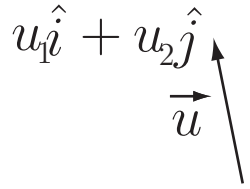
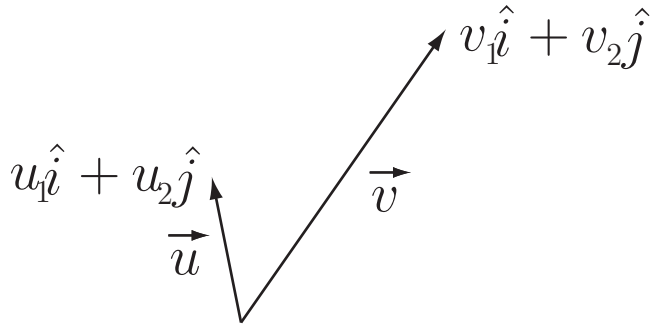
Vector Addition

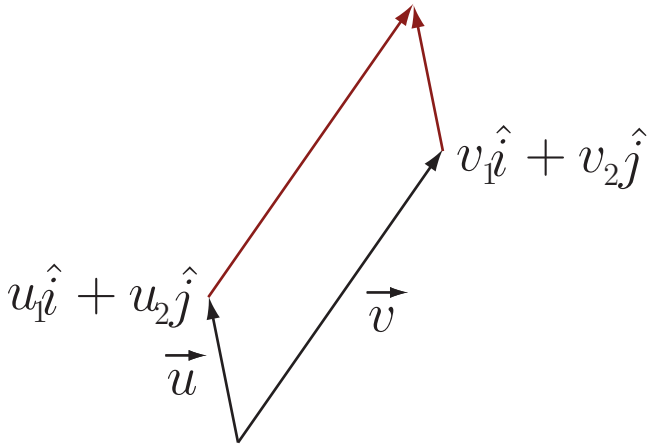
Vector Addition



Vector Addition



Vector Addition



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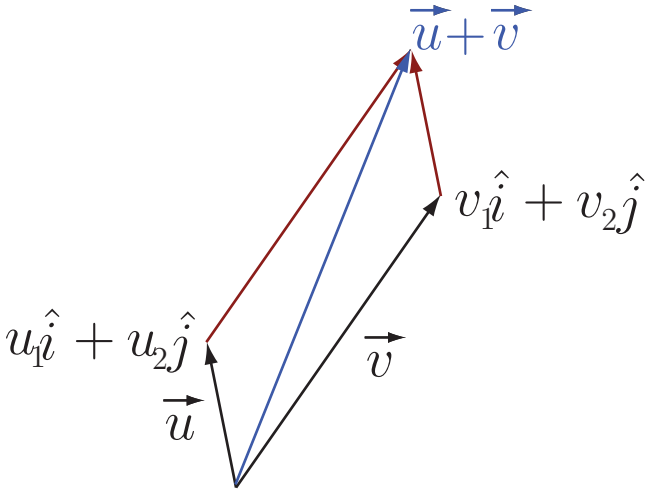
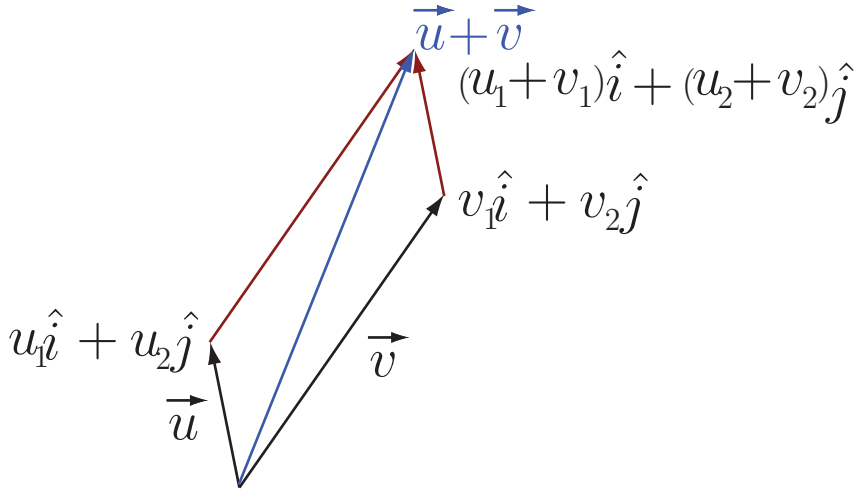


Vector Addition



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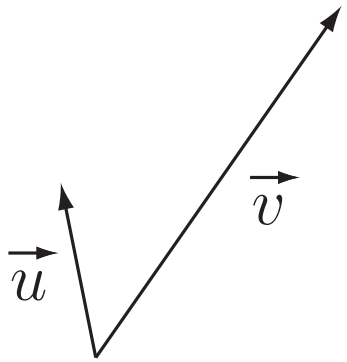

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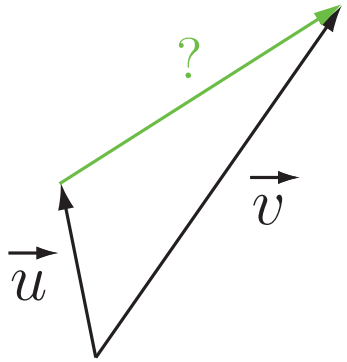

