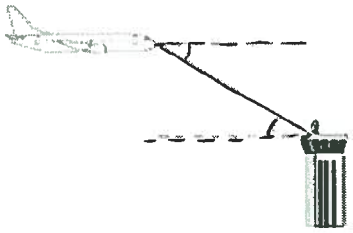
Section 11.2 Applications of Right-angled Triangle Trigonometry

Angles of Elevation & Depression
Remember… these angles are always congruent…



∠1 is the angle of depression from the airplane to the building. (always goes down FROM horizontal)

∠2 is the angle of elevation from the building to the airplane. (always goes up FROM horizontal)

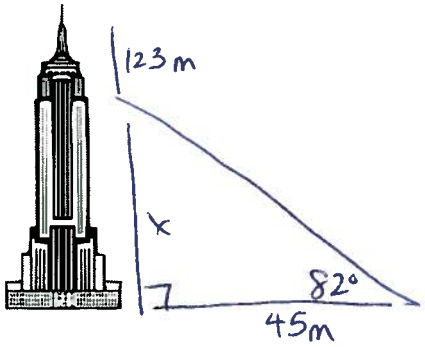
Example: Mr Kaiser was standing 45 meters from the base of the Empire State Building. He estimated that the angle of elevation to the top of the 86th floor (the observatory) is 82°. If the total height of the building is another 123 meters above the 86th floor, what is the approximate height of the building?

$\tan 82 = \frac{x}{45}$

$x = 320.19\text{ m}$

$+ 123$

443.19 meters



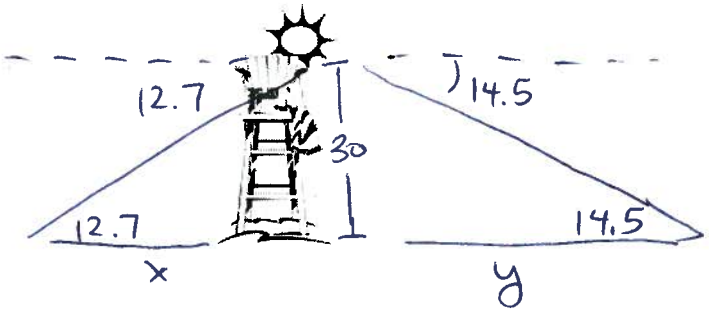
Example: Two swimmers are observed by a lifeguard in a 30-foot tower above the water. One swimmer was to the right and one was to the left. The angles of depression from the lifeguard to each swimmer are 12.7° and 14.5°. How far apart are the swimmers?

$\tan 12.7 = \frac{30}{x}$

$x = 133.1$

$\tan 14.5 = \frac{30}{y}$

$y = 116.0$



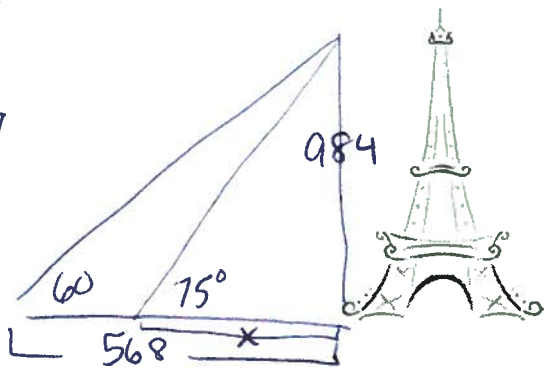
$x + y =$

249.1 feet

Example: Mrs. Hott and Mrs. Haley took a trip to Paris together. Mr. Kaiser had to stay home and prepare stuff for IB (Ha, Ha!) The Eiffel Tower is approximately 984 feet tall. They observed the angle of elevation to the top of the tower was 60° when they were 568 feet away. Later they observed the angle of elevation to the top of the tower to be 75°. How much closer were they now to the tower than they were earlier in the day?

$\tan 75 = \frac{984}{x}$

$x = 263.7$

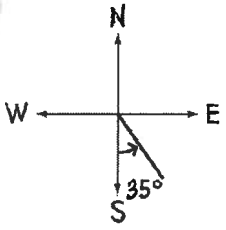


How much closer?

