

# Functions

- Functions used to break problem down into small, "bite-sized" pieces.
- Functions have an optional type of return value, a name, and optional arguments
- Functions return at most, ONE value
- Functions must be either "prototyped" or declared prior to use. Good programming practices requires all functions to be prototyped.

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# Functions

type of value returned

name of function

parameters of function (variables in)

```
double hyp(double a, double b)
{
    double sum, result;
    sum = a*a + b*b;
    result = sqrt(sum);
    return result;
}
```

Single value returned by function

## Alternate way of writing above function

```
double hyp(double a, double b)
{
    return sqrt(a*a + b*b);
}
```

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## Functions - complete program

```
#include <stdio.h>
#include <math.h>
double hyp(double a, double b);
void main()
{
    double x,y,h;
    printf("Enter two legs of triangle: ");
    scanf("%lf %lf",&x,&y);
    h=hyp(x,y);
    printf("Trgle w legs %lf and %lf has hyp of %lf\n",x,y,h);
}
double hyp(double a, double b)
{
    double sum, result;
    sum = a*a + b*b;
    result = sqrt(sum);
    return result;
}
```

prototype (note semi-colon )

actual function definition  
(NO semi-colon )

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## Functions - scope

```
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#include <math.h>
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void main()
{
    double x,y,h;
    printf("Enter two legs of triangle: ");
    scanf("%lf %lf",&x,&y);
    h=hyp(x,y);
    printf("Trgle w legs %lf and %lf has hyp of %lf\n",x,y,h);
}
double hyp(double a, double b)
{
    double sum, result;
    sum = a*a + b*b;
    result = sqrt(sum);
    return result;
}
```

x

y

h

4

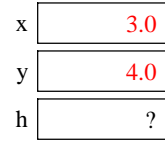
## Functions - scope

```
#include <stdio.h>
#include <math.h>

double hyp(double a, double b);

void main()
{
    double x,y,h;
    printf("Enter two legs of triangle: ");
    scanf("%lf %lf",&x,&y);
    h=hyp(x,y);
    printf("Trgle w legs %lf and %lf has hyp of %lf\n",x,y,h);
}

double hyp(double a, double b)
{
    double sum, result;
    sum = a*a + b*b;
    result = sqrt(sum);
    return result;
}
```



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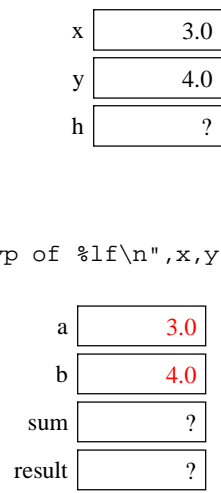
## Functions - scope

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#include <math.h>

double hyp(double a, double b);

void main()
{
    double x,y,h;
    printf("Enter two legs of triangle: ");
    scanf("%lf %lf",&x,&y);
    h=hyp(x,y);
    printf("Trgle w legs %lf and %lf has hyp of %lf\n",x,y,h);
}

double hyp(double a, double b)
{
    double sum, result;
    sum = a*a + b*b;
    result = sqrt(sum);
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}
```



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## Functions - scope

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#include <math.h>

double hyp(double a, double b);

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{
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    scanf("%lf %lf",&x,&y);
    h=hyp(x,y);
    printf("Trgle w legs %lf and %lf has hyp of %lf\n",x,y,h);
}

double hyp(double a, double b)
{
    double sum, result;
    sum = a*a + b*b;
    result = sqrt(sum);
    return result;
}
```

x	3.0
y	4.0
h	?

a	3.0
b	4.0
sum	25.0
result	?

7

## Functions - scope

```
#include <stdio.h>
#include <math.h>

double hyp(double a, double b);

void main()
{
    double x,y,h;
    printf("Enter two legs of triangle: ");
    scanf("%lf %lf",&x,&y);
    h=hyp(x,y);
    printf("Trgle w legs %lf and %lf has hyp of %lf\n",x,y,h);
}

double hyp(double a, double b)
{
    double sum, result;
    sum = a*a + b*b;
    result = sqrt(sum);
    return result;
}
```

x	3.0
y	4.0
h	?

a	3.0
b	4.0
sum	25.0
result	5.0

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### Functions - scope

```
#include <stdio.h>
#include <math.h>

double hyp(double a, double b);

void main()
{
    double x,y,h;
    printf("Enter two legs of triangle: ");
    scanf("%lf %lf",&x,&y);
    h=hyp(x,y);
    printf("Trgle w legs %lf and %lf has hyp of %lf\n",x,y,h);
}

double hyp(double a, double b)
{
    double sum, result;
    sum = a*a + b*b;
    result = sqrt(sum);
    return result;
}
```

x	3.0
y	4.0
h	?

