

Set

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Functions

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$\mathbb{R}, \mathbb{Z}, \mathbb{Q}, \mathbb{Z}^+$

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Does $\{x \in \mathbb{R} : x \geq 4\}$ include 4?

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Function

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What does $\in$ mean?

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$\{x \in \mathbb{R} : x > 2\}$ in words

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Relation

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Is $\{(1, 2), (1, 5)\}$ a function?

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“is an element of”, e.g. $3 \in \{1, 2, 3\}$

a collection of items, called elements



the set of all real numbers x such that x is
greater than 2

real numbers, integers, rational numbers,
positive integers



any set of ordered pairs (input, output)

yes, $\geq$ includes the end value ($>$ does not)



no: the input 1 has two outputs

a relation where every input has exactly one
output



Is $\{(2, 3), (4, 3), (5, 1)\}$ a function?

Which mappings are functions?



Domain

Range



Domain and range of $\{(1, 3), (2, 5), (4, 5)\}$

Domain of $f(x) = \frac{1}{x}$



Domain of $f(x) = \sqrt{x}$

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



one-to-one and many-to-one (one-to-many is not)

yes: many-to-one is allowed, each input has one output



the set of all outputs (y values)

the set of all allowed inputs (x values)



$\{x \in \mathbb{R} : x \neq 0\}$, because you cannot divide by zero

domain $\{1, 2, 4\}$, range $\{3, 5\}$



$\{y \in \mathbb{R} : y \geq 0\}$

$\{x \in \mathbb{R} : x \geq 0\}$, because you cannot take the square root of a negative number



Vertical line test

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Which fail the vertical line test?

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How do you read the domain from a graph?

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How do you read the range from a graph?

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Closed circle and open circle

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What does $f(x)$ mean?

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If $f(x) = 3x - 2$, find $f(4)$

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If $f(x) = x^2 + 1$, find $f(-3)$

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a circle and a sideways parabola



a graph is a function if every vertical line
crosses it at most once



look bottom to top along the y-axis



look left to right along the x-axis



“f of x”: the output when the input is x. It is
not f times x



closed ● includes the end value, open ○
does not



$$(-3)^2 + 1 = 9 + 1 = 10$$



$$3(4) - 2 = 10$$



If $f(x) = 3x - 2$ and $f(x) = 13$, find x

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$f(2) = 7$ means...

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Inverse function f^{-1}

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Is $f^{-1}(x)$ the same as $\frac{1}{f(x)}$?

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How do you find f^{-1} ?

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Inverse of $f(x) = 3x - 2$

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**Graph of f^{-1} compared
with f**

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**When does an inverse
exist?**

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the point (2, 7) is on the graph of f



$$3x - 2 = 13, \text{ so } x = 5$$



no: f^{-1} is the inverse, $\frac{1}{f(x)}$ is the reciprocal



undoes f : if $f(a) = b$ then $f^{-1}(b) = a$



$$x = 3y - 2, \text{ so } f^{-1}(x) = \frac{x + 2}{3}$$



write $y = f(x)$, swap x and y , then rearrange
to make y the subject



when f is one-to-one; x^2 needs its domain
restricted to $x \geq 0$



the reflection of f in the line $y = x$



$$(f \circ g)(x)$$



$$f(x) = 2x + 1 \text{ and } g(x) = x^2: \text{ find } (f \circ g)(x)$$



$$\text{Same functions: find } (g \circ f)(x)$$



$$f(f^{-1}(x))$$



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



$f(g(x))$: do g first, then f



x



$$(2x + 1)^2 = 4x^2 + 4x + 1, \text{ so the order matters}$$

