

1. Years that are evenly divisible by 400 or are evenly divisible by 4 but not by 100 are leap years. For example, because 1600 is evenly divisible by 400, 1600 was a leap year. Similarly, because 1988 is evenly divisible by 4 but not by 100, it was also a leap year. Using this information, write a C++ function that accepts the year as user input and returns a 1 if the passed year is a leap year or a 0 if it isn't..
2. Write a C++ function named `fracpart()` that returns the fractional part of any number passed to it. For example, if the number 256.879 is passed to `fracpart()`, the number 0.879 should be returned.
3. The following is an extremely useful programming algorithm for rounding a real number to  $n$  decimal places:

Step 1: Multiply the number by  $10^n$

Step 2: Add 0.5

Step 3: Delete the fractional part of the result

Step 4: Divide by  $10^n$

For example, using this algorithm to round the number 78.374625 to three decimal places yields:

Step 1:  $78.374625 \times 10^3 = 78374.625$

Step 2:  $78374.625 + 0.5 = 78375.125$

Step 3: Retaining the integer part = 78375

Step 4: 78375 divided by  $10^3 = 78.375$

Using this algorithm, write a C++ function that accepts a user-entered value and returns the result rounded to two decimal places.

4. One major source of electricity is hydroelectric generation, in which flowing water is redirected to turn a turbine generator. The power generated by this water flow is given by this formula:

$$P = \rho \times Q \times H \times g$$

P is the power generated by the water flow (watts = J/s = kg-m<sup>2</sup>/s<sup>2</sup>-1/s).

$\rho$  is the water density (kg/m<sup>3</sup>)

Q is the volume flow rate (m<sup>3</sup>/s).

g is the acceleration caused by gravity (9.81 m/s<sup>2</sup>).

H is the distance (in m) water falls on its way to the generator, known as the head.

Using this formula, write a C++ function named `powerGen()` that accepts two doubleprecision arguments (one for the head distance and one for the water flow) and returns the power generated in watts.

5. The volume, V, of a cylinder is given by this formula:

$$V = \pi r^2 L$$

r is the cylinder's radius, and L is its length. Using this formula, write a C++ function named `cylvol()` that accepts a cylinder's radius and length and returns its volume.

6. The side surface area, S, of a cylinder is given by this formula:

$$S = 2\pi r l$$

r is the cylinder's radius, and l is its length. Using this formula, write a C++ function named `surfarea()` that accepts a cylinder's radius and length and returns its side surface area.

7. Write a function named `rightTriangle()` that accepts the lengths of two sides of a right triangle as the arguments `a` and `b`. The subroutine should determine and return the hypotenuse, `c`, of the triangle. (Hint: Use Pythagoras' theorem,  $c^2 = a^2 + b^2$ .)
8. Write a C++ program that accepts the rectangular coordinates of two points (`x1`, `y1`) and (`x2`, `y2`), calculates the distance of each point from the origin, and calculates the distance between the two points. The distance, `d`, between two points is given by this formula:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

9. Write a program to simulate the roll of two dice. If the total of the two dice is 7 or 11, you win; otherwise, you lose. Embellish this program as much as you like, with betting, different odds, different combinations for win or lose, stopping play when you have no money left or reach the house limit, displaying the dice, and so forth. (Hint: Calculate the dots showing on each die with the expression `dots = (int)(6.0 * random number + 1)`, where the random number is between 0 and 1.)
10. Euclid's method for finding the greatest common divisor (GCD) of two positive integers consists of the following steps: Step 1: Divide the larger number by the smaller and retain the remainder. Step 2: Divide the smaller number by the remainder, again retaining the remainder. Step 3: Continue dividing the previous remainder by the current remainder until the remainder is zero, at which point the last non-zero remainder is the GCD.