

## Section 11.5 The Cosine Rule

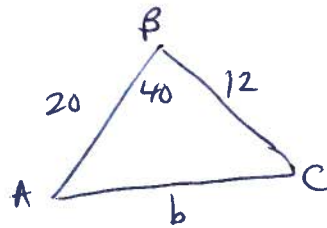
Sometimes you cannot use the Sine Rule. If you don't have a side and an angle opposite it then you may have to use the Cosine Rule. Unlike the Sine Rule, the Cosine Rule does not have an ambiguous case.

Cosine Rule:  $a^2 = b^2 + c^2 - 2bc \cos A$   
(see pg 386 for alternate forms and the proof)

Note: When computing keep as much as you can in your calculator to ensure the most accurate answer. Also make sure you are in DEGREE mode!

Example: Solve the following triangles. Round answers to the nearest tenth.

1)  $B=40^\circ, a=12, c=20$



$$b^2 = 12^2 + 20^2 - 2(12)(20)\cos 40$$

$$b^2 \approx 176.3$$

$$b = 13.3$$

Now I can switch to  
The Sine Rule

$$\frac{\sin 40}{13.3} = \frac{\sin A}{12}$$

$$\frac{12 \sin 40}{13.3} = \sin A$$

$$A = 35.4$$

(no Quad 2  $\sim 144.6$   
is too big if I  
already have  $B=40^\circ$ !)

$$C = 104.6^\circ$$

2)  $a=8, b=5, c=10$

Always find largest  
angle first with  
Cosine Rule!

$$10^2 = 8^2 + 5^2 - 2(8)(5)\cos C$$

$$100 = 64 + 25 - 80 \cos C$$

$$11 = -80 \cos C$$

$$-\frac{11}{80} = \cos C$$

$$C = 97.9^\circ$$

(I already have an obtuse  
angle which means no  
more Quad 2 angles!)

$$\frac{\sin A}{8} = \frac{\sin 97.9}{10}$$

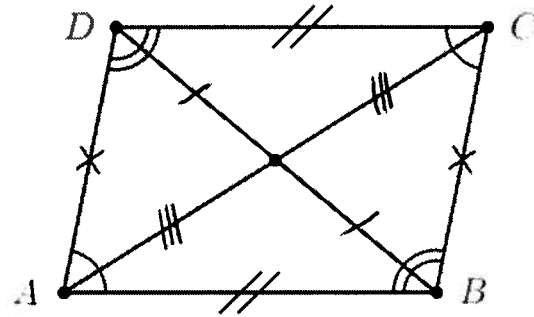
$$A = 52.4^\circ$$

$$B = 29.7^\circ$$

(Again Quad 2  
 $127.6^\circ$  won't  
work!)

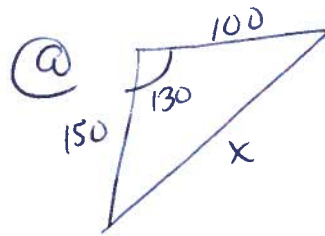
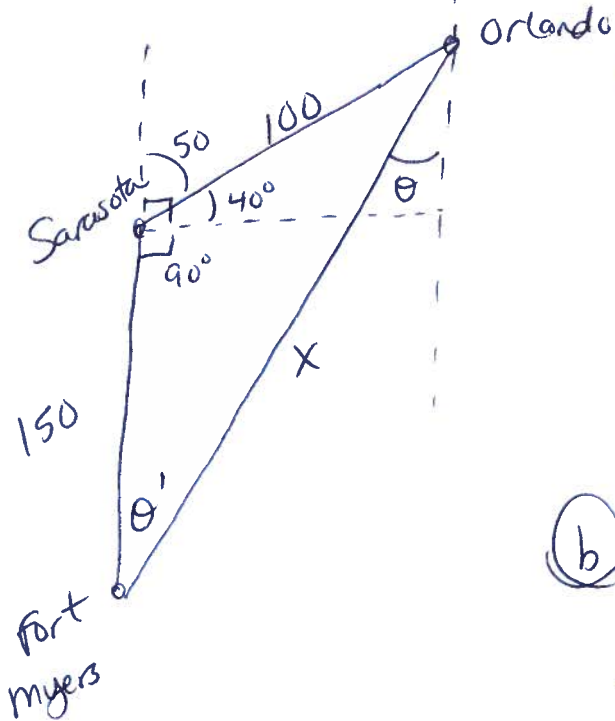
Note: A parallelogram has the following properties...

- Opposite Sides Parallel
- Opposite Sides Congruent
- Opposite Angles Congruent
- Vertical Angles Congruent
- Diagonals that Bisect (cut in half)



Example: A plane flies due north from Ft. Myers to Sarasota, a distance of 150 miles. Then the plane flies at a bearing N 50° E and flies to Orlando, a distance of 100 miles.

- a.) How far is it from Ft. Myers to Orlando?
- b.) What bearing should the pilot take to fly directly back to Ft Myers from Orlando?



$$X^2 = 150^2 + 100^2 - 2(150)(100)\cos 130^\circ$$

$$X^2 \approx 51783.6$$

$$X = 227.6 \text{ miles}$$

(b)  $\theta' = \theta$  (parallel lines/transversal)

$$\frac{\sin 130}{227.6} = \frac{\sin \theta'}{100}$$

$$\theta' = 19.7^\circ \text{ (quad 2 doesn't make sense!)}$$

Bearing

S 19.7° W

$$\text{or } 180 + 19.7 = 199.7^\circ$$