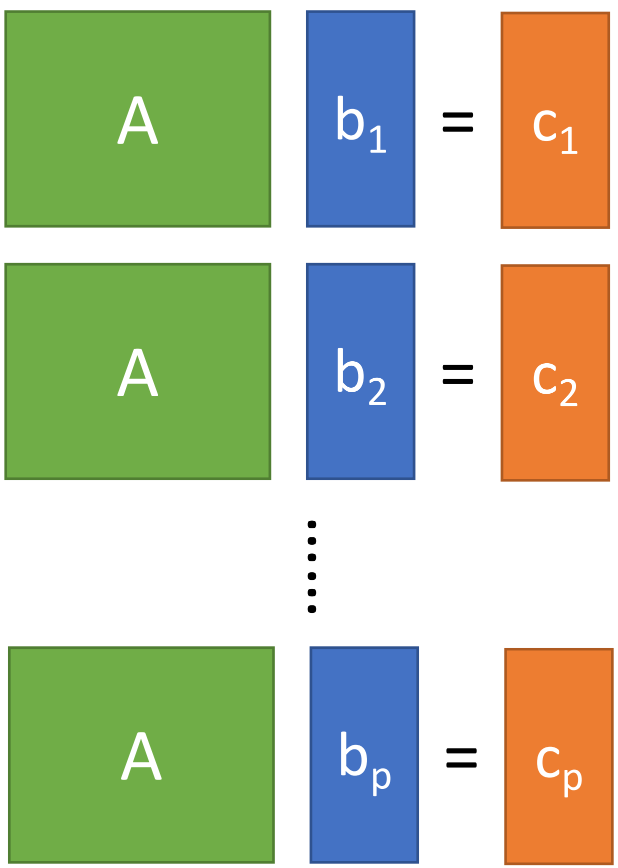
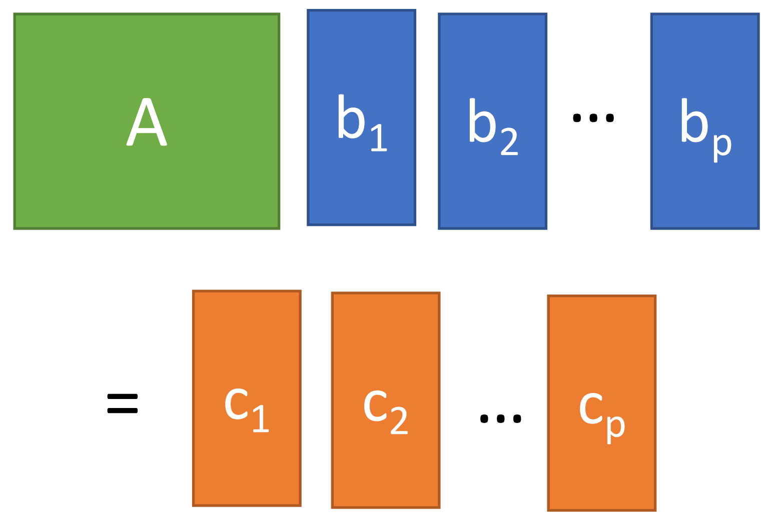
Matrix Multiplication

What does it mean?

