

### Trigonometry: The Law of Sines

The LAW OF SINES is a powerful triangle tool which is used to find missing sides or angles of ANY triangle. By matching up angles with their **opposite sides**, the equation is:

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

**Example:** Find the missing side x:

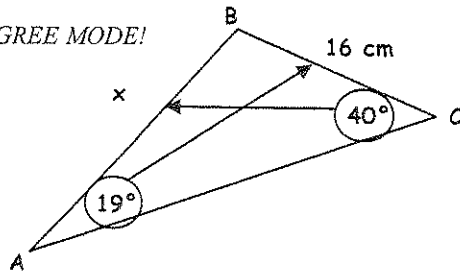
How about finding the other unknowns?

$$\frac{\sin 19^\circ}{16} = \frac{\sin 40^\circ}{x} \text{ DEGREE MODE!}$$

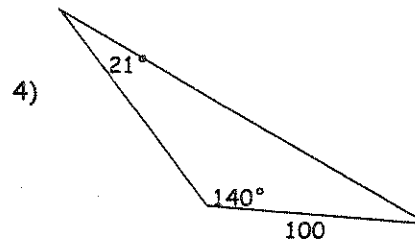
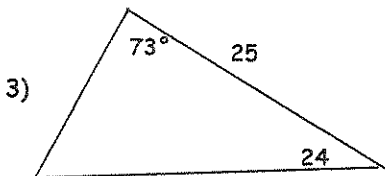
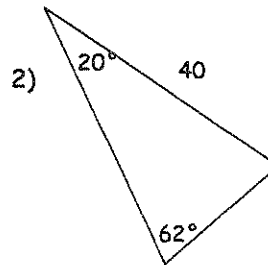
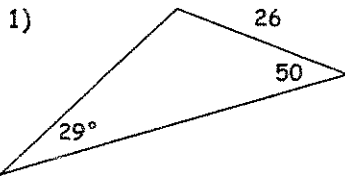
$$\frac{.326}{16} = \frac{.643}{x}$$

$$.326x = 10.288$$

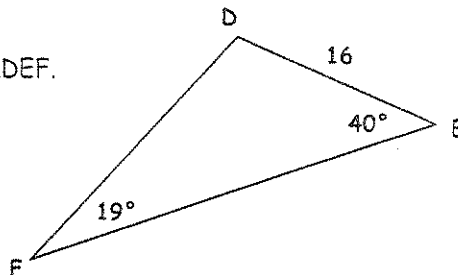
$$x = 31.56 \text{ cm}$$



Solve each triangle:



5) Find the perimeter of  $\triangle DEF$ .



The LAW OF SINES can also be used to find missing angles.

**Example:** Find the missing angle  $x$ :

$$\frac{\sin x^\circ}{36} = \frac{\sin 75^\circ}{50}$$

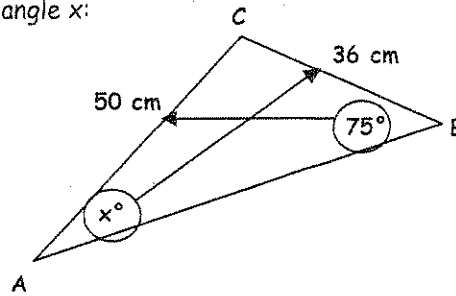
$$\frac{\sin x^\circ}{36} = \frac{.966}{50}$$

$$50(\sin x^\circ) = 34.776$$

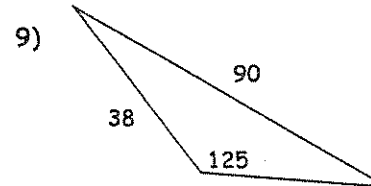
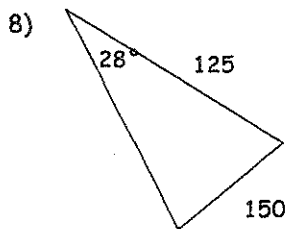
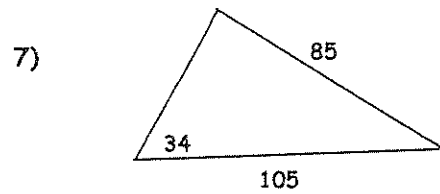
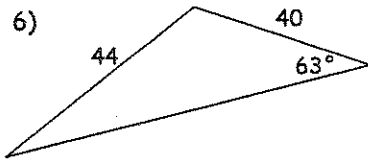
$$\sin x^\circ = .69532$$

$$x = 44^\circ \text{ (using inverse sine on your calculator)}$$

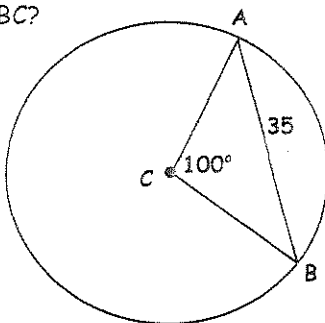
What about the other unknowns?



