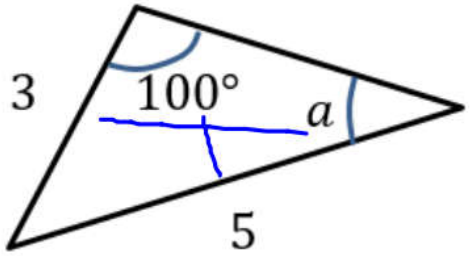
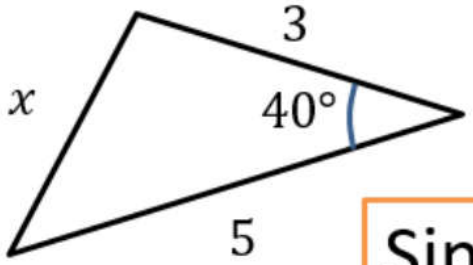
Sine or cosine rule?

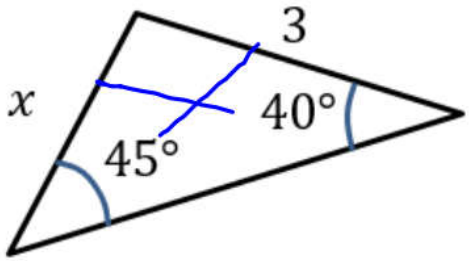
Recall that whenever we have **two "side-angle pairs"** involved, use sine rule. If there's **3 sides** involved, we can use cosine rule.

Sine | Cosine

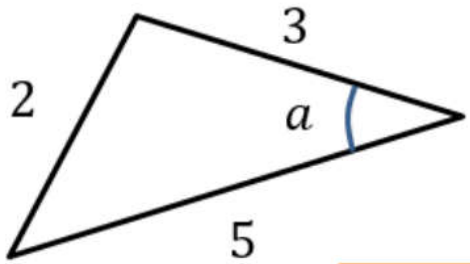




Sine | Cosine

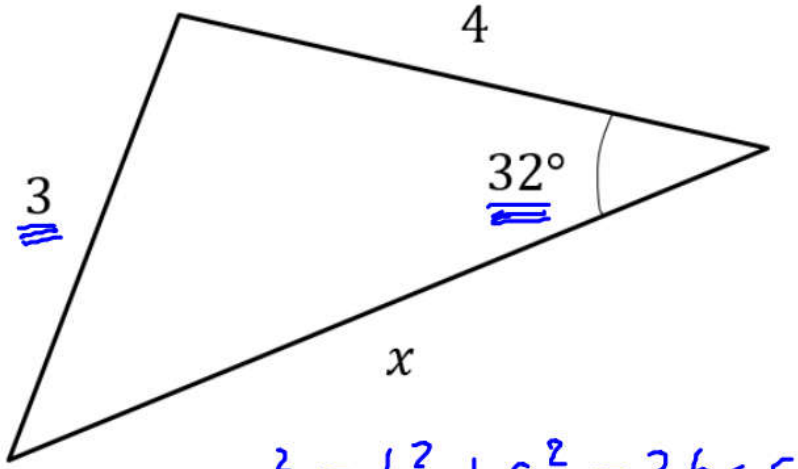


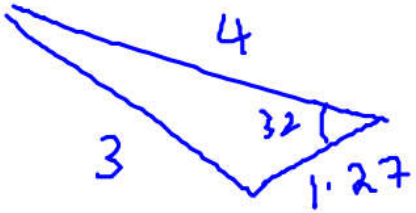
Sine | Cosine

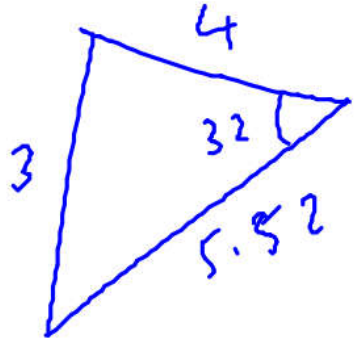


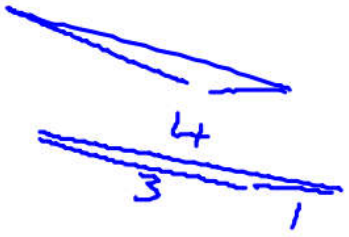
Sine | Cosine

Sine or cosine rule?