a	3.0
b	4.0
sum	25.0
result	5.0

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### Functions - scope

```
#include <stdio.h>
#include <math.h>

double hyp(double a, double b);

void main()
{
    double x,y,h;
    printf("Enter two legs of triangle: ");
    scanf("%lf %lf",&x,&y);
    h=hyp(x,y);
    printf("Trgle w legs %lf and %lf has hyp of %lf\n",x,y,h);
}

double hyp(double a, double b)
{
    double sum, result;
    sum = a*a + b*b;
    result = sqrt(sum);
    return result;
}
```

x	3.0
y	4.0
h	5.0

NOTE - a and b are NOT copied back to x and y

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## Exercise - What prints (if 5, 12 entered)

```

#include <stdio.h>
#include <math.h>
double hyp(double a, double b);
void main()
{
    double x,y,h;
    printf("Enter two legs of triangle: ");
    scanf("%lf %lf",&x,&y);
    h=hyp(x,y);
    printf("Trgle w legs %lf and %lf has hyp of %lf\n",x,y,h);
} //ANSWER: Trgle w legs 5.000000 and 12.000000 has hyp of 5.000000

double hyp(double a, double b)
{
    double sum, result;
    a = 3;
    b = 4;
    sum = a*a + b*b;
    result = sqrt(sum);
    return result;
}

```

x   
 y   
 h   
  
 a   
 b   
 sum   
 result

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## Functions - pass by address

```

#include <stdio.h>
#include <math.h>
void get_r_theta(double a, double b,
                double *adr_r, double *adr_th);
void main()
{
    double x,y,h,r,th;
    printf("Enter x, y components of vector: ");
    scanf("%lf %lf",&x,&y);
    get_r_theta(x,y,&r,&th);
    printf("Vector with x=%lf and y=%lf
           has r=%lf, theta=%lf\n",x,y,r,th);
}

void get_r_theta(double a, double b,
                double *adr_r, double *adr_th)
{
    double sum;
    sum = pow(a,2)+pow(b,2); //or a*a+b*b;
    *adr_r = sqrt(sum);
    *adr_th = atan2(b,a);
}

```

x  4600  
 y  4608  
 r  4610  
 th  4618

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## Functions - pass by address

```

#include <stdio.h>
#include <math.h>
void get_r_theta(double a, double b,
                 double *adr_r, double *adr_th);
void main()
{
    double x,y,h;
    printf("Enter x, y components of vector: ");
    scanf("%lf %lf",&x,&y); // user enters 3,4
    get_r_theta(x,y,&r,&th);
    printf("Vector with x=%lf and y=%lf
           has r=%lf, theta=%lf\n",x,y,r,th);
}

void get_r_theta(double a, double b,
                 double *adr_r, double *adr_th)
{
    double sum;
    sum = pow(a,2)+pow(b,2); //or a*a+b*b;
    *adr_r = sqrt(sum);
    *adr_th = atan2(b,a);
}

```

x	3.0	4600
y	4.0	4608
r	?	4610
th	?	4618

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## Functions - pass by address

```

#include <stdio.h>
#include <math.h>
void get_r_theta(double a, double b,
                 double *adr_r, double *adr_th);
void main()
{
    double x,y,h;
    printf("Enter x, y components of vector: ");
    scanf("%lf %lf",&x,&y);
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    printf("Vector with x=%lf and y=%lf
           has r=%lf, theta=%lf\n",x,y,r,th);
}

void get_r_theta(double a, double b,
                 double *adr_r, double *adr_th)
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    double sum;
    sum = pow(a,2)+pow(b,2); //or a*a+b*b;
    *adr_r = sqrt(sum);
    *adr_th = atan2(b,a);
}

```

x	3.0	4600
y	4.0	4608
r	?	4610
th	?	4618
a	3.0	7380
b	4.0	7388
adr_r	4610	7390
adr_th	4618	7394
sum	?	7398

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## Functions - pass by address

```

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{
    double x,y,h;
    printf("Enter x, y components of vector: ");
    scanf("%lf %lf",&x,&y);
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    printf("Vector with x=%lf and y=%lf
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```

x	3.0	4600
y	4.0	4608
r	?	4610
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a	3.0	7380
b	4.0	7388
adr_r	4610	7390
adr_th	4618	7394
sum	25.0	7398
		15

## Functions - pass by address

```

#include <stdio.h>
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void get_r_theta(double a, double b,
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}

```

x	3.0	4600
y	4.0	4608
r	5.0	4610
th	?	4618
a	3.0	7380
b	4.0	7388
adr_r	4610	7390
adr_th	4618	7394
sum	25.0	7398
		16



## Functions - pass by address

```

#include <stdio.h>
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    scanf("%lf %lf",&x,&y);
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    *adr_r = sqrt(sum);
    *adr_th = atan2(b,a);
}

```

x	3.0	4600
y	4.0	4608
r	5.0	4610
th	36.87	4618
a	3.0	7380
b	4.0	7388
adr_r	4610	7390
adr_th	4618	7394
sum	25.0	7398

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## Functions - pass by address

```

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void main()
{
    double x,y,h;
    printf("Enter x, y components of vector: ");
    scanf("%lf %lf",&x,&y);
    get_r_theta(x,y,&r,&th);
    printf("Vector with x=%lf and y=%lf
           has r=%lf, theta=%lf\n",x,y,r,th);
}
void get_r_theta(double a, double b,
                double *adr_r, double *adr_th)
{
    double sum;
    sum = pow(a,2)+pow(b,2); //or a*a+b*b;
    *adr_r = sqrt(sum);
    *adr_th = atan2(b,a);
}

```

x	3.0	4600
y	4.0	4608
r	5.0	4610
th	36.87	4618

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