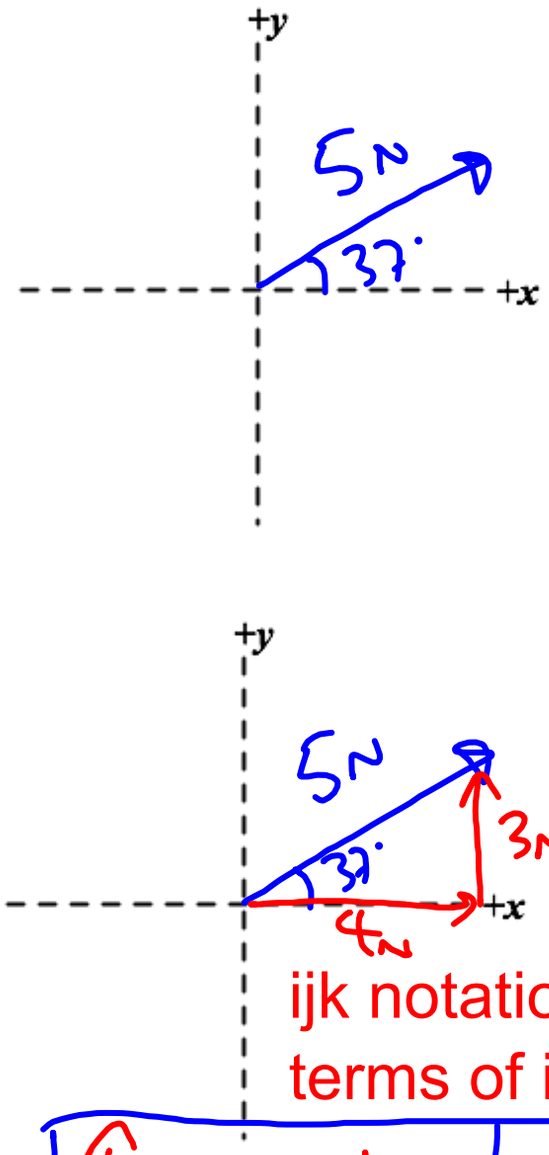
Vectors in ijk Notation

- What is ijk notation?
- How to convert to ijk
- How to combine vectors in ijk
- How to convert back to magnitude & direction

What is ijk Notation?

Vectors have magnitude and direction. And that is probably how you saw them written last year.