Matrix Multiplication - Meaning

- ***Multiple Input*** $C = AB$





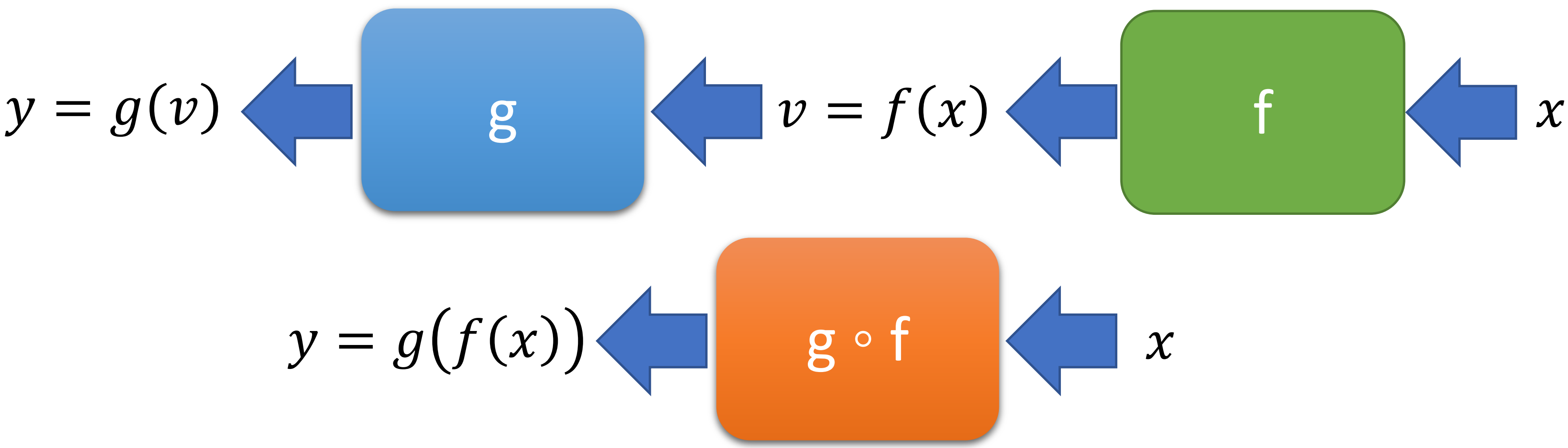
$$AB = A[b_1 \quad b_2 \quad \cdots \quad b_p]$$

$$= [Ab_1 \quad Ab_2 \quad \cdots \quad Ab_p]$$

Matrix Multiplication - Meaning

The notation $g \circ f$ is read as "g circle f", "g round f", "g about f", "g composed with f", "g after f", "g following f", "g of f", "f then g", or "g on f".

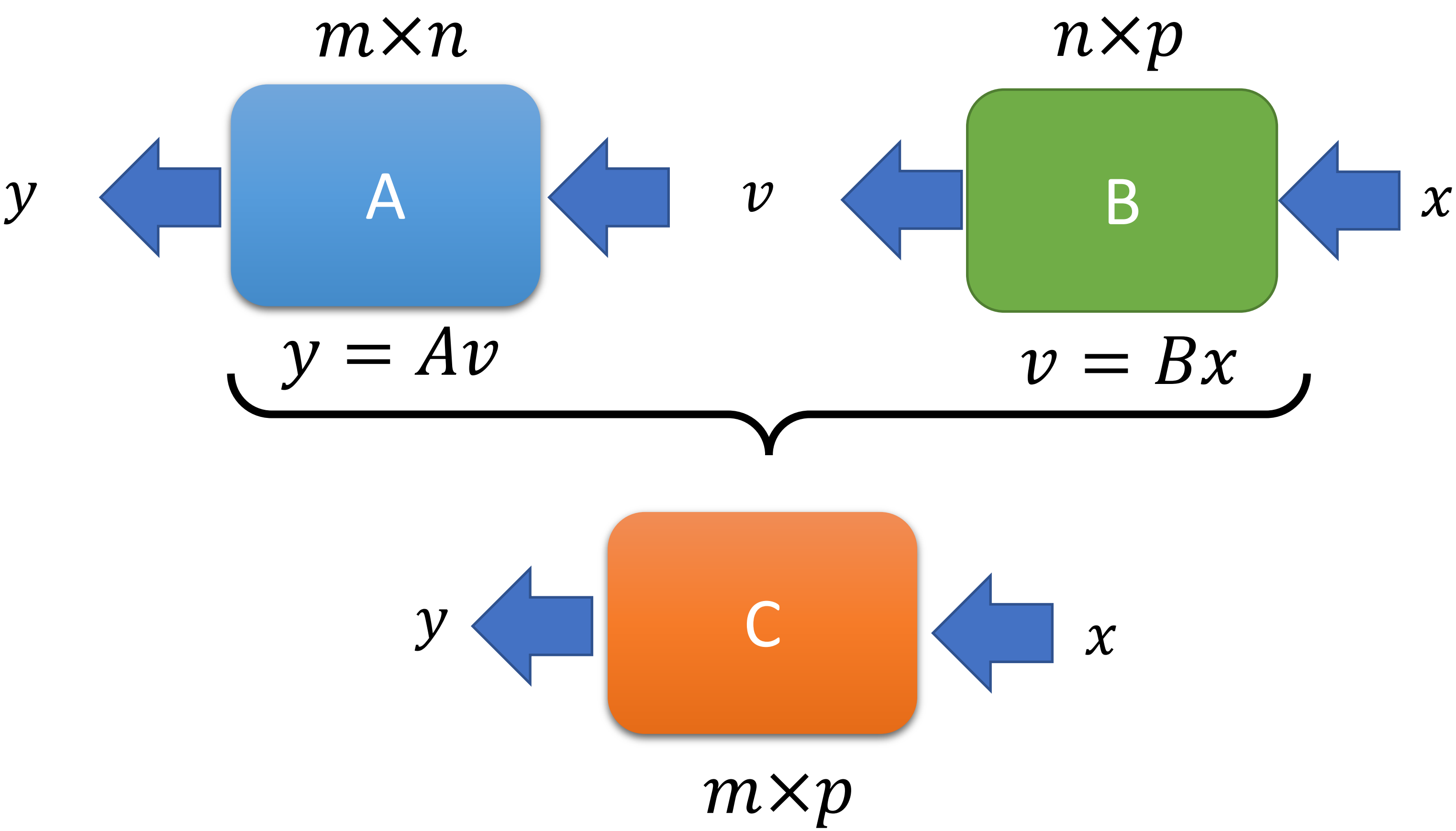
- ***Composition***
  - Given two functions f and g, the function $g\left(f(.)\right)$ is the composition g°f.



