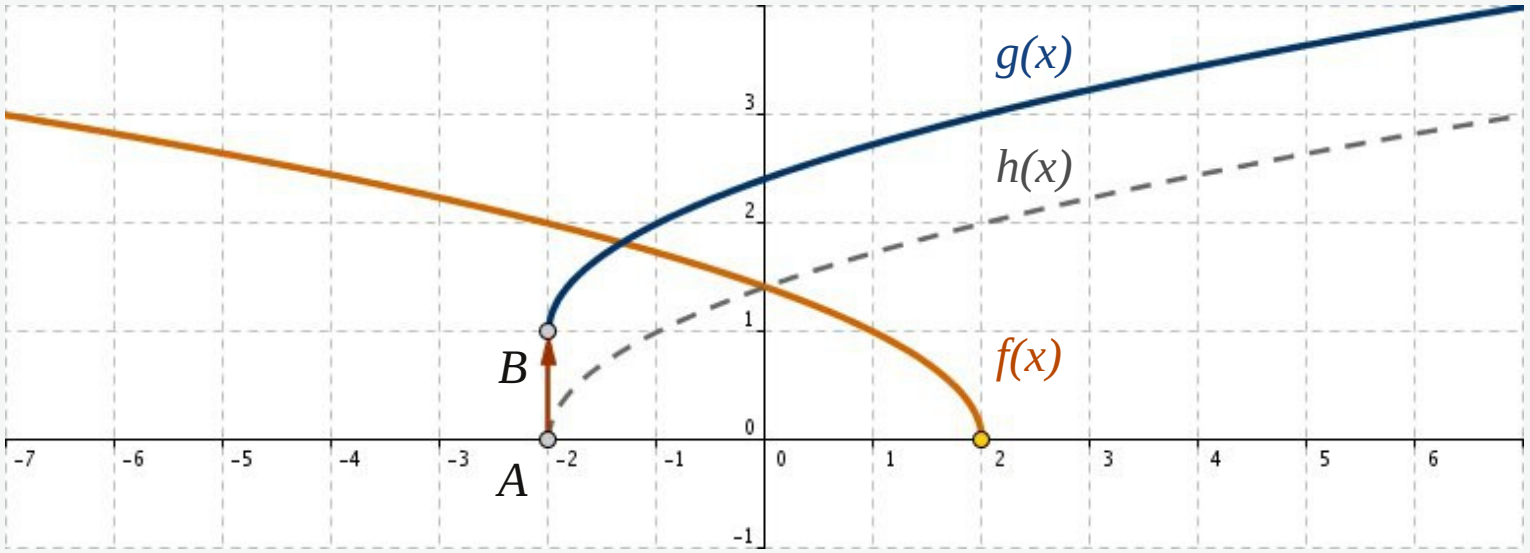

Fig. 9: Root functions $f(x)$, $g(x)$ and $h(x)$

$$f(x) = \sqrt{2 - x}$$

$$h(x) = \sqrt{x + 2} \quad \overset{\overset{AB}{\frown}}{\rightarrow} \quad g(x) = \sqrt{x + 2} + 1$$