

Functions

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

$$y = x^2 + 2$$

$$x \mapsto x^2 + 2$$

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

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

$$f(5) = 27$$

$$f(x) \Big|_{x=5} = 27$$

$$f: 5 \mapsto 27$$

$$\text{at } x=5, f=27$$

variable - input - argument

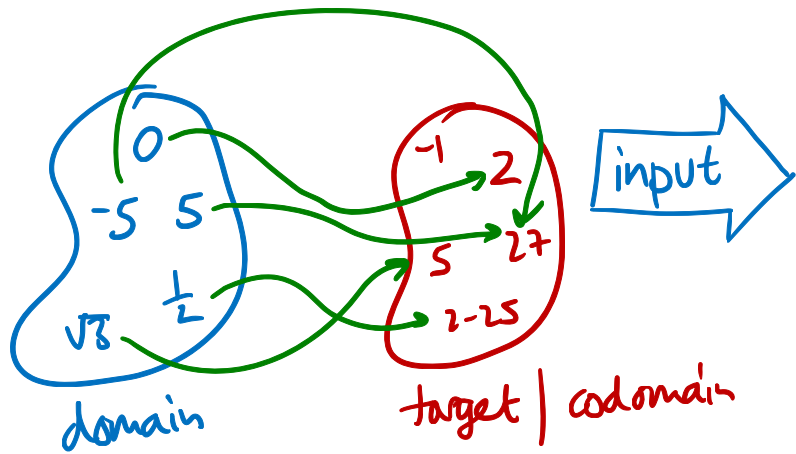
value - output

parameter

domain - feasible region

codomain - target - range

Functions



function

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

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

x	y
0	2
5	27
1/2	2.25
√3	5

$$f(0) = 0^2 + 2 = 2$$

$$f(5) = 5^2 + 2 = 27$$

$$f\left(\frac{1}{2}\right) = \left(\frac{1}{2}\right)^2 + 2 = 2.25$$

$$f(\sqrt{3}) = (\sqrt{3})^2 + 2 = 5$$

$$f(-5) = (-5)^2 + 2 = 27$$

$$f(2t) = (2t)^2 + 2 = 4t^2 + 2$$

$$f(3t^2 + 1) = (3t^2 + 1)^2 + 2 = 9t^4 + 6t^2 + 3$$

$$y = x^2 + 2$$

$$x \mapsto x^2 + 2$$

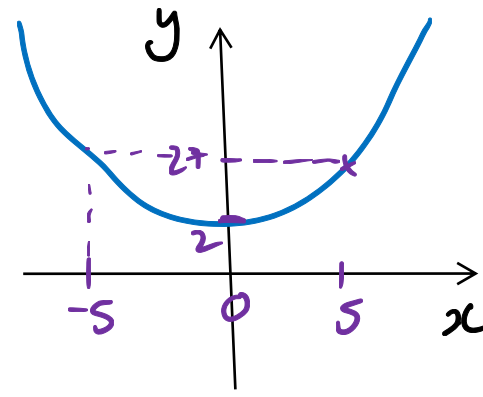
$$f: x \mapsto x^2 + 2$$

$$f(5) = 27$$

$$f(x) \Big|_{x=5} = 27$$

$$f: 5 \mapsto 27$$

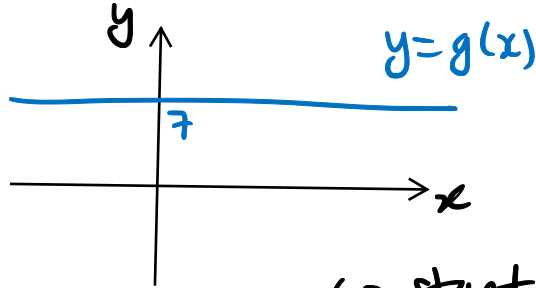
at $x=5, f=27$



Functions

$$g(x) = 7$$

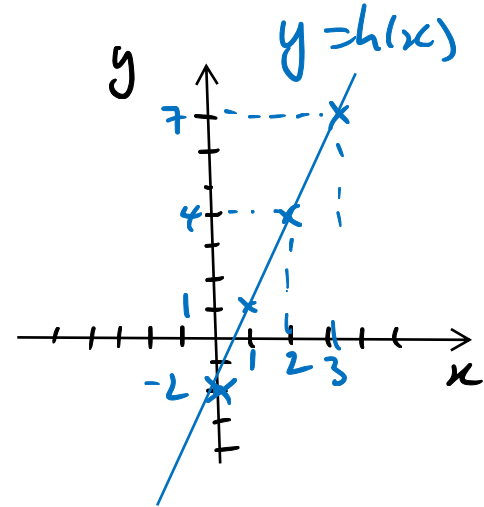
x	g(x)
0	7
5	7
1000	7



Constant
 $g(x) = c$

$$h(x) = 3x - 2$$

x	h(x)
0	$3 \times 0 - 2 = -2$
1	$3 \times 1 - 2 = 1$
2	$3 \times 2 - 2 = 4$
3	$3 \times 3 - 2 = 7$

