Lab Sheet 2

For loops and if statements

1. Write a program that reads an integer from the users. Then your program should display a message indicating whether the integer is odd or even. (Hint: the % operator may come in handy.)

2. It is commonly said that one human year equates to seven dog years. However this fails to recognize that dogs reach adulthood in approximately two years. As a result, some believe that it is better to count each of the first two human years as 10.5 dog years and then count each additional year as 4 dog years. Write a program that implements the conversion from human years to dog years as described above.

3. A quadratic function has the form $f(x) = ax^2 + bx + c$, where a, b and c are constants and a is nonzero. The real roots of this equation can be found using the formula

$$\frac{-b \stackrel{+}{-} \sqrt{b^2 - 4ac}}{2a}$$

   If the square root is zero the equation has a single root and if it is negative the equation has no (real) roots. Write a program that computes the real roots of a quadratic function. Your program should begin by prompting the user for the values of a, b and c. Then it should display a message indicating how many roots it has along with the values of those roots (if any).

4. Write a Python program that asks the user to enter a non-negative integer and that outputs the factorial of that number. Recall that the factorial of n (denoted $n!$) is defined as follows:

$$n! = n \cdot (n-1) \cdot (n-2) \cdots 3 \cdot 2 \cdot 1$$

   Do not use the `math.factorial` function and do not use lists.

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5. The non-trivial factors of a positive integer n are those integers , other than 1 and n, that divide evenly into it. The factors of 10 are 2 and 5, those of 28 are $2, 4, 7$ and 14. Some numbers such as 2, 3 or 7 (the primes) have no nontrivial factors. Write a program that prints out the non trivial factors for every number from 2 to 100 inclusive. Each number in that range should appear on a line of its own followed by a colon followed by a space-separated list of its non-trivial factors, if any e.g.

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28 : 2 4 7 14
```

   Note that normally a `print(. . .)` displays a complete line, any subsequent print displaying on the line(s) below. The `print(. . . , end = "")` variant displays material on the current line of output, while ensuring the next print continues on the same line.

6. Write a Python program that requsts the user to enter a real number x and that calculates and prints an approximation of the quantity e^x based on the first hundred terms of the infinite sum

$$e^x = \sum_{k=0}^{\infty} \frac{x^k}{k!}$$

Recall that $k!$ denotes the factorial of k. Do not use the `math.factorial` function. Hint: It should not be necessary to compute each term in the sum from scratch.