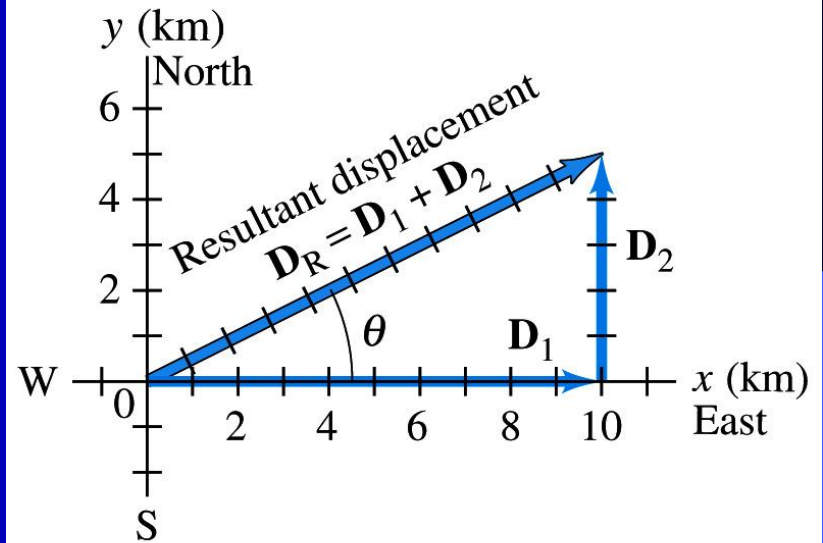
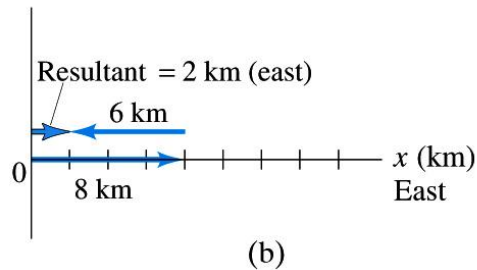
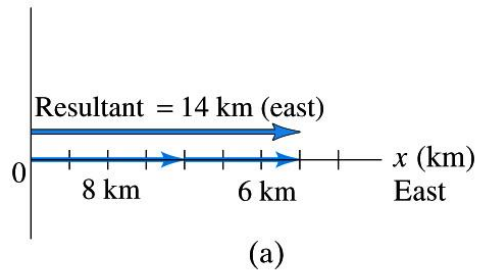
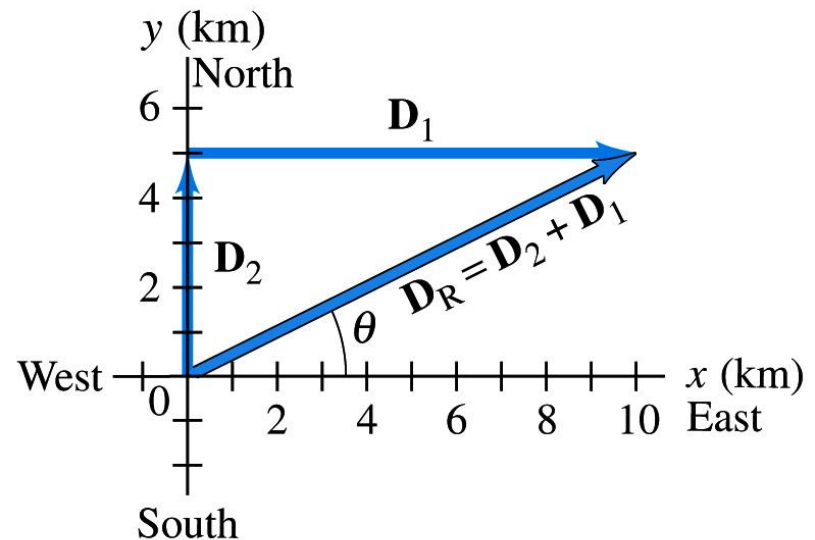
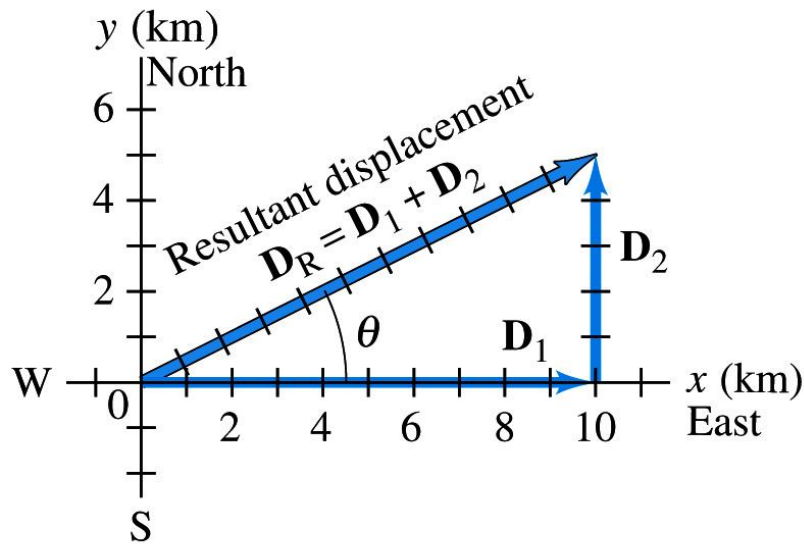


