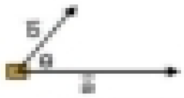
# Vectors

## ADDING VECTORS

### Parallelogram Method

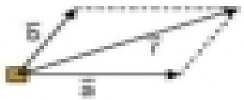
The parallelogram method is used to add two vectors acting at an angle θ with respect to each other.

Consider two vectors, $\vec{a}$ and $\vec{b}$, acting on the same object:



From the tip of vector $\vec{a}$, draw a line equal in length to $\vec{b}$, and parallel to $\vec{b}$. From the tip of vector $\vec{b}$, draw a line equal in length to $\vec{a}$ and parallel to $\vec{a}$.

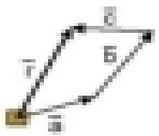
Draw the diagonal from the object to the opposite corner. This vector is called the **resultant**, and it is the vector of the sum of $\vec{a}$ and $\vec{b}$. The resultant, acting alone, produces the same effect as its component vectors acting together.



### Graphical Addition

If the graphical representations of vector are drawn with *high* precision, the resultant can be measured with considerable accuracy, regardless of how many vectors are being added. This is where the tip-to-tail method is used. Consider the three vectors acting on the object at right.

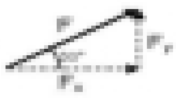
Arrange all the vectors from tip to tail. The resultant is the vector from the tail of the first vector to the tip of the last vector.



## RESOLVING VECTORS INTO COMPONENTS

Often it is useful to break down (resolve) a vector into components. Usually we break a vector into horizontal and vertical components, but in the case of movement on a ramp, we might break a vector into components parallel to the surface of the ramp and perpendicular to the surface.

Consider a 10.0-N force, F, acting at a 30° angle to the horizontal, as in the diagram to the right. We can resolve this vector into horizontal and vertical components. The horizontal component, $F_x = F \cos 30°$ $= 8.66$ N, and the vertical component, $F_y = F \sin 30° = 5.00$ N





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