# Relations and Functions

Wednesday, January 16, 2019 1:00 PM

A relation is a set of ordered pairs.

The 1st element in an ordered pair of a relation is called the input. The 2nd element is called the output.

| State | Average Fine for 15 mph over speed limit |
|---|---|
| Conn. | $200 |
| Oregon | $145 |
| Utah | $145 |
| Iowa | $90 |
| Kansas | $30 |

A = { (Conn, $200); (Oregon, $145); (UT, $145); (Iowa, $90); (Kansas, $30) }

$B = \{(\$200, \text{Conn}); (\$145, \text{Oregon}); (\$145, \text{UT}); (\$90, \text{Iowa}); (\$30, \text{Kansas})\}$

The domain of a relation is the set of inputs

The Range of a relation is the set of outputs.

E.g. $A_D = \{\text{Conn}, \text{Oregon}, \text{UT}, \text{Iowa}, \text{Kansas}\}$

Domain of A

$A_R = \{\$200, \$145, \$90, \$30\}$

Range of A

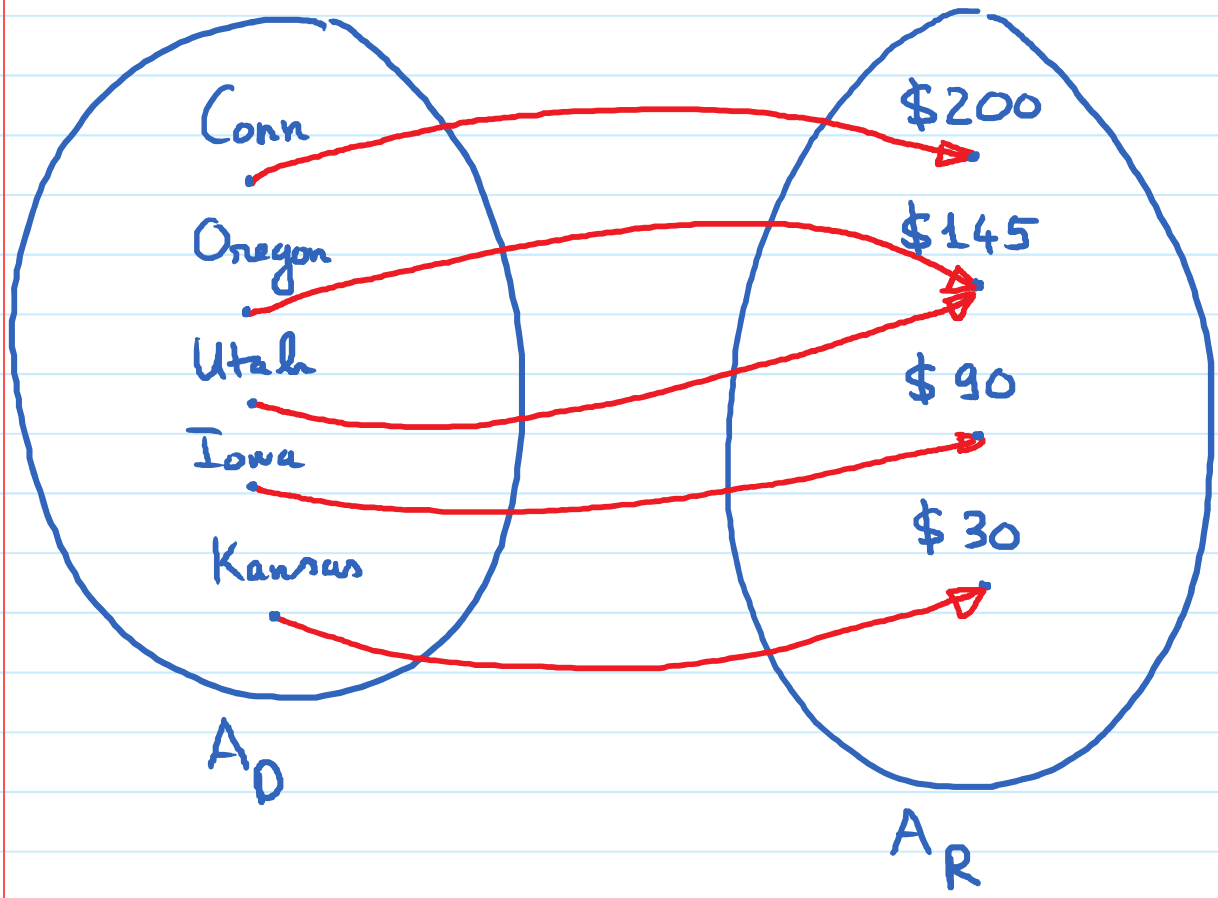
$B_D = \{\$200, \$145, \$90, \$30\}$

$B_R = \{\text{Conn}, \text{Oregon}, \text{UT}, \text{Iowa}, \text{Kansas}\}$

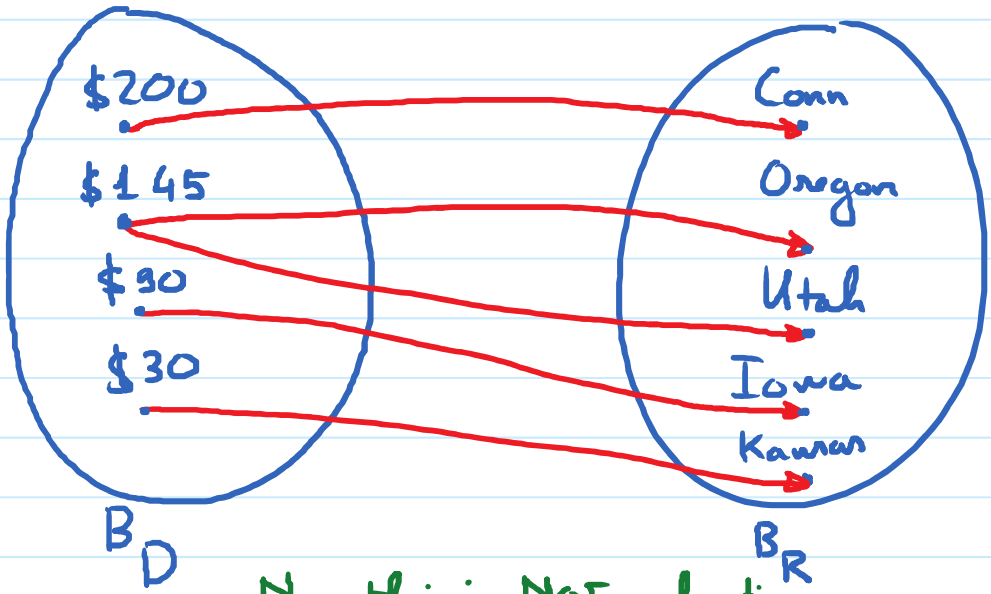
## Definition of a function:

A function is a relation where each element of the domain corresponds to only ONE element in the range.

