Vector Arithmetic

- + and - operators
- *: Scale Factor
- Scale Factor < 0

+ and - operators

> **What**: Addition and Subtraction of Vectors
> **Why**: Detailed computations
> **Time To Complete**: 2 hours



\+

```
//+ addition ;

v1 = {a,2,c}+{1,b,3};

show v1;

save as addition;
```

Output:

```
"v1" → {1 + a, 2 + b, 3 + c}
```

'//' : **Comment Operator** instructing the Grammarian to ignore its sentence

'**v1**' : identifier for a variable or **variable name**

'**=**': **Assignment Operator** copying the Right Hand Side to Left Hand Side

'**{ }**' : curly brackets, enclosing the list of elements in between

'**a,2,c**' : **Elements** of the vector enclosed in '{ }' brackets

'**;**' : **Delimiter** called semicolon indicating the end of a Free Form sentence, separating sentences

'**show**': textually displays the followed variables

'**save as**': instructs the Grammarian to save the Free Form script and all its interim computations in cloud objects

-

```
//- subtraction ;

v1 = {a,2,c}-{1,b,3};

show v1;

save as subtraction;
```

Output:

```
"v1" → {-1 + a, 2 - b, -3 + c}
```

Properties

0-vector

```
//+ 0 ;

v1 =  {a,b,c}  + {0, 0, 0};

show v1;

save as subtraction;
```

Output:

```
"v1" → {a, b, c}
```

```
//- 0 ;

v1 =  {a,b,c}  - {0, 0, 0};

show v1;

save as subtraction;
```

Output:

```
"v1" → {a, b, c}
```

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*: Scale Factor

> **What**: Scale a vector
> **Why**: Computations to alter the length and direction of a vector
> **Time To Complete**: 1-3 hours



Multiply a vector by a numeral from the **left**.

```
v  =  5.4 * {x,y};

show  v;

save as scale;
```

Multiply a vector by a numeral from the **right**.

```
v  =   {x,y}*5.4;

show  v;

save as scale;
```

Output

```
"v" → {5.4*x, 5.4*y}
```

u ought to be a variable/symbol or a numeral. **u** cannot be another vector.

```
v  =  u * {a, b, c, d, e, f};

show  v;

save as scale;
```

Output

```
"v" → {a*u, b*u, c*u, d*u, e*u, f*u}
```

Scale Factor < 0

> **What**: Negative scale factor
> **Why**: How to reverse a vector to point in the opposite direction
> **Time To Complete**: 1-3 hours



```
v1  = {1,1};
v2 = -1*v1;

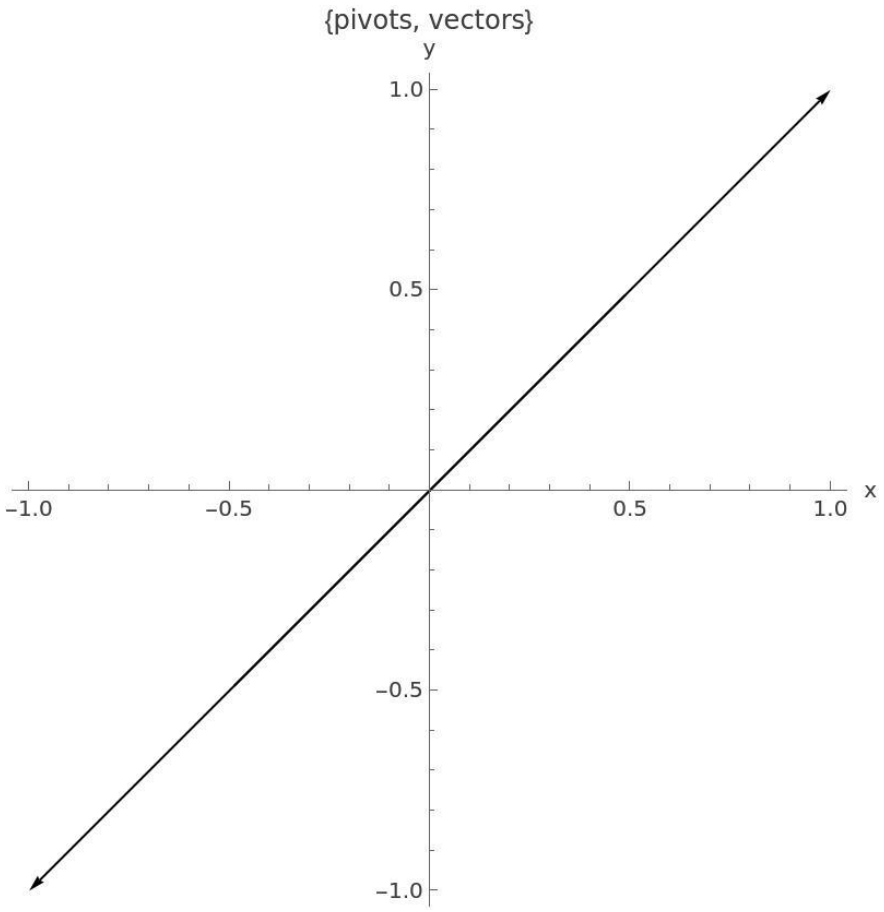
//list of pivots;
pivots = {{0,0}, {0,0}};

//list of vectors;
vectors = {v1,v2};

vectorplot pivots vectors;

save as scale;
```

Output


{pivots, vectors}
y
1.0
0.5
−0.5
−1.0
−1.0
−0.5
0.5
1.0
x