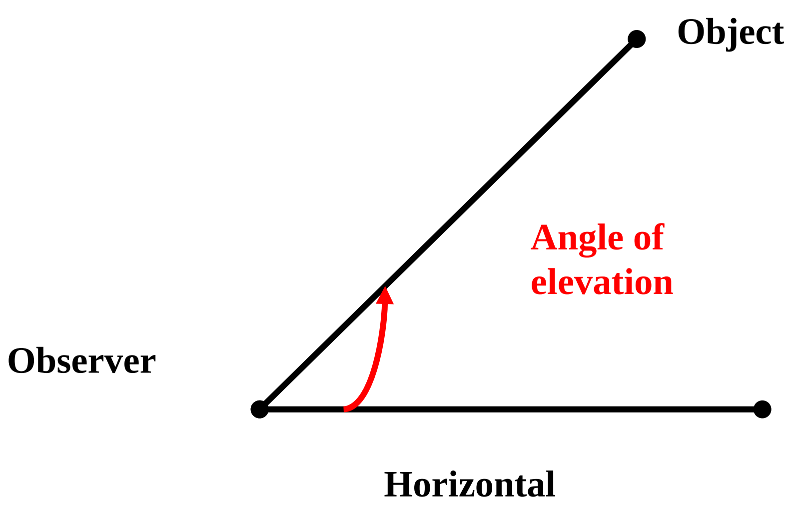
4.8 Trigonometric Applications and Models

Objectives:

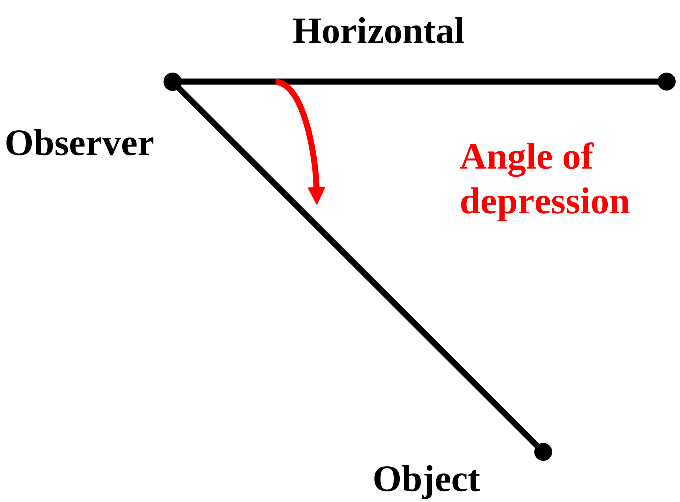
- Use right triangles to solve real-life problems.
- Use directional bearings to solve real-life problems.
- Use harmonic motion to solve real-life problems.

Terminology

- **Angle of elevation** – angle from the horizontal upward to an object.

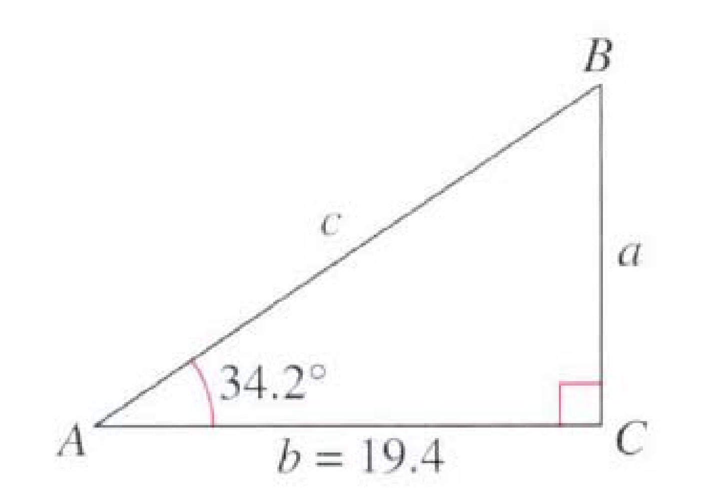


- **Angle of depression** – angle from the horizontal downward to an object.



