

Section 1.1 Functions

Examples

1) $f(x) = 1 - 8x$.

To find $f(2)$:

$1 - 8x$ $\xrightarrow{\text{input } 2}$ $\rightarrow 1 - 8(2) = 1 - 16 = -15$

To find $f(-3)$:

$1 - 8x$ $\xrightarrow{\text{input } -3}$ $\rightarrow 1 - 8(-3) = 1 - (-24) = 1 + 24 = 25$

2) $f(x) = x$, $g(x) = x^2 + x + 1$

To find $f(1) + g(2)$:

x $\xrightarrow{\text{input } 1}$ $\downarrow$ 1 , $x^2 + x + 1$ $\xrightarrow{\text{input } 2}$ $\downarrow$ $2^2 + 2 + 1 = 4 + 2 + 1 = 7$

Then $f(1) + g(2) = 1 + 7 = 8$.

To find $f(2) \cdot g(-1)$:

x $\xrightarrow{\text{input } 2}$ $\downarrow$ 2 , $x^2 + x + 1$ $\xrightarrow{\text{input } -1}$ $\downarrow$ $(-1)^2 + (-1) + 1 = 1 - 1 + 1 = 1$

Then $f(2) \cdot g(-1) = 2 \cdot 1 = 2$

3) $f(x) = x^2 + 1$.

Compute:

$f(2) = 2^2 + 1 = 5$

$f(a) = a^2 + 1$

$f(a+h) = (a+h)^2 + 1$

Piecewise Functions

$$f(x) = \begin{cases} \text{Rule 1} & x < 1 \\ \text{Rule 2} & x \geq 1 \end{cases} \rightarrow \begin{cases} \text{if } x < 1, \text{ do rule 1} \\ \text{if } x \geq 1, \text{ do rule 2} \end{cases}$$

$f(-100) \rightarrow \text{Rule 1}$

$f(100) \rightarrow \text{Rule 2}$

$f(0) \rightarrow \text{Rule 1}$

$f(0.9) \rightarrow \text{Rule 1}$

$f(1) \rightarrow \text{Rule 2}$

$f(3) \rightarrow \text{Rule 2}$

Examples

$$1) f(x) = \begin{cases} x+1 & x < -1 \\ -x^2-1 & x \geq -1 \end{cases}$$

$$f(-2) = (-2) + 1 = -1$$

$$f(2) = -(2)^2 - 1 = -4 - 1 = -5$$

$$f(-1) = -(-1)^2 - 1 = -1 - 1 = -2$$

$$2) g(x) = \begin{cases} x-1 & x < -1 \\ x^3 & -1 \leq x < 1 \\ x+1 & x \geq 1 \end{cases}$$

$$g(-2) = (-2) - 1 = -3$$

$$g(-1) = (-1)^3 = -1$$

$$g(0) = 0^3 = 0$$

$$g(1) = (1) + 1 = 2$$

Domains

Domain = "where function is defined"

Example

$$1) \frac{1}{x-1} \rightarrow \text{Defined everywhere but } x=1$$

$\rightarrow$ say domain is $\checkmark$ called a union symbol
 $(-\infty, 1) \cup (1, \infty)$

$$2) \frac{1}{(x-1)(x+1)} \rightarrow \text{Defined everywhere but } x=1 \text{ and } x=-1$$

$\rightarrow$ say domain is
 $(-\infty, -1) \cup (-1, 1) \cup (1, \infty)$

$$3) \sqrt{x+1} \rightarrow \text{Defined for } x+1 \geq 0 \rightarrow \text{for } x \geq -1$$

$\rightarrow$ say domain is
 $[-1, \infty)$

"(" and ")" mean exclude

"[" and "]" mean include

$$4) \frac{1}{\sqrt{x+1}} \rightarrow \text{Defined for } x+1 > 0 \rightarrow \text{for } x > -1$$

$\rightarrow$ say domain is $(-1, \infty)$

Problems

1) Find domain of $f(x) = \frac{x+1}{\sqrt{2x-3}}$

- Can't divide by zero
- Can't square root neg. #

↳ must have $2x-3 > 0 \rightarrow 2x > 3 \rightarrow x > \frac{3}{2}$

↳ domain is $(\frac{3}{2}, +\infty)$

2) Find domain of $f(x) = \frac{1}{x^2-1}$

- Can't divide by zero

↳ $x^2-1=0 \rightarrow (x-1)(x+1)=0 \rightarrow 0$ when $x=1, -1$.

↳ Domain is where $x \neq 1, x \neq -1$.

↳ Domain is $(-\infty, -1) \cup (-1, 1) \cup (1, +\infty)$.