Vectors



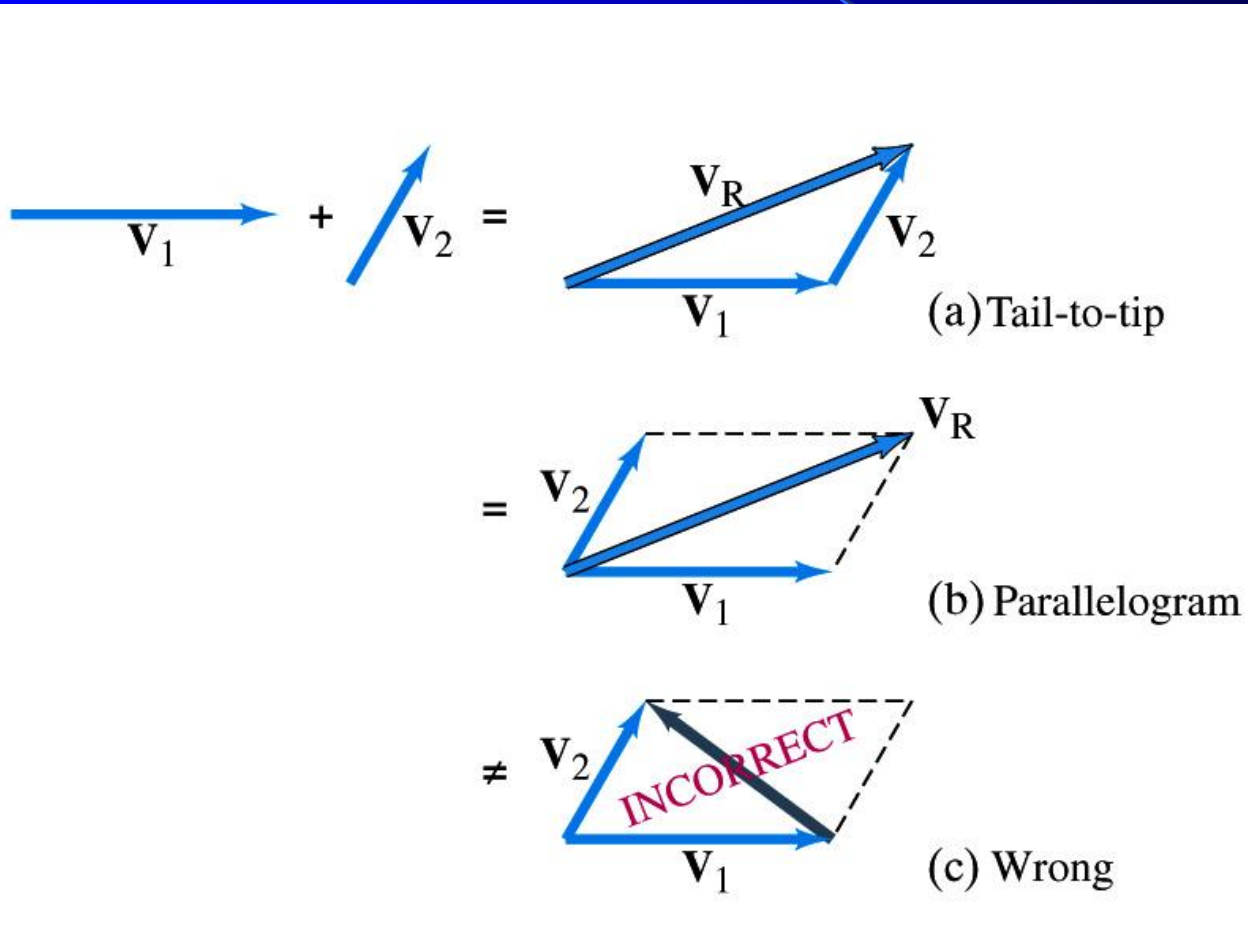
How to add two vectors?

