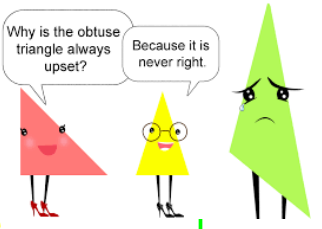
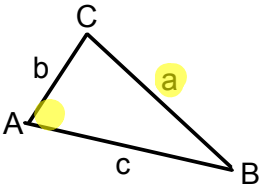
Date: _____

8.4 Applying the Cosine Law





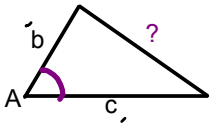
Formula:

$a^2 = b^2 + c^2 - 2bc \cos A$
$b^2 = a^2 + c^2 - 2ac \cos B$
$c^2 = a^2 + b^2 - 2ab \cos C$

All three of the formulas are the same. You just need to remember to put your unknown on the left and the angle opposite to it in the equation.

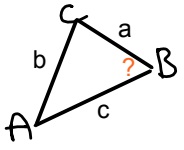
Conditions to Use the Cosine Law

1) We know two sides and the angle between them (contained angle).



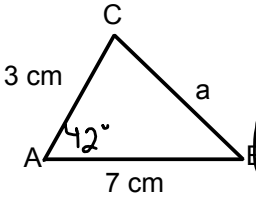
To solve for a side (a)

2) We know all three sides and no angles.



Solving for an angle (B)

Example 1: Determine the measure of a to the nearest tenth of a centimeter.



$a^2 = b^2 + c^2 - 2bc \cos A$

$a^2 = (3)^2 + (7)^2 - 2(3)(7) \cos 42°$ ← type this in and solve

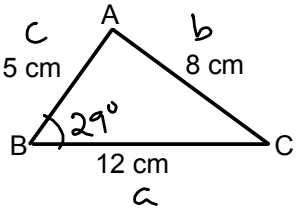
$a^2 = 9 + 49 - 42 \cos 42°$

$a^2 = 58 - 42 \cos 42°$ Do NOT subtract 58 + 42!

$a^2 = \sqrt{26.8}$

$a = 5.2$ cm

Example 2: Find the measure of angle B to the nearest degree.



$b^2 = a^2 + c^2 - 2ac \cos B$

$8^2 = 12^2 + 5^2 - 2(12)(5) \cos B$

$64 = 144 + 25 - 120 \cos B$

$64 = 169 - 120 \cos B$

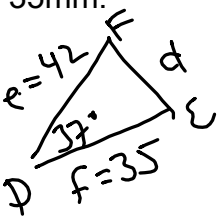
$64 - 169 = -120 \cos B$

$\frac{-105}{-120} = \frac{-120 \cos B}{-120}$

$0.875 = \cos B$ → $\cos^{-1}$

$B = 29°$

Example 3: Find the perimeter of ΔDEF if D = 37°, e = 42 mm,and f = 35mm.



$d^2 = (42)^2 + (35)^2 - 2(42)(35)\cos 37°$

$\sqrt{d^2} = \sqrt{641.01}$

$d = 25.3\text{ mm}$

$P = s_1 + s_2 + s_3$

$P = e + f + d$

$P = 42 + 35 + 25.3$

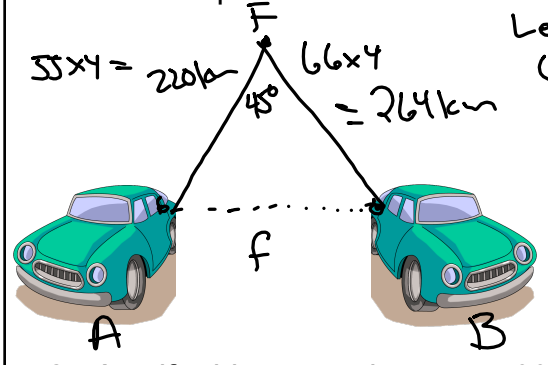
$= 102.3\text{ mm}$

Problem Solving with the Cosine Law

Approach these problems the same way that you approach sine law problems! Draw a diagram and write clear let statements, even in your homework. This way you won't forget on your test!

Practice Problems:

1. Two cars choose different sides of a fork in the road. The road diverges at 45°. The first car is going 55 km/h and the second car is going 66 km/h. How far apart will the cars be after four hours?



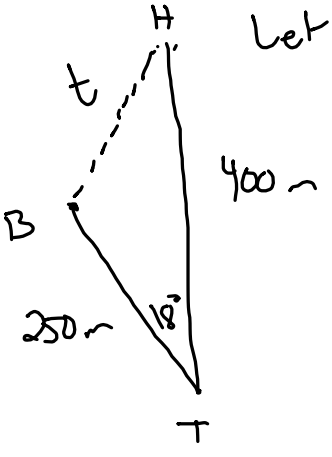
Let f be the distance between the cars.

$f^2 = 220^2 + 264^2 - 2(220)(264)\cos 45°$

$f = 189.6\text{ km}$

∴ The cars are 189.6km apart.

2. A golfer hits a tee shot on a 400 m straight golf hole. The ball is hit at an 18° angle to the left and lands 250 m from the tee. How far is the ball from the hole, to the nearest meter?



Let t be the distance to the hole.

$t^2 = 250^2 + 400^2 - 2(250)(400)\cos 18°$

$t = 179.7\text{ m}$

∴ The ball is 179.7m from the hole.