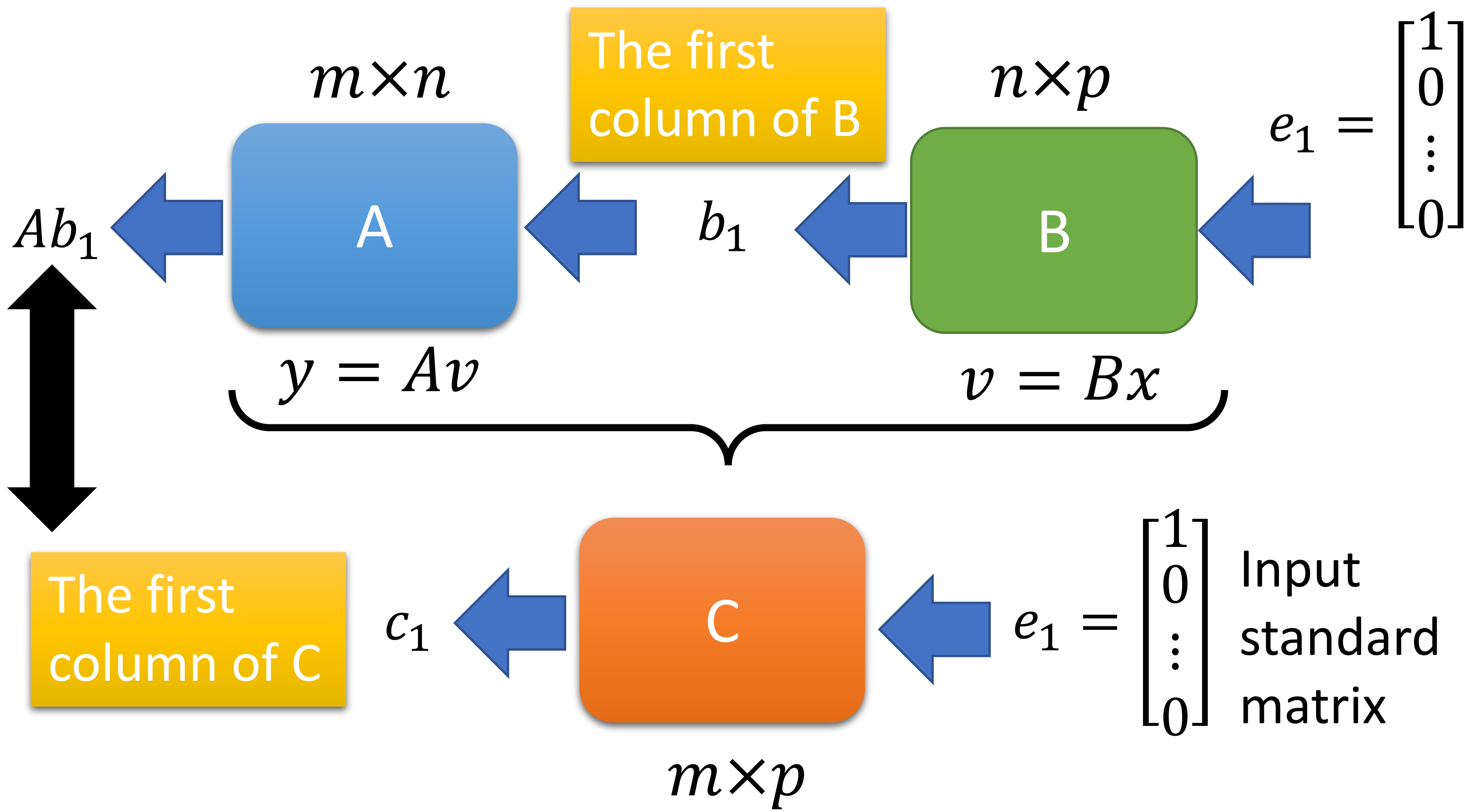
Matrix multiplication is the composition of two linear functions.

