Applications of Vectors

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10:25 AM

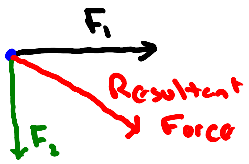
Some physical quantities may be represented by vectors:

FORCE
ACCELERATION
VELOCITY

Two forces "combine" the way vectors "ADD".

If F_1 and F_2 are two forces simultaneously acting on an object, the vector sum of F_1+F_2 is called the Resultant Force.

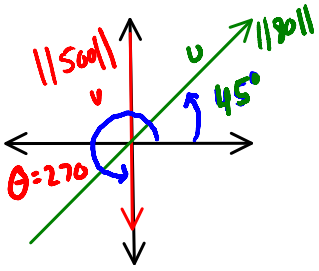
The resultant force produces the same effect on the object as that obtained when F_1 and F_2 act on the object:



Two common types of applications of vectors deal with "aircraft flying" and "boats in current".

Ex. 1

a) A Boeing 737 aircraft maintains a constant airspeed of 500 mph in the direction due South. The velocity of the "Jet Stream" is 80 mph in a north-easterly direction.



1) Find the component of the airplane $\vec{v}$ and component of the Jet Stream $\vec{u}$.

speed = $\|\ \|$ direction = θ

$\vec{v} = \langle 500\cos 270, 500\sin 270 \rangle$

$\vec{v} = \langle 0, -500 \rangle$

$\vec{u} = \langle 80\cos 45, 80\sin 45 \rangle$

$\vec{u} = \langle 56.57, 56.57 \rangle$

2) Find the actual speed of the aircraft relative to the ground. actual speed = aircraft + wind

$v + u = a$

$\langle 0, -500 \rangle + \langle 56.57, 56.57 \rangle$

$\vec{a} = \langle 56.57, -443.43 \rangle$

$|\vec{a}| = \sqrt{(56.57)^2 + (-443.43)^2}$

$|\vec{a}| = 447.02$ mph

b) A cruise ship maintains a constant speed of 70 mph in the direction south. The velocity of the current is 20 mph in a north-easterly direction.

$\vec{v} = \langle 0, -70 \rangle$ $\vec{u} = \langle 14.14, 14.14 \rangle$

$\vec{a} = \langle 14.14, -55.86 \rangle$

$|\vec{a}| = 57.6$ mph

c) Find the component form of the vector that represents the velocity of an airplane descending at a speed of 100 mph at an angle of 30° below the horizontal.

$||v|| = 100$ mph $\theta = 330°$

$\langle 100 \cos 330, 100 \sin 330 \rangle$

$\vec{v} = \langle 86.60, -50 \rangle$