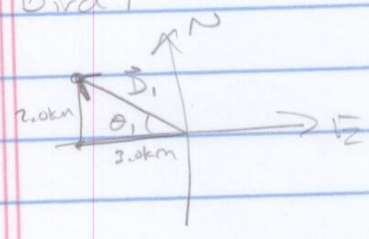
Homework Ch 1 MC 23, Problems 6, 60

MC 1.23 A bird flies 3.0 km due West and then 2.0 km due North. Another bird flies 2.0 km due West and 3.0 km due North. What is the angle between the net displacement vectors for the two birds?

Bird 1



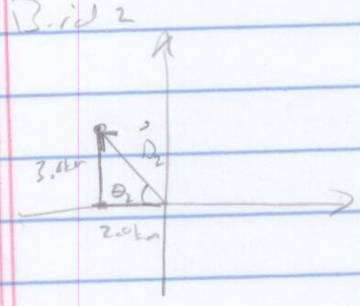
$$\tan\theta_1 = \frac{2.0\,km}{3.0\,km}$$

$$\theta_1 = \tan^{-1}(0.667)$$

$$= 33.7^\circ$$

← Don't round until the whole problem is complete.

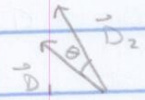
Bird 2



$$\tan\theta_2 = \frac{3.0\,km}{2.0\,km}$$

$$\theta_2 = \tan^{-1}(1.5)$$

$$\theta_2 = 56.3^\circ$$

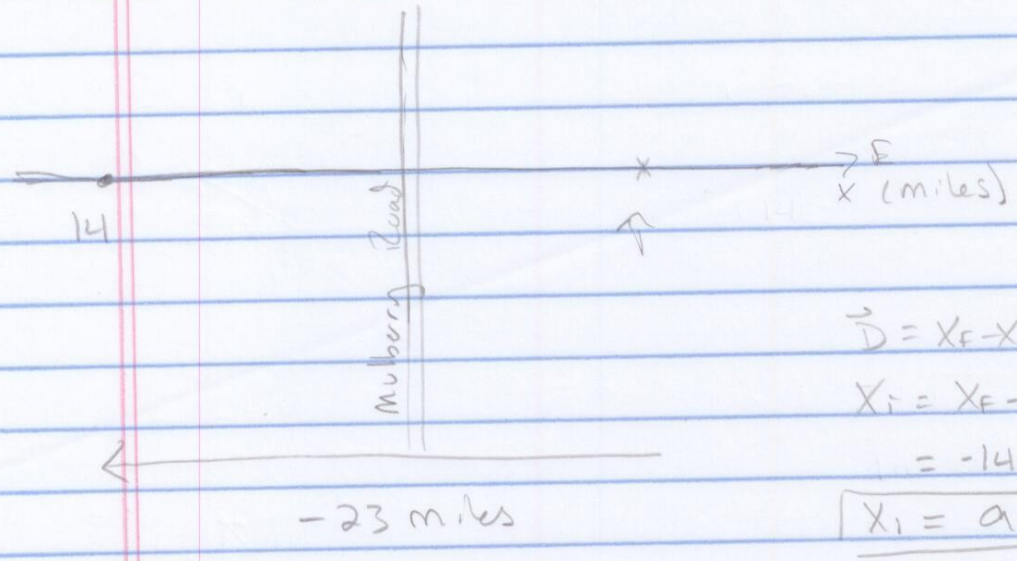


$$\theta = \theta_2 - \theta_1$$

$$56.3^\circ - 33.7^\circ = 22.6^\circ$$

$$\boxed{23^\circ}$$ ← sig figs

1.6 A car travels along a straight east-west road. A coordinate system is established on the road, with x increasing to the east. The car ends up 14 mi west of the intersection with Mulberry Road. If its displacement was -23 mi, how far from and on which side of Mulberry Road did it start?



$\vec{D} = X_F - X_i$

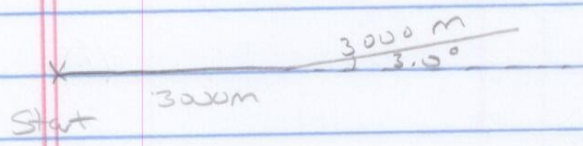
$X_i = X_F - \vec{D}$

$= -14\,mi - -23\,mi$

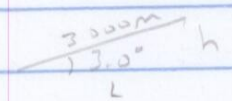
$\boxed{X_i = 9\,mi}$

The car must have started 9 miles East of Mulberry Road.

1.60 A large passenger aircraft accelerates down the runway for a distance of 3000 m before leaving the ground. It then climbs at a steady 3.0° angle. After the plane has traveled 3000 m along this new trajectory, a) how high is it, and b) how far horizontally is it, from its initial position.



To find how high, I'll just look at the part of its top where its climbing



$$\sin\theta = \frac{opp}{hyp}$$

$$\sin 3.0° = \frac{h}{3000m}$$

$$3000m \sin 3.0° = h$$

$$\boxed{157m = h}$$

b.) I will use the triangle from above to find horizontal of the climb and then add that to the 3000 m down the runway before take off.

$$\cos\theta = \frac{adj}{hyp}$$

$$\cos 3.0° = \frac{L}{3000m}$$

$$3000m \cos 3.0° = L$$

$$2996m = L$$

$$3000m + 2996m = 5996m$$

$$\boxed{= 6000m}$$

We only have 2 sig figs