Commutative Law

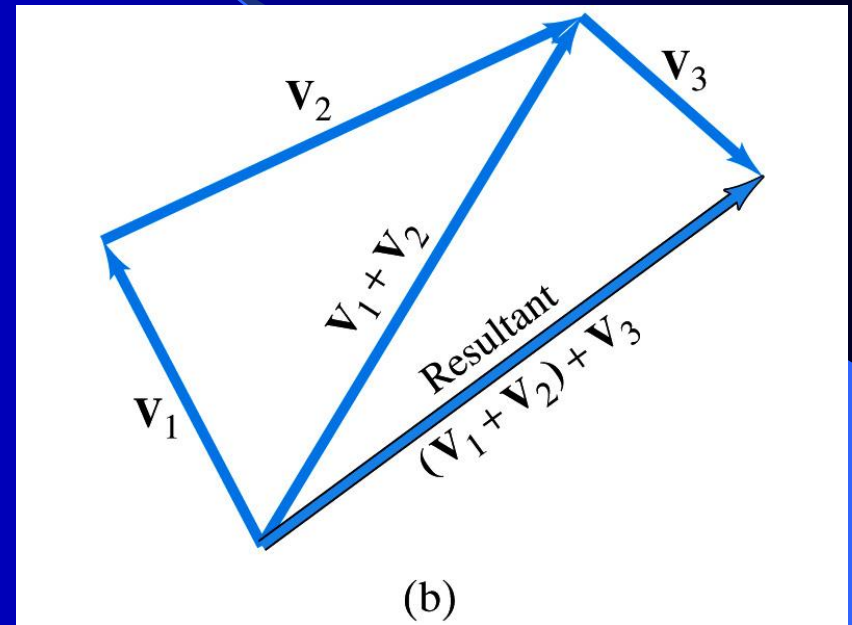
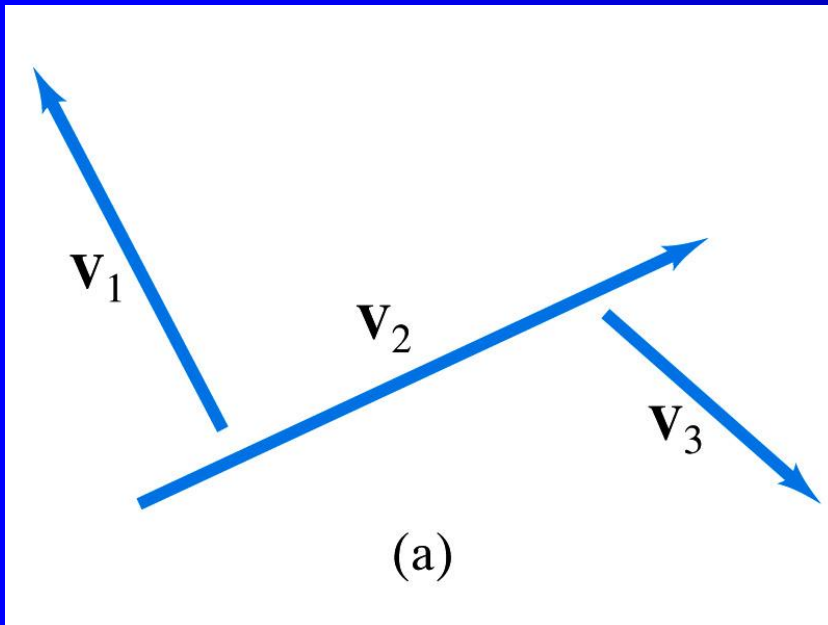


The order of how you add 2 vectors does not matter!

