Hatch Reference Manual

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Storing

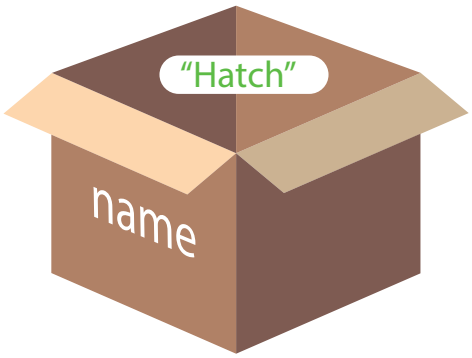
Variables

What is a Variable?

A variable is a container that stores data. This data can change.

The text "Hatch" is stored in the variable name.

```
var name = "Hatch";
```



Assigning Values to Variables

Use the = Equal Sign to assign a value to a variable.

1. The value always goes to the right of the equal sign.

```
var name = "Hatch";
```

A-Z Text must be within quotes

```
"Hatch"
```

Storing

Variables

Types of Values you can Store

Variables can hold text and numbers including integers and decimals.

1. Use quotes to store text

```
var name = "Hatch";
```

123. Storing numbers

```
var num = 5.3;
```

How to Name your Variables

Variable name are case sensitive and must be unique and MUST follow these 3 rules:

1. Starts with a Letter

```
var name;
```

2. Must contain ONLY

3. Cannot be a JavaScriptKeyword

4. Data Types
Arrays
Objects
Functions

Variables

Reassigning Variables

You can change a value stored in a variable while the code runs.

1. Original Variable

```
var num = 1;
```

2. New Variables

Adds 5 to num

```
num+=5;
```

num = 6

Multiplies num by 5

```
num*=5;
```

num = 5

Subtract num by 5

```
num-=5;
```

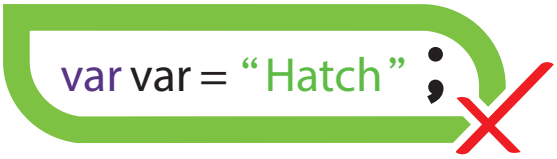
num = 4

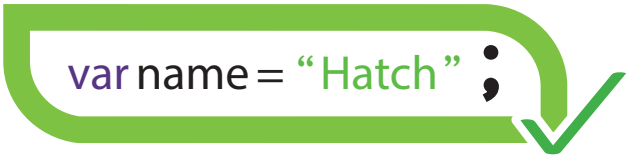
Reserved Keywords

Reserved Keywords

In English "CAT" is a defined word that has a specific meaning. JavaScript has those as well.

1. The word var can only be used as a JavaScript Keyword





EX. Here are some examples:

Reserved	User
var	name
loop	cat
draw	x

Using Booleans

Booleans allow you to turn specific components on and off. They are stored as true or false .

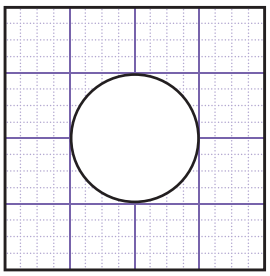
Using Booleans

Increasing the frame rate will not change the way the program runs significantly.

This is a boolean that stores true or false in a variable named circle.

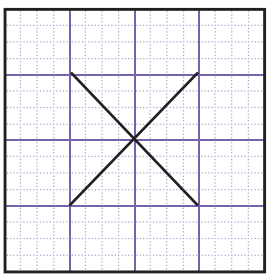
```
var circle = true;
```

```
var circle = true;
if (circle) {
  ellipse (200 , 200 , 200 , 200);
}
```



This will draw a circle if var circle is true.

```
var circle = false;
if (circle) {
   line (100 , 100 , 300 , 300);
   line (100 , 300 , 300 , 100);
}
```



This will draw an X if it is false.

Colour Basics

RGB Colours

In a computer, colors are made by combining three colours together: Red, Green, and Blue.

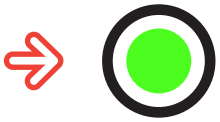
By setting different values for Red, Green, and Blue you can create any colour!

