

8.2 Law of Cosines

Law of Cosines SAS, SSS

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

SSS
 $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$

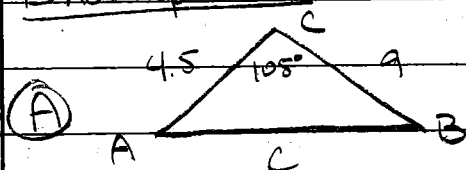
$b^2 = a^2 + c^2 - 2ac \cos B$

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

$c^2 = a^2 + b^2 - 2ab \cos C$

$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$

Example 1 Solve the triangle



$c^2 = 4.5^2 + 9^2 - 2(4.5)(9) \cos 105^\circ$

$c = 11.055$

$\cos A = \frac{4.5^2 + 11.055^2 - 9^2}{2(4.5)(11.055)}$

$A = \cos^{-1}(.6177\dots)$

$A = 51.848^\circ$

$\frac{9}{\sin 105} = \frac{11.055}{\sin A}$
 $11.055 \sin A = 9 \sin 105$

$\frac{11.055}{11.055} \sin A = \frac{9 \sin 105}{11.055}$

$A = \sin^{-1}\left(\frac{9 \sin 105}{11.055}\right)$

$51.848 + 105 + B = 180$

$B = 23.152^\circ$

$A = 51.848^\circ$

Law of Sines
 ASA
 AAS
 SSA

Calculator:
 12nd / Ans

$$\textcircled{B} \quad a = 55 \quad b = 25 \quad c = 72$$

$$\cos A = \frac{25^2 + 72^2 - 55^2}{2(25)(72)} \quad \cos B = \frac{55^2 + 72^2 - 25^2}{2(55)(72)}$$

$$A = \cos^{-1}(.77\bar{3})$$

$$B = \cos^{-1}(.95\bar{7})$$

$$\boxed{A = 39.346^\circ}$$

$$\boxed{B = 16.749^\circ}$$

$$39.346 + 16.749 + C = 180$$

$$\boxed{C = 123.905^\circ}$$

Heron's Formula Give three sides of a triangle a , b and c :

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)} \quad \text{where } s = \frac{a+b+c}{2}$$

Example 2 Use Heron's Formula to find the area
 $a = 33 \quad b = 36 \quad c = 25$

$$s = \frac{33 + 36 + 25}{2}$$

$$= 47$$

$$A = \sqrt{47(47-33)(47-36)(47-25)}$$

$$= \sqrt{159236}$$

$$= \boxed{399.044 \text{ u}^2}$$

Applications

8.2

6.6 # 106

Area of a parallelogram
 $A = bh$