Another way to add vectors



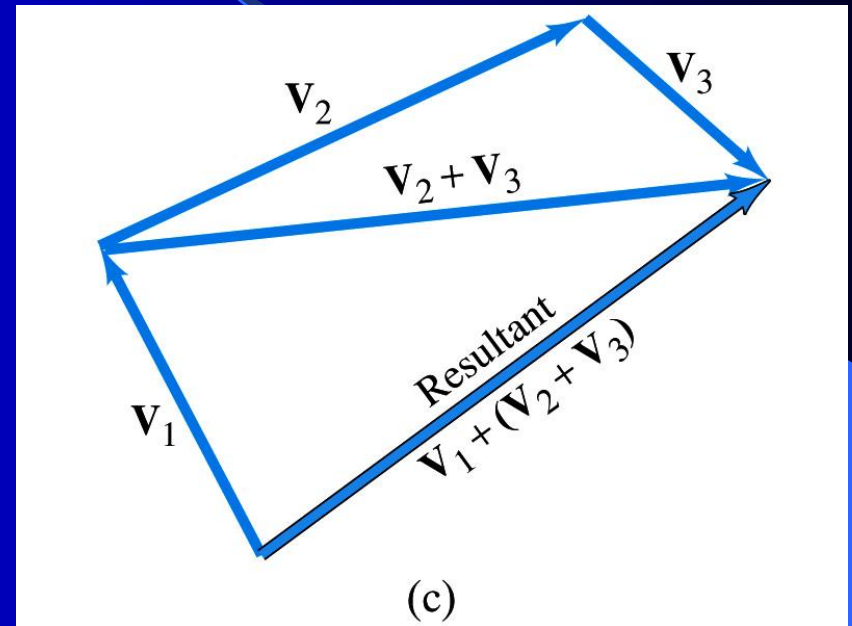
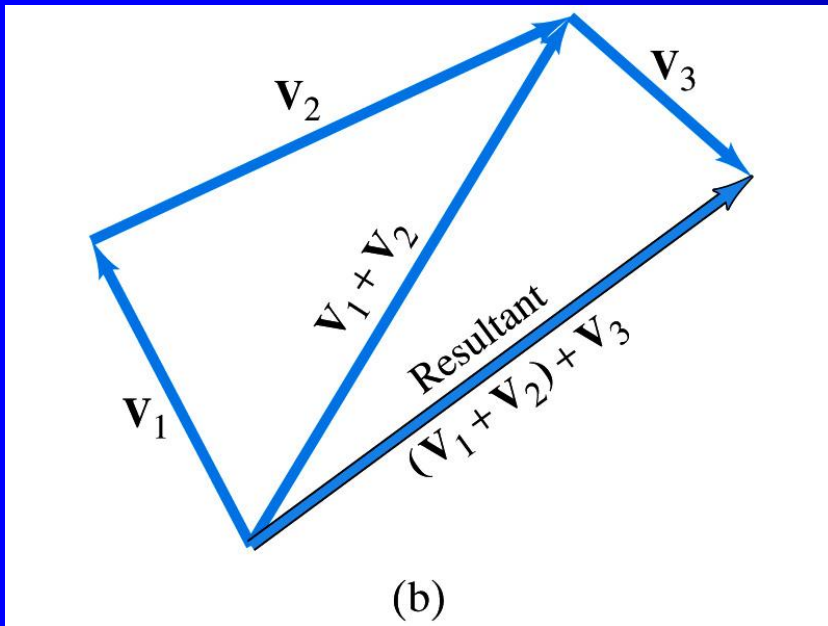
Associative Law



Add vectors tail to tip

Does the order of additions matter?