E.g. Relation A.




Yes, this is a function.




No, this is NOT a function.
(Reason: you know it)

E.g. Determine whether a given relation is a function

(a) $I = \{(10,8), (6,4), (2,0), (-2,-4)\}$ Y

(b) $K = \{(3,4), (3,5), (8,9), (1,0)\}$ N

(c) $J = \{(1,2), (1,3), (1,-5)\}$ N

(d) $P = \{(1,2), (3,2), (2019,2)\}$ Y.

## Function Notation

Function Notation is another way of writing an equation.

It lets us deginate the output that corresponds to a given input.

$$y = 3x + 7 \longrightarrow f(x) = 3x + 7.$$

Replace y by $f(x)$ (Read as f of x)

This gives us a way to calculate the output (value of the function) at a given input x.

To find the value of a function at a given # or variable, we substitute that # or variable into the equation and evaluate or simplify.

E.g. $f(x) = 3x + 7$ → $3(\square) + 7$

$f(1) = 3 \cdot (1) + 7 = 10$

$f(100) = 3 \cdot (100) + 7 = 307$

$f(-3) = 3 \cdot (-3) + 7 = -2$

Read as $f \cdot f - 3$

$f(\boxed{2h}) = 3 \cdot (2h) + 7 = 6h + 7$

$f(\boxed{2x}) = 3 \cdot (2x) + 7 = 6x + 7$

$f(x^2) = 3x^2 + 7$

$f(x-2) = 3 \cdot (x-2) + 7 = 3x + 1.$