122 HOMEWORK #7

5 ea. 95 poss

(1) $P(-2,7)$, $Q(5,-17)$ Find component form:

$\overrightarrow{PQ} = \langle 5-(-2), -17-7 \rangle = \boxed{\langle 7,-24\rangle}$

(2) $\bar{u} = \langle 3,7\rangle \Longrightarrow$

$|\bar{u}| = \sqrt{3^2+7^2} = \sqrt{9+49} = \sqrt{58} \Longrightarrow$

$\boxed{\frac{1}{|\bar{u}|}\bar{u} = \frac{1}{\sqrt{58}}\langle 3,7\rangle}$

(3) Vector of length 13 in direction of $\bar{u}$

is $\boxed{\frac{13}{\sqrt{58}}\langle 3,7\rangle}$

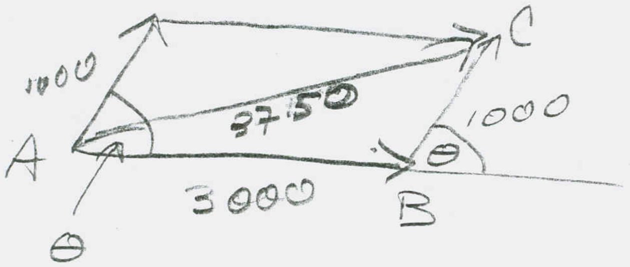
(4) $3\langle 3,7\rangle - 2\langle -2,5\rangle$

$= \langle 9+4, 21-10\rangle = \boxed{\langle 13,11\rangle}$

(5) $|\bar{u}|=3$, $\theta = 83^\circ \Longrightarrow$

$\bar{u} = 3\langle \cos 83^\circ, \sin 83^\circ\rangle \approx \boxed{\langle .366, 2.978\rangle}$

(6)



We find B & then $\theta = 180^\circ - B$:

SSS - Law of cosines

$\boxed{\theta \approx 47.384^\circ}$

$b^2 = a^2+c^2-2ac\cos B$

$3750^2 = 1000^2+3000^2-2(1000)(3000)\cos B \Longrightarrow$

$\cos B = \frac{-3750^2+1000^2+3000^2}{2(1000)(3000)} \approx -.67708\bar{3}$

$\longrightarrow B \approx 132.6161427 \Longrightarrow$

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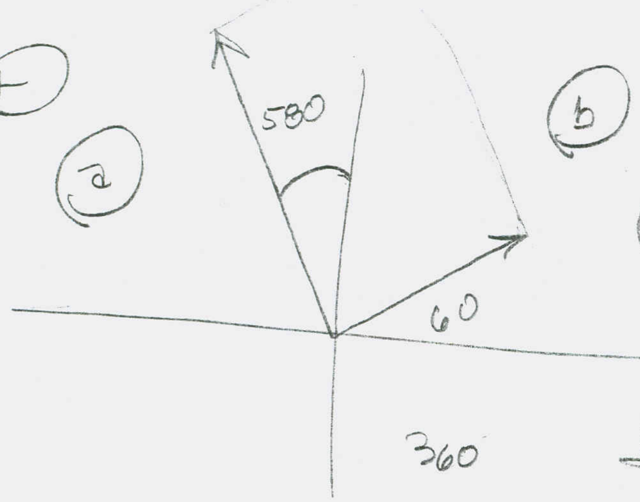
(7)

(a)



(b) Wind : $\boxed{60 \langle \cos 45^\circ, \sin 45^\circ \rangle}$

(c) Plane : $360^\circ - 332^\circ = 28^\circ$

$28^\circ + 90^\circ = 118^\circ$

$\boxed{580 \langle \cos 118^\circ, \sin 118^\circ \rangle}$

(d) Speed of jet is modulus of the resultant :

$\langle 60 \cos 45^\circ + 580 \cos 118^\circ, 60 \sin 45^\circ + 580 \sin 118^\circ \rangle$