Really Red!

```
color ( 255 , 0 , 0 ) ;
```

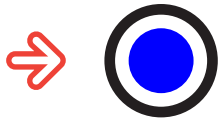
Really Green!

```
color ( 0 , 255 , 0 ) ;
```



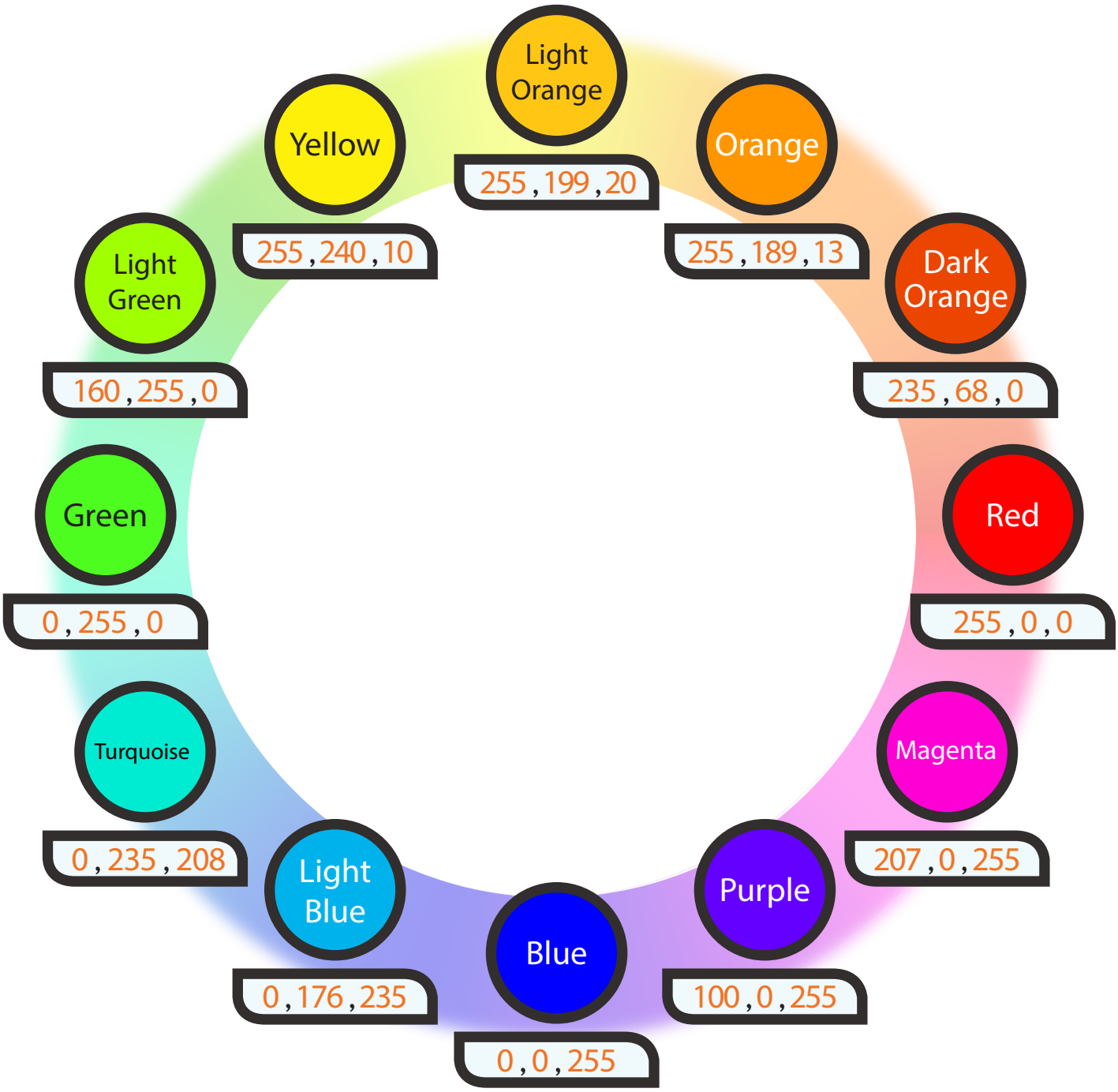
Really Blue!

```
color ( 0 , 0 , 255 ) ;
```