$\vec{F} = 5\,N, 37°$

$\vec{F} = (4\,N)\hat{i} + (3\,N)\hat{j}$

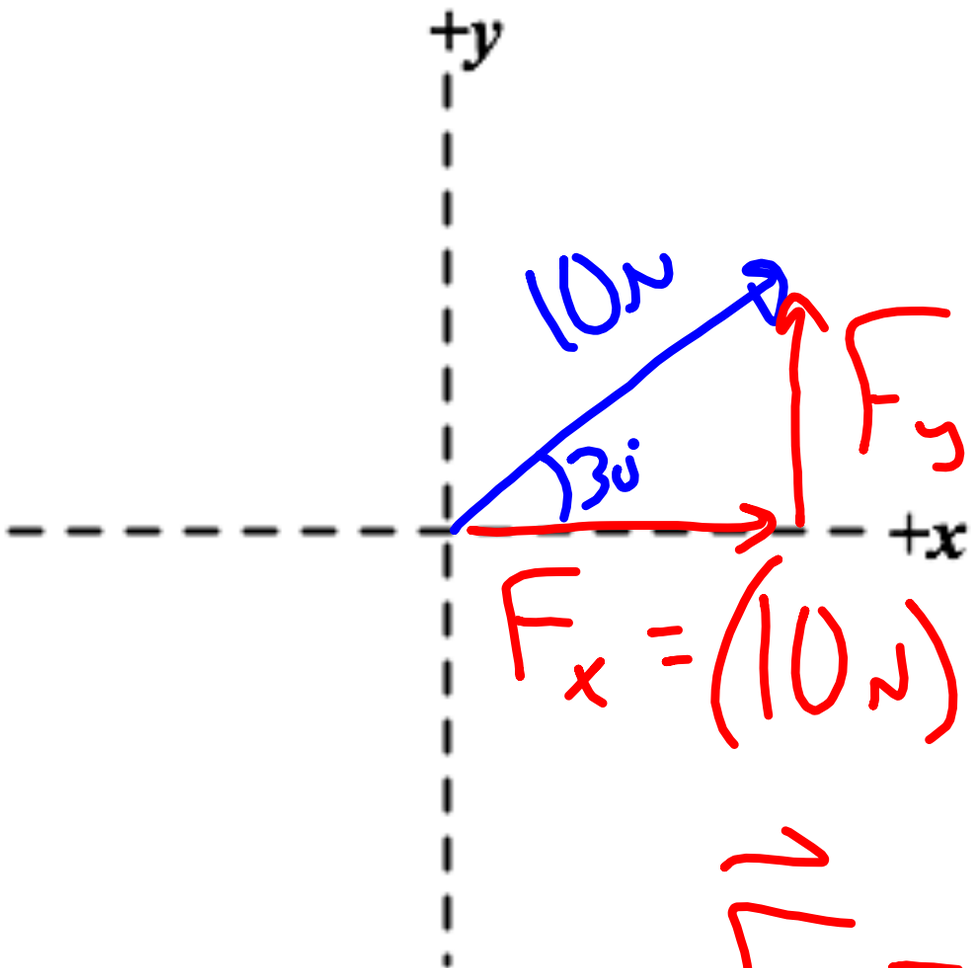
ijk notation is a way of writing the vector in terms of its components.

$\hat{i}$ is x-dir	$\hat{j}$ is y-dir	$\hat{k}$ is z-dir

Converting to ijk

Convert the vector to ijk notation.

