

Scalar multiplication in the xy-coordinate system:

Let  $\vec{u} = (-5, 7)$ . Then  $4\vec{u} = 4(-5, 7) = (4(-5), 4(7)) = (-20, 28)$

$$-2\vec{u} = -2(-5, 7) = (-2(-5), -2(7)) = (10, -14)$$

$$\|\vec{u}\| = \sqrt{(-5)^2 + 7^2} = \sqrt{25 + 49} = \sqrt{74}$$

$$\|4\vec{u}\| = \sqrt{(-20)^2 + (28)^2} = \sqrt{400 + 784} = \sqrt{1184} = \sqrt{16(74)} = 4\sqrt{74}$$

$$\|-2\vec{u}\| = \sqrt{10^2 + (-14)^2} = \sqrt{100 + 196} = \sqrt{296} = \sqrt{4(74)} = 2\sqrt{74}$$

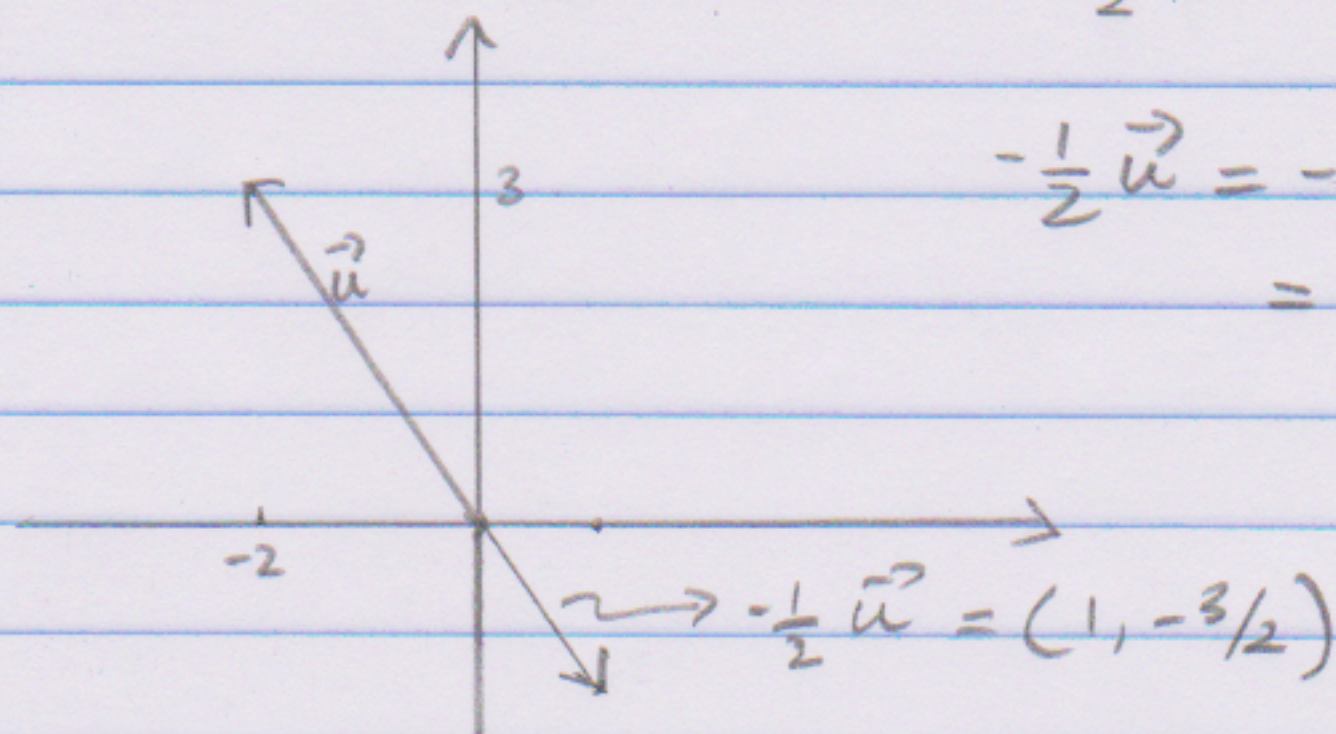
As you can see  $\|4\vec{u}\| = 4\|\vec{u}\|$

And  $\|-2\vec{u}\| = |-2|\|\vec{u}\| = 2\|\vec{u}\|$

In general,  $\|k\vec{u}\| = |k|\|\vec{u}\|$  for any scalar  $k$ .

Example

Let  $\vec{u} = (-2, 3)$ . Find  $-\frac{1}{2}\vec{u}$ .



$$-\frac{1}{2}\vec{u} = -\frac{1}{2}(-2, 3) = (1, -3/2)$$

$$-\frac{1}{2}\vec{u} = (1, -3/2)$$