Four Interactions

- Gravity
- Electromagnetism
- Strong
- Weak

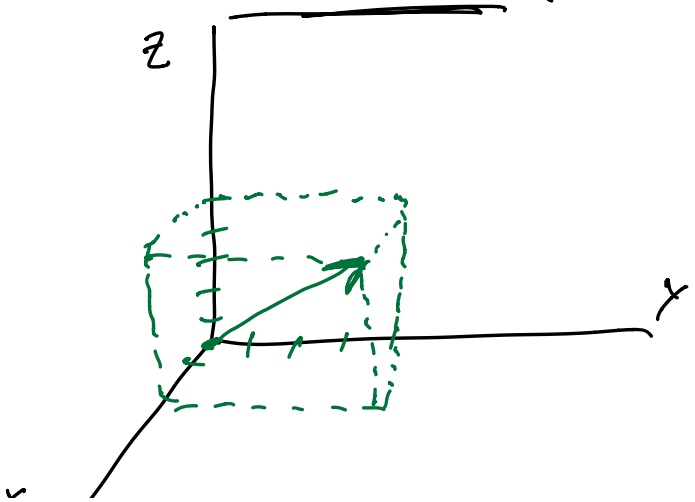
Vectoss

- Magnitude
- Direction

$\vec{r} = \langle r_x, r_y, r_z \rangle$

$\vec{r} = r_x \hat{x} + r_y \hat{y} + r_z \hat{z}$

Ex $\vec{r} = \langle 2, 4, 5 \rangle$ m



Length of a vector?

$$|\vec{r}| = \sqrt{r_x^2 + r_y^2 + r_z^2}$$

$$\vec{r} = \langle 2, 4, 5 \rangle \text{ m}$$

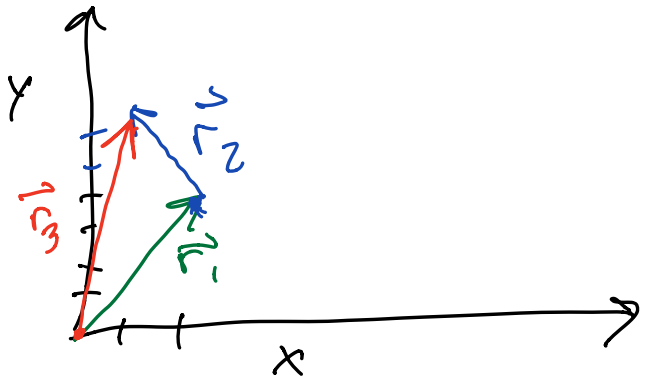
$$|\vec{r}| = \sqrt{4+16+25} \simeq 6.7 \text{ m}$$

Vector Addition

$$\vec{r}_1 = \langle 2, 4, 0 \rangle$$

$$\vec{r}_2 = \langle -1, 2, 0 \rangle$$

$$\vec{r}_3 = \vec{r}_1 + \vec{r}_2 = \langle 1, 6, 0 \rangle$$

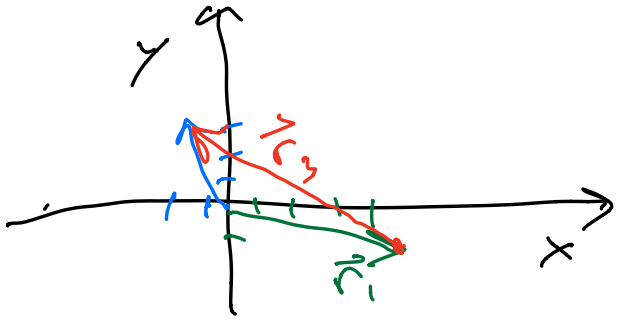


Subtraction

$\vec{r}_1 = \langle 4, -1, 0 \rangle$

$\vec{r}_2 = \langle -2, 3, 0 \rangle$

$\vec{r}_3 = \vec{r}_2 - \vec{r}_1 = \langle -6, 4, 0 \rangle$



Scalar Mult

$k\vec{r} = \langle kr_x, kr_y, kr_z \rangle$

$5\vec{r}, -\frac{1}{2}\vec{r}, \ldots$

Unit vector

$|\vec{r}| = 1$

$\hat{x} = \langle 1, 0, 0 \rangle$

$\vec{r}_1 = \langle 4, 2, 0 \rangle$

$\hat{r}_1$?

$|\vec{r}_1| = \sqrt{16+4} \approx 4.47$

$\hat{r}_1 = \frac{1}{|\vec{r}_1|} \langle 4, 2, 0 \rangle$

$\hat{r}_1 = \langle 0.89, 0.44, 0 \rangle$

$|\hat{r}_1| = 1$