Loops

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Quiz: Khan Academy: Intro to While Loop

What does this JavaScript program display on the canvas?

```javascript
fill(0, 0, 0);
var message = "y is now ";
var y = 10;
while(y < 60)
{
    text(message + y, 30, y);
    y += 15;
}
```

- a) y is now 10
- b) y is now 10 25 40 55
- c) y is now 30 10 30 25 30 40 30 55
- d) y is now 10 25 40 55
- e) y is now 10 25 40 55 40 55
- f) y is now 10 25 40 55 40 55 40 55
Print Multiples of 3 from 3 to 30

1) \text{fill}(0, 0, 0);
2)
3) \text{text}(3, 0, 10);
4) \text{text}(6, 0, 10);
5) \text{text}(9, 0, 10);
6) \text{text}(12, 0, 10);
7) \text{text}(15, 0, 10);
8) \text{text}(18, 0, 10);
9) \text{text}(21, 0, 10);
10) \text{text}(24, 0, 10);
11) \text{text}(27, 0, 10);
12) \text{text}(30, 0, 10);

Canvas:

Print Multiples of 3 from 3 to 30

1) \text{fill}(0, 0, 0);
2)
3) \text{text}(3, 10, 10);
4) \text{text}(6, 20, 10);
5) \text{text}(9, 30, 10);
6) \text{text}(12, 40, 10);
7) \text{text}(15, 50, 10);
8) \text{text}(18, 60, 10);
9) \text{text}(21, 70, 10);
10) \text{text}(24, 80, 10);
11) \text{text}(27, 90, 10);
12) \text{text}(30, 100, 10);

Canvas:
Print Multiples of 3 from 3 to 30

1) `fill(0, 0, 0);`
2) `text(3, 0, 10);`
3) `text(6, 20, 10);`
4) `text(9, 40, 10);`
5) `text(12, 60, 10);`
6) `text(15, 80, 10);`
7) `text(18, 100, 10);`
8) `text(21, 120, 10);`
9) `text(24, 140, 10);`
10) `text(27, 160, 10);`
11) `text(30, 180, 10);`
12) `text(33, 200, 10);`

Canvas: 3 6 9 12 15 18 21 24 27 30

Quiz: What is displayed on the Canvas?

`textSize(30);`
`fill(0, 0, 0);`
`var message = "y=";`
`var y = 100;`
`while(y < 200)`
`{`
`    text(message + y, 30, y);`
`    y += 25;`
`}`

(a) y=125
    y=150
    y=175
(b) y=100
    y=125
    y=150
    y=175
(c) y=100
    y=125
    y=150
    y=175
    y=200
(d) y=100, 100, 100
    y=125, 100, 125
    y=150, 150, 150
    y=175, 30, 175
    y=200, 30, 200
Print the Factors of an Integer

- Examples: num = 10 : Factors: 1, 10, 2, 5
- num = 12: Factors: 6, 2, 12, 1, 3, 4

- Algorithm:
  
  ```plaintext
  var i = 1.
  Loop while i is less than or equal to num.
  if i divides evenly into num then print i.
  Add 1 to i.
  ```

Modulus Operator

1) `fill(0, 0, 0);`
2) `text( 7 % 3, 10, 10);` 1
3) `text( 8 % 3, 10, 30);` 2
4) `text( 9 % 3, 10, 50);` 0
5) `text(10 % 3, 10, 70);` 1
Quiz: What is displayed on the Canvas?

1) `fill(0, 0, 0);`
2) `text( 22 % 5, 10, 10);`

(a) 2  (b) 4  (c) 4.4  (d) 4 10 10  (e) 4 5 10 10

---

Quiz: What is displayed on the Canvas?

1) `var brenda = 1;`
2) `fill(0, 0, 0);`
3) `while (brenda < 5)`
4) `{`
5) `  text( 7 % brenda, 10, 15*brenda);`
6) `  brenda += 1;`
7) `}`

(a) 0 1 1 3 3  (b) 1 2 1 2 3  (c) 0 1 1 7  (d) 1 7  (e) 7
Print the Factors of an Integer

1) `fill(0, 0, 0);`  
2) `var y = 10;`  
3) `var num = 50;`  
4) `var i = 1;`  
5) `while (i <= num) {`  
6) `7) if (num % i === 0) {`  
7) `8) text(i, 10, y);`  
8) `y += 20;`  
9) `10) }`  
11) `11) i += 1;`  
12) `}`

In JavaScript, % is the modulus operator. It returns the remainder.

If a large font is used, more than 20 will need to be added to y each time a new factor is found and displayed.

