SECTION 4.8: APPLICATIONS

PART A: WORD PROBLEMS

We did a word problem in Notes 4.32. Some tips:

• Read the problem carefully. Underline, highlight, or summarize key pieces of information so that you don't have to keep rereading the entire problem.

• Define variables, draw and label diagrams, draw tables, etc. Visual aids often help.

> In Calculus: You will need to distinguish between aspects of the problem that remain fixed (or constant) and aspects that change.

• Make appropriate unit conversions. For example, if lengths are given in both inches and feet, make sure you use only inches or only feet when you draw diagrams and write equations.

• Sometimes, the problem gives you "red herrings" – information that does not help you solve the problem. Ignore them.

• Make sure you clearly indicate the answer(s) to the question(s) you are asked, especially if your work is messy.

• Make sure you answer **all** the questions you are asked.

• Sometimes, x does not represent your final answer. You may need to use some variation, such as $x+10$. (For example, maybe the length of a rectangle is 10 feet longer than the width (x), and you're supposed to give the length.)

• You are typically expected to give exact answers in a math class. However, on word problems, you may be asked to round off answers to a particular number of decimal places or significant digits. Avoid approximating anything until the end. You don't want to compromise the accuracy of your final answer by introducing inappropriate roundoff errors. The memory key on your calculator may be helpful. If you do round off intermediate results, use many significant digits.

• Write units where appropriate. If, for example, both feet and inches are given in a problem, make sure you know which one you have been dealing with.

• See if your answer makes sense.

• Be prepared to write your conclusions in plain English.

PART B: SOLVING RIGHT TRIANGLES

If you know two sides (i.e., side lengths) of a right triangle, or if you know one side and one of the acute angles of a right triangle, then you can "solve" the triangle, meaning that you can find all of the remaining side lengths and angles.

Tools

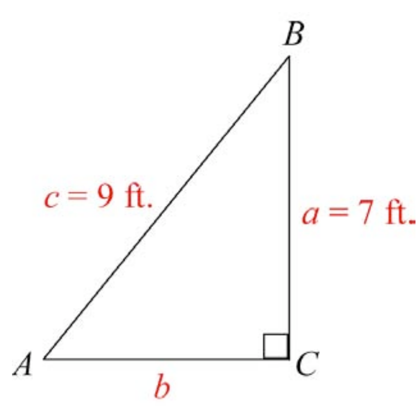
• The sum of the interior angles of a triangle is 180°, or π radians.
A right triangle has a right angle and two acute (and complementary) angles.

• The Pythagorean Theorem

• SOH-CAH-TOA

Example

Solve the triangle below. Round off Angles A and B to the nearest degree.



Observe that a "faces" A, b faces B, and c (the hypotenuse) faces C (the right angle). This is conventional.

Warning: If a had been given as 84 inches, convert units!

Solution

We are given a and c, and we know C is a right angle.
We must find b, A, and B.

Since we know two sides of a right triangle, we can use the Pythagorean Theorem to find the third side.

$$a^2 + b^2 = c^2$$
$$(7)^2 + b^2 = (9)^2$$
$$49 + b^2 = 81$$
$$b^2 = 32$$
$$b = \pm\sqrt{32}$$
$$\text{Take } b = \sqrt{32} \qquad (\text{Take the positive root.})$$
$$b = \sqrt{16 \cdot 2}$$
$$\boldsymbol{b = 4\sqrt{2}} \textbf{ ft.} \qquad (\text{Write units where appropriate.})$$

Let's find Angle A, which is an acute angle such that $\sin A = \frac{7}{9}$.

A is $\sin^{-1}\left(\frac{7}{9}\right)$. In degrees, this is about 51°.

$\boldsymbol{A \approx 51^\circ}$

Angle B is the complement of Angle A.

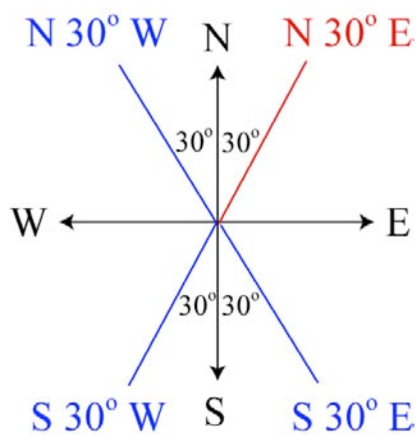
$B \approx 90^\circ - 51^\circ$

$\boldsymbol{B \approx 39^\circ}$

PART C: BEARING AND NAVIGATION

See p.334.

An example of a bearing is N 30° E. The first letter must be N (for due north) or S (for due south), the last letter must be W (for due west) or E (for due east), and the angle measure in the middle must be acute. N 30° E is read "30 degrees east of north." The corresponding direction is a northeasterly direction (indicated in red below) that makes a 30° angle with the direction corresponding to due north. Other related directions of interest are indicated in blue.



In air navigation, bearings are measured clockwise from due north.
For example, N 30° E corresponds to simply 30°, but S 30° E corresponds to 150°: