Name: key

Vector Word Problems

A DC-10 jumbo jet maintains an airspeed of 550 miles per hour in a southwesterly direction. The velocity of the jet stream is a constant 80 miles per hour from the west. Find the actual speed and direction of the aircraft.

1. What angle is the jet flying from standard position?

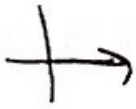
$\theta = 225°$

2. Write the vector that represents the magnitude and direction of the jet. Leave your numbers in exact form. Remember to use the equation : $v = \|v\|(\cos\theta i + \sin\theta j)$

$V_j = 550\cos 225\,i + 550\sin 225\,j$

$V_j = -275\sqrt{2}\,i - 275\sqrt{2}\,j$

3. What is the angle of the wind from standard position?



$0°$

4. Write the vector that represents the magnitude and direction of the wind. Leave your numbers in exact form.

$V_w = 80\cos 0\,i + 80\sin 0\,j$

$V_w = 80\,i$

5. Find the vector that represents the magnitude and direction of the jet and the wind combined.

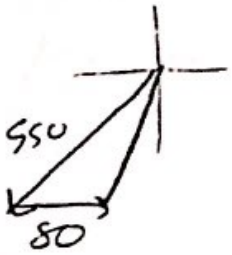
$V_j + V_w = (-275\sqrt{2} + 80)\,i + (-275\sqrt{2})\,j$

Steve: x y

6. Find the speed of the jet and the wind combined; this is the actual speed. (Remember: speed is magnitude!) Round to 3 decimal places.

$\|V_j + V_w\| = \sqrt{x^2 + y^2} \approx 496.66$ mph

7. Find the direction of the jet and the wind combined; this is the actual direction the aircraft will be. Draw a picture of your angles from #1 and #3 to give you a context for whether you can use the answer the calculator gives you or if you need to find an alternate answer. Round your angle to 3 decimal places.



$\tan\theta = \frac{y}{x}$ Stored values

$\theta = 51.540^\circ$

$+ 180$

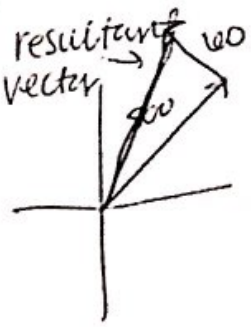
$\theta = 231.540^\circ$

8. What direction is the jet actually flying?

S 38.46° W

9. Write the actual speed and direction in a complete sentence.

10. An airplane has an airspeed of 500 kilometers per hour bearing $N45°E$. The wind velocity is 60 kilometers 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? What is its direction?



$V_p = 500\cos 45\,i + 500\sin 45\,j$

$V_p = 250\sqrt{2}\,i + 250\sqrt{2}\,j$

$V_w = 60\cos 120\,i + 60\sin 120\,j$

$V_w = -30\,i + 30\sqrt{3}\,j$

$V_p + V_w = (250\sqrt{2} - 30)\,i + (250\sqrt{2} + 30\sqrt{3})\,j$

(X) (Y)

Speed → $\sqrt{x^2+y^2} \approx 518.777$ mph

Direction → $\tan\theta = y/x$

$\theta = 51.414°$ OR N 38.586° E

11. An airplane has an airspeed of 600 kilometers per hour bearing $S30°E$. The wind velocity is 40 kilometers per hour in the direction $S45°E$. Find the resultant vector representing the path of the plane relative to the ground. What is the ground speed of the plane? What is its direction?

$V_p = 600\cos 300\,i + 600\sin 300\,j$

$V_p = 300\,i - 300\sqrt{3}\,j$

$V_w = 40\cos 315\,i + 40\sin 315\,j$

$V_w = 20\sqrt{2}\,i - 20\sqrt{2}\,j$

$V_p + V_w = (300 + 20\sqrt{2})\,i + (-300\sqrt{3} - 20\sqrt{2})\,j$

(X) (Y)

Speed = $\sqrt{x^2+y^2} \approx 638.72$ km/hr

Direction → $\tan\theta = y/x$

$\theta = -59.07°$ $+360$ OR $\boxed{300.93°}$

$\theta = S\,29.93°E$