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

$3^2 = 4^2 + x^2 - 2 \times 4 \times x \times \cos 32$

$9 = 16 + x^2 - (8\cos 32)x$

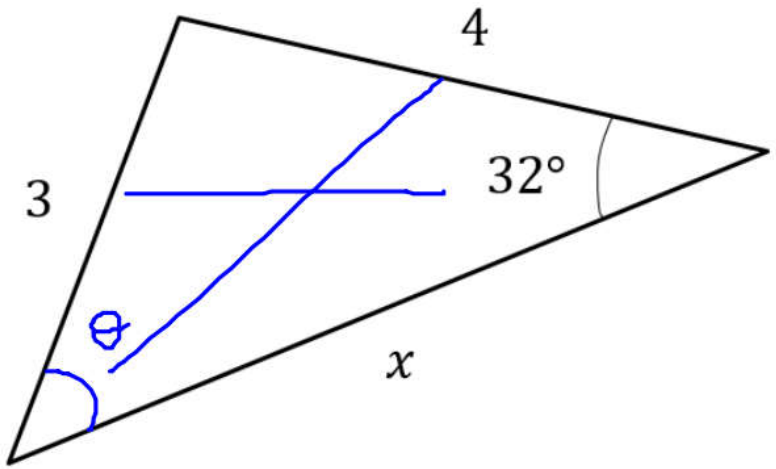
$0 = x^2 - (8\cos 32)x + 7$

$a = 1 \quad b = -8\cos 32 \quad c = 7$

$x = 5.52$ cm ✓ or $x = 1.27$ cm ✓

$x > 1$

Sine or cosine rule?

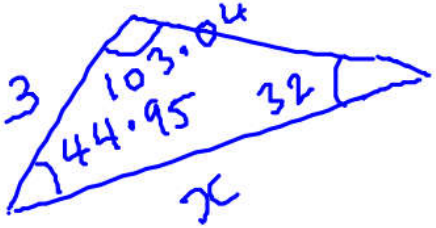


$$\frac{\sin\theta}{4} = \frac{\sin 32}{3}$$

$$\sin\theta = \frac{4\sin 32}{3}$$

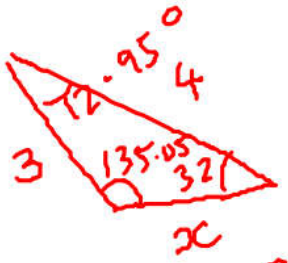
$$\theta = 44.95$$

$$\theta = 180 - 44.95$$
$$= 135.05^\circ$$



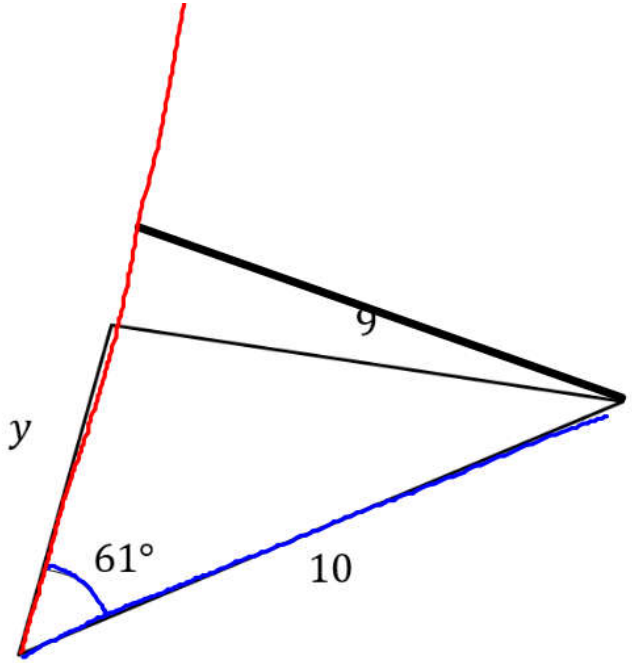
$$\frac{x}{\sin 103.04} = \frac{3}{\sin 32}$$