$\vec{F} = 10_N, 30°$



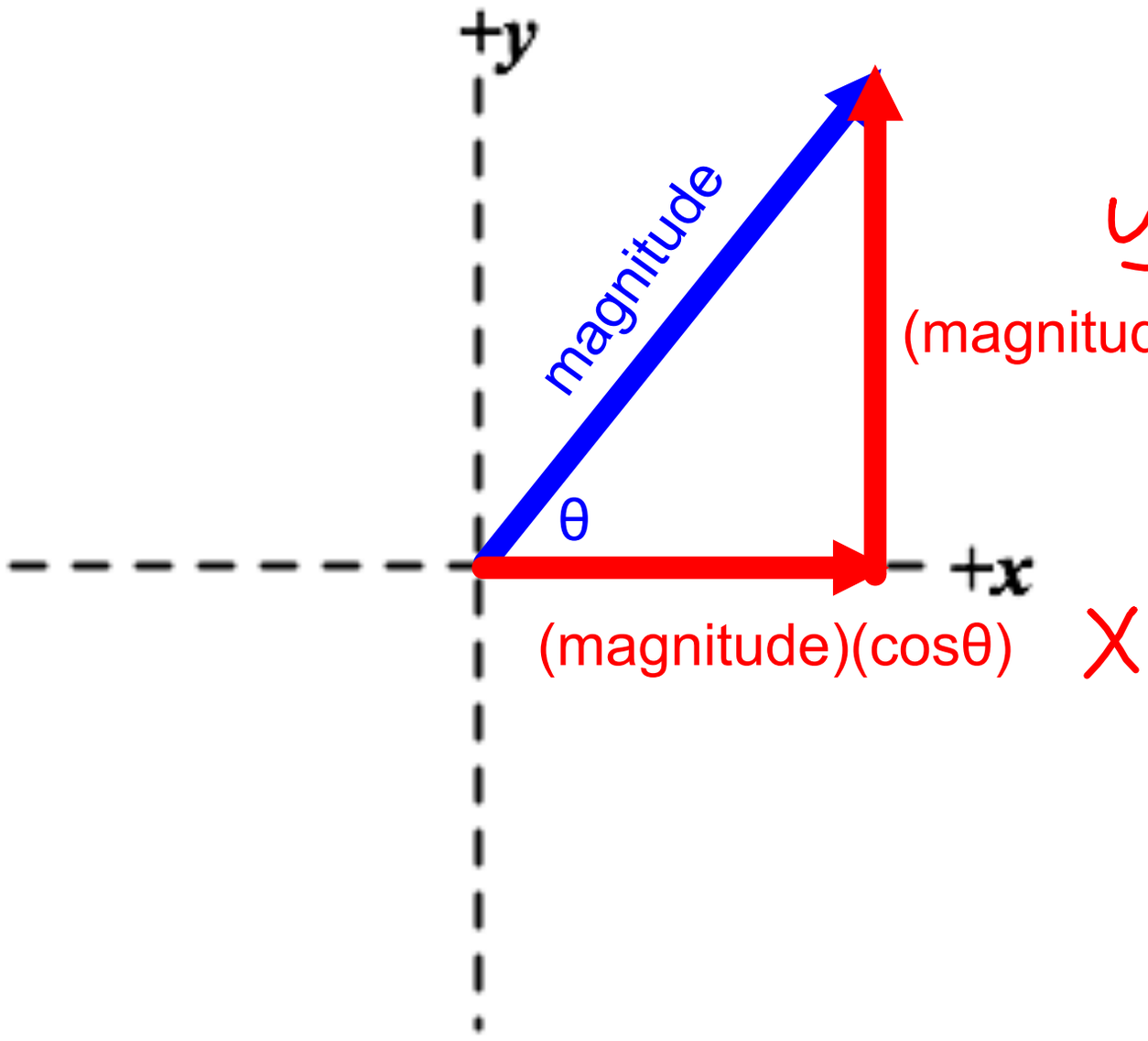
$F_y = (10N)\sin 30° = 5N$

$F_x = (10N)\cos(30°) = 8.7N$

$\vec{F} = (8.7N)\hat{i} + (5N)\hat{j}$

Converting to ijk

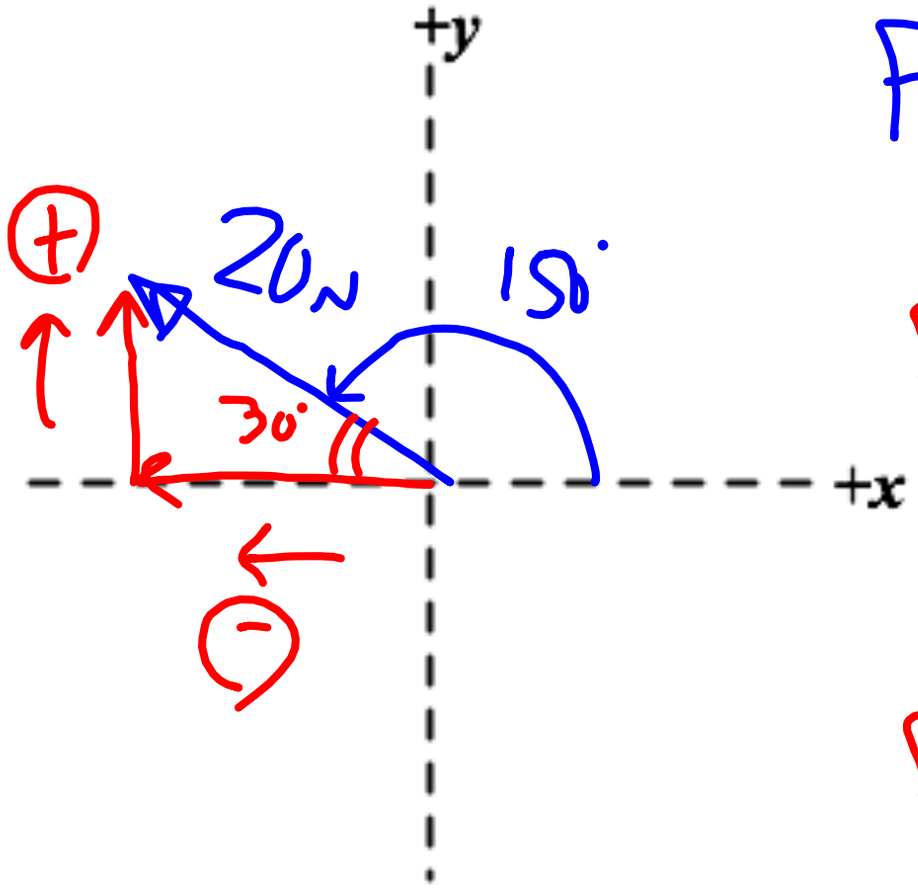
In general, if you have the angle with the x-axis...