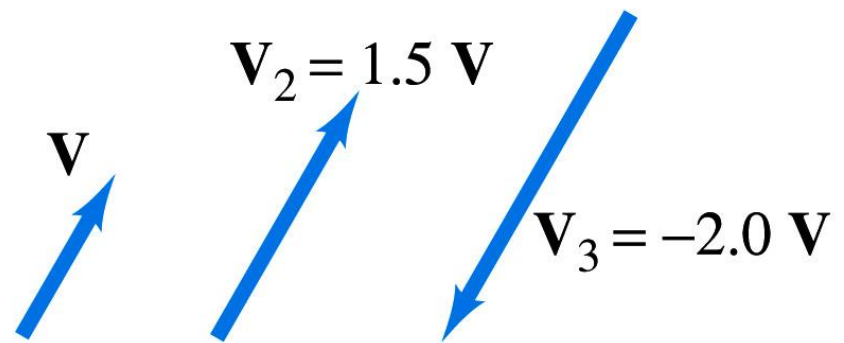
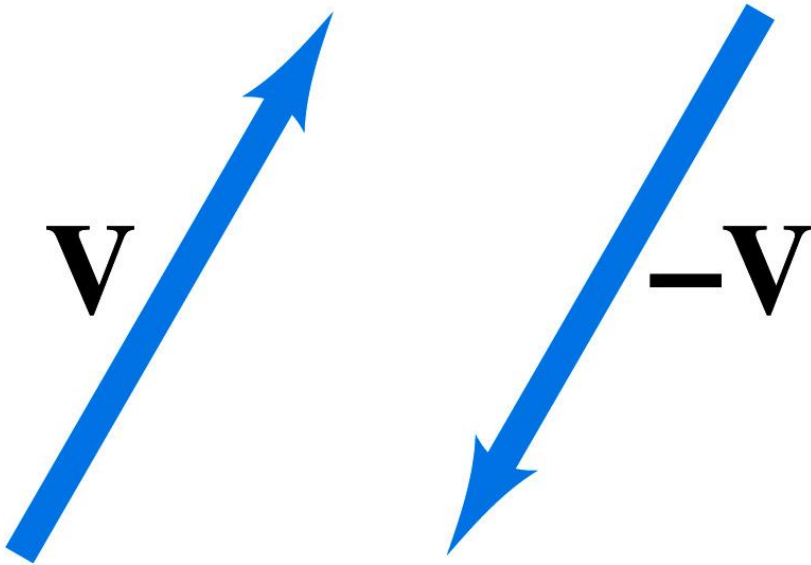
Associative Law



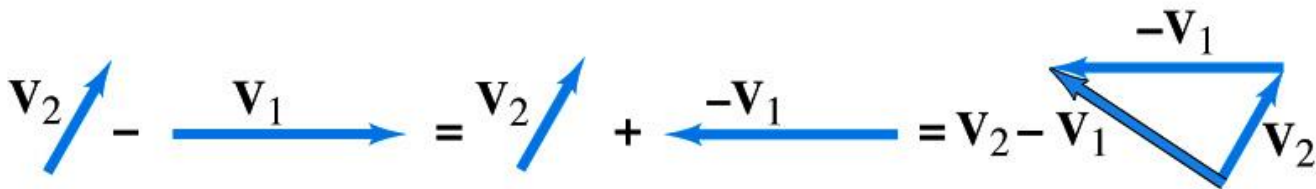
Add vectors tail to tip

Does the order of additions matter? NO!