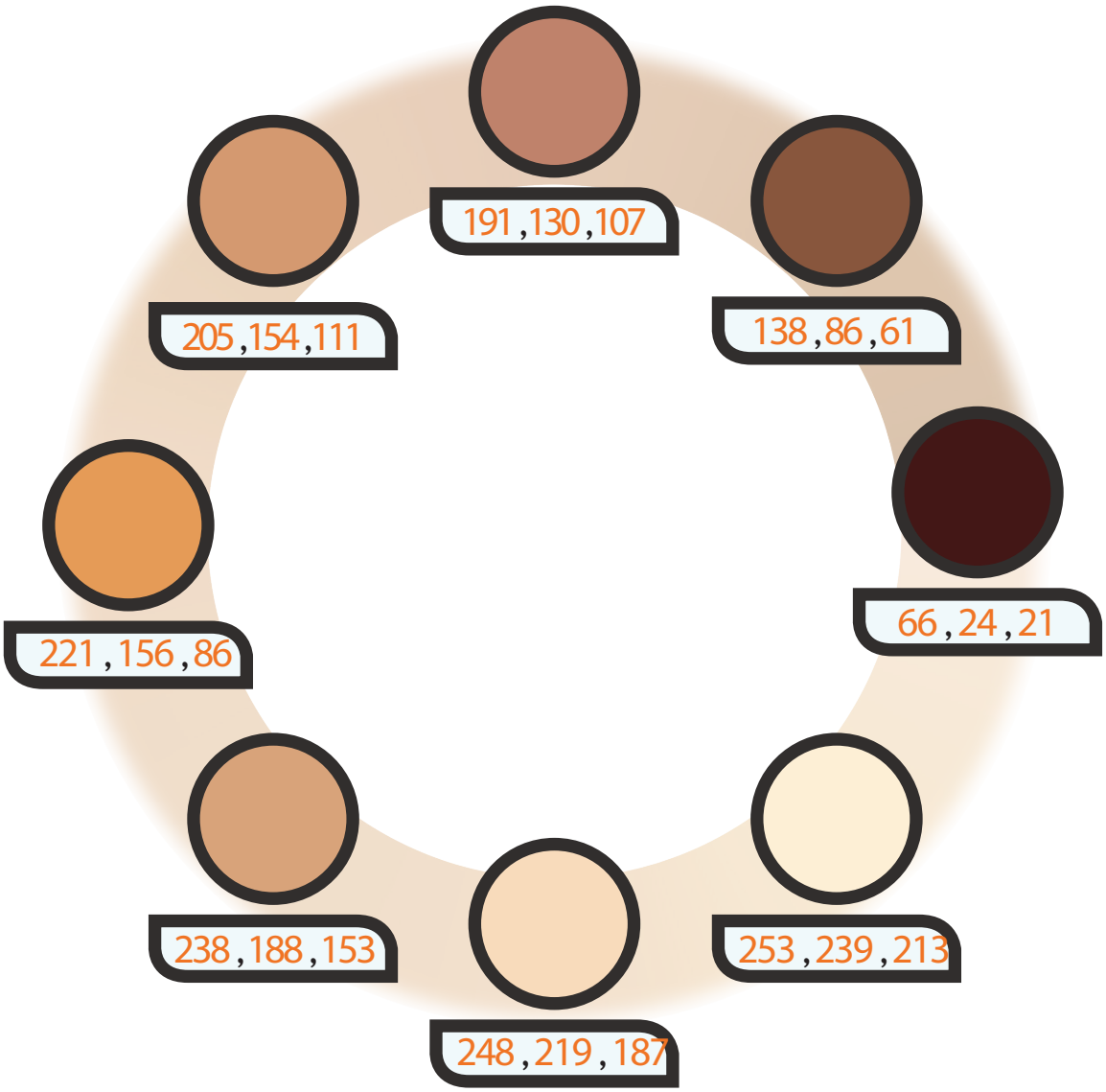
White	Light Grey	Grey	Dark Grey	Black
255 , 255 , 255	192 , 192 , 192	128 , 128 , 128	64 , 64 , 64	0 , 0 , 0

RGB Colour Wheel



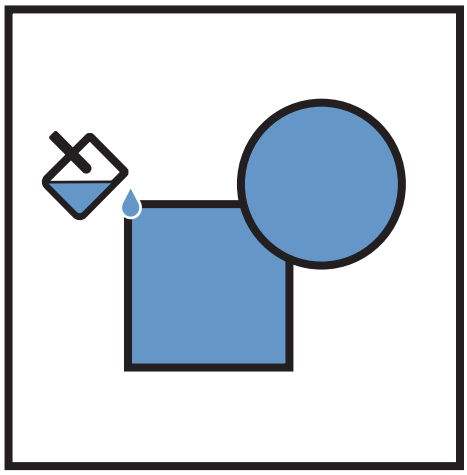
Colouring

Skin Tones



Order of Colours

Set the colour of multiple shapes. All shapes will be filled with the colour after the fill function.



