In[95]:=
```
(********************)
(* Functions        *)
(********************)

(* returns a list of all the
 Gaussian Integers with norm equal to n *)
normSolver[n_] := Module[{a, b, sqrtn, answerlist},
   sqrtn = Sqrt[n];
   answerlist = {};
   For[a = Floor[-sqrtn], a ≤ sqrtn,  a++,
      For[b = Floor[-sqrtn], b ≤ sqrtn, b++,
         If[Equal[n, a*a + b*b],
            answerlist = Append[answerlist, a + b*I];
        ];
        ];
   ];

   Return[answerlist];
  ];

(* If z and w are Gaussian integers,
this module returns True if z divides w, otherwise
 it returns False *)
gaussianDivides[z_, w_] := Module[{quotient},
   quotient = Simplify[w / z];
   If[IntegerQ[Re[quotient]] && IntegerQ[Im[quotient]],
    Return[True];
   ];
   Return[False];
  ];
```

```
(* Given a Gaussian integer z,
this function returns a list of all
 the Gaussian integers that divide z *)
findAllDivisors[z_] := Module[{answerList,
    zNorm, normDivisors, possibleDivisorList, i},

   possibleDivisorList = {};
   answerList = {};

   (* get the norm of z
    and then find all possible divisors of
    that norm *)
   zNorm = Norm[z] ^ 2;
   normDivisors = Divisors[zNorm];

   (* find all w that could possibly divide z *)
   For[i = 1, i ≤ Length[normDivisors], i ++,
     possibleDivisorList = Join[possibleDivisorList,
       normSolver[normDivisors[[i]]]];
   ];

   (* Now check which ones actually do divide w *)
   For[i = 1, i ≤ Length[possibleDivisorList], i ++,
     If[gaussianDivides[possibleDivisorList[[i]], z],
        answerList =
       Append[answerList, possibleDivisorList[[i]]];
     ];
   ];

   Return[answerList];
```

```
  ];

(* returns true if z is a prime in the
 Gaussian Integers.   returns False otherwise *)
isPrime[z_] := Module[{},
   If[Equal[Length[findAllDivisors[z]], 8],
    Return[True];
   ];

    Return[False];
  ];
```

```
(**********************************
******)
(* Test some
 Gaussian integers *)
(**********************************
********)
```

In[99]:=
```
z = 2;
answer = findAllDivisors[z];
Print["Here are the divisors of ",
  z, " : ", answer];
Print["There are ", Length[answer],
  " divisors of ", z, "."];
If[isPrime[z],
  Print[z, " is prime."]
  ,
  Print[z, " is not prime."]
 ];
```

```
Here are the divisors of 2 : {-1, -i, i, 1,
  -1 - i, -1 + i, 1 - i, 1 + i, -2, -2 i, 2 i, 2}
There are 12 divisors of 2.
2 is not prime.
```

```
(**********************
********)
```

In[104]:=
```
z = 3;
answer = findAllDivisors[z];
Print["Here are the divisors of ",
  z, " : ", answer];
Print["There are ", Length[answer],
  " divisors of ", z, "."];
If[isPrime[z],
  Print[z, " is prime."]
  ,
  Print[z, " is not prime."]
 ];
```

```
Here are the divisors of 3
  : {-1, -i, i, 1, -3, -3 i, 3 i, 3}
There are 8 divisors of 3.
3 is prime.
```

```
(**********************
********)
```

In[109]:=
```
z = 5;
answer = findAllDivisors[z];
Print["Here are the divisors of ",
  z, " : ", answer];
Print["There are ", Length[answer],
  " divisors of ", z, "."];
If[isPrime[z],
  Print[z, " is prime."]
  ,
  Print[z, " is not prime."]
 ];
```

```
Here are the divisors of 5 :
 {-1, -ⅈ, ⅈ, 1, -2 - ⅈ, -2 + ⅈ, -1 - 2 ⅈ, -1 + 2 ⅈ,
  1 - 2 ⅈ, 1 + 2 ⅈ, 2 - ⅈ, 2 + ⅈ, -5, -5 ⅈ, 5 ⅈ, 5}
There are 16 divisors of 5.
5 is not prime.
```

```
(**********************
********)
```

