- Previous topic:
  - Introduction to **for**-loop
- Now:
  - Review **for**-loop
  - User-defined function

Pattern for doing something *n* times

```
n= _____
for k= 1:n
    % code to do
    % that something
end
```

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Syntax of the **for** loop

```
for <var>= <start value>:<incr>:<end bound>
    statements to be executed repeatedly
end
```

Loop body

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Syntax of the **for** loop

```
for <var>= <start value>:<incr>:<end bound>
    statements to be executed repeatedly
end
```

Loop header specifies all the values that the index variable will take on, one for each pass of the loop.

E.g, `k= 3:1:7` means `k` will take on the values 3, 4, 5, 6, 7, one at a time.

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for loop examples

```
for k= 2:0.5:3
     disp(k)
end
```
`k` takes on the values _____
Non-integer increment is OK

```
for k= 1:4
     disp(k)
end
```
`k` takes on the values _____
Default increment is 1

```
for k= 0:-2:-6
     disp(k)
end
```
`k` takes on the values _____
"Increment" may be negative

```
for k= 0:-2:-7
     disp(k)
end
```
`k` takes on the values _____
Colon expression specifies a *bound*

```
for k= 5:2:1
     disp(k)
end
```

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In the loop body, never change the value of the loop variable

```
n= _____
for k= 1:n
    % code to do
    % that something
end
```

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Another way to estimate π

$$1+\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}+\cdots\approx\frac{\pi^2}{6}$$

Write a script to sum 100 terms of the above series and then calculate π.

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Drawing ASCII diagrams

Print these diagrams on the Command Window

```
*******
*******
*******
*******
```

```
*
**
***
****
*****
******
```

Printing is done left to right and top to bottom.
What is a simpler (sub)problem?
→ Print just one row of asterisks.
What is an even simpler (sub)problem?
→ Print just one single asterisk!

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Keyword to indicate this is a function file (not a script)

```
function printRepeatChar(theChar,n)
% Print to the Command Window the
% character in variable theChar n times.
% n is non-negative integer.
% Add a linebreak.

for k= 1:n
    fprintf('%c', theChar)
end
fprintf('\n')
```

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Function name, same as the file name

```
function printRepeatChar(theChar,n)
% Print to the Command Window the
% character in variable theChar n times.
% n is non-negative integer.
% Add a linebreak.

for k= 1:n
    fprintf('%c', theChar)
end
fprintf('\n')
```

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Parameters, also called input parameters

```
function printRepeatChar(theChar,n)
% Print to the Command Window the
% character in variable theChar n times.
% n is non-negative integer.
% Add a linebreak.

for k= 1:n
    fprintf('%c', theChar)
end
fprintf('\n')
```

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Function header

```
function printRepeatChar(theChar,n)
% Print to the Command Window the
% character in variable theChar n times.
% n is non-negative integer.
% Add a linebreak.

for k= 1:n
    fprintf('%c', theChar)
end
fprintf('\n')
```

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Function comments, or specifications
(VERY IMPORTANT to have this comment)

```
function printRepeatChar(theChar,n)
% Print to the Command Window the
% character in variable theChar n times.
% n is non-negative integer.
% Add a linebreak.

for k= 1:n
    fprintf('%c', theChar)
end
fprintf('\n')
```

Function body

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Calling a function (invoking a function)

- I have a function with this header:

```
function printRepeatChar(theChar,n)
```

- I will call function printRepeatChar like this:

```
printRepeatChar('*',8)
```

- The function header tells you everything you need to know about how to call the function

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Drawing ASCII diagrams

```
*******          *
*******          **
*******          ***
*******          ****
*******          *****
                 ******
```

```
% printRectangle
for r= 1:4
   % Print rth row
   printRepeatChar('*',7)
end
```

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Given this function:

```
function m = convertLength(ft,in)
% Convert length from feet (ft) and inches (in)
% to meters (m).
   . . .
```

How many proper calls to convertLength are shown below?

```
f= …;   n= …;
d= convertLength(f,n);
d= convertLength(f*12+n);
d= convertLength(f+n/12);
x= min(convertLength(f,n), 1);
y= convertLength(pi*(f+n/12)^2);
```

A: 1 B: 2 C: 3 D: 4 E: 5 or 0

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General form of a user-defined function

function [*out1*, *out2*, …]= *functionName* (*in1*, *in2*, …)
% 1-line comment to describe the function
% Additional description of function

Executable code that at some point assigns values to output parameters out1, out2, …

- *in1*, *in2*, … are defined when the function begins execution. Variables *in1*, *in2*, … are called function *parameters* and they hold the function *arguments* used when the function is invoked (called).
- *out1*, *out2*, … are not defined until the executable code in the function assigns values to them.

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My twinkling stars …

- What is the algorithm? First, what are the individual tasks?

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Implement this function

```
function r = randReal(lo,hi)
% r is a random real number in the
% interval (lo,hi)
```

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Implement this function

```
function [x,y] = randPt(lo,hi)
% x and y are random real numbers in the
% interval (lo,hi)
```

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