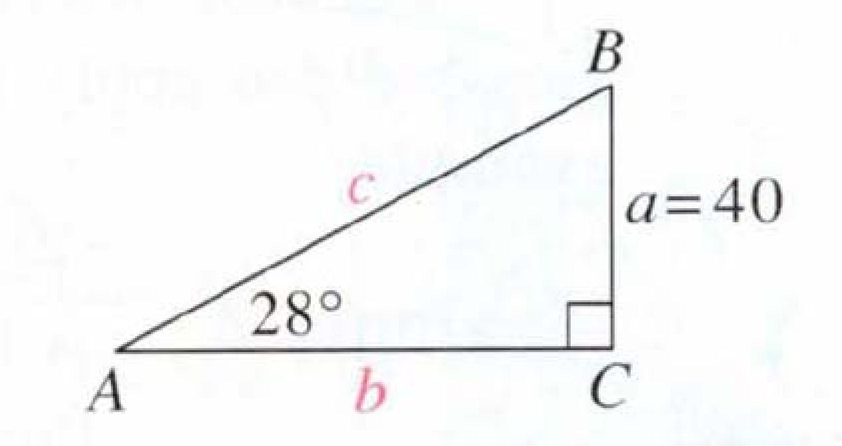
Example

- *Solve the right triangle for all missing sides and angles.*



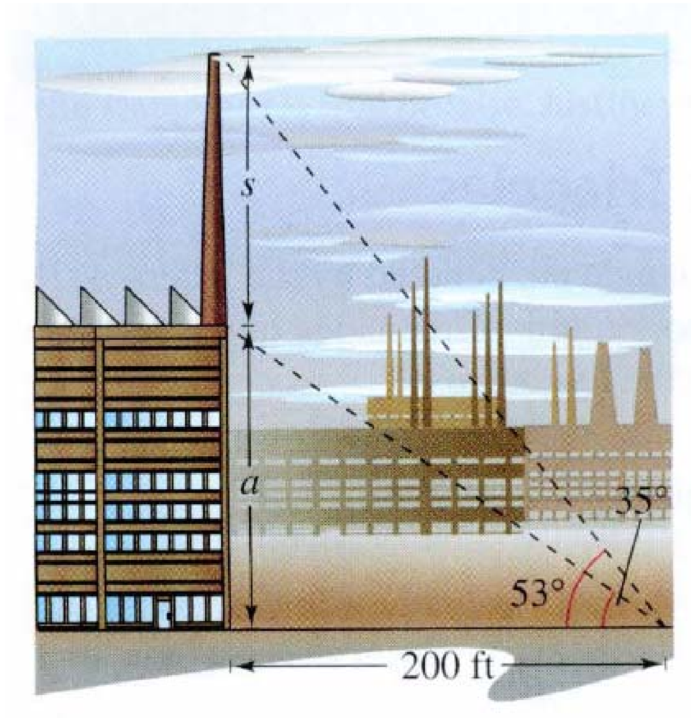
You Try

- *Solve the right triangle for all missing sides and angles.*



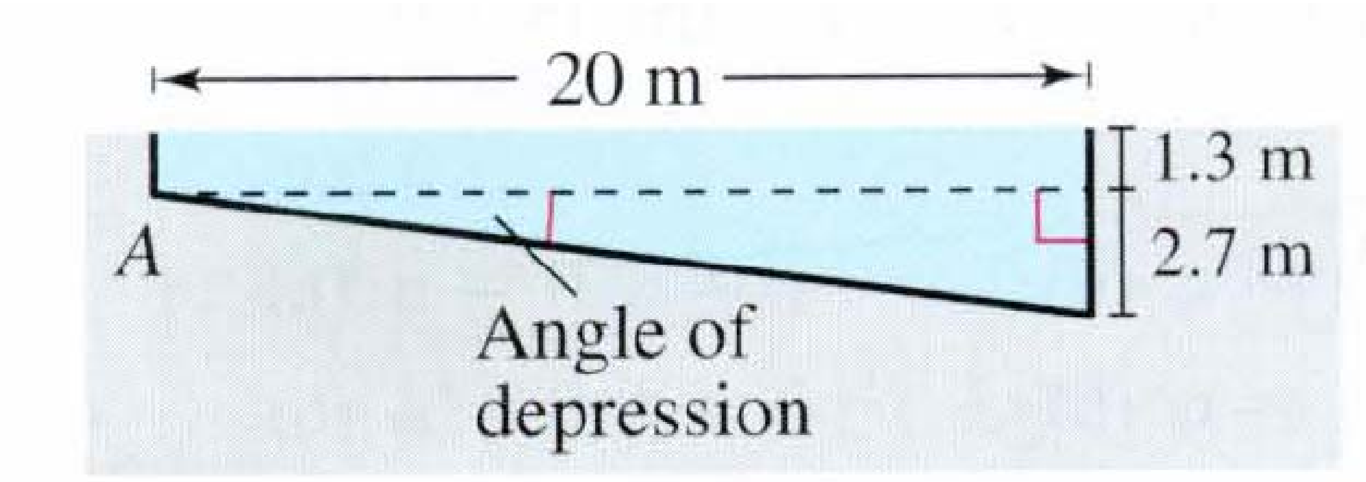
Example – Solving Rt. Triangles

At a point 200 feet from the base of a building, the angle of elevation to the bottom of a smokestack is 35°, and the angle of elevation to the top of the smokestack is 53°. Find the height of the smokestack.



You try:

