2. Show that the first 100 primes greater 3 are either of the form 6k + 1 or 6k + 5.

<!DOCTYPE html>

<html>

<head>

<meta charset="utf-8">

<title>Question 2.2</title>

<script type="text/javascript">

function primeProof(){

var primes = [];

var ul = document.createElement('ul');

var count = 0;

while(count < 100){

primes = addPrime(primes);

if(primes[primes.length - 1] > 3){

count++;

}

}

var less3 = true;

var pos = 0;

while(less3){

if (primes[pos] < 3) {

pos++;

}

else if(primes[pos] == 3){

pos++;

less3 = false;

}

else{

console.log("3 not in array");

}

}

var proof = true;

var toPrint = "";

for(i = 0; i < 100; i++){

if(!plus1Form(primes[pos])){

if(!plus5Form(primes[pos]) && plus5Form(primes[pos]) != 0){

toPrint = toPrint + "<br/>Proof is false";

proof = false;

}

else{

toPrint = toPrint + "<br/>6(" + plus5Form(primes[pos]) + ")+5 = " + primes[pos];

}

}

else{

toPrint = toPrint + "<br/>6(" + plus1Form(primes[pos]) + ")+1 = " + primes[pos];

}

pos++;

}

document.write("The proof is " + proof);

document.write(toPrint);

}

function addPrime(array){

if(array.length == 0){

return [1];

}

var num = array[array.length - 1] + 1;//Next Num

var find = true;

if(num == 2){

find = false;

array.push(num);

}

else if(num%2 == 0){

num++;

}

while(find){

var div = num - 1;

var flag = true;

while(flag && div > 1){

if(num%div == 0){

flag = false;

}

else{

div--;

}

}

if(div == 1){

find = false;

array.push(num);

}

else{

num = num + 2;//speed up the process

}

}

return array;

}

function plus1Form(num){

var test = 0;

while(test < num){

if(((6\*test) + 1) == num){

return test;

}

else{

test++;

}

}

return false;

}

function plus5Form(num){

var test = 0;

while(test < num){

if(((6\*test) + 5) == num){

return test;

}

else{

test++;

}

}

return false;

}

</script>

</head>

<body onload="primeProof()">

<h1>Prime Number Proof</h1><br/>

</body>

</html>

4. Support the claim that 12 + 32 + 52 + … + (2n + 1)2 =  , by showing that it is true for all n ≤ 100. Now try to prove it.

<!DOCTYPE html>

<html>

<head>

<meta charset="utf-8">

<title>Question 2.4</title>

<script type="text/javascript">

function oddSquares(){

var proof = true;

for(var i = 1; i <= 100; i++){

if(longWay(i) != shortWay(i)){

proof = false;

var failed = i;

}

}

if(proof){

document.write("The proof is true for numbers 1 - 100");

}

else{

document.write("The proof is false by the number " + failed);

}

}

function longWay(num){

var sum = 0;

for(var i = num; i > 0; i--){

sum = sum + (((2\*i) - 1) \* ((2\*i) - 1));

}

return sum;

}

function shortWay(num){

return (num\*((4\*(num\*num))-1))/3;

}

</script>

</head>

<body onload="oddSquares()">

<h1>Odd Square Sums</h1><br/>

</body>

</html>

6. Use the chart method to find the sum of the first n fourth powers. Test it for all n ≤ 100.