

## L4. Iteration with for-loops

The idea of Repetition  
The for-loop construct

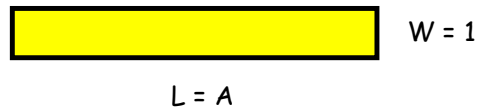
## Motivating Problem: Computing Square Roots

Given a positive number  $A$ , find its square root.

## A Geometric Restatement

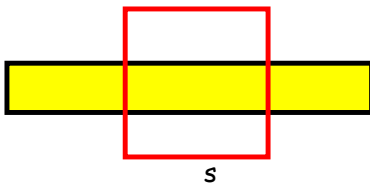
Given a positive number  $A$ , find a square whose area is  $A$ .

## An Initial Guess



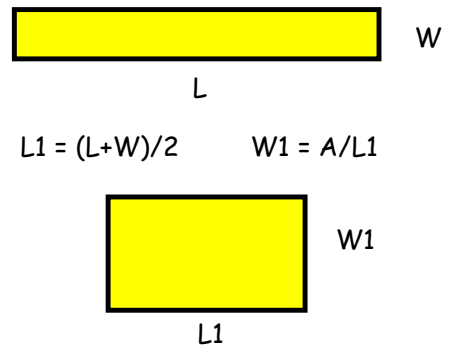
How can we make this rectangle "more square"?

## Observation

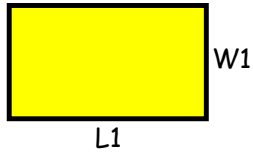


The answer is in between  $L$  and  $W$ :  
 $W < s < L$

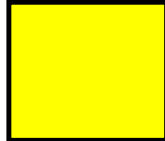
## Idea:



Repeat:



$$L2 = (L1+W1)/2 \quad W2 = A/L2$$



## A Script

```
A = input('A:');  
L0 = A; W0 = A/L0;  
  
L1 = (L0 + W0)/2; W1 = A/L1;  
L2 = (L1 + W1)/2; W2 = A/L2;  
L3 = (L2 + W2)/2; W3 = A/L3;  
L4 = (L3 + W3)/2; W4 = A/L4;
```

## A Modified Script

```
A = input('A:');  
L = A; W = A/L;  
  
L = (L + W)/2; W = A/L;  
L = (L + W)/2; W = A/L;  
L = (L + W)/2; W = A/L;  
L = (L + W)/2; W = A/L;
```

## Handling the Repetition

```
A = input('A:');  
L = A; W = A/L;  
  
for k=1:4  
    L = (L + W)/2; W = A/L;  
end
```

## More General

```
A = input('A:');  
nSteps = input('nSteps:');  
L = A; W = A/L;  
  
for k=1:nSteps  
    L = (L + W)/2; W = A/L;  
end
```

To repeat something N times:

N = \_\_\_\_\_

```
for i = 1:N
```

Put the something here.

```
end
```

To repeat something N times:

N = \_\_\_\_\_

```
for i = 1:N
```

Put the something here.

← The Loop  
"body"

```
end
```

To repeat something N times:

N = \_\_\_\_\_

```
for i = 1:N
```

← The "count variable"

Put the something here.

← The Loop  
"body"

```
end
```

### Another Example

```
for k = 1:10  
    x = rand;  
    fprintf('%10.6f\n',x)  
end
```

Displays 10 random numbers.

### Built-In Function rand

The statement

```
x = rand
```

assigns a "random" number between 0 and 1 to the variable x.

### Another Example

```
for k = 1:10  
    x = rand;  
    fprintf('%10.6f\n',x)  
end
```

Displays 10 random numbers.

E.g.,

```
0.579736  
0.609194  
0.256451  
0.246079  
0.149936  
0.564178  
0.027311  
0.790830  
0.437630  
0.997130
```

## Simulation Using rand

Question:

A stick with unit length is split into two parts.

The breakpoint is randomly selected.

On average, how long is the shorter piece?

```
s = 0;
for k=1:1000
% Break the k-th stick
  x = rand;
  if x<=.5
% Shorter part has length x
    s = s+x;
  else
% Shorter part has length 1-x
    s = s+(1-x);
  end
end
ave = s/1000
```