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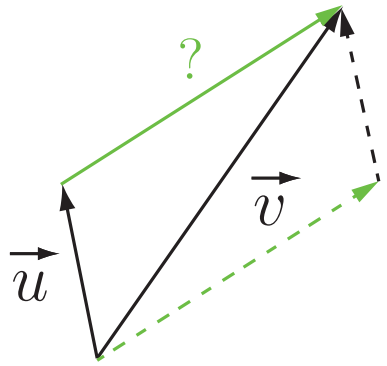
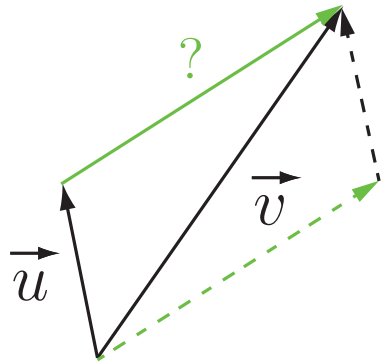
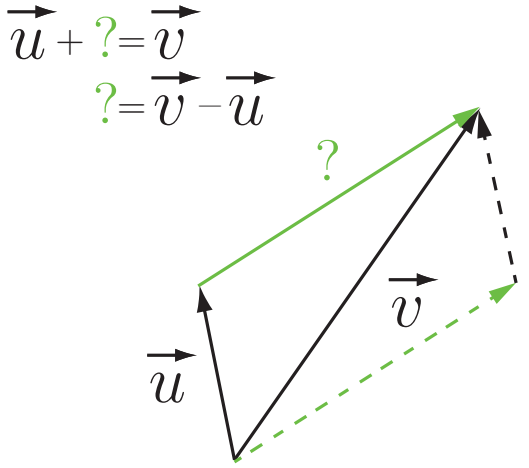


Vector Addition

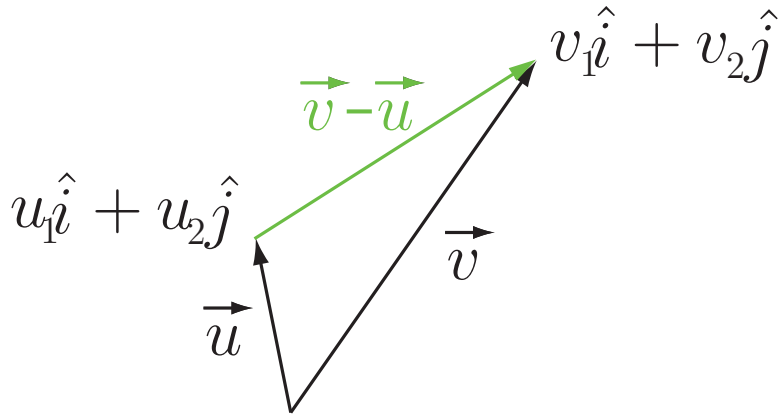
$$\vec{u} + ? = \vec{v}$$



Vector Addition



Vector Addition



Vector Addition

Example: Find $\vec{u} + \vec{v}$ if $||\vec{u}|| = 15$ with direction $\theta = 67^\circ$ and $||\vec{v}|| = 21$ with direction $\phi = 128^\circ$.

Vector Addition

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Solution: $\vec{u} = (15\cos\theta, 15\sin\theta) = (15\cos 67^\circ, 15\sin 67^\circ)$.

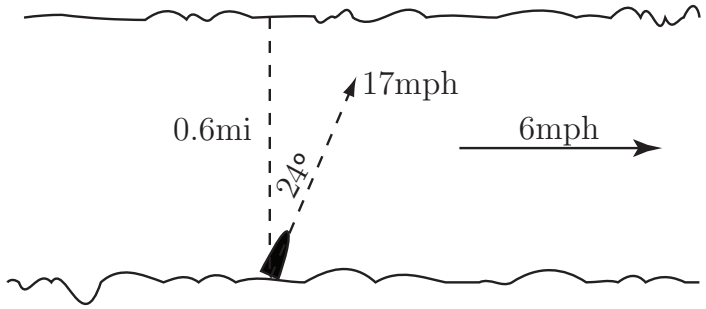
$\vec{v} = (21\cos\phi, 21\sin\phi) = (-21\cos 52^\circ, 21\sin 52^\circ)$

Then $\vec{u} + \vec{v} = (15\cos 67^\circ - 21\cos 52^\circ, 15\sin 67^\circ + 21\sin 52^\circ)$

$||\vec{u} + \vec{v}|| \approx \sqrt{(-7.06)^2 + (30.36)^2} \approx 31.17$ with direction $\theta \approx \arctan\left(\dfrac{30.36}{-7.06}\right) \approx -77^\circ \longrightarrow 103^\circ$.

River Crossing

A boat launches from one shore of a river at a heading 24° downstream. The river is 0.6 miles wide in most places. If the current moves at 6mph and the boat's speed, relative to the water, is 17mph,



(a) How far down the opposite shore will the boat arrive?

(b) How long will it take to get there?

(c) How far will the boat have traveled getting there?

(d) How fast (relative to the shore) did the boat travel?

(e) At what angle should the boat launch in order to land directly across the river from where it started? (Assume the boat's speed relative to the water is still 17mph.)

Air Travel

An airplane is flying with an airspeed of 450 mph heading N40°E while a wind is blowing at 35 mph heading S70°E. Determine the resulting ground speed and direction of the plane.