Getting Input form an HTML Page

```html
<body>
<h1>Enter a <i>positive integer</i> and I will display its factors:
   <input type="text"
       style="font-size: 100%"
       id="inputNum"
       value="100">
</h1>
```

```javascript
var inputNum = document.getElementById("inputNum");
var num = Number(inputNum.value);
```
Print the **Prime** Factors of an Integer

- 1 is NOT a prime number. The first 20 prime numbers are: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71.
- Examples: num= 10 : Prime Factors: 2, 5
  
  num = 12: Prime Factors: 2, 2, 3
- Algorithm:
  
  ```
  var prime = 2.
  Loop while prime <= the square root of num:
    if prime divides evenly into num then
      Print prime.
      Change num to equal num divided by prime.
    if prime does NOT divide evenly into num then
      add 1 to prime.
  ```

Why will this work? For example, if num = 16, then 4, which divides 16, yet is not a prime, should not (will not) get printed.

---

Print the Factors of an Integer

```plaintext
1) var y = 10;
2) var num = 50;
3) var prime = 2;
4) while (prime <= sqrt(num))
   {
     if (num % prime === 0)
       {
         text(prime, 10, y);
         y += 30;
         num = num / prime;
       }
     else
       {
         prime +=1;
       }
   }
7) if (num > 1) text(num, 10, y);
```

Note that each time a prime factor is found and printed (in line 7), `prime` is factored out of `num` (line 9: `num = num / prime`). Thus, each time a factor is found, the upper limit of the while loop gets smaller.

Contrariwise, each iteration when the current `prime` is NOT a factor of the remaining `num`, `prime` is increased by 1.
What Pattern Does this Draw?

```javascript
strokeWeight(2);
stroke(0,200,0);
line(0,0, 0, 100);
line(0,0, 10, 100);
line(0,0, 20, 100);
line(0,0, 30, 100);
line(0,0, 40, 100);
line(0,0, 50, 100);
line(0,0, 60, 100);
line(0,0, 70, 100);
line(0,0, 80, 100);
line(0,0,100, 100);
line(0,0,110, 100);
line(0,0,120, 100);
```

Drawing the first 4 lines shows the pattern.

Use a Loop to Shorten Repeated Code

```javascript
strokeWeight(2);
stroke(0,200,0);
var x = 0;
while (x <= 120)
{
    line(0,0, x, 200);
    x += 10;
}
```

```javascript
strokeWeight(2);
stroke(0,200,0);
line(0,0, 0, 200);
line(0,0, 10, 200);
line(0,0, 20, 200);
line(0,0, 30, 200);
line(0,0, 40, 200);
line(0,0, 50, 200);
line(0,0, 60, 200);
line(0,0, 70, 200);
line(0,0, 80, 200);
line(0,0,100, 200);
line(0,0,110, 200);
line(0,0,120, 200);
```
Deriving the Code to Draw a Pattern

8) \texttt{var i = 0;}
9) \texttt{while (i<=200)}
10) \{ \texttt{line(0, i, i, 200); //x_1, y_1, x_2, y_2}
11) \quad i += 10;
12) \}

\[(x_1, y_1) \rightarrow (x_2, y_2)\]
\[(0,0) \rightarrow (0,200)\]
\[(0,10) \rightarrow (10,200)\]
\[(0,20) \rightarrow (20,200)\]
\[(0,30) \rightarrow (30,200)\]

Pole: Internet Access

In order to access to the Internet within the United States boarders, the government should:

a) Require a national ID (or bio ID) and password be entered.

b) Require a card with a unique ID chip be inserted into the computer and remain inserted while access is allowed.

c) Hold hosting sites responsible for all content posted on those sites.

d) Leave Internet access as it is with pseudo anonymity: casual users can be easily tracked by companies, and on a need-to-know basis, the government trace anything they want.

e) Enable methods for true anonymity.
Quiz: Which Image is Drawn?

//Assume the canvas is 200x200 pixels
var i = 0;
while (i<=200)
{
    line(200, 0, i, 200); //x_1,y_1,x_2,y_2
    i += 10;
}

For Loop

<script>
    function setup()
    {
        for (var i=1; i<10; i++)
        {
            console.log(i);
        }
    }
</script>
For Loop

```javascript
var x = 1;
for (var i=1; i<10; i++)
{
    x = x * 2;
    console.log(i + ', ' + x);
}
```

For Loop

```javascript
<script>
    function setup()
    {
        var x = 1;
        for (var i=1; i<=10; i++)
        {
            x = x * 2;
            console.log(i + ', ' + x);
        }
    }
</script>
```
Spirograph

A Closer Look at Spirograph

http://www.mathematische-basteleien.de/spirographs.htm