$$x = 5.52\text{ cm}$$



$$\frac{x}{\sin 12.95} = \frac{3}{\sin 32}$$

$$x = 1.27\text{ cm}$$



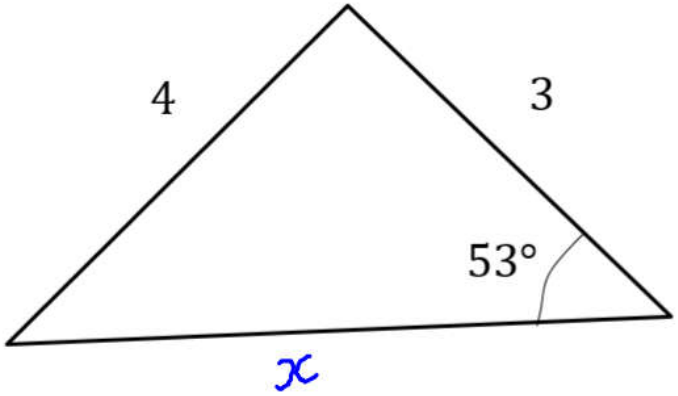
$$9^2 = y^2 + 10^2 - 2 \times y \times 10 \times \cos 61$$

$$81 = y^2 + 100 - (20\cos 61)y$$

$$0 = y^2 - (20\cos 61)y + 19$$

$$y = 6.97 \text{ or } y = 2.73$$

For our diagram $y = 2.73$cm



Find the area

$$4^2 = 3^2 + x^2 - 2 \times 3 \times x \times \cos 53$$

$$16 = 9 + x^2 - (6\cos 53)x$$

$$0 = x^2 - (6\cos 53)x - 7$$

$$x = 5.01 \text{ cm} \text{ or } -1.\text{xx cm}$$

$$\text{Area} = \frac{1}{2} \times 3 \times x \times \sin 53$$

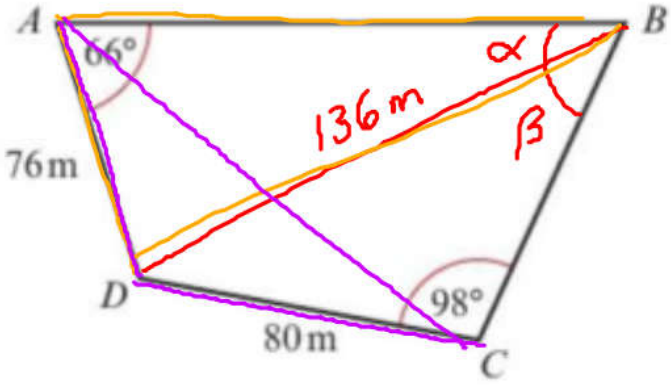
$$= 5.9999..$$

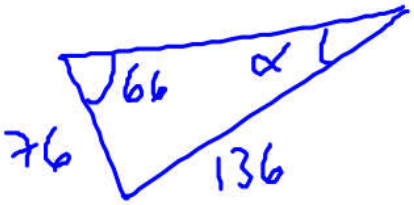
$$= 6.00 \text{ units}^2$$

10 A zookeeper is building an enclosure for some llamas.
The enclosure is in the shape of a quadrilateral as shown.
If the length of the diagonal BD is 136 m