Converting to ijk

Convert the vector to ijk notation.

$\vec{F} = 20\,N, 150°$



$F_x = (20\,N)\cos 30°$

$= 17.3\,N$

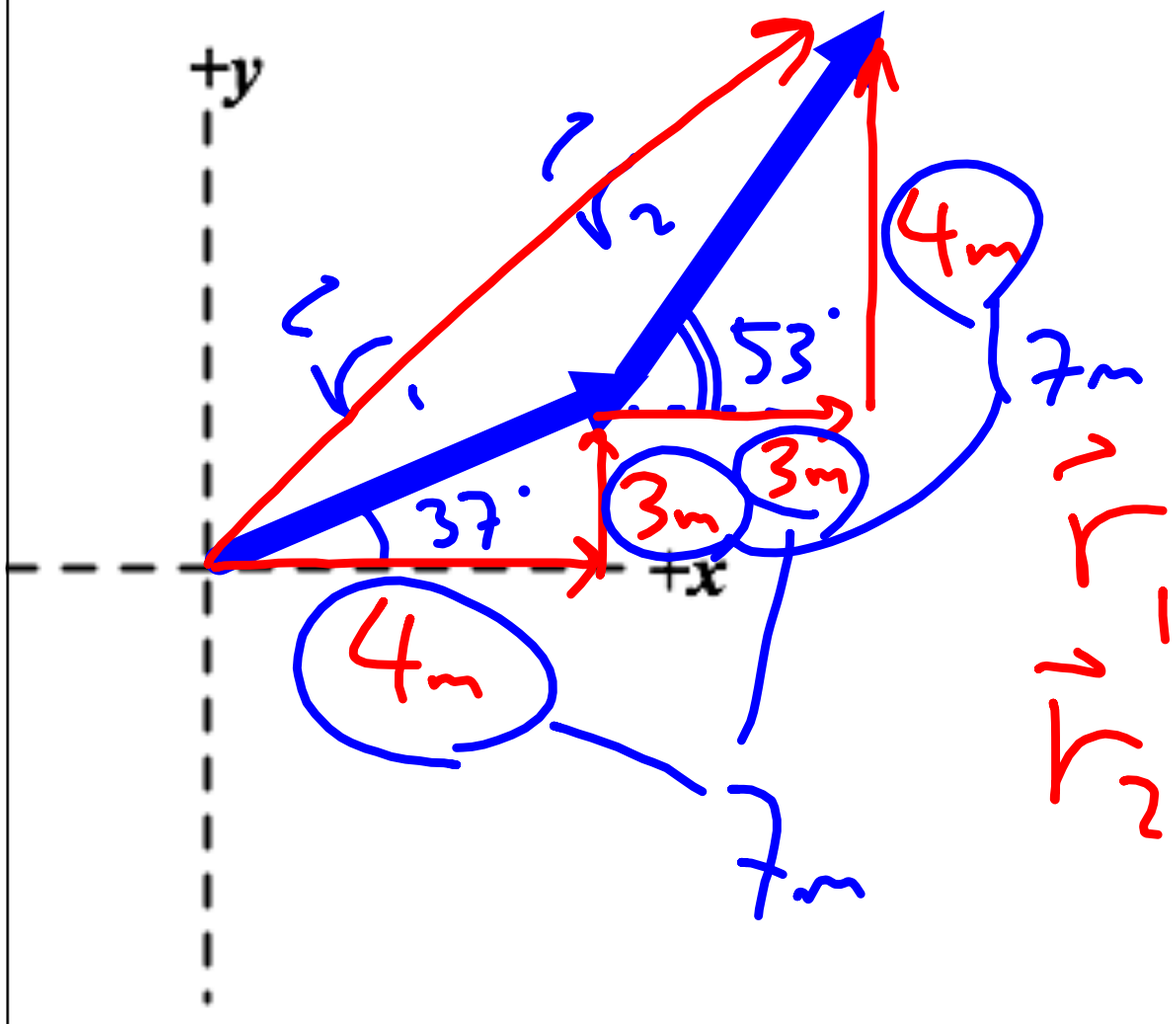
$F_y = (20N)\sin 30°$

$= 10N$

$\vec{F} = (-17.3N)\hat{i} + (10N)\hat{j}$

Why ijk?

Combining vectors becomes very easy.



$$\vec{r}_1 = 5\text{m}, 37^\circ$$

$$\vec{r}_2 = 5\text{m}, 53^\circ$$

$$\vec{r}_1 = (4\text{m})\hat{i} + (3\text{m})\hat{j}$$