Stroke is the outline, Fill is the inside.

```
fill(100, 150, 200);
rect(100, 150, 150, 150);
ellipse(250, 150, 150, 150);
```

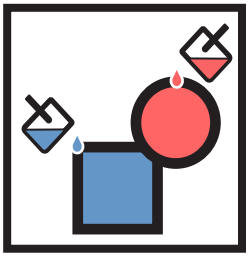
1. Fill and Stroke act on all shapes below them.

Acts on both shapes

```
stroke(10);
fill(100, 150, 200);
rect(100, 150, 150, 150);
fill(250, 100, 100);
ellipse(250, 150, 150, 150);
```

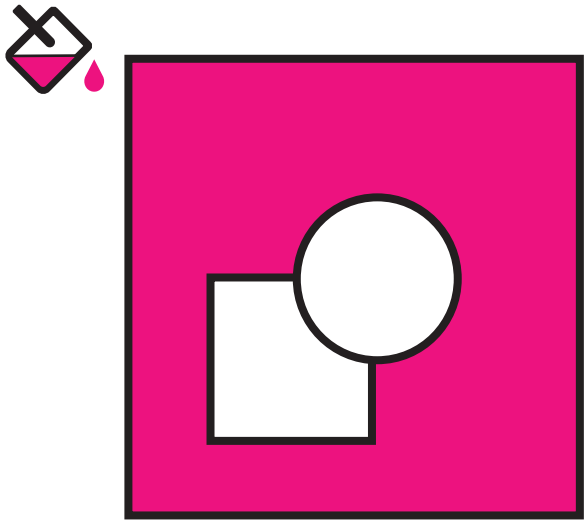
Fills the rectangle

Fills the ellipse



Background

Set the background colour of the canvas.



The amount of Blue and the Transparency

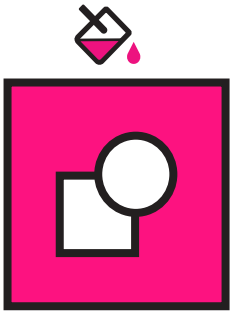
```
background ( R , G , B , A ) ;
```

The amount of Red and Green

Setting the Background Colour

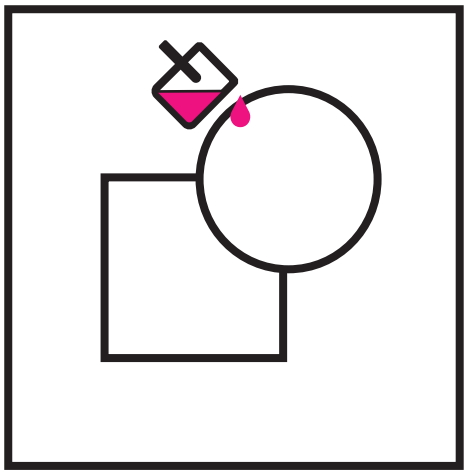
The background function sets the colour of the canvas.

```
background ( 255 , 0 , 128 ) ;
rect ( 100 , 150 , 150 , 150 ) ;
ellipse ( 250 , 150 , 150 , 150 ) ;
```



Fill

Fills acts on the inside of shapes and text and fills them with colour.



