Section 9.1 – Applications Involving Right Triangles

For the duration of this class, we will label the sides and angles of triangles so that the angles are in CAPITAL letters and the sides are in lowercase letters, and each side will bear the same letter as the angle opposite it. Notice in the figure to the right that side "a" is opposite angle "A" and side "b" is opposite angle "B". And, as with any right triangle, \(a^2 + b^2 = c^2\), and since the sum of all angles must equal 180°, and the right angle is 90°, then the other two angles must add up to 90° (\(A + B = 90°\)).

Example: Use the given information to solve the triangle.

a) \(b = 4, B = 10°\); find \(a, c\), and \(A\).

Since \(B = 10°\), then \(A = 90° - 10° = 80°\) → \(A = 80°\)

\[
\sin B = \frac{b}{c} \rightarrow \sin(10°) = \frac{4}{c} \rightarrow c = \frac{4}{\sin(10°)} \rightarrow c \approx 23.04
\]

\[
\tan B = \frac{b}{a} \rightarrow \tan(10°) = \frac{4}{a} \rightarrow a = \frac{4}{\tan(10°)} \rightarrow a \approx 22.69
\]

We could have used any of the trig functions with angle \(A\) or \(B\) to find the values of \(a\) and \(c\). For instance, we could have said \(\cos A = \frac{b}{c}\) to find \(c\) or \(\sin A = \frac{a}{c}\), so the trig functions and angles I chose to use were arbitrary.

b) \(a = 2, b = 8\); find \(c, A\), and \(B\).
APPLICATIONS IN NAVIGATION AND SURVEYING

In navigation and surveying, the "direction" or "bearing" is the acute angle between any point and the north-south line. The angles are labeled as North-or-South(degree measurement)East-or-West. For example, P4 in the figure to the right would be labeled as _____________________________.

Remember that, unlike a typical coordinate system, you are measuring the angle from the vertical, not the horizontal!

Example: #30) Finding the Bearing of a Ship

A ship leaves the port of Miami with a bearing of S80°E and a speed of 15 knots. After 1 hour, the ship turns 90° toward the south. After 2 hours, maintaining the same speed, what is the bearing to the ship from port?

Since the ship sailed for 1 hour at the initial bearing and sailed 2 hours at the second bearing, and since it has gone the same speed the entire time, then the distance traveled is twice as far at the second bearing as it was at the first.