

Intrinsic or Library Functions

sqrt (4.0)

Function Name

Argument

Most languages have common built in functions to handle common mathematical operations. In C++ these include:

cos - cosine
sin - sine
tan - tangent
log - natural logarithm
log10 - logarithm base 10
exp - raise e(2.71..) to the given power
fabs - get the absolute value of a floating point value
abs - get the absolute value of an integer value.

```

#include <iostream>
#include <cmath>          // for the trig functions
#include <cstdliblib>

using namespace std;

int main( void )
/*
 * This program prints out a trig table using
 * the intrinsic C/C++ functions.  It steps
 * from 0 to 2*PI in 0.25 radian steps.
 *
 * Note:  All trig functions take radians in
 *        C/C++!!
 */
{
    float angle;

    angle = 0.0;
    while (angle < 2.0 * 3.14159) {
        cout << angle << "  " << sin(angle)

```

```

        << " " << cos(angle) << " "
        << tan(angle) << endl;
    angle = angle + 0.25;
}

return EXIT_SUCCESS;
}

#include <iostream>
#include <cmath>
#include <cstdlib>

using namespace std;

int main( void )
/*
 * This program prints out a table of square
roots, squares, and cubes
 * using the intrinsic C/C++ functions. It
steps from 0 to 50.
 *

```

```

    */
{
    float value, root, square, cube;

    value = 0.0;
    while (value <= 50.0) {
        root    = sqrt(value);
        square  = pow(value, 2.0);
        cube    = pow(value, 3.0);
        cout << value << "    " << root << "    "
             << square << "    " << cube << endl;
        value = value + 1;
    }
    return EXIT_SUCCESS;
}

```

Text - Programming Project 4

```
#include <iostream>
#include <cmath>
#include <cstdlib>

/*
 * Programming Project 4 from the text.
 *
 * Step 1:  Input the angle, distance to
 *          target, and velocity
 *
 * Step 2:  Compute time of flight
 *          (distance/(velocity * cos(theta)))
 *
 * Step 3:  Compute height at target
 *
 * Step 4:  Output result of flight.
 */
using namespace std;

int main( void )
{
    float theta, distance, velocity;

    /*
```

```

* Step 1:  Input the angle, distance to
*          target, and velocity
*/
cout << "Input the angle in radians: ";
cin  >> theta;

cout << "Input the distance to the target (in feet) : ";
cin  >> distance;

cout << "Input the initial velocity of the projectile
(ft/sec) : ";
cin  >> velocity;

cout << "Theta      = " << theta << endl;
cout << "Distance = " << distance << endl;
cout << "Velocity = " << velocity << endl;

return EXIT_SUCCESS;
}

```

Version 2

```
#include <iostream>
#include <cmath>
#include <cstdlib>

/*
 * Programming Project 4 from the text.
 * Step 1:  Input the angle, distance to
 *         target, and velocity
 * Step 2:  Compute time of flight
 *         (distance/(velocity * cos(theta)))
 * Step 3:  Compute height at target
 * Step 4:  Output result of flight.
 */
using namespace std;

int main( void )
{
    float theta, distance, velocity;
    float time, velocity;
    /*
     * Step 1:  Input the angle, distance to
     * target, and velocity
     */
    cout << "Input the angle in radians: ";
```

```

    cin  >> theta;

    cout << "Input the distance to the target (in feet) : ";
    cin  >> distance;

    cout << "Input the initial velocity of the projectile
(ft/sec) : ";
    cin  >> velocity;

    cout << "Theta      = " << theta << endl;
    cout << "Distance = " << distance << endl;
    cout << "Velocity = " << velocity << endl;
/* Step 2:  Compute time of flight
 *          (distance/(velocity * cos(theta)))
 */
    time = distance / (velocity * cos(theta));

    cout << "Time      = " << time << " seconds" << endl;
/* Step 3:  Compute height at target
 * Step 4:  Output result of flight.
 */
    height = velocity * sin(theta) * time -
              32.17 * time * time / 2.0;
    cout << "Height    = " << height << endl;

    return EXIT_SUCCESS;
}

```

Building Your Own Functions

Need to determine inputs and outputs from the function. In essence we are building a black box.

Easiest Case -- No inputs or outputs.

Example:

```
void instruct ( void )
{
    cout << "This program takes an angle" << endl;
    cout << "in radians, a distance to a" << endl;
    cout << "target (in feet) and an initial " << endl;
    cout << "velocity in feet/second. It will" << endl;
    cout << "compute the time in the air for " << endl;
    cout << "the projectile and the height " << endl;
    cout << "above the target that the " << endl;
    cout << "projectile will pass at." << endl;
    return;
}
```

Next version -- inputs but no outputs

```
void computeHeight (float t, float angle, float v)
{
    float height;

    height = v * sin(angle) * t - 32.17 *t *t / 2.0;
    cout << "The projectile will pass over the
```

```
target" << endl;
    cout << "at a height of " << height << " feet" <<
endl;

    return;
}
```

How do the arguments work?

They are positional. When the routine is called each of the arguments is copied over in the order it appears. Names have nothing to do with it. So to call this from our other main program we would have:

```
computeHeight(time, theta, velocity);
```

Returning Values

```
float getTheta(void)
{
    float angle;

    cout << "Input the angle in radians : ";
    cin >> angle;
    return angle;
}

float getDistance (void)
{
    float distance;

    cout<<"Input the distance to the target in feet :
";
    cin >> distance;

    return distance;
}

float getVelocity (void)
{
```

```
float v;  
  
cout<<"Input the initial velocity of the "  
      <<"projectile in ft/sec : ";  
cin >> v;  
  
return v;  
}
```

The Revised Program

```
#include <iostream>
#include <cmath>
#include <cstdlib>

using namespace std;

void  instruct(void);
float  getAngle(void);
float  getDistance(void);
float  getVelocity(void);
void  computeHeight(float t, float angle, float v);

int main( void )
{
    float theta, distance, velocity;
    float time, velocity;
    /*
    * Step 1:  Input the angle, distance to
    * target, and velocity
    */
    instruct();
    theta = getAngle();
    distance = getDistance();
    velocity = getVelocity();
```

```

/* Step 2: Compute time of flight
 *          (distance/(velocity * cos(theta)))
 */
time = distance/(velocity * cos(theta));

cout << "Time          = " << time << " seconds" << endl;
/* Step 3: Compute height at target
 * Step 4: Output result of flight.
 */
computeHeight(time, theta, velocity);

return EXIT_SUCCESS;
}

void instruct ( void )
{
    cout << "This program takes an angle" << endl;
    cout << "in radians, a distance to a" << endl;
    cout << "target (in feet) and an initial " << endl;
    cout << "velocity in feet/second. It will" << endl;
    cout << "compute the time in the air for " << endl;
    cout << "the projectile and the height " << endl;
    cout << "above the target that the " << endl;
    cout << "projectile will pass at." << endl;
    return;
}

```

```

float getTheta(void)
{
    float angle;

    cout << "Input the angle in radians : ";
    cin >> angle;
    return angle;
}

float getDistance (void)
{
    float distance;

    cout<<"Input the distance to the target in feet : ";
    cin >> distance;

    return distance;
}

float getVelocity (void)
{
    float v;

    cout<<"Input the initial velocity of the "
        <<"projectile in ft/sec : ";
    cin >> v;
}

```

```
    return v;
}

void computeHeight (float t, float angle, float v)
{
    float height;

    height = v * sin(angle) * t - 32.17 *t *t / 2.0;
    cout << "The projectile will pass over the target" <<
endl;
    cout << "at a height of " << height << " feet" << endl;

    return;
}
```