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/*  SSS_Basic.cpp

    This program solves the side-side-side ( SSS ) problem in trigonometry.

    More specifically, if the lengths of three sides of a triangle are known,
    this program will solve for the three angles.

    Units:  The units of input for the three side lengths is actually
    unimportant, so long as all three sides are given in the same units.
    This program reports results in both radians and degrees.

    Written August 2011 by John Bell, as a sample solution to HW1 for CS 109

    This version fulfills the basic assignment, without any optional
    enhancements.

*/

#include <iostream>       // For input and output
#include <cmath>          // For sines and cosines, etc.

using namespace std;      // For easy use of cin and cout

int main( void ) {

    // First to declare necessary variables.

    double sideA, sideB, sideC;             // 3 sides, any dimensions
    double angleA, angleB, angleC;              // in radians
    double angleA_deg, angleB_deg, angleC_deg; // in degrees
    double numerator, denominator;             // For use in cosine law

    // Next to explain the program to the user

    cout << "\nWelcome to program SSS_Basic.\n\n";
    cout << "Written August 2011 by John Bell, jbell, for CS 109.\n\n";
    cout << "This program will find the three angles of a triangle,\n";
    cout << "given the lengths of the three sides.\n\n";
    cout << "Input can be given in any consistent units.\n";
    cout << "Results are reported in both radians and degrees.\n\n";

    // Now get input from the user.  No error checking in this version.

    cout << "Please enter the length of the longest side: ";
    cin >> sideC;
    cout << "Now please enter the length of the second side: ";
    cin >> sideA;
    cout << "And finally, please enter the length of the third side: ";
    cin >> sideB;

    // First calculate angle C using the cosine law

    numerator = sideA * sideA + sideB * sideB - sideC * sideC;
    denominator = 2.0 * sideA * sideB;
    angleC = acos( numerator / denominator );

    // Next calculate angles A and B using the sine law

    angleA = asin( sideA / sideC * sin( angleC ) );
    angleB = asin( sideB / sideC * sin( angleC ) );
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    // Convert angles from radians to degrees

    angleA_deg = angleA * 180.0 / M_PI;  // M_PI defined in <cmath>
    angleB_deg = angleB * 180.0 / M_PI;
    angleC_deg = angleC * 180.0 / M_PI;

    // And finally, echo input and report results.
    // No formatting in this version.

    cout << "\n\nHere are your results:\n\n";
    cout << " Side                  Opposing Angle\n";
    cout << "Length        ( radians )       ( degrees )\n";
    cout << " " << sideC << "\t\t" << angleC << "\t\t" << angleC_deg << endl;
    cout << " " << sideA << "\t\t" << angleA << "\t\t" << angleA_deg << endl;
    cout << " " << sideB << "\t\t" << angleB << "\t\t" << angleB_deg << endl
         << endl;

    // Tha tha tha that's all folks !

    system( "PAUSE" );    // Only needed for Dev C++

    return 0;

} // main
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