1. Design, write, compile, and run a program that determines the work, W, performed by a piston engine providing a force of 1000 N over a distance of 15 centimeters. The following formula is used to determine the work performed:

$$W = F \times d$$

F is the force provided by the piston in Newtons.
d is the distance the piston moves in meters.

2. Design, write, compile, and run a C++ program that calculates and displays the velocity of water flowing out of the tube shown in Figure 2.19. The velocity of water flowing into the tube is 1 ft/sec, the input tube radius is 0.75 , and the output tube radius is 0.5 . The output velocity is given by this formula.

$$v_{out} = v_{in}\left(\frac{r_{in}}{r_{out}}\right)^2$$

v_{out} is the output velocity.
v_{in} is the input velocity.
r_{out} is the radius of the output tube.
r_{in} is the radius of the input tube.

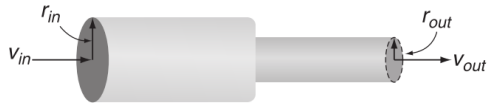

Figure 2.19 Water flowing through a tube

3. Write a C++ program to calculate the circumference of a circle having a radius of 3.3 inches. The formula for determining the circumference, c, of a circle is c = 2πr, where r is the radius and π equals 3.1416.

4. The value of π can be approximated by this series:

$$4\left(1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots.\right)$$

Using this formula, write a program that calculates and displays the value of π, using 2, 3, and 4 terms of the series.

5. Write, compile, and run a program to calculate and display the fourth root of a user-entered number. Recall from elementary algebra that you find the fourth root of a number by raising the number to the 1/4 power. (Hint: Don't use integer division—can you see why?) Verify your program by calculating the fourth roots of this test data: 81, 16, 1, and 0. When you're finished, use your program to determine the fourth roots of 42, 121, 256, 587, 1240, and 16,256。

6. Given an integer x, return true if x is palindrome integer.An integer is a palindrome when it reads the same backward as forward. For example, 121 is palindrome while 123 is not.

Example 1:
Input: x = 121
Output: true

Example 2:
Input: x = -121
Output: false
Explanation: From left to right, it reads -121. From right to left, it becomes 121-. Therefore it is not a palindrome.

Example 3:
Input: x = 10
Output: false
Explanation: Reads 01 from right to left. Therefore it is not a palindrome.

Example 4:
Input: x = -101
Output: false

Constraints:-2^31 <= x <= 2^31 – 1

7. Find First and Last Position of Element in Sorted Array. Given an array of integers nums sorted in ascending order, find the starting and ending position of a given target value.If target is not found in the array, return [-1, -1].

Example 1:
Input: nums = [5,7,7,8,8,10], target = 8
Output: [3,4]

Example 2:
Input: nums = [5,7,7,8,8,10], target = 6
Output: [-1,-1]

Example 3:
Input: nums = [], target = 0
Output: [-1,-1]

Constraints:
0 <= nums.length <= 10^5
-10^9 <= nums[i] <= 10^9
nums is a non-decreasing array.
-10^9 <= target <= 10^9