- *A swimming pool is 20 meters long and 12 meters wide. The bottom of the pool is slanted so that the water depth is 1.3 meters at the shallow end and 4 meters at the deep end, as shown. Find the angle of depression of the bottom of the pool.*

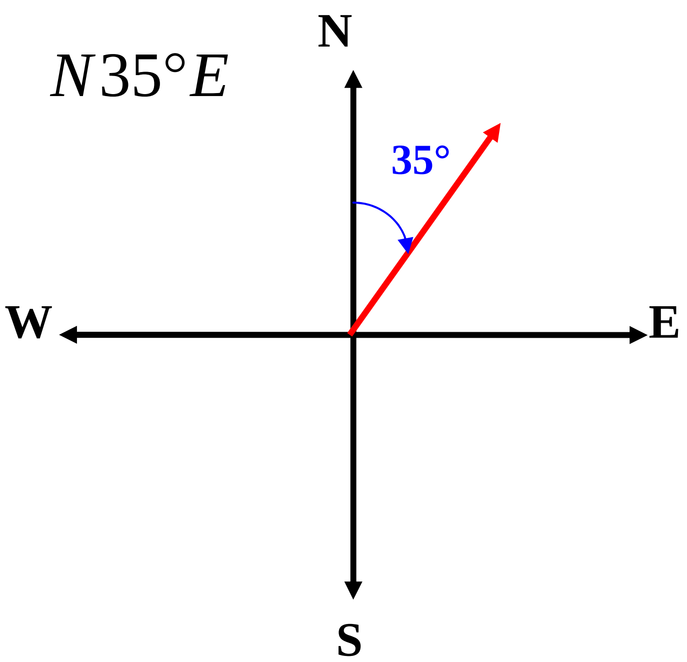


7.69°

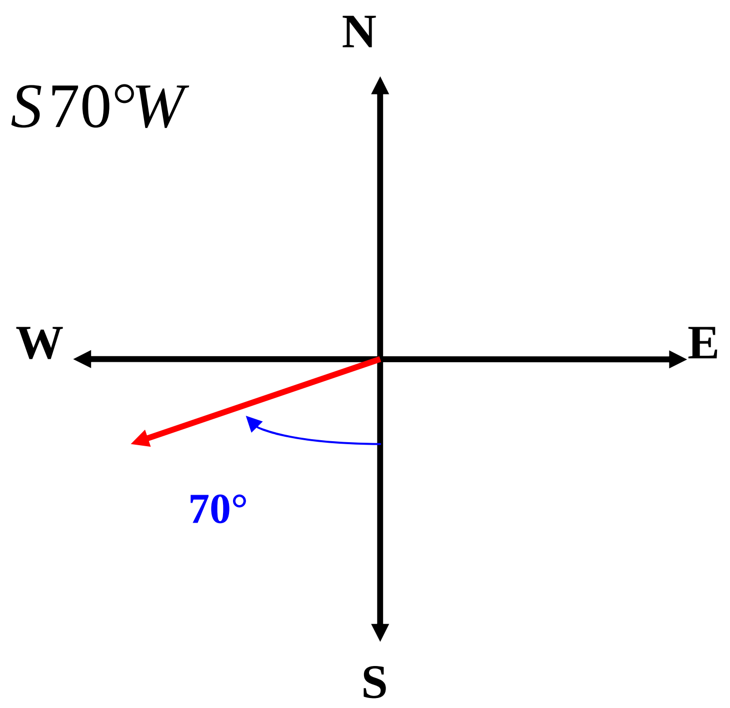
Trigonometry and Bearings

- *In surveying and navigation, directions are generally given in terms of bearings. A bearing measures the acute angle that a path or line of sight makes with a fixed north-south line.*

