

```

1 function generateStar(n) {
2     var output
3
4     for(var i=1;i<=n;i++){
5         output=""
6         for(var j=1;j<=i;j++){
7             output+=j
1 function generateStar(n){
2     var output
3
4     for(var i=1;i<=n;i++){
5         output=""
6         for (var j=1;j<=i;j++){
7             if(j===i || j==1){
8                 output+='R'
9             }else {
10                output+='Y'
11            }
12        }
13        console.log(output)
14    }
15 }

```

The star script is based on a small snippet that makes a triangle. By modifying the snippet slightly, the desired result is easily achieved.

By adding an if statement the numbers can be replaced with letters representing the different colour beads.

```

1 function generateStar(n){
2     var output
3
4     for(var i=1;i<=n+1;i++){
5         output=""
6         if(i<n+1){
7             for(var k=i;k<=n;k++){
8                 output+=' '
9             }
10        }for(var j=1;j<=2*n+1;j++){
11            output+=" "
12        }for(var j=1;j<=i;j++) {
13            if(j===i || j==1) {
14                output+='R '
15            }else {
16                output+='Y '
17            };
18        }
19        console.log(output)
20    }
21 }

```

Here, two additional set of for loops have been added. These add spacing to make the triangle display correctly when - followed by the rest of the star.

Ignoring both spacing and the different colours, this is the equivalent of

$$\sum_{i=1}^{n+1} i$$

Or

$$\frac{(n + 1)((n + 1) + 1)}{2}$$

```

1  function generateStar(n){
2      var output=''
3      for (var i=0;i<=n+1;i++){
4          if(i==0){
5              for(var j=1;j<=3*n+4;j++){
6                  if(j<=n+2 || j>=2*n+2){
7                      output+='R  '
8                  }else{
9                      output+='Y  '
10                 }
11             }
12         }else{
13             for(var j=1;j<=i;j++){
14                 output+=' '
15             }
16             for (var j=1;j<=3*n+4-i;j++){
17                 if(j===3*n+4-i || j===1){
18                     output+='R  '
19                 }else{
20                     output+='Y  '
21                 }
22             }
23         }
24         console.log(output)
25         output=''
26     }
27 }

```

Ignoring the parts created earlier, the script starts by initializing the variable “output” and clearing it. The first for-loop manages the number of rows. Because the first row is different, the if-statement isolates the first row. Inside, it makes  $n+2$  on each side red and the middle  $n$  yellow. If it is not on the first row however, it needs to add spacing. The for loop makes  $3n + 4 - i$  beads on each row. Inside is an if-statement that makes the first and last of each row red.

This makes a trapezoid equivalent of

$$\sum_{i=0}^{n+2} 3n + 4 - i$$

Or

$$(n + 2) \left( 3n + 4 - \frac{(n + 1)}{2} \right)$$

Both including the middle row.

```

1 function generateStar(n){
2   var output=''
3   for (var i=n;i>=0;i--){
4     if(i==0){
5       for(var j=1;j<=3*n+4;j++){
6         if(j<=n+2 || j>=2*n+2){
7           output+='R '
8         }else{
9           output+='Y '
10        }
11      }
12    }else{
13      for(var j=1;j<=i;j++){
14        output+=' '
15      }
16      for (var j=1;j<=3*n+4-i;j++){
17        if(j===3*n+4-i || j===1){
18          output+='R '
19        }else{
20          output+='Y '
21        }
22      }
23    }
24    console.log(output)
25    output=''
26  }
27 }
28
29 function generateStar(n){
30   var output
31
32   for(var i=n+1;i>=1;i--){
33     output=""
34     if(i<n+1){
35       for(var k=i;k<=n;k++){
36         output+=' '
37       }
38     }
39     }for(var j=1;j<=2*n+1;j++){
40       output+=" "
41     }for(var j=1;j<=i;j++) {
42       if(j===i || j===1) {
43         output+='R '
44       }else {
45         output+='Y '
46       };
47     };
48   }
49   console.log(output)
50 }
51 }

```

Similarly, in the next trapezoid, the “i” for-loop is inverted. The other difference is the number of rows being one less,  $n + 1$ .

This makes it

$$\sum_{i=0}^{n+1} 3n + 4 - i$$

Or

$$(n + 1) \left( 3n + 4 - \frac{n}{2} \right)$$

At last is the inverse of the first loop, making a reversed triangle.

Once again, without colours.

$$\sum_{i=1}^{n+1} i$$

Or

$$\frac{(n + 1)((n + 1) + 1)}{2}$$

The first triangle has the formula

$$\sum_{i=1}^{n+1} i$$

Or

$$\frac{(n+1)((n+1)+1)}{2}$$

Cutting off the triangle gives a trapezoid of size

$$\sum_{i=0}^{n+2} 3n+4-i$$

Or

$$(n+2) \left( 3n+4 - \frac{(n+1)}{2} \right)$$

which is including the middle row. This makes the other be one row shorter at

$$\sum_{i=0}^{n+1} 3n+4-i$$

Or

$$(n+1) \left( 3n+4 - \frac{n}{2} \right)$$

At last we have a final triangle which is the same as the first.

$$\sum_{i=1}^{n+1} i$$

In summary, a for-loop works like a sigma. All the summations can be converted into a simple algebraic expression. To confirm that the solution works, the expressions added together should correspond to  $6n^2 + 18n + 13$ .