Matrix Multiplication - Meaning

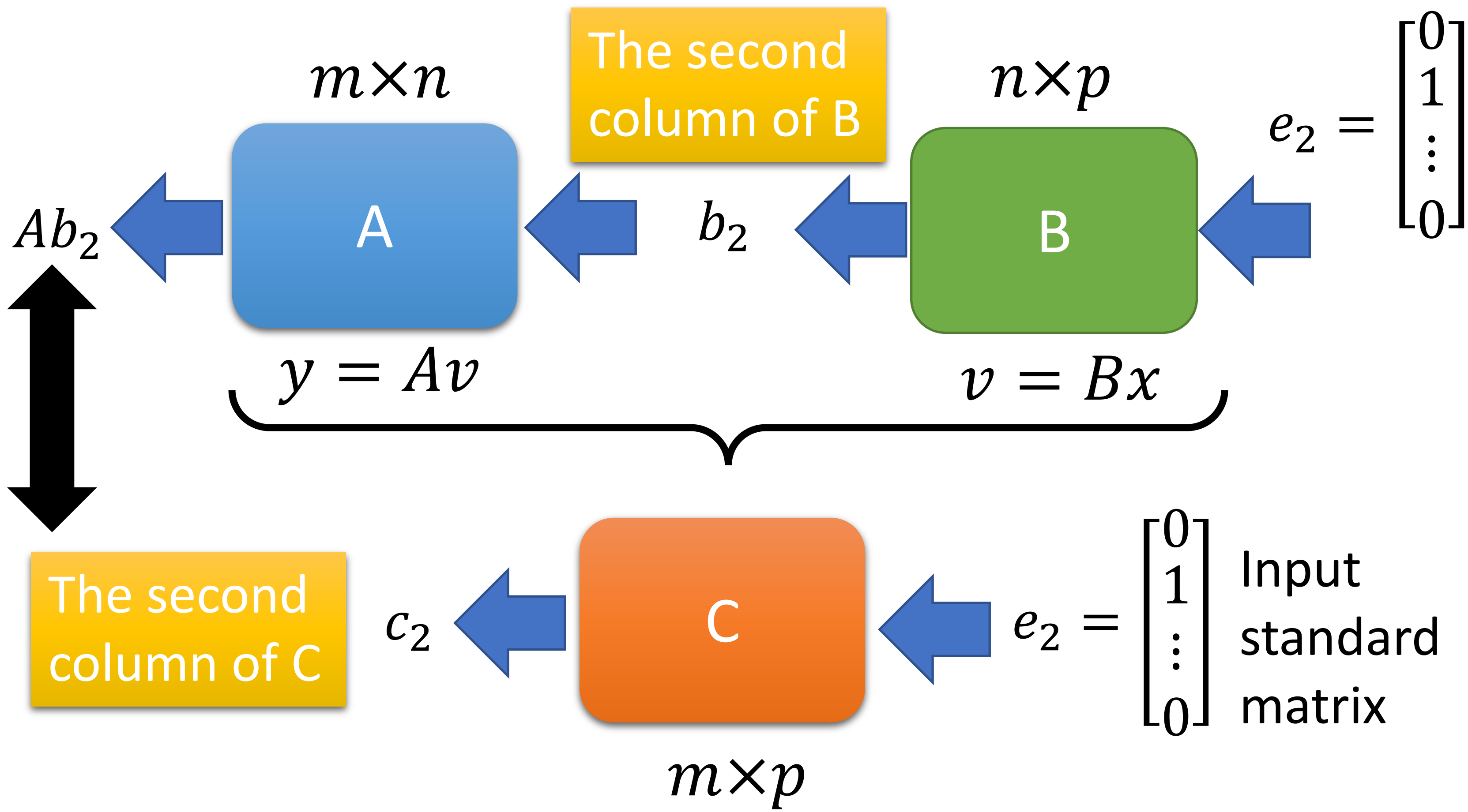
- ***Composition***

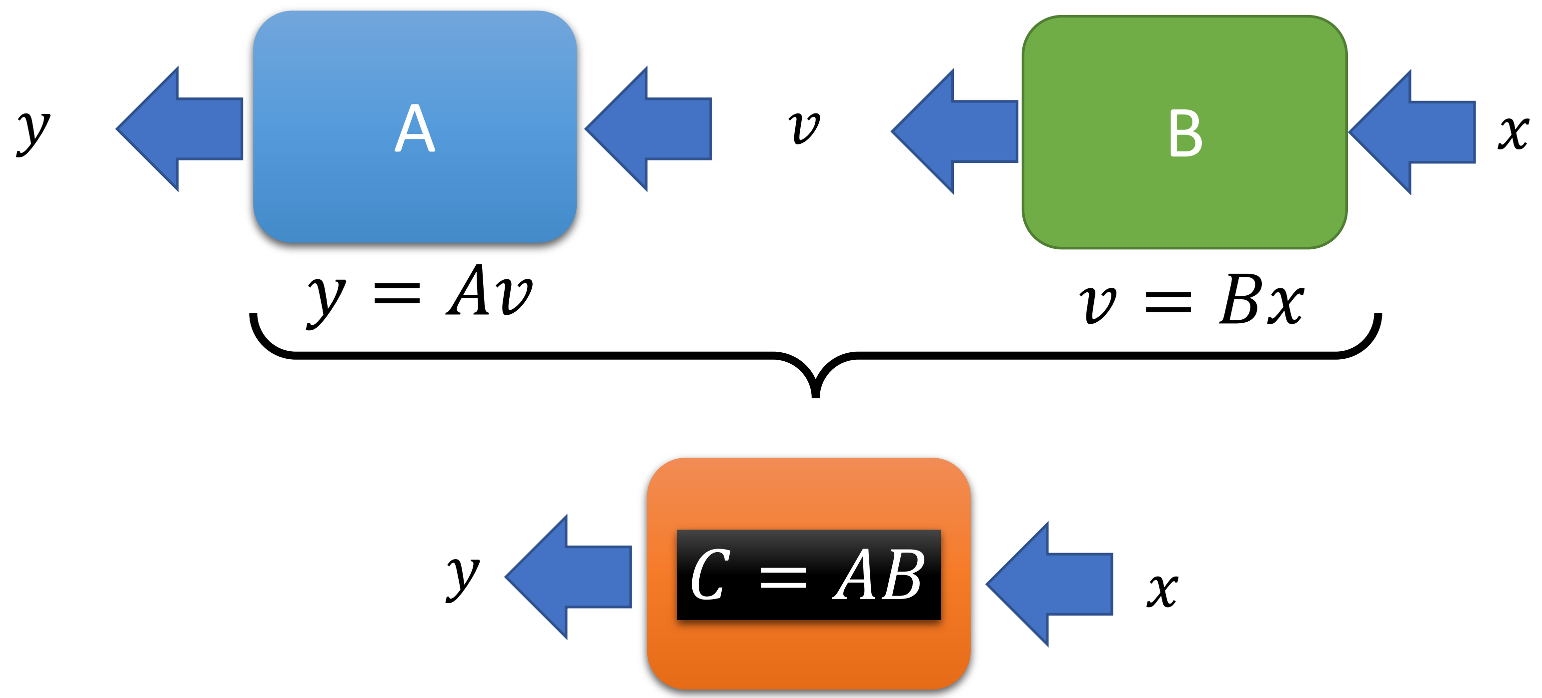


Matrix Multiplication - Meaning



Matrix Multiplication - Meaning



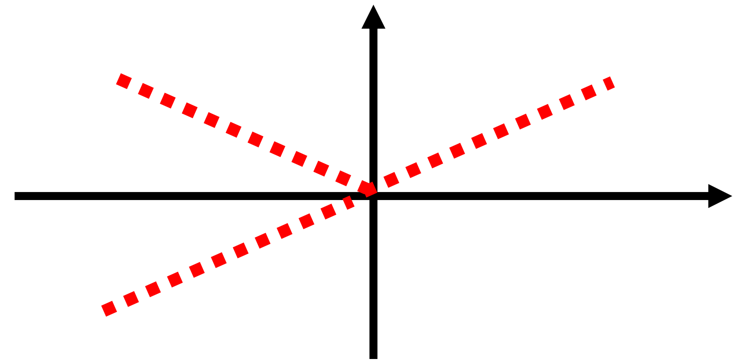