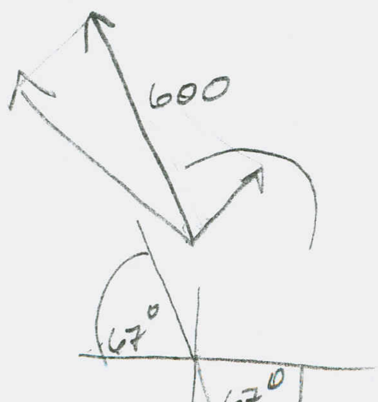
$\approx \langle -229.8670995, 554.5360107 \rangle$

Speed is $\sqrt{a^2 + b^2} \approx \sqrt{52838.88345 + 307510.1872}$

$\approx$ ≈ 600.2908217

$\approx \boxed{600 \text{ mph}}$

(e) True Direction of the jet



$\theta' \approx \arctan\left(\frac{554.5360107}{-229.8670995}\right)$

≈ -67.4849419

$\approx -67.48^\circ \approx -67^\circ$

$90^\circ - 67^\circ = 23^\circ$, so it's

true bearing is $360^\circ - 23^\circ$

$\boxed{= 337^\circ}$

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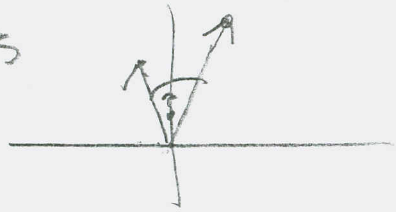
(8) $\langle 3,7\rangle \cdot \langle -2,5\rangle = -6+35 = \boxed{29}$

(9) $|\langle 3,7\rangle| = \boxed{\sqrt{58}}$ by previous work.

(10) (a) Angle between $\langle 3,7\rangle$ & $\langle -2,5\rangle$



$\cos\theta = \dfrac{\bar{u}\cdot\bar{v}}{\|\bar{u}\|\|\bar{v}\|}$ $\qquad 2^2+5^2=29$

$= \dfrac{29}{\sqrt{58}\sqrt{29}} \Rightarrow \theta = \arccos\left(\dfrac{29}{29\sqrt{2}}\right) = \boxed{45^\circ}$

(10 b) Between $\langle 2,3\rangle$ & $\langle -12,8\rangle$

$\cos\theta = \dfrac{\bar{u}\cdot\bar{v}}{\|\bar{u}\|\|\bar{v}\|} = \dfrac{-24+24}{\|\bar{u}\|\|\bar{v}\|} = 0 \rightarrow \boxed{\theta = 90^\circ}$

(11) (a) $\langle 3,7\rangle \cdot \langle -2,5\rangle = 29 \neq 0 \rightarrow$ $\boxed{\text{Not orthogonal}}$

(b) $\langle 2,3\rangle \cdot \langle -12,8\rangle = 0 \rightarrow$ $\boxed{\text{orthogonal}}$

(12) $\text{proj}_{\bar{v}}\,\bar{u} = \dfrac{\bar{u}\cdot\bar{v}}{\|\bar{v}\|^2}\bar{v} = \dfrac{29}{(\sqrt{29})^2}\bar{v} = \bar{v} = \boxed{\langle -2,5\rangle}$

Wrong $\bar{u}, \bar{v}$

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(12) $\bar{u} = \langle 2,3 \rangle$, $\bar{v} = \langle -12, 8 \rangle \Longrightarrow$

$$\text{proj}_{\bar{v}}\,\bar{u} = \frac{\bar{u} \cdot \bar{v}}{\|\bar{v}\|^2}\,\bar{v} = 0\,\bar{v} = \boxed{\bar{0}} \longrightarrow$$

(13) $\bar{u}$ is already orthogonal to $\bar{v}$!

So, $\bar{u} = \langle 2,3 \rangle + \bar{0}$!

Too easy!

part that's orthogonal to $\bar{v}$

part that's parallel to $\bar{v}$.