

1. The two roots of a quadratic equation $ax^2 + bx + c = 0$ can be obtained using the following formula:

$$r_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a} \quad \text{and} \quad r_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

$b^2 - 4ac$ is called the discriminant of the quadratic equation. If it is positive, the equation has two real roots. If it is zero, the equation has one root. If it is negative, the equation has no real roots.

Write a program that prompts the user to enter values for a, b, and c and displays the result based on the discriminant. If the discriminant is positive, display two roots. If the discriminant is 0, display one root. Otherwise, display "The equation has no real roots".

Note that you can use `Math.pow(x, 0.5)` to compute \sqrt{x} . Here are some sample runs.

Case 1:

Enter a, b, c: 1.0 3 1

The equation has two roots -0.381966 and -2.61803

Case 2:

Enter a, b, c: 1 2.0 1

The equation has one root -1

2. A linear equation can be solved using Cramer's rule. Write a program that prompts the user to enter a, b, c, d, e, and f and displays the result. If $ad - bc$ is 0, report that "The equation has no solution."

Sample Input:

Enter a, b, c, d, e, f: 9.0 4.0 3.0 -5.0 -6.0 -21.0

Sample Output:

x is -2.0 and y is 3.0

3. Write a program that prompts the user to enter an integer for today's day of the week (Sunday is 0, Monday is 1, ..., and Saturday is 6). Also prompt the user to enter the number of days after today for a future day and display the future day of the week.

Here is a sample run:

Sample Run:

Enter today's day: 1

Enter the number of days elapsed since today: 3

Today is Monday and the future day is Thursday

4. Write a program that prompts the user to enter three integers and display the integers in non-decreasing order.

5. An ISBN-10 (International Standard Book Number) consists of 10 digits: $d_1d_2d_3d_4d_5d_6d_7d_8d_9d_{10}$. The last digit, d_{10} , is a checksum, which is calculated from the other nine digits using the following formula:

$$(d_1 \times 1 + d_2 \times 2 + d_3 \times 3 + d_4 \times 4 + d_5 \times 5 + d_6 \times 6 + d_7 \times 7 + d_8 \times 8 + d_9 \times 9) \% 11$$

If the checksum is 10, the last digit is denoted as X according to the ISBN-10 convention. Write a program that prompts the user to enter the first 9 digits and displays the 10-digit ISBN (including leading zeros). Your program should read the input as an integer. Here are sample runs:

Enter the first 9 digits of an ISBN as integer: 013601267
The ISBN-10 number is 0136012671

Enter the first 9 digits of an ISBN as integer: 013031997
The ISBN-10 number is 013031997X

6. Write a program that prompts the user to enter the month and year and displays the number of days in the month. For example, if the user entered month 2 and year 2012, the program should display that February 2012 had 29 days. If the user entered month 3 and year 2015, the program should display that March 2015 had 31 days.
7. Write a program that prompts the user to enter a three-digit integer and determines whether it is a palindrome number. A number is palindrome if it reads the same from right to left and from left to right.
8. Write a program that plays the popular scissor-rock-paper game. (A scissor can cut a paper, a rock can knock a scissor, and a paper can wrap a rock.) The program randomly generates a number 0, 1, or 2 representing scissor, rock, and paper. The program prompts the user to enter a number 0, 1, or 2 and displays a message indicating whether the user or the computer wins, loses, or draws. Here are sample runs:
scissor (0), rock (1), paper (2): 1 The computer is scissor. You are rock. You won
scissor (0), rock (1), paper (2): 2 The computer is paper. You are paper too. It is a draw
9. A shipping company uses the following function to calculate the cost (in dollars) of shipping based on the weight of the package (in pounds).

$$c(w) = \begin{cases} 3.5, & \text{if } 0 < w \leq 1 \\ 5.5, & \text{if } 1 < w \leq 3 \\ 8.5, & \text{if } 3 < w \leq 10 \\ 10.5, & \text{if } 10 < w \leq 20 \end{cases}$$

Write a program that prompts the user to enter the weight of the package and display the shipping cost. If the weight is greater than 50, display a message “the package cannot be shipped.”

10. Write a program that reads three edges for a triangle and computes the perimeter if the input is valid. Otherwise, display that the input is invalid. The input is valid if the sum of every pair of two edges is greater than the remaining edge.

Zeller’s congruence is an algorithm developed by Christian Zeller to calculate the day of the week. The formula is

$$h = \left(q + \frac{26(m+1)}{10} + k + \frac{k}{4} + \frac{j}{4} + 5j \right) \% 7$$

where

- h is the day of the week (0: Saturday, 1: Sunday, 2: Monday, 3: Tuesday, 4: Wednesday, 5: Thursday, 6: Friday).
- q is the day of the month.
- m is the month (3: March, 4: April, ..., 12: December). January and February are counted as months 13 and 14 of the previous year.
- j is the century (i.e., $\text{year}/100$).
- k is the year of the century (i.e., $\text{year} \% 100$).

Note that the division in the formula performs an integer division. Write a program that prompts the user to enter a year, month, and day of the month, and displays the name of the day of the week. Here are some sample runs:

Enter year: (e.g., 2012): 2015

Enter month: 1-12: 1

Enter the day of the month: 1-31: 25

Day of the week is Sunday

Enter year: (e.g., 2012): 2012

Enter month: 1-12: 5

Enter the day of the month: 1-31: 12

Day of the week is Saturday

(Hint: January and February are counted as 13 and 14 in the formula, so you need to convert the user input 1 to 13 and 2 to 14 for the month and change the year to the previous year.)