

Section 1.2: Relations & Functions

Domain & Range Unless stated otherwise, the domain of a function defined by an equation $y = f(x)$ is assumed to be the largest subset of the real numbers for which the value $f(x)$ is defined. In general, we eliminate any real numbers for which $f(x)$ is not defined as a real number. Recall

- ▶ division by zero is not defined
- ▶ negative numbers do not have any even roots (square root, fourth root, etc.)
- ▶ other *function properties* are (or will be) known such as negative numbers having no logarithms

Example

Determine the domain of each function.

$$(b) f(x) = \frac{\sqrt{x}}{x-1}$$

What x values are not in the domain?

* $x-1 \neq 0$ so $x \neq 1$

* from \sqrt{x} we need $x \geq 0$.

So the domain is all x such that $x \geq 0$

and $x \neq 1$. In set notation, the

domain is $[0, 1) \cup (1, \infty)$.

\cup - union set \cup set "set and set"

$[$ value included $($ -value not included

\cap intersection

Question

The domain of $f(x) = \frac{x^2}{\sqrt[4]{x+3}}$ is

- (a) $(-3, \infty)$
- (b) $(-2, 0) \cup (0, \infty)$
- (c) $[-3, \infty)$
- (d) $(-\infty, -3) \cup (-3, \infty)$

Because $\sqrt[4]{x+3}$ is
in the denominator, we
require $x+3 > 0$

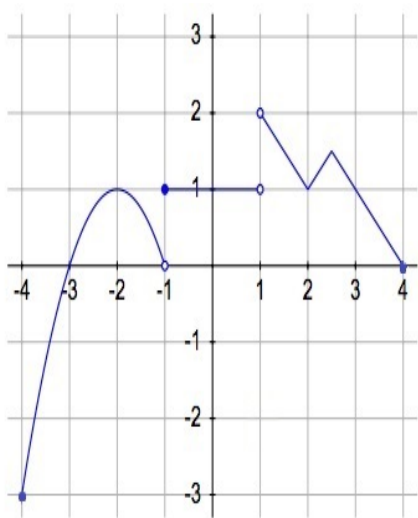
i.e. $x > -3$

Domain & Range

- ▶ The range may be difficult to infer from a formula. Sometimes it is possible by recalling known properties—e.g. $|x|$ is always nonnegative.
- ▶ The domain and range can often be determined from a graph.
- ▶ Recall that the range is the set of all possible $f(x)$ —i.e. y —values.

Domain & Range from a Graph

Domain \rightarrow x-values



The left and right most x-values are -4 and 4.

all x in $[-4, -1)$ are included.

all x in $[-1, 1)$ are included.

all x in $(1, 4]$ are included

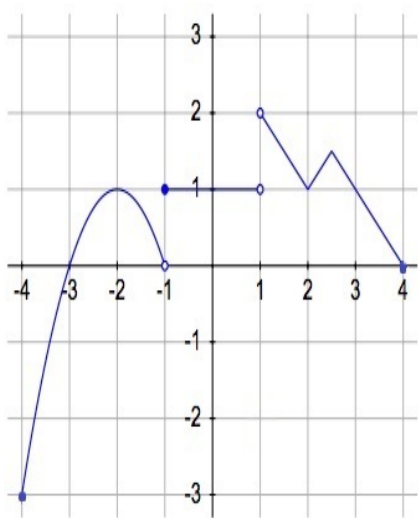
The domain is

$$[-4, 1) \cup (1, 4]$$

$$[-4, -1) \cup [-1, 1)$$

Figure: Identify the domain from the plot of $y = f(x)$

Domain & Range from a Graph



Range y-values

The lowest and highest y-values are -3 and 2.

All y in $[-3, 1]$ are included. All y in $(1, 2)$ are as well.

The range is $[-3, 2)$.

Figure: Identify the range from the plot of $y = f(x)$