Transparency means see through

The amount of Blue and the Transparency

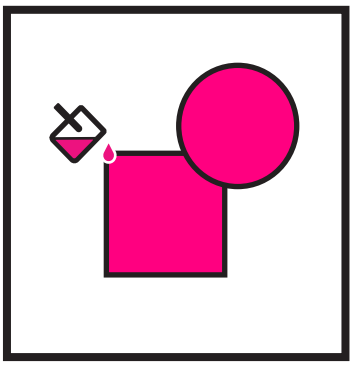
```
fill ( R , G , B , A ) ;
```

The amount of Red and Green

Filling Shapes with Colour

Place the fill function before the shapes.

```
fill ( 255 , 0 , 128 ) ;
rect ( 100 , 150 , 150 , 150 ) ;
ellipse (250 , 150 , 150 , 150 ) ;
```

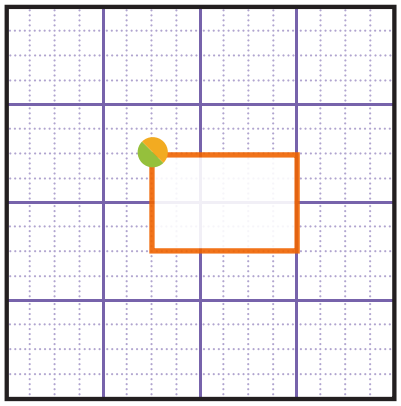


Stroke

This is the outline of a shape, or the colour of a line.

1. The stroke function changes the colour of the outline.

```
stroke ( 240 , 100 , 0 ) ;
rect ( 150 , 150 , 150 , 100 ) ;
```

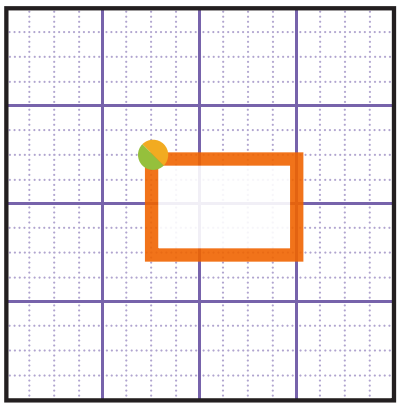


N noStroke ( ) ; removes the outline.

StrokeWeight

This changes the thickness of the outline.

```
strokeWeight ( 5 ) ;
rect ( 150 , 150 , 150 , 100 ) ;
```



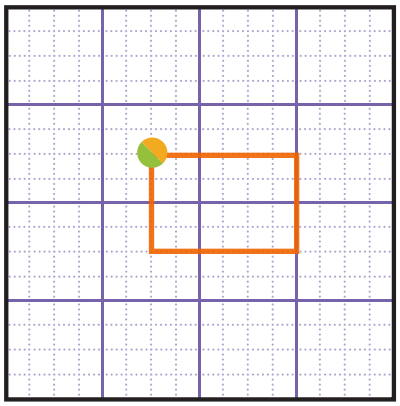
noStroke & noFill

You can remove the colour or the outline by calling the noFill or noStroke functions. The inside of these functions are empty. They do not require parameters.

noFill

Using noFill removes the inside colour of a shape or text.

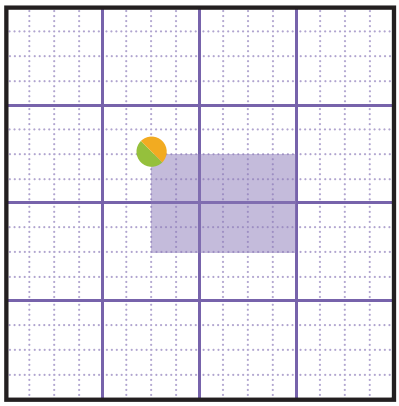
```
noFill ( ) ;
stroke ( 240 , 100 , 0 ) ;
rect ( 150 , 150 , 150 , 100 ) ;
```



noStroke

Using noStroke removes the outline of a shape

```
noFill ( ) ;
fill ( 139 , 121 , 184 ) ;
rect ( 150 , 150 , 150 , 100 ) ;
```



ColorMode

You can use HSB to adjust colours differently.

HSB

HSB means hue / saturation / brightness.

Max Value

```
noStroke ( ) ;
colorMode ( HSB , 400 ) ;
for ( var i = 0 ; i < 4 0 0 ; i ++ ) {
    for ( var j = 0 ; j < 4 0 0 ; j ++ ) {
    fill ( i , j , 400 ) ;
    ellipse ( i , j , 1 , 1 ) ;
    }
}
```

HSB allows you to draw rainbows easily.

Hue

Is the colour Red, Green and Blue.