$$\vec{r}_2 = (3\text{m})\hat{i} + (4\text{m})\hat{j}$$

$$= (7\text{m})\hat{i} + (7\text{m})\hat{j}$$

Combining Vectors in ijk

$\vec{r}_1 = (4_m)\hat{i} - (3_m)\hat{j}$

$\vec{r}_2 = (2_m)\hat{i} + (2_m)\hat{j}$

$\vec{r}_3 = (-1_m)\hat{i} + (4_m)\hat{j}$

Find:

$\vec{r}_4 = \vec{r}_1 - \vec{r}_2 + 3\vec{r}_3$

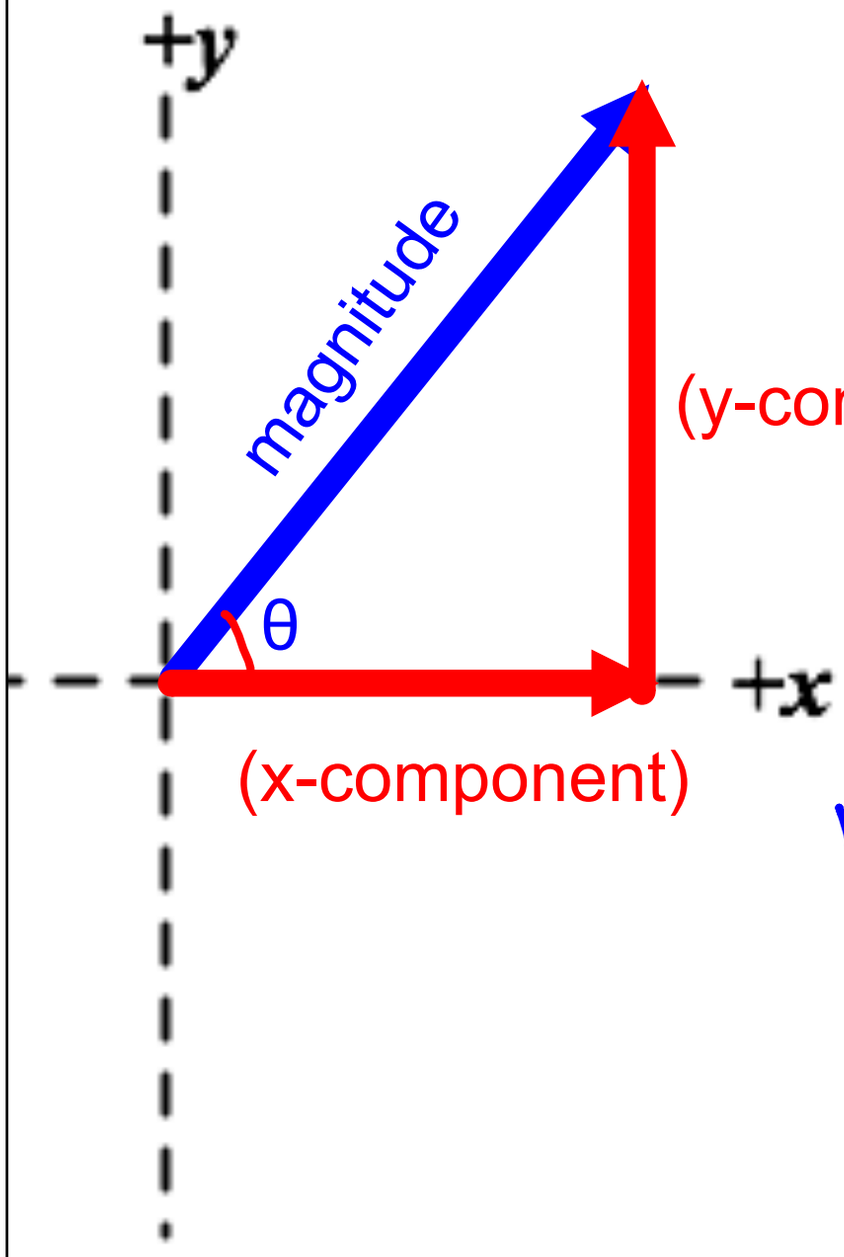
$\vec{r}_1 = (4_m)\hat{i} - (3_m)\hat{j}$

