

# Unit 2

Computing Practice and Programming

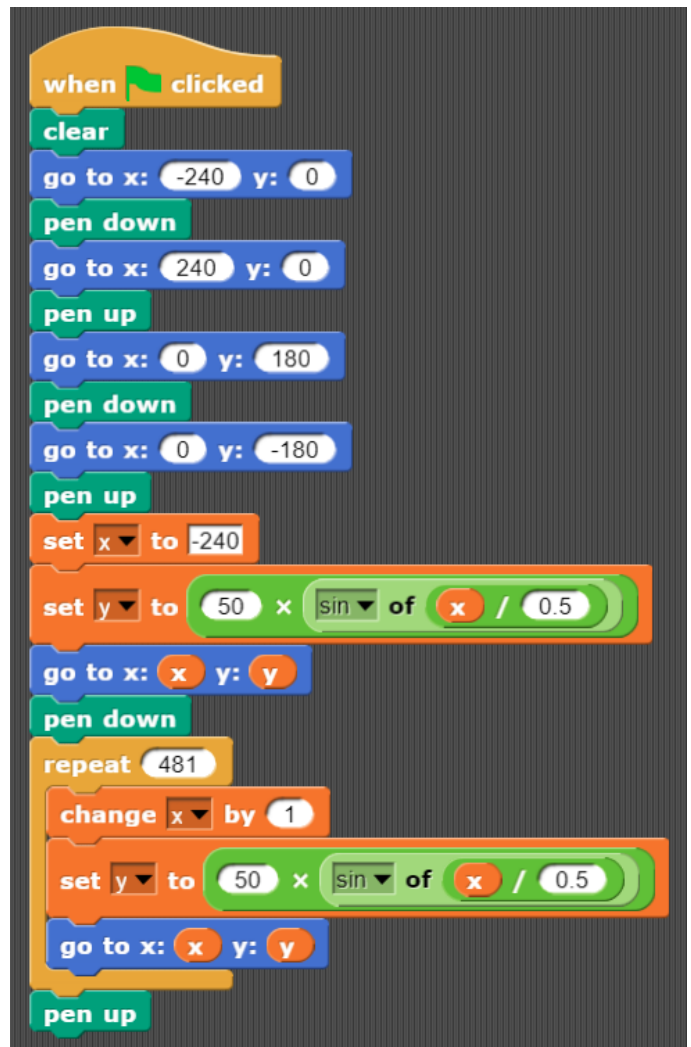
## Part 3: Developing Programs

### Write Programs to Solve Mathematical Problems

#### Functions

In mathematics, a function receives an input and produces one single output. This behavior can easily be represented in a computer program. A common trigonometric function is the sine.

The program to the right draws a section of this sine curve function on the coordinate plane. Initially, the program draws the coordinate plane. It then begins at the far left and draws each coordinate with  $x$  incrementing by one and  $y$  calculated using the sin function. After the sine curve is drawn for this region, the repeat stops, and the pen is lifted.



```
when clicked
clear
go to x: -240 y: 0
pen down
go to x: 240 y: 0
pen up
go to x: 0 y: 180
pen down
go to x: 0 y: -180
pen up
set x to -240
set y to 50 * sin of x / 0.5
go to x: x y: y
pen down
repeat 481
  change x by 1
  set y to 50 * sin of x / 0.5
  go to x: x y: y
pen up
```

## Equations

Similarly, equations can be solved through the use of a program. An equation is a mathematical statement containing an equals sign and one or more variables.

A common equation is the quadratic equation,  $ax^2 + bx + c = 0$ . This equation is easily solved through the use of the quadratic formula,  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$  and we can represent that by solving for x in our program.

In the SNAP program to the right, the values of a, b, and c are collected from the user. The discriminant,  $b^2 - 4ac$ , is then calculated. Using knowledge from math, we know that if this value is less than zero there are no real solution, if it is equal to zero there is one solution, and if it is greater than zero, there are two solutions. This logic is applied using an if and if-else statement. The solution is then calculated using the remaining parts of the quadratic formula and either the one solution or both solutions are displayed to the user.

```
when clicked
ask Entera and wait
set a to answer
ask Enterb and wait
set b to answer
ask Enter c and wait
set c to answer
set discriminant to (b x b - 4 x a x c)
if discriminant < 0
say There are no real solutions. for 2 secs
else
if discriminant = 0
say There is one real solution. for 2 secs
set solution1 to (-1 x b + sqrt of discriminant) / (2 x a)
say join The solution is solution1 for 2 secs
else
say There are two real solutions. for 2 secs
set solution1 to (-1 x b + sqrt of discriminant) / (2 x a)
set solution2 to (-1 x b - sqrt of discriminant) / (2 x a)
say join The first solution is solution1 for 2 secs
say join The second solution is solution2 for 2 secs
```