0 = Red

200 = Green

400 = Blue

Red is the lowest value, green is the middle value and blue is the highest.

Saturation

Is how much grey.

0 = Grey

400 = Colour

Lightness

Is how much Black vs. White.

0 = Black

400 = White

You can set the top value as the second argument

ColorMode

You can use RGB of you can use HSB as parameters in colorMode( );

RGB

This is Red, Green and Blue. You can also add in the max value as the second argument.

Max Value

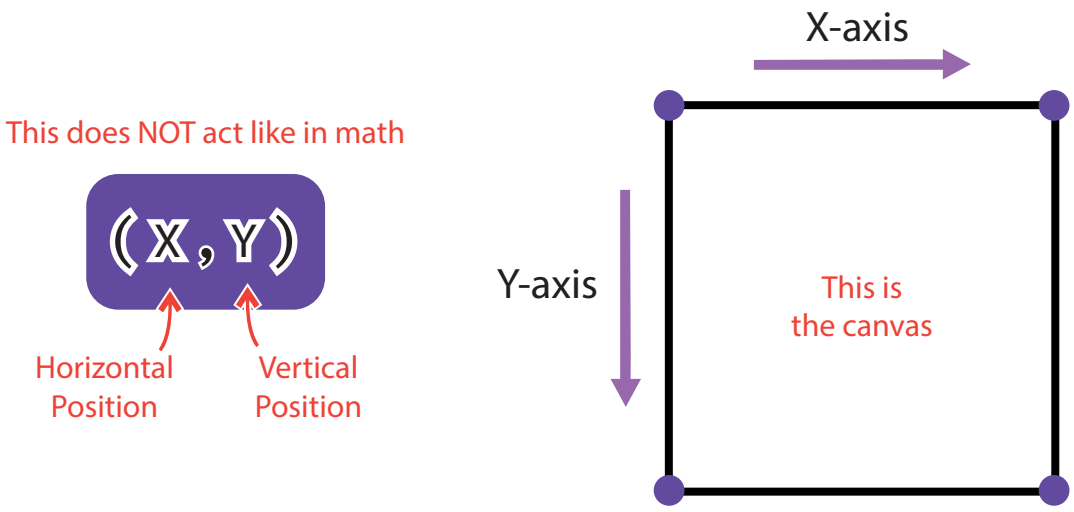
```
noStroke ( ) ;
colorMode ( RGB , 400 ) ;
for ( var i = 0 ; i < 4 0 0 ; i ++ ) {
    for ( var j = 0 ; j < 4 0 0 ; j ++ ) {
    fill ( i , j , 0 ) ;
    ellipse ( i , j , 1 , 1 ) ;
    }
} ;
```

I used 400 to have a more gradual change and fill all the canvas

Coordinate Plane

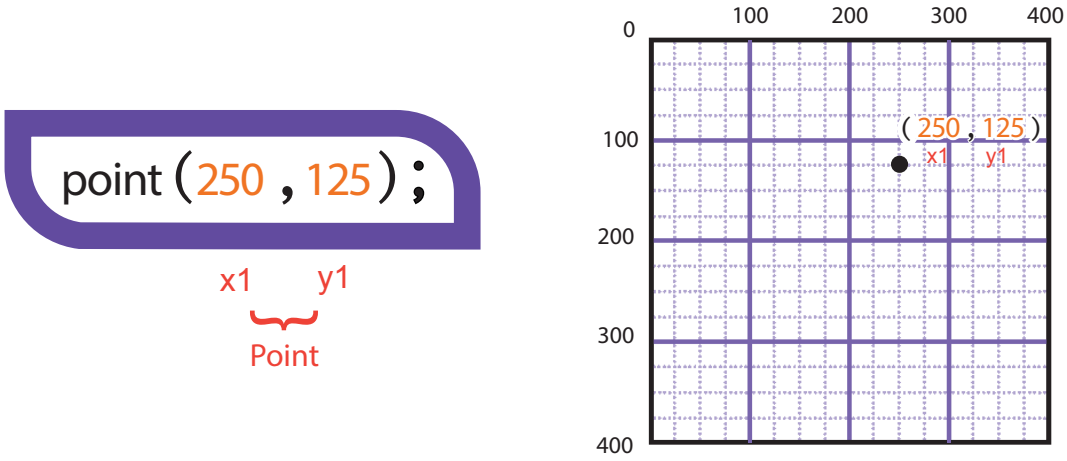
What is the Coordinate Plane?