In[119]:=
```
z = 10;
answer = findAllDivisors[z];
Print["Here are the divisors of ",
  z, " : ", answer];
Print["There are ", Length[answer],
  " divisors of ", z, "."];
If[isPrime[z],
  Print[z, " is prime."]
  ,
  Print[z, " is not prime."]
 ];
```

```
Here are the divisors of 10 :
 {-1, -i, i, 1, -1 - i, -1 + i, 1 - i, 1 + i,
  -2, -2 i, 2 i, 2, -2 - i, -2 + i, -1 - 2 i,
  -1 + 2 i, 1 - 2 i, 1 + 2 i, 2 - i, 2 + i,
  -3 - i, -3 + i, -1 - 3 i, -1 + 3 i, 1 - 3 i,
  1 + 3 i, 3 - i, 3 + i, -4 - 2 i, -4 + 2 i,
  -2 - 4 i, -2 + 4 i, 2 - 4 i, 2 + 4 i, 4 - 2 i,
  4 + 2 i, -5, -5 i, 5 i, 5, -5 - 5 i, -5 + 5 i,
  5 - 5 i, 5 + 5 i, -10, -10 i, 10 i, 10}
There are 48 divisors of 10.
10 is not prime.
```

```
(**********************
********)
```

In[134]:=
```
z = 11;
answer = findAllDivisors[z];
Print["Here are the divisors of ",
  z, " : ", answer];
Print["There are ", Length[answer],
  " divisors of ", z, "."];
If[isPrime[z],
  Print[z, " is prime."]
  ,
  Print[z, " is not prime."]
 ];
```

```
Here are the divisors of 11 :
 {-1, -ⅈ, ⅈ, 1, -11, -11 ⅈ, 11 ⅈ, 11}
There are 8 divisors of 11.
11 is prime.
```

```
(**********************
********)
```

In[124]:=
```
z = 13;
answer = findAllDivisors[z];
Print["Here are the divisors of ",
  z, " : ", answer];
Print["There are ", Length[answer],
  " divisors of ", z, "."];
If[isPrime[z],
  Print[z, " is prime."]
  ,
  Print[z, " is not prime."]
 ];
```

```
Here are the divisors of 13
  : {-1, -ⅈ, ⅈ, 1, -3 - 2 ⅈ, -3 + 2 ⅈ,
  -2 - 3 ⅈ, -2 + 3 ⅈ, 2 - 3 ⅈ, 2 + 3 ⅈ,
  3 - 2 ⅈ, 3 + 2 ⅈ, -13, -13 ⅈ, 13 ⅈ, 13}
There are 16 divisors of 13.
13 is not prime.
```

```
(**********************
********)
```