Solve each triangle:



10) Find the area of circle C by using the Law of Sines to find the radius. Hint: What kind of triangle is ABC?



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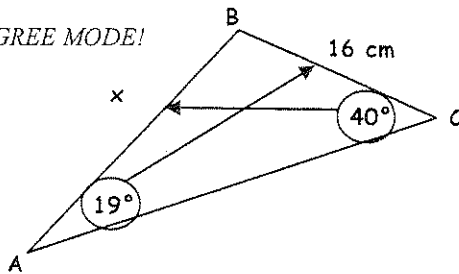
**Example:** Find the missing side x:

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$$\frac{.326}{16} = \frac{.643}{x}$$

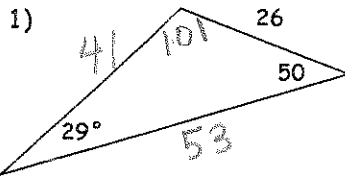
$$.326x = 10.288$$

$$x = 31.56 \text{ cm}$$



How about finding the other unknowns?

Solve each triangle:



$$\frac{\sin 101}{x} = \frac{\sin 29}{26}$$

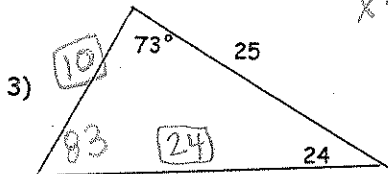
$$\sin 101(26) = \sin 29 x$$

$$\frac{\sin 101(26)}{\sin 29} = x$$

$$53 \approx x$$

$$\frac{\sin 50}{x} = \frac{\sin 29}{26}$$

$$\sin 50(26) = \sin 29 x$$



$$\frac{\sin 73}{x} = \frac{\sin 83}{25}$$

$$\sin 73(25) = \sin 83 x$$

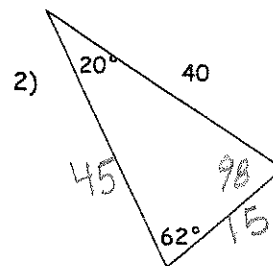
$$\frac{\sin 73(25)}{\sin 83} = x$$

$$x = \frac{\sin 50(26)}{\sin 29}$$

$$\frac{\sin 24}{x} = \frac{\sin 83}{25}$$

$$\sin 24(25) = \sin 83 x$$

$$\frac{\sin 24(25)}{\sin 83} = x$$



$$\frac{\sin 20}{x} = \frac{\sin 62}{40}$$

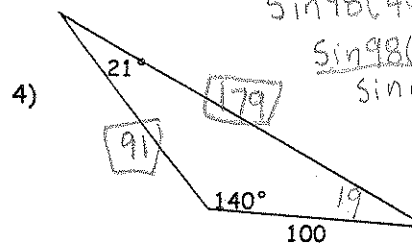
$$\sin 62 x = \sin 20(40)$$

$$x = 15$$

$$\frac{\sin 98}{x} = \frac{\sin 62}{40}$$

$$\sin 98(40) = \sin 62 x$$

$$\frac{\sin 98(40)}{\sin 62} = x$$



$$\frac{\sin 21}{100} = \frac{\sin 140}{x}$$

$$\sin 21 x = \sin 140(100)$$

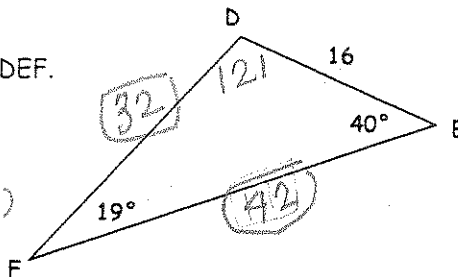
$$x = \frac{\sin 140(100)}{\sin 21}$$

5) Find the perimeter of  $\triangle DEF$ .

$$\frac{\sin 121}{x} = \frac{\sin 19}{16}$$

$$\sin 19 x = \sin 121(16)$$

$$x = \frac{\sin 121(16)}{\sin 19}$$



$$\frac{\sin 21}{100} = \frac{\sin 19}{x}$$

$$\sin 21(x) = \sin 19(100)$$

$$P = 32 + 16 + 42 = 90$$

This worksheet was adapted from <http://www.bgsd.k12.wa.us/riv/homework/Geometry/LawOfSines.doc>

$$\frac{\sin 40}{x} = \frac{\sin 19}{16}$$

$$\sin 19 x = \sin 40(16)$$

$$x = \frac{\sin 40(16)}{\sin 19}$$

The LAW OF SINES can also be used to find missing angles.