$N35°E$



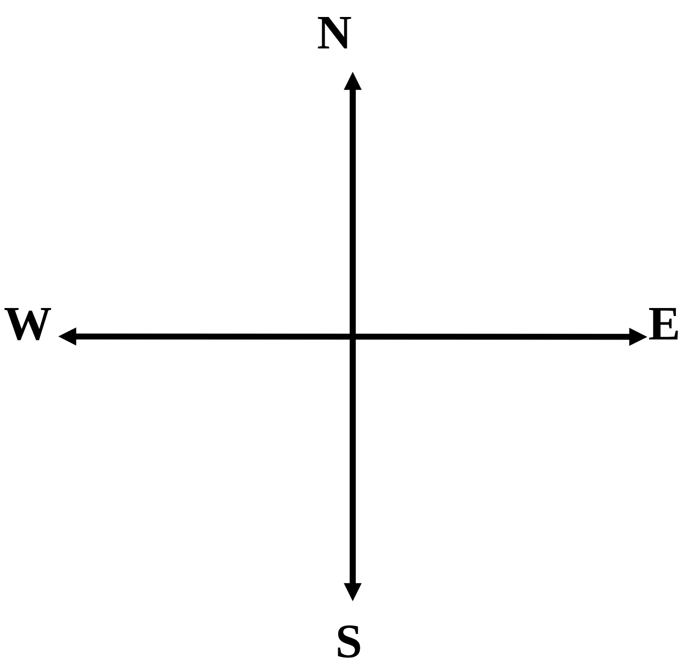
$S70°W$



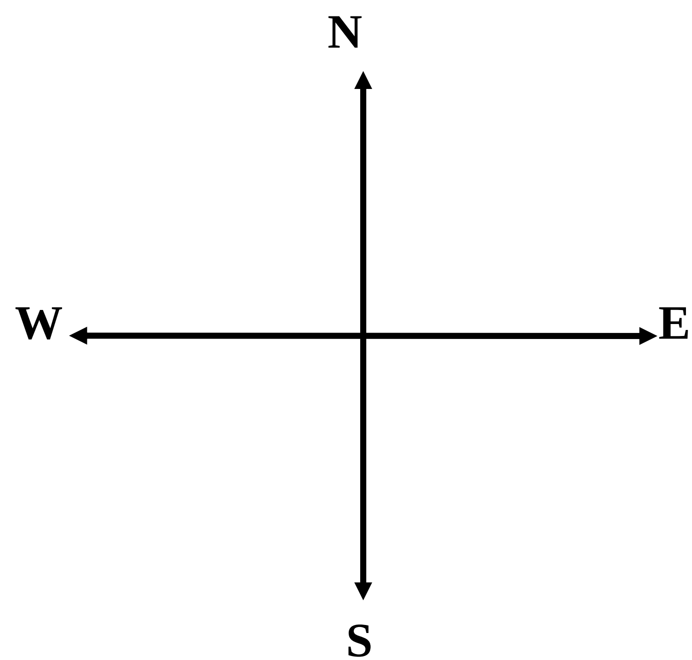
Trig and Bearings

- *You try. Draw a bearing of:*

$N80^0W$



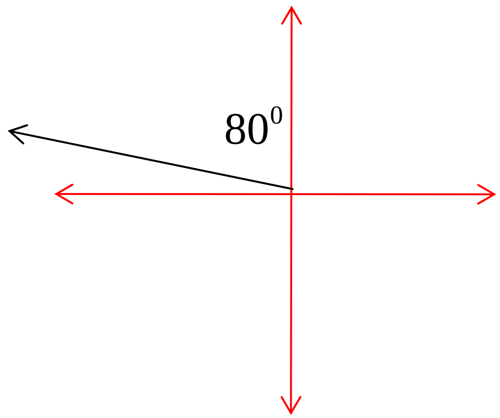
$S30^0E$



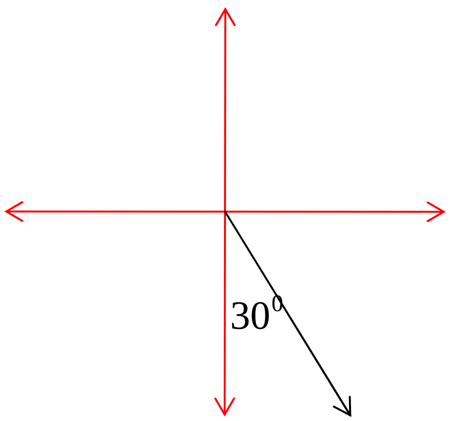
Trig and Bearings

- *You try. Draw a bearing of:*

N80⁰W



S30⁰E

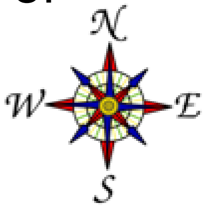


Example – Finding Directions Using Bearings

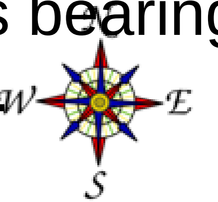
- A hiker travels at 4 miles per hour at a heading of S 35° E from a ranger station. After 3 hours how far south and how far east is the hiker from the station?