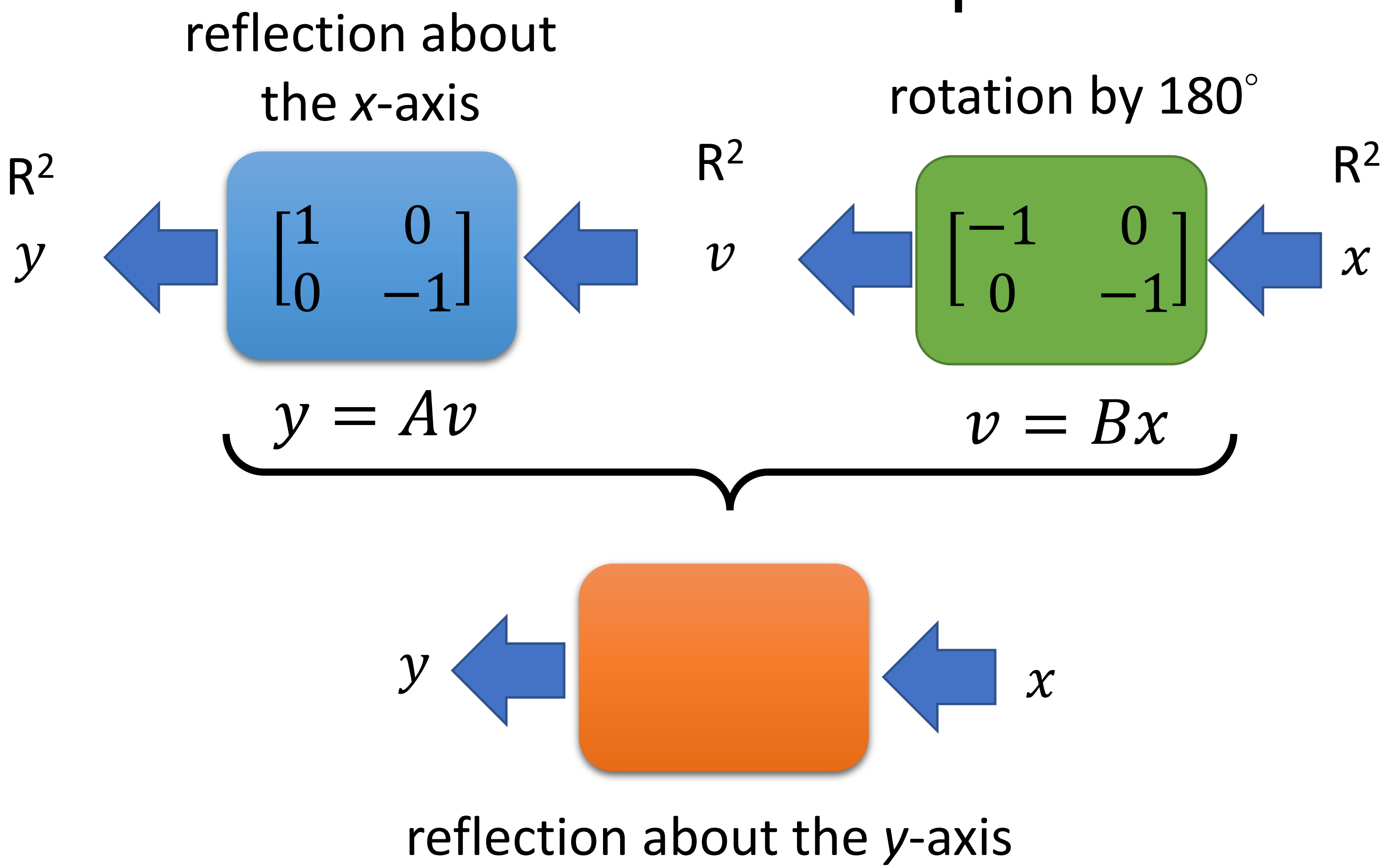
The composition of A and B is

$$C = [Ab_1 \quad Ab_2 \quad \cdots \quad Ab_p\,]$$

Matrix Multiplication

Example




reflection about the x-axis
rotation by 180°
R^2
y
$\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$
R^2
v
$\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$
R^2
x
$y = Av$
$v = Bx$
y
x
reflection about the y-axis

Example

$$\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} = \begin{bmatrix} & \\ & \end{bmatrix}$$