

Name: Key

Ex. An airplane has an air speed of 500 km per hour bearing N45°E. The wind velocity is 60 km per hour in the direction N30°W. Find the resultant vector representing the path of the plane relative to the ground. What is the ground speed of the plane and the direction?

$$V_A = 500 \cos 45^\circ i + 500 \sin 45^\circ j = \frac{500\sqrt{2}}{2} i + \frac{500\sqrt{2}}{2} j = 250\sqrt{2} i + 250\sqrt{2} j$$

$$V_W = 60 \cos 120^\circ i + 60 \sin 120^\circ j = 60(-\frac{1}{2}) i + \frac{60\sqrt{3}}{2} j = -30i + 30\sqrt{3} j$$



$$V = (250\sqrt{2} - 30) i + (250\sqrt{2} + 30\sqrt{3}) j \quad \text{EXACT}$$

$$V = 323.55 i + 405.51 j \quad \text{Approximate}$$

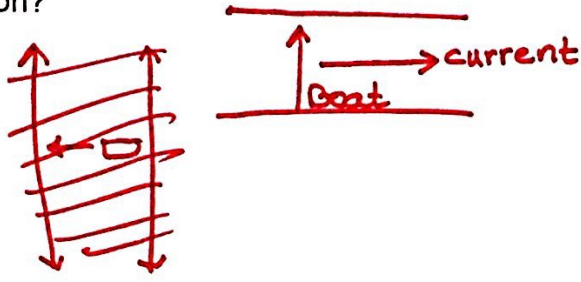
Speed: $\sqrt{A^2 + B^2} = 518.8 \text{ mph}$

Direction $\theta = \tan^{-1}(\frac{B}{A}) = 51.4^\circ$

N 38.6° E



Ex. A small motorboat in still water maintains a speed of 20 mph. In heading directly across the river (that is, perpendicular to the current) whose current speed is 3mph, find the vector representing the speed and direction of the motor boat. What is the true speed of the motorboat? What is its direction?



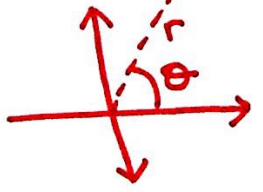
$$V_B = 20 \cos 90^\circ i + 20 \sin 90^\circ j = 20(0) i + 20(1) j = 20j$$

$$V_C = 3 \cos 0^\circ i + 3 \sin 0^\circ j = 3(1) i + 3(0) j = 3i$$

$$V_{B+C} = 3i + 20j$$

Speed = $\sqrt{3^2 + 20^2} = 20.22 \text{ mph}$

direction: $\theta = \tan^{-1}(\frac{20}{3}) = 81.5^\circ$



Bearing 8.5°
or N 8.5° E

20.22 mph N 8.5° E

Assuming boat traveling N & current E.