**Example:** Find the missing angle  $x$ :

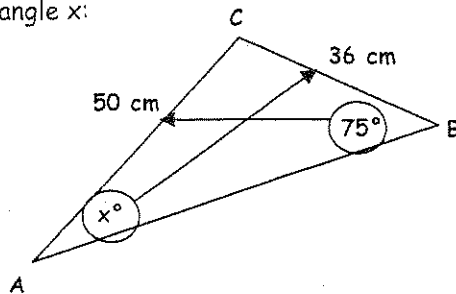
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$$\frac{\sin x^\circ}{36} = \frac{.966}{50}$$

$$50(\sin x^\circ) = 34.776$$

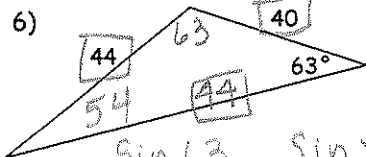
$$\sin x^\circ = .69532$$

$$x = 44^\circ \text{ (using inverse sine on your calculator)}$$



What about the other unknowns?

Solve each triangle:



$$\frac{\sin 63}{44} = \frac{\sin x}{40}$$

$$\sin x(44) = \sin 63(40)$$

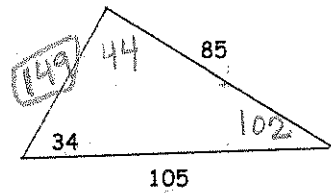
$$\sin x = \frac{\sin 63(40)}{44}$$

$$\sin x = .81000$$

$$\frac{\sin 63}{x} = \frac{\sin 63}{44}$$

$$\sin 63(44) = \sin 63 x$$

$$x = \frac{\sin 63(44)}{\sin 63}$$



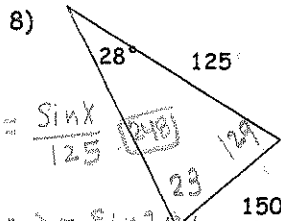
$$\frac{\sin 102}{x} = \frac{\sin 34}{85}$$

$$\frac{\sin 34}{85} = \frac{\sin x}{105}$$

$$\sin x(85) = \sin 34(105)$$

$$\sin x = \frac{\sin 34(105)}{85}$$

$$\sin x = .6908$$



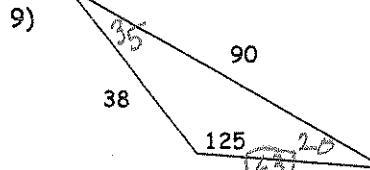
$$\frac{\sin 28}{150} = \frac{\sin x}{125}$$

$$\sin x(150) = \sin 28(125)$$

$$\sin x = \frac{\sin 28(125)}{150}$$

$$\sin x = .3912$$

$$\frac{\sin 129}{x} = \frac{\sin 28}{150}$$



$$\frac{\sin 125}{90} = \frac{\sin 35}{x}$$

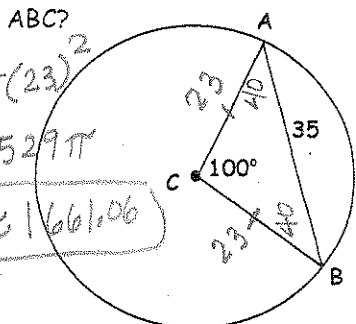
$$\frac{\sin 125}{90} = \frac{\sin x}{38}$$

$$\sin x(90) = \sin 125(38)$$

$$\sin x = .3459$$

$$x \approx 20$$

10) Find the area of circle C by using the Law of Sines to find the radius. Hint: What kind of triangle is ABC?



$$A = \pi(23)^2$$

$$A = 529\pi$$

$$A \approx 1661.06$$

$$\frac{\sin 40}{x} = \frac{\sin 100}{35}$$

$$\sin 100 x = \sin 40(35)$$

$$x = \frac{\sin 40(35)}{\sin 100}$$