Multiples of a Vectors

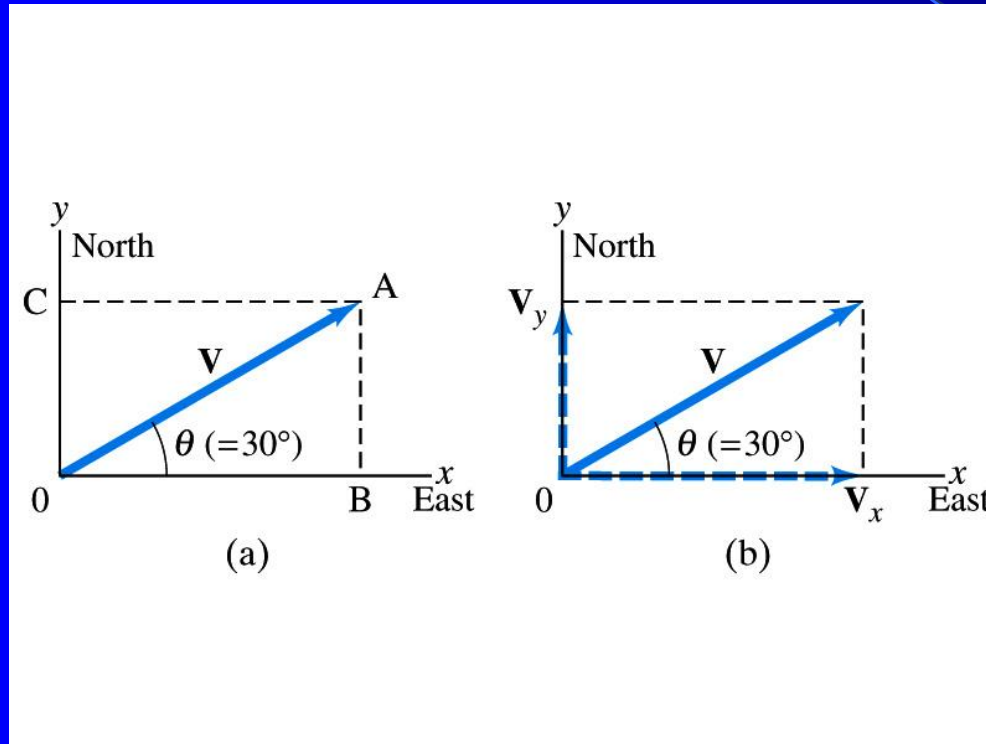


Subtracting a Vectors

$$\mathbf{V}_2 - \mathbf{V}_1 = \mathbf{V}_2 + (-\mathbf{V}_1) = \mathbf{V}_2 - \mathbf{V}_1$$


The diagram illustrates the process of subtracting vector \mathbf{V}_1 from vector \mathbf{V}_2 . It shows the equation $\mathbf{V}_2 - \mathbf{V}_1 = \mathbf{V}_2 + (-\mathbf{V}_1) = \mathbf{V}_2 - \mathbf{V}_1$. The first part shows vector \mathbf{V}_2 (blue arrow pointing up and right) minus vector \mathbf{V}_1 (blue arrow pointing right). The second part shows vector \mathbf{V}_2 plus vector $-\mathbf{V}_1$ (blue arrow pointing left). The third part shows the resulting vector $\mathbf{V}_2 - \mathbf{V}_1$ (blue arrow pointing up and right) as the diagonal of a parallelogram formed by \mathbf{V}_2 and $-\mathbf{V}_1$.

