2.1/2.2 I Range of Functions

A. Range

rng f all outputs

B. About Range

These are the "answers" you get back.

You want to know which y-value answers you get.

This is, in general, much more difficult than finding domain.

You have to determine limitations on the functions outputs.

C. Some Guidelines

1. x^2, x^4, x^6, etc. — in general, even powers of anything i.e. $(\text{junk})^8$

   typically has smallest y-value 0 and no upper limit

2. $\sqrt{\ }, \sqrt[4]{\ }, \sqrt[6]{\ }$, etc. also typically have smallest y-value 0 with no upper limit

3. other techniques will come later.

D. Examples

Example 1: Find dom f and rng f for $f(x) = x^2 - 2$

Solution

Domain: No denominators; no even roots: $\boxed{\text{dom } f = (-\infty, \infty)}$

Range: Using guideline #1: x^2 has smallest y-value 0 and no upper limit

$\Rightarrow$ $x^2 - 2$ has smallest y-value -2 and no upper limit

$$\boxed{\text{rng } f = [-2, \infty)}$$

Example 2: Find dom g and rng g for $g(x) = \sqrt{2x-1} + 5$

Solution

Domain: set inside ≥ 0: $2x - 1 \geq 0 \Rightarrow x \geq \frac{1}{2}$

$$\boxed{\text{dom } g = [\tfrac{1}{2}, \infty)}$$

Range: Using guideline #2: $\sqrt{2x-1}$ has smallest y-value 0 and no upper limit

$\Rightarrow$ $\sqrt{2x-1} + 5$ has smallest y-value of 5 and no upper limit

$$\boxed{\text{rng } g = [5, \infty)}$$

Example 3: Let $h(x) = 6 - (x+1)^2$. Find rng h

Solution

Using guideline #1: $(x+1)^2$ has smallest y-value 0 and no upper limit

Thus $6 - (x+1)^2$ is 6 at biggest with no lower limit

$$\boxed{\text{rng } h = (-\infty, 6]}$$