Section 3.4: Airplane Navigation

$$ {}_p\vec{v}_e = {}_p\vec{v}_a + {}_a\vec{v}_e $$

Symbol	Velocity Vector	Speed	Direction
${}_pv_e$	Velocity of plane wrt earth	ground speed	tracking
${}_pv_a$	velocity of plane wrt air	airspeed	heading
${}_av_e$	velocity of wind wrt earth	wind speed	wind velocity

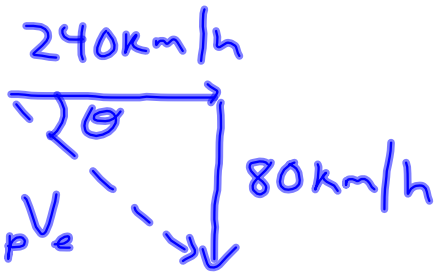
Type 1

1. An airplane has an air speed of 240 km/h and a heading of east. An 80.0 km/h wind is blowing from the north.
A) Calculate the plane's ground speed and tracking.

$_pV_a$ = 240 km/h [E]

$_aV_e$ = 80 km/h [S]

$_pV_e$ = ?



$_pV_e^2 = (240\ km/h)^2 + (80\ km/h)^2$

$_pV_e$ = 252 km/h

$_pV_e$ = 250 km/h [E 18° S]

$\tan\theta = \frac{80\ km/h}{240\ km/h}$

$\theta = 18°$

B) What is the plane's displacement after 2.3 hours.

$d = {}_pV_e\, t$

$= (250\ km/h\ [E\ 18°\ S])(2.3\ h)$

$= 580\ km\ [E\ 18°\ S]$

Type 2 tracking

2. A pilot wants to fly due South. The airplane has an air speed of 2.0×10^2 km/h. There is a 62 km/h wind blowing from the East.

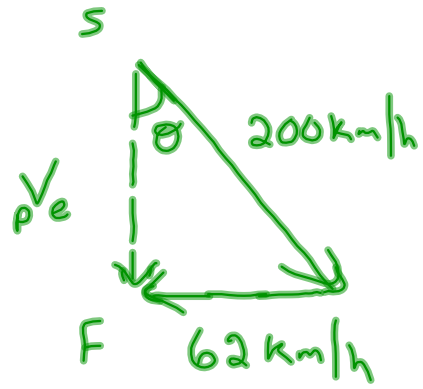
A) Determine the heading the pilot should use.

$V_a = 200\ km/h\ [?]$ (a)

② $V_e = 62\ km/h\ [W]$

① $V_e = ?\ [S]$ (b)

head to head



$\sin\theta = \frac{62\ km/h}{200\ km/h}$

$\theta = 18°$ [S 18° E]

B) Determine the pilot's ground speed.

$V_e^2 = (200\ km/h)^2 - (62\ km/h)^2$

$V_e = 190\ km/h$

C) How long will it take him to get to his destination which is 350 km [S] of his initial position?

$t = \frac{d}{V} = \frac{350\ km}{190\ km/h} = 1.8\ h.$