In[129]:=
```
z = 100;
answer = findAllDivisors[z];
Print["Here are the divisors of ",
  z, " : ", answer];
Print["There are ", Length[answer],
  " divisors of ", z, "."];
If[isPrime[z],
  Print[z, " is prime."]
  ,
  Print[z, " is not prime."]
 ];
```

```
Here are the divisors of 100 :
 {-1, -ⅈ, ⅈ, 1, -1 - ⅈ, -1 + ⅈ, 1 - ⅈ, 1 + ⅈ, -2,
  -2 ⅈ, 2 ⅈ, 2, -2 - ⅈ, -2 + ⅈ, -1 - 2 ⅈ, -1 + 2 ⅈ,
  1 - 2 ⅈ, 1 + 2 ⅈ, 2 - ⅈ, 2 + ⅈ, -2 - 2 ⅈ, -2 + 2 ⅈ,
  2 - 2 ⅈ, 2 + 2 ⅈ, -3 - ⅈ, -3 + ⅈ, -1 - 3 ⅈ,
  -1 + 3 ⅈ, 1 - 3 ⅈ, 1 + 3 ⅈ, 3 - ⅈ, 3 + ⅈ, -4, -4 ⅈ,
  4 ⅈ, 4, -4 - 2 ⅈ, -4 + 2 ⅈ, -2 - 4 ⅈ, -2 + 4 ⅈ,
  2 - 4 ⅈ, 2 + 4 ⅈ, 4 - 2 ⅈ, 4 + 2 ⅈ, -5, -4 - 3 ⅈ,
  -4 + 3 ⅈ, -3 - 4 ⅈ, -3 + 4 ⅈ, -5 ⅈ, 5 ⅈ, 3 - 4 ⅈ,
  3 + 4 ⅈ, 4 - 3 ⅈ, 4 + 3 ⅈ, 5, -6 - 2 ⅈ, -6 + 2 ⅈ,
  -2 - 6 ⅈ, -2 + 6 ⅈ, 2 - 6 ⅈ, 2 + 6 ⅈ, 6 - 2 ⅈ,
  6 + 2 ⅈ, -7 - ⅈ, -7 + ⅈ, -5 - 5 ⅈ, -5 + 5 ⅈ,
```

$$-1-7\,i,\ -1+7\,i,\ 1-7\,i,\ 1+7\,i,\ 5-5\,i,$$
$$5+5\,i,\ 7-i,\ 7+i,\ -8-4\,i,\ -8+4\,i,\ -4-8\,i,$$
$$-4+8\,i,\ 4-8\,i,\ 4+8\,i,\ 8-4\,i,\ 8+4\,i,$$
$$-10,\ -8-6\,i,\ -8+6\,i,\ -6-8\,i,\ -6+8\,i,$$
$$-10\,i,\ 10\,i,\ 6-8\,i,\ 6+8\,i,\ 8-6\,i,\ 8+6\,i,$$
$$10,\ -10-5\,i,\ -10+5\,i,\ -5-10\,i,\ -5+10\,i,$$
$$5-10\,i,\ 5+10\,i,\ 10-5\,i,\ 10+5\,i,\ -14-2\,i,$$
$$-14+2\,i,\ -10-10\,i,\ -10+10\,i,\ -2-14\,i,$$
$$-2+14\,i,\ 2-14\,i,\ 2+14\,i,\ 10-10\,i,\ 10+10\,i,$$
$$14-2\,i,\ 14+2\,i,\ -15-5\,i,\ -15+5\,i,\ -5-15\,i,$$
$$-5+15\,i,\ 5-15\,i,\ 5+15\,i,\ 15-5\,i,\ 15+5\,i,$$
$$-20,\ -16-12\,i,\ -16+12\,i,\ -12-16\,i,$$
$$-12+16\,i,\ -20\,i,\ 20\,i,\ 12-16\,i,\ 12+16\,i,$$
$$16-12\,i,\ 16+12\,i,\ 20,\ -20-10\,i,\ -20+10\,i,$$
$$-10-20\,i,\ -10+20\,i,\ 10-20\,i,\ 10+20\,i,$$
$$20-10\,i,\ 20+10\,i,\ -25,\ -25\,i,\ 25\,i,\ 25,$$
$$-30-10\,i,\ -30+10\,i,\ -10-30\,i,\ -10+30\,i,$$
$$10-30\,i,\ 10+30\,i,\ 30-10\,i,\ 30+10\,i,$$
$$-25-25\,i,\ -25+25\,i,\ 25-25\,i,\ 25+25\,i,$$
$$-40-20\,i,\ -40+20\,i,\ -20-40\,i,\ -20+40\,i,$$
$$20-40\,i,\ 20+40\,i,\ 40-20\,i,\ 40+20\,i,$$
$$-50,\ -50\,i,\ 50\,i,\ 50,\ -50-50\,i,\ -50+50\,i,$$
$$50-50\,i,\ 50+50\,i,\ -100,\ -100\,i,\ 100\,i,\ 100\}$$

```
There are 180 divisors of 100.
100 is not prime.
```