$-\vec{r}_2 = (-2_m)\hat{i} + (-2_m)\hat{j}$

$3\vec{r}_3 = (-3_m)\hat{i} + (12_m)\hat{j}$

$\vec{r}_3 = (-1_m)\hat{i} + (7_m)\hat{j}$

Converting back to magnitude & direction



$$\theta = \tan^{-1}\left(\frac{\text{y-comp}}{\text{x-comp}}\right)$$

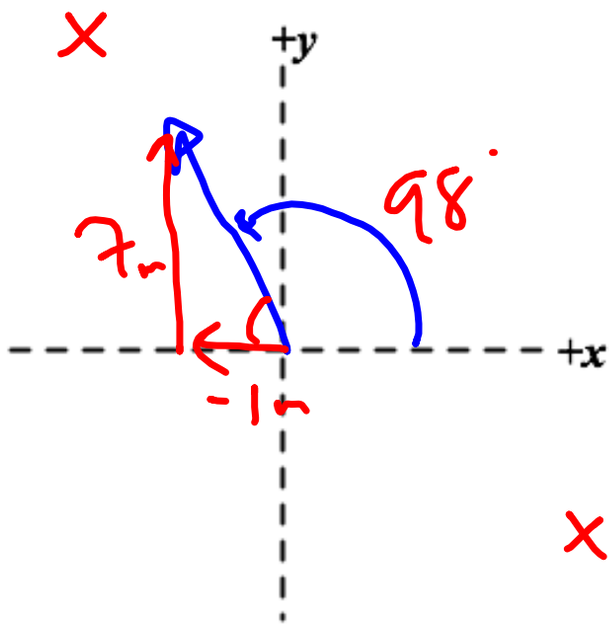
↑ with x-axis

$$\text{mag} = \sqrt{(\text{x-comp})^2 + (\text{y-comp})^2}$$

Converting back to magnitude & direction

Convert the vector back to magnitude and direction notation

$$\vec{r}_4 = (-1m)\hat{i} + (7m)\hat{j}$$



$$\theta = \tan^{-1}\left(\frac{7}{1}\right)$$

$$= 82°$$

$$180° - 82° = 98°$$

$$= \sqrt{(-1)^2 + (7)^2} = 7.1m$$

$$\vec{r}_4 = 7.1m,\ 98°$$