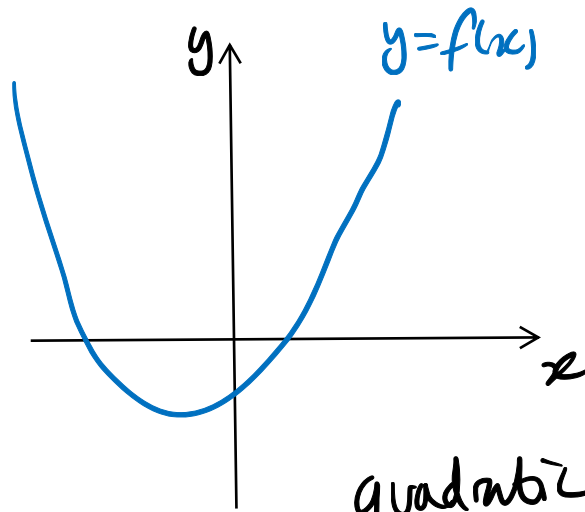


h is linear

$$h(x) = mx + c$$

$$f(x) = 3x^2 + 2x - 7$$

x	f(x)
-2	$3(-2)^2 + 2(-2) - 7 = 1$
-1	$3(-1)^2 + 2(-1) - 7 = -6$
0	$3 \times 0^2 + 2 \times 0 - 7 = -7$
1	$3(1^2) + 2 \times 1 - 7 = -2$



