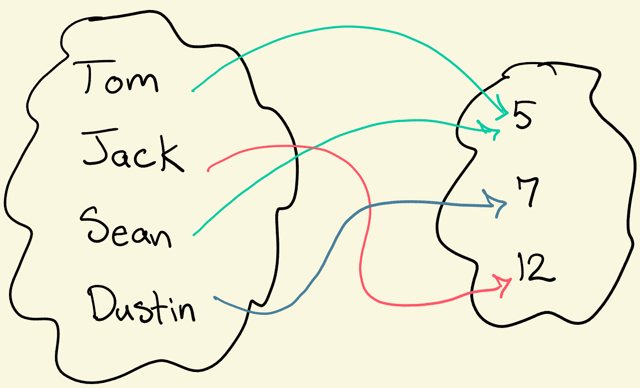
Section 1.3

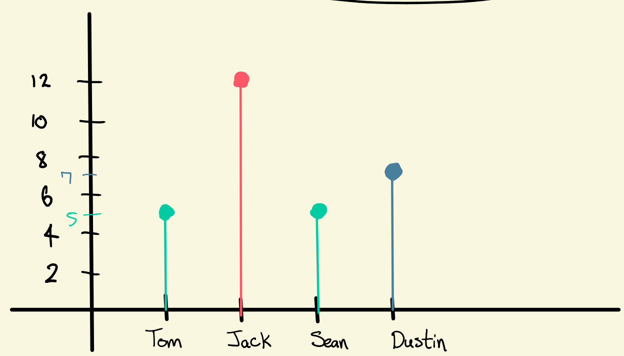
1. (2 points) Use the relation given in the table above to answer the following.
   (a) Write a set of ordered pairs (x, y) that defines the relation.
   (b) Write the domain of the relation.
   (c) Write the range of the relation.
   (d) Determine if the relation defines y as a function of x.

Actor x	Number of Oscar Nominations y
Tom Hanks	5
Jack Nicholson	12
Sean Penn	5
Dustin Hoffman	7

What's the Picture?

Note: Function with no formula





Domain $\longmapsto$ Range

("x's", strings) $\longmapsto$ ("y's", integer numbers)

1a) Relation = { ("Tom", 5)
("Jack", 12)
("Sean", 5)
("Dustin", 7) }

1b) See picture

1c) Range(Relation) = {5, 7, 12}

Careful! This is a set.

1d) Yes! Why?

"deterministic", unique outputs

A relation is a function if and only if for every x_0 in the domain, there is at most one y in the range that is related to x_0.

2. (1 point) Given $f(x) = x^2 + 3x$ and $g(x) = \frac{1}{x}$, evaluate the function at the given value of x.

(a) $f(-2) =$

(b) $g(-\frac{1}{2}) =$

2a) If $f(x) = x^2 + 3x$ and $x = -2$, then

$$f(-2) = (-2)^2 + 3 \cdot (-2)$$
$$= 4 + (-6)$$
$$= -2.$$

$\boxed{\text{So } f(-2) = -2.}$

2b) If $g(x) = 1/x$ and $x = (-1/2)$, then

$$g(-1/2) = 1/(-1/2)$$
$$= (2/-1) \qquad \text{Since } 1/(a/b) = b/a$$
$$= -(2/1)$$
$$= -2,$$

$\boxed{\text{so } g(-1/2) = -2.}$

3. (2 points) Write the domain of the function in interval notation.

(a) $f(x) = \dfrac{x-3}{x-4}$

2a) What can go wrong?

a) $?/0$ (dividing by zero)

b) $\sqrt{-?}$ (Square root of a negative)

Here (a) happens when $x-4=0$,

$$x-4=0$$

$$\Rightarrow (x-4)+4 = 0+4$$

$$\Rightarrow x = 0+4$$

$$\Rightarrow x = 4,$$

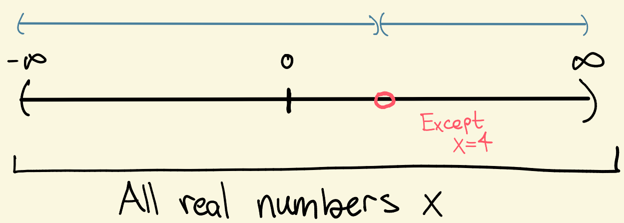
So 4 is <u>not</u> in the domain.

No other problems, so

domain(f) = {All real numbers x, <u>except</u> $x=4$}

$= (-\infty, 4) \cup (4, \infty)$

What's the picture?



Union of two open intervals

(b) $g(x) = \sqrt{x+9}$

Problem: negative square roots ($\sqrt{?}$ where $? < 0$)

Here $? = x+9$

$x+9<0 \quad \Rightarrow (x+9)-9 < 0-9$

$\Rightarrow x < -9$

So every $x < -9$ is <u>not</u> in the domain

So $\text{domain}(g) = \{\text{Real numbers that are } \underline{\text{not}} < -9\}$

$$= \{\text{Real numbers that are } \underline{\text{are}} \geq -9\}$$

$$= [-9, \infty)$$

Check: can we include $x=-9$?

$$g(-9) = \sqrt{(-9)+9}$$

$$= \sqrt{0}$$

Zero okay! Just no negatives.

$= 0$, i.e. $g(x)$ makes sense at $x=-9$.

What's the picture?