And now: the math



$$\mathbf{V} = (V_x, V_y)$$

Vector components in coordinate system

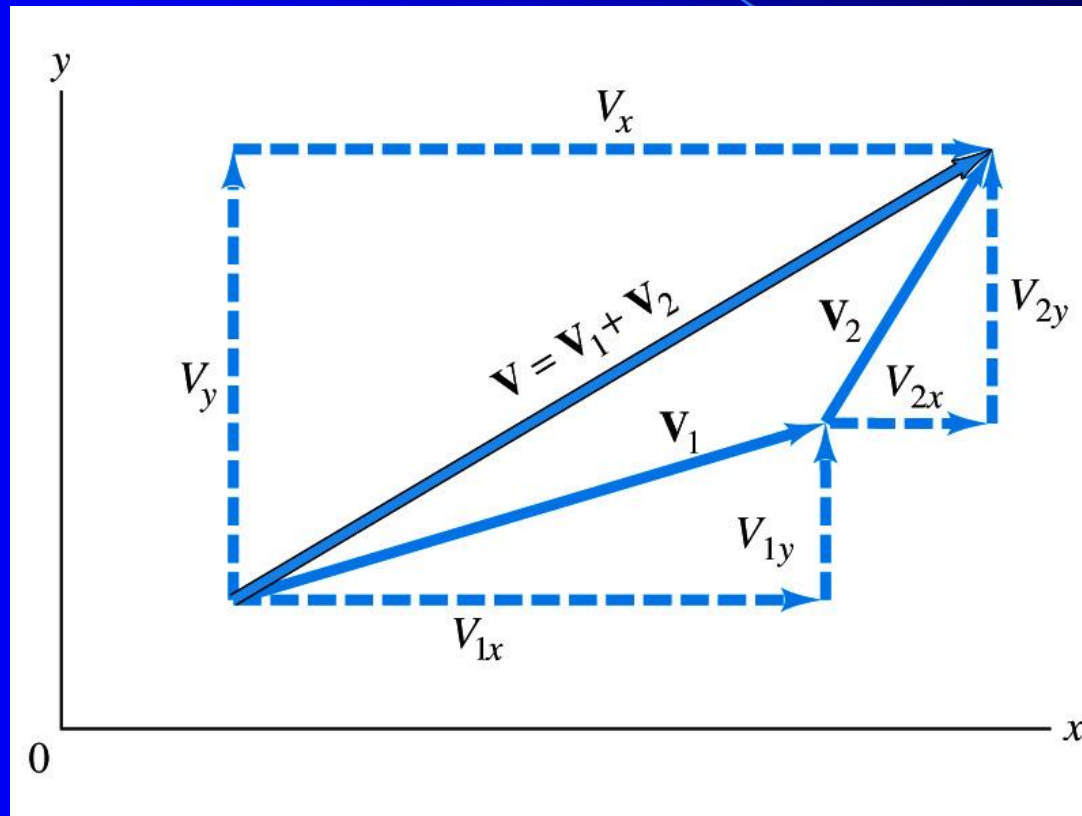
$$V_x = V \cos\theta$$

$$V_y = V \sin\theta$$

$$V^2 = V_x^2 + V_y^2$$

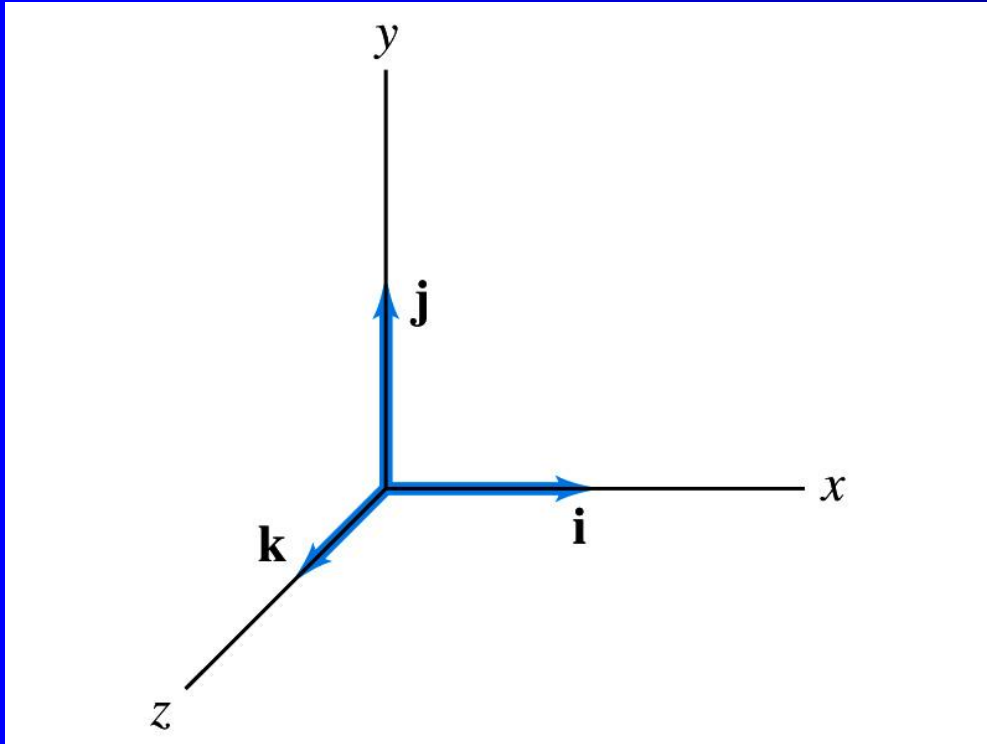
$$\tan\theta = V_x / V_y$$

And now: the math



$$\mathbf{V} = \mathbf{V}_1 + \mathbf{V}_2 = (V_{1x} + V_{2x}, V_{1y} + V_{2y})$$

Unit vectors



$$\begin{aligned}\mathbf{V} &= (V_x) \mathbf{i} + (V_y) \mathbf{j} \\ &= \mathbf{V}_1 + \mathbf{V}_2 \\ &= (V_{1x} \mathbf{i} + V_{1y} \mathbf{j}) + \\ &\quad (V_{2x} \mathbf{i} + V_{2y} \mathbf{j}) \\ &= (V_{1x} + V_{2x}) \mathbf{i} + \\ &\quad (V_{1y} + V_{2y}) \mathbf{j}\end{aligned}$$

$$\mathbf{V} = V_x \mathbf{i} + V_y \mathbf{j} + V_z \mathbf{k}$$