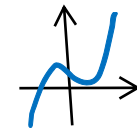
quadratic

$$f(x) = ax^2 + bx + c$$

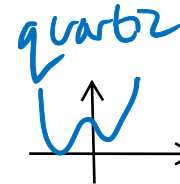
$a \neq 0$

polynomial

$$f(x) = a_n x^n + \dots + a_2 x^2 + a_1 x + a_0$$



cubic $2x^3 + 3x^2 + 7x + 5$

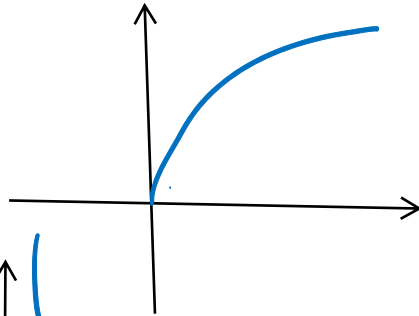


quartic $5x^4 + 3x^2 + 2$

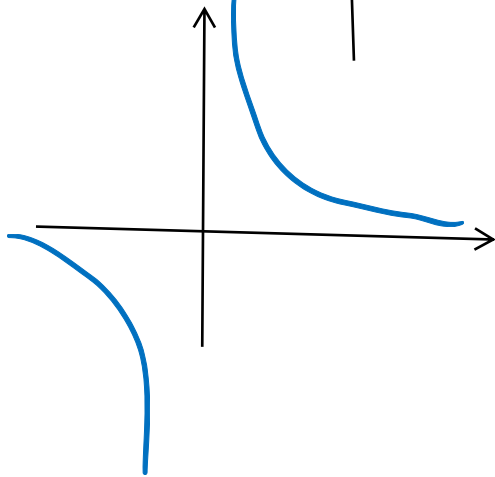
Functions

$f(x) = 3x^5$ power function
monomial

\sqrt{x} , $x \geq 0$

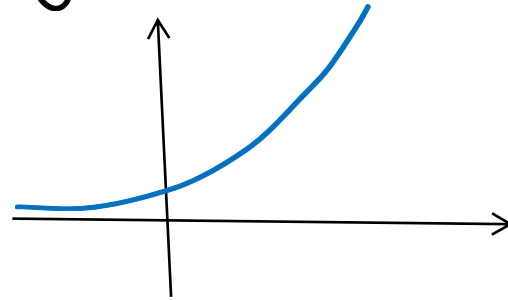


$\frac{1}{t}$, $t \neq 0$



$f(t) = \frac{1}{3t+2}$, if $3t+2 \neq 0$
 $t \neq -\frac{2}{3}$

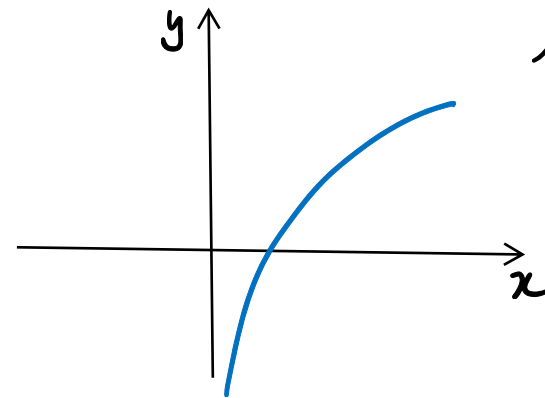
$g(x) = 3^x$ exponential



$g(x) = a^x$

$a > 0$
constant

$h(x) = \log_3(x)$



logarithmic

$x > 0$

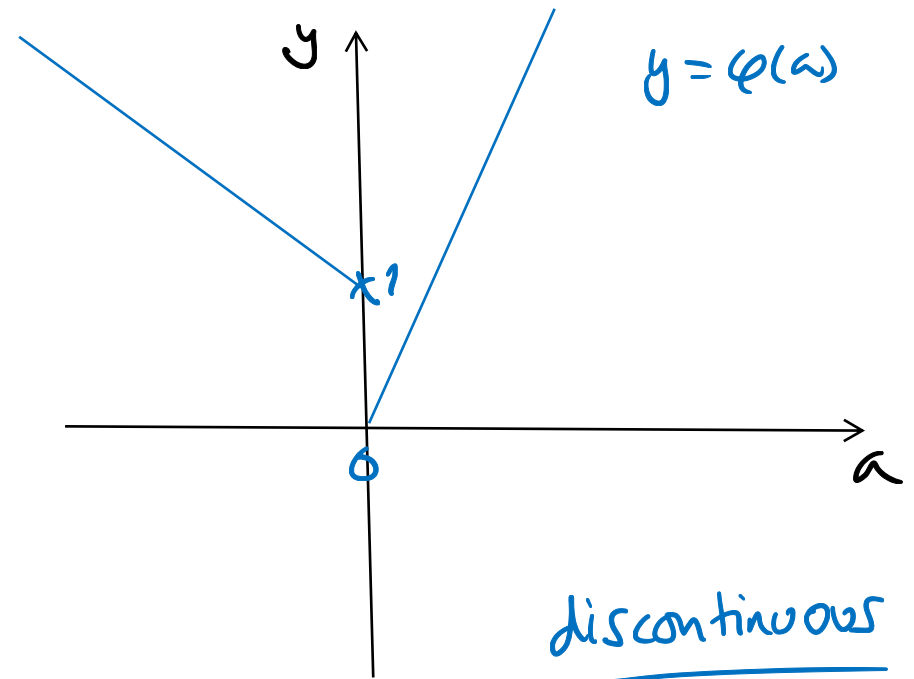
Functions

$$\varphi(a) = \begin{cases} 2a & \text{if } a > 0 \\ 1-a & \text{if } a \leq 0 \end{cases}$$

$$\begin{aligned} \varphi(7) &= 2 \times 7 && \text{since } 7 > 0 \\ &= 14 \end{aligned}$$

$$\begin{aligned} \varphi(2) &= 2 \times 2 && \text{since } 2 > 0 \\ &= 4 \end{aligned}$$

$$\begin{aligned} \varphi(-3) &= 1 - (-3) && \text{since } -3 \leq 0 \\ &= 4 \end{aligned}$$



Functions

$$F(x, y) = 3x^2y^4$$

$$\begin{aligned} F(5, -1) &= 3 \times (5^2) \times (-1)^4 \\ &= 3 \times 25 \times 1 \\ &= 75 \end{aligned}$$

$$F(x, y) \Big|_{(5, -1)}$$

$$\pi = AK^{1/4}L^{3/4}$$

π as a function of (K, L)

$$\pi(K, L) = \underbrace{AK^{1/4}L^{3/4}}_{\text{variables}} \underbrace{A}_{\text{parameter}}$$

π as a function of A

$$\pi(A) = \underbrace{AK^{1/4}L^{3/4}}_{\text{variable}} \underbrace{A}_{\text{parameters}}$$

Functions

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

$$g(x) = x + 5$$

$$\begin{aligned}(f+g)(x) &= f(x) + g(x) \\ &= 3x^2 + x + 5\end{aligned}$$

$$\begin{aligned}\left(\frac{f}{g}\right)(x) &= \frac{f(x)}{g(x)} = \frac{3x^2}{x+5} \\ &g(x) \neq 0, \quad x \neq -5\end{aligned}$$

$$7f(x) = 7(3x^2) = 21x^2$$

Composition

$$\begin{aligned}(fg)(x) &= f(x)g(x) \\ &= 3x^2(x+5) \\ &= 3x^3 + 15x^2\end{aligned}$$

$$\begin{aligned}(f \circ g)(x) &= f(g(x)) \\ &= 3(g(x))^2 \\ &= 3(x+5)^2 \\ &= 3x^2 + 30x + 75\end{aligned}$$

$$\begin{aligned}(g \circ f)(x) &= g(f(x)) \\ &= f(x) + 5 \\ &= 3x^2 + 5\end{aligned}$$