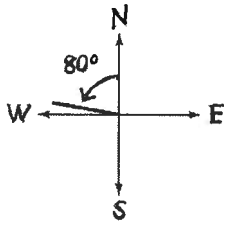
$568 - 263.7$

304.3 feet closer

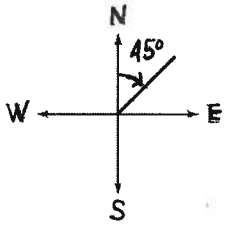
In surveying and navigation, directions are generally given in terms of bearings. An example of a bearing using compass points is N 70°E, read "70 degrees east of north." The first letter must be N or S (for due North/South), the last letter must be W or E (for due West/East), and the angle measure must be acute.



S 35°E



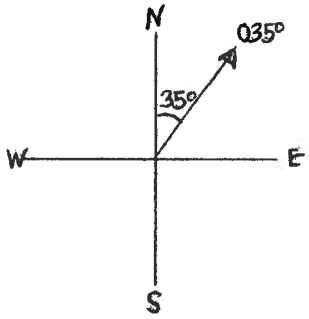
N 80° W



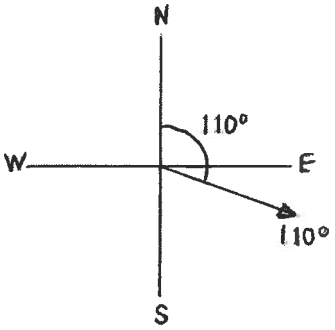
N 45° E or just NE

Directions simply given with three-figure bearings are measured in degrees *clockwise* from north.

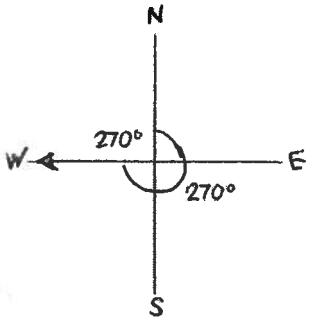
035° means 35° clockwise from North



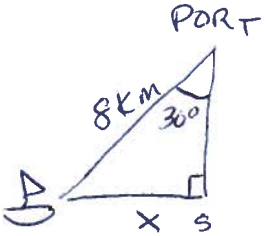
110° means 110° clockwise from North



270° means 270° clockwise from North. This would be the same as 'due west'



Example: A boat sails from a certain port in the direction S 30° W. After the boat has sailed 8 km, how far is it due west of the port?



$\sin 30 = \frac{x}{8}$

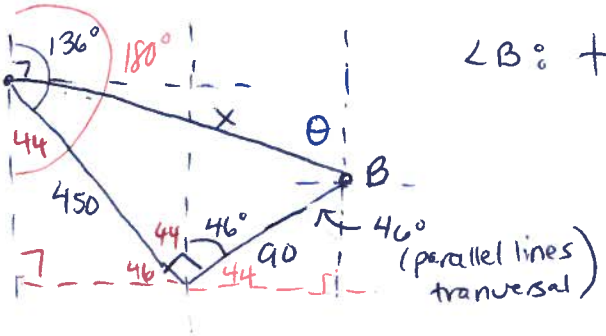
$\frac{1}{2} = \frac{x}{8}$

$x = 4$ km

Example: A pilot flies a plane from airport A at a bearing of 136°, traveling at an average speed of 180 mph for two and a half hours. At the end of the two and a half hours the pilot changes directions and continues to fly at the same speed for another half an hour at a bearing of 46° to airport B. The pilot then flies directly back from airport B to airport A. What is the distance between the two airports and what bearing must the pilot take to return to airport A?

180 mph × 2.5 = 450 miles

180 mph × .5 = 90 miles



$\angle B$: $\tan B = \frac{450}{90}$

$B = 78.7°$

$46 + 78.7 = 124.7$

$\theta = 180 - 124.7$

55.3

Distance from B to A:

$450^2 + 90^2 = x^2$

$x \approx 459$ miles

Bearing N 55.3° W

or $180 + 124.7 = 304.7°$

Exercise 11C