

Problem statement:

Write a program to check whether a number is prime or not?

In order to solve this problem, we need to understand some basic terms.

BASIC TERMINOLOGY

- ★ **Prime number** – A **number greater than 1** is called a prime number, if it has only two factors, namely 1 and the number itself.

Example: 2, 3, 5, 7, 11...

- ★ **Composite number** – A **composite number** is a positive integer which is not prime i.e. which has factors other than 1 and itself.

Example: 4, 6, 8, 9, 10...

Now lets address one important question

Question - Is 1 a prime number?

Solution – No. It is not a prime number because according to the definition of prime numbers – A prime number is a number which has exactly two divisors, 1 and itself. But 1 has only one divisor i.e. itself. Therefore it is not a prime number.

Another reason – it violates the **fundamental theorem of arithmetic**

According to this theorem – Every positive integer greater than one can be written **uniquely** as the product of primes.

Example: $9 = 3 * 3$

But we can also write it as:

$$9 = 3 * 3 * 1$$

$$9 = 3 * 3 * 1 * 1$$

$$9 = 3 * 3 * 1 * 1 * 1$$

...

In order to find whether a number is prime or not,
We first need to calculate the square root of that number and then we divide that number by numbers less than or equal to the square root of that number. **If it is divisible by any of the numbers** then we can say that **the number is not a prime number** else it is a prime number.

Example: suppose we need to find whether 23 is prime number or not

Step 1 - **Take square root of 23.** Which is nearly $4.7958 \approx 5$

Step 2 - **divide 23 by numbers greater than 2 and less than or equal to 5.** If it is divisible by any of those numbers then it is not prime else it is prime.

As 23 is not divisible by any of those numbers therefore, 23 is a prime number

PART 1 – FINDING THE SQUARE ROOT

```
#include <math.h>
int main()
{
    int x, val1;
    val1 = ceil(sqrt(x));
}
```

Example: $\text{sqrt}(2) = 1.414$
 $\text{ceil}(1.414) = 2$

- ★ sqrt means square root
- ★ available in `math.h` library

Syntax: `double sqrt(double x)`

- ★ `ceil` function returns a smallest integer greater than or equal to x
- ★ available in `math.h` library

Syntax: `double ceil(double x)`

PART 2 – CHECK THE DIVISIBILITY

```
int val2 = x, count = 0;
for(i=2; i<=val1; i++)
{
    if(val2 % i == 0)
        count = 1;
}
```

PART 3 – CHECK WHETHER A NUMBER IS PRIME OR NOT

```
if((count == 0 && val2 != 1) || val2 == 2 || val2 == 3)
    printf("%d is a prime number", val2);
else
    printf("%d is not a prime number", val2);
```



```
#include <stdio.h>
#include <math.h>
```

```
int main()
{
    int x;
    int i, val1, val2, count=0;
    printf("Please enter a number (only positive integers): ");
    scanf("%d", &x);
```

```
    val1 = ceil(sqrt(x));
```

```
    val2 = x;
```

```
    for(i=2; i <= val1; i++)
```

```
    {
```

```
        if(val2%i == 0)
```

```
            count=1;
```

```
    }
```

```
    if((count == 0 && val2 != 1) || val2 == 2 || val2 == 3)
```

```
        printf("%d is a prime number", val2);
```

```
    else
```

```
        printf("%d is not a prime number", val2);
```

```
    return 0;
```

```
}
```

Part 1

Part 2

Part 3