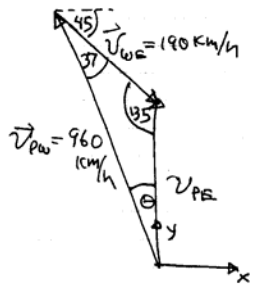
Ex. A jetliner with airspeed 960 km/h departs on a flight to a city 1290 km due northward. There is a steady 190 km/h wind from the northwest.

a) In what direction (heading) should pilot take?

$v_{PW} = 960$ km/h
$v_{WE} = 190$ km/h
$v_{PE} =$ TBD
$x = 1290$ km



$$\frac{\sin\theta}{190} = \frac{\sin 135}{960}$$

$$\theta = 8.0^\circ$$

b) Calculate the groundspeed of jetliner.
Using Law of Cosines

$$v_{PE}^2 = (960)^2 + (190)^2 - 2(960)(190)\cos 37$$

$$v_{PE} = 816 \text{ km/h}$$

c) How long will trip take?

$$t = \frac{x}{v_{PE}} = \frac{1290 \text{ km}}{816 \text{ km/h}}$$

$$t = 1.58 \text{ hr}$$

Solving Vectorially

$$\vec{v}_{PE} = \vec{v}_{PW} + \vec{v}_{WE}$$

$$\vec{v}_{PE} = v_{PE}\vec{j}$$

$$\vec{v}_{PW} = -960\sin\theta\,\vec{i} + 960\cos\theta\,\vec{j}$$

$$\vec{v}_{WE} = 190\cos 45\,\vec{i} - 190\sin 45\,\vec{j}$$
$$= \frac{190}{\sqrt{2}}\vec{i} - \frac{190}{\sqrt{2}}\vec{j}$$

$$v_{PE}\vec{j} = -960\sin\theta\,\vec{i} + 960\cos\theta\,\vec{j} + \frac{190}{\sqrt{2}}\vec{i} - \frac{190}{\sqrt{2}}\vec{j}$$

$$v_{PE}\vec{j} = (134 - 960\sin\theta)\vec{i} + (960\cos\theta - 134)\vec{j}$$

Equating components:

X-comp: $0 = 134 - 960\sin\theta$

$$\sin\theta = \frac{134}{960}$$

$$\theta = 8.0^\circ \checkmark$$

Y-comp: $v_{PE} = 960\cos\theta - 134$

$$v_{PE} = 816 \text{ km/h} \checkmark$$