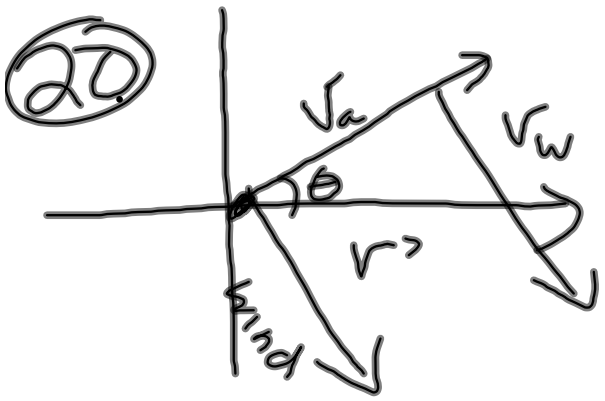
20.



$v_a = 250(\cos\theta i + \sin\theta j)$

$v_w = 40(\cos 315^\circ i + \sin 315^\circ j)$

(always from horizontal)

$v = ||v||(\cos 0^\circ i + \sin 0^\circ j)$

$\star\ 250\cos\theta + 40\cos 315^\circ = ||v||\cos 0^\circ$

(the i's)

$250\sin\theta + 40\sin 315^\circ = ||v||\sin 0^\circ$

(the j's)

$250\sin\theta + 40\left(-\frac{\sqrt{2}}{2}\right) = 0$

$\theta = 6.5^\circ$ so, $N\ 83.5^\circ E$

So $\Rightarrow$ from $\star$

$250\cos(6.5^\circ) + 40\left(\frac{\sqrt{2}}{2}\right) = ||v||$

$276.7\text{ mph} = ||v||$

(19.)

$$V_a = 550(\cos 225°\, i + \sin 225°\, j)$$
$$= 550\left(-\frac{\sqrt{2}}{2} i + -\frac{\sqrt{2}}{2} j\right)$$
$$= -275\sqrt{2}\, i - 275\sqrt{2}\, j$$
$$V_w = 80(\cos 0\, i + \sin 0\, j)$$
$$= 80\, i$$
$$V = V_a + V_w$$
$$\left(80 - \sqrt{2}(275)\right) i - \sqrt{2}(275)\, j$$

actual speed $= \|v\|$

$$= \sqrt{\left(80 - \sqrt{2}(275)\right)^2 + \left(-\sqrt{2}(275)\right)^2}$$
$$= 496.66 \text{ mph}$$

direction $\cos\theta = \dfrac{(v)\cdot(-j)}{\|v\|\,\|-j\|}$

$$\cos\theta = \frac{225\sqrt{2}}{(496.66)(1)}$$

$$\Rightarrow \theta = S\,38.5°\,W$$