Example – Finding Directions Using Bearings

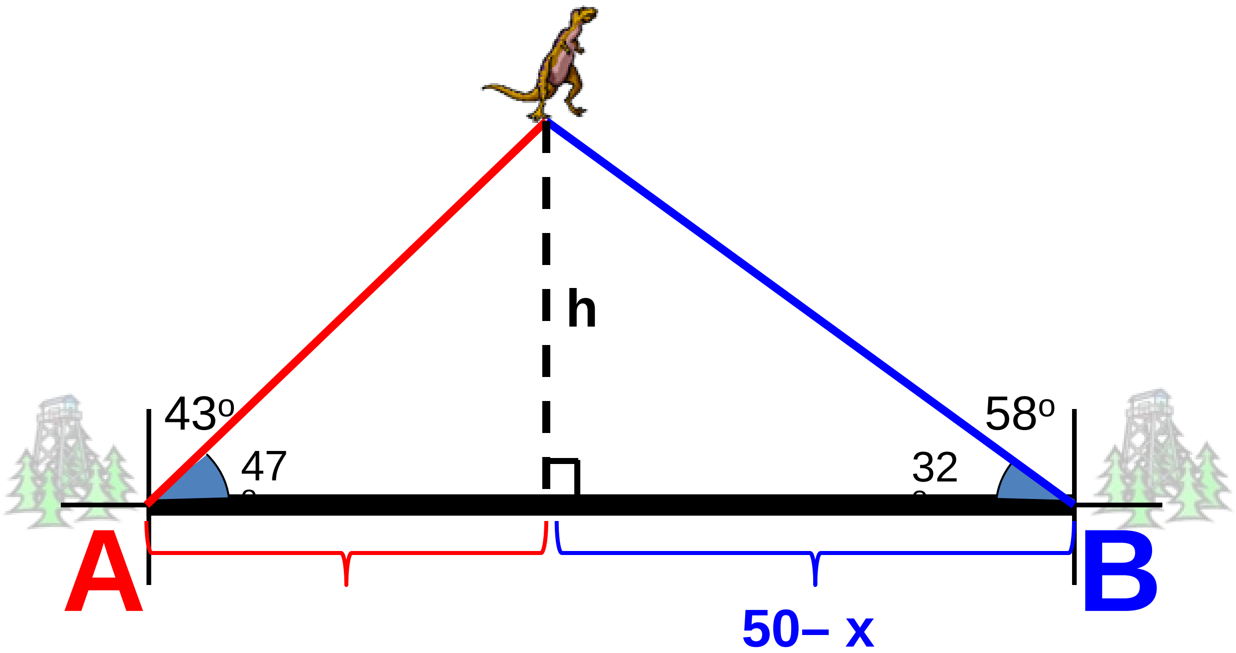
A ship leaves port at noon and heads due west at 20 knots, or 20 nautical miles (nm) per hour. At 2 P.M. the ship changes course to N 54^o W. Find the ship's bearing and distance from the port of departure at 3 P.M.



A ship leaves port at noon and heads due west at 20 knots, or 20 nautical miles (nm) per hour. At 2 P.M. the ship changes course to N 54^o W. Find the ship's bearing and distance from the port of departure at 3 P.M.