a find the angle between the fences AB and BC

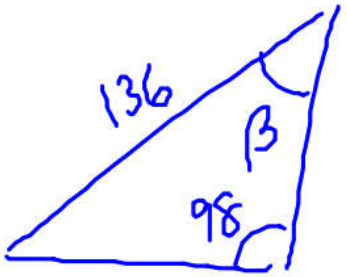
b find the length of fence AB





$$\frac{\sin\alpha}{76} = \frac{\sin 66}{136}$$

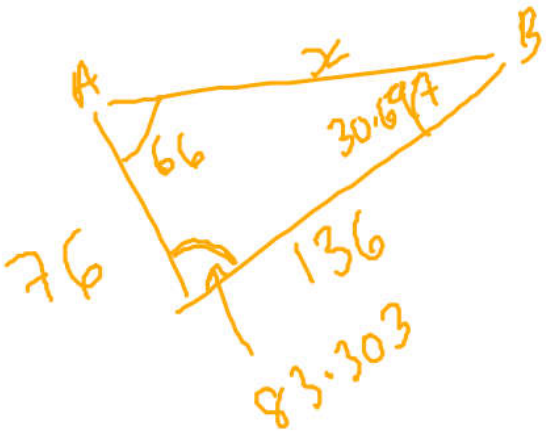
$$\alpha = 30.697...$$



$$\frac{\sin\beta}{80} = \frac{\sin 98}{136}$$

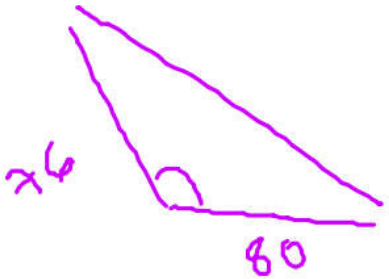
$$\beta = 35.627..^\circ$$

$$\angle ABC = \alpha + \beta$$
$$= 66.3^\circ.$$



$$x^2 = 76^2 + 136^2 - 2\times 76\times 136\times \cos 83.303^\circ$$

$$x = 148 \text{ m}.$$

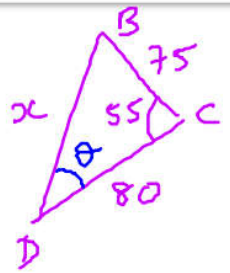


Problem Solving With Sine/Cosine Rule

The diagram shows the locations of four mobile phone masts in a field, $BC = 75\ m$.
$CD = 80m$, angle $BCD = 55°$ and angle $ADC = 140°$.
In order that the masts do not interfere with each other, they must be at least 70m apart.
Given that A is the minimum distance from D, find:

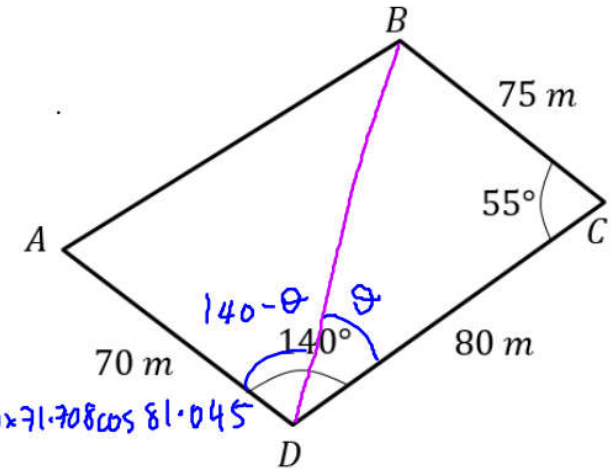
a) The distance A is from B
b) The angle BAD
c) The area enclosed by the four masts.

a)



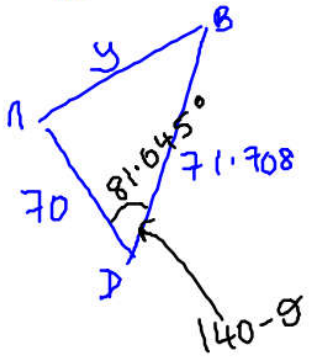
$$\frac{\sin\theta}{75} = \frac{\sin 55}{x}$$

$$\theta = 58.954\ldots$$



$$x^2 = 75^2 + 80^2 - 2\times 80\times 75\times\cos 55$$

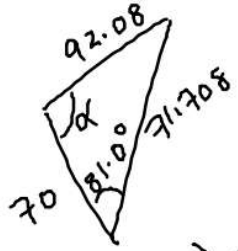
$$x = 71.708\ldots.$$



$$y^2 = 70^2 + 71.708^2 - 2\times 70\times 71.708\cos 81.045$$

$$y = 92.1\ m \quad (3sf).$$

b)



$$\frac{\sin\alpha}{71.708} = \frac{\sin 81.0}{92.08}$$

$$\alpha = 50.3°.$$

Ex 9E

c) Area is 2 triangles

$$= \frac{1}{2}\times 71.708\times 80\times\sin 58.954$$

$$+ \frac{1}{2}\times 71.708\times 70\times\sin 81.045$$

$$= 4936.6\ldots = 4940 m^2\ (3sf)$$