Two lookout towers are 50 kilometers apart. Tower A is due west of tower B. A roadway connects the two towers. A dinosaur is spotted from each of the towers. The bearing of the dinosaur from A is N 43^o E. The bearing of the dinosaur from tower B is N 58^o W. Find the distance of the dinosaur to the roadway that connects the two towers.

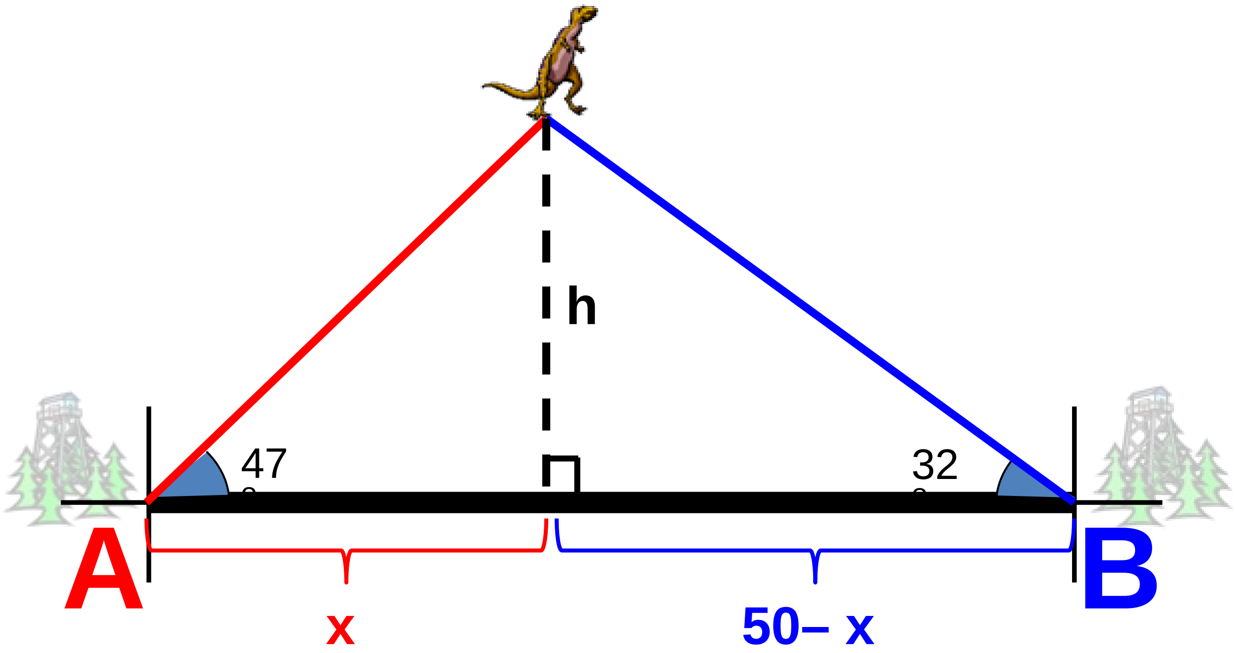


$$\tan(47^o) = \frac{h}{x}$$

$$x \cdot \tan(47^o) = h$$

$$\tan(32^o) = \frac{h}{50 - x}$$

$$(50 - x)\tan(32^o) = h$$



$$x \cdot \tan(47^o) = h$$

$$(50 - x)\tan(32^o) = h$$

$$x \cdot \tan(47^o) = (50 - x)\tan(32^o)$$

$$x \cdot \tan(47^o) = 50\tan(32^o) - x\tan(32^o)$$

$$x \cdot \tan(47^o) + x\tan(32^o) = 50\tan(32^o)$$

$$x\left[\tan(47^o) + \tan(32^o)\right] = 50\tan(32^o)$$

$$x = \frac{50\tan(32^o)}{\tan(47^o) + \tan(32^o)}$$

$$\frac{50\tan(32^o)}{\tan(47^o) + \tan(32^o)} \cdot \tan(47^o) = h$$

$$19.741 = h$$

19.741 km

Two lookout towers spot a fire at the same time. Tower B is Northeast of Tower A. The bearing of the fire from tower A is N 33^o E and is calculated to be 45 km from the tower. The bearing of the fire from tower B is N 63^o W and is calculated to be 72 km from the tower. Find the distance between the two towers and the bearing from tower A to tower B.