The coordinate plane / grid is a two-dimensional surface formed by the x-axis and y-axis.



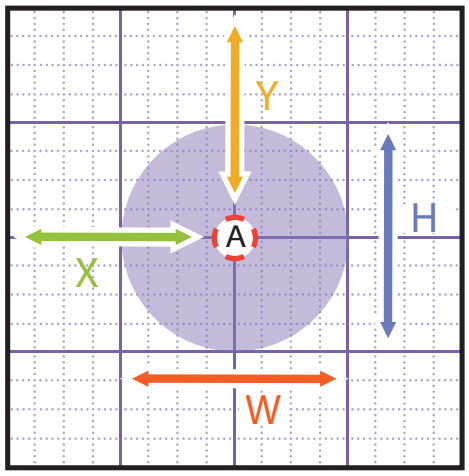
How to use the Coordinate Plane

Use the x and y coordinates to place items on the canvas.



Ellipse

Draws an Oval or Circle from the center point A



The W and H of the circle

```
ellipse ( 200 , 200 , 200 , 200 ) ;
```

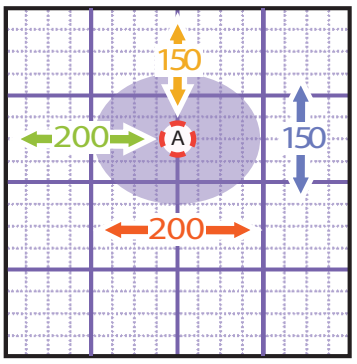
The X and Y position
of the oval's center point A

How to Draw an Oval

Set the ellipse's center point first,
then set the width and height.

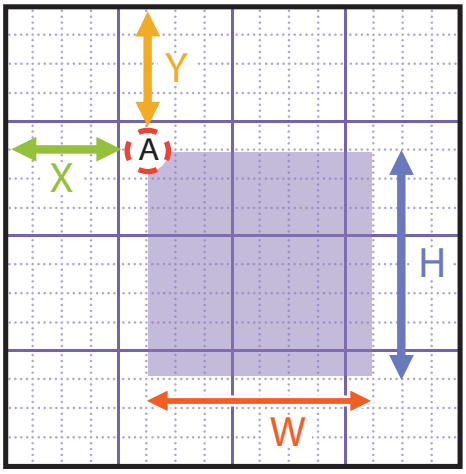
```
ellipse ( 200 , 150 , 150 , 200 ) ;
```

The X and Y position
of the oval's center point A



Rect

Draws a Rectangle or Square from the upper left corner point A



The W and H of the rectangle

```
rect ( 125 , 125 , 200 , 200 );
```

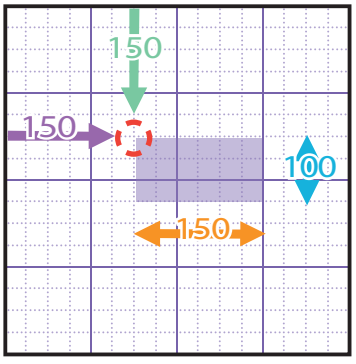
The X and Y position
of the rectangle's center point A

How to Draw a Rectangle

Set the rectangle's upper left corner first,
set the width and height.

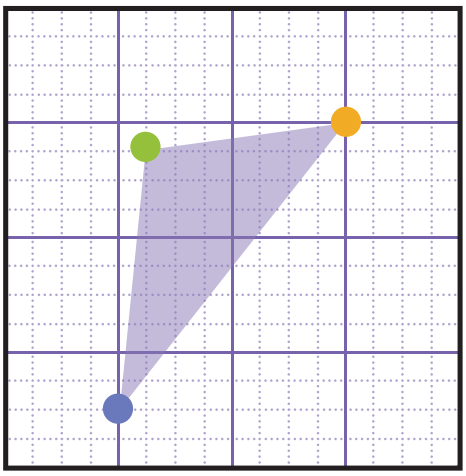
```
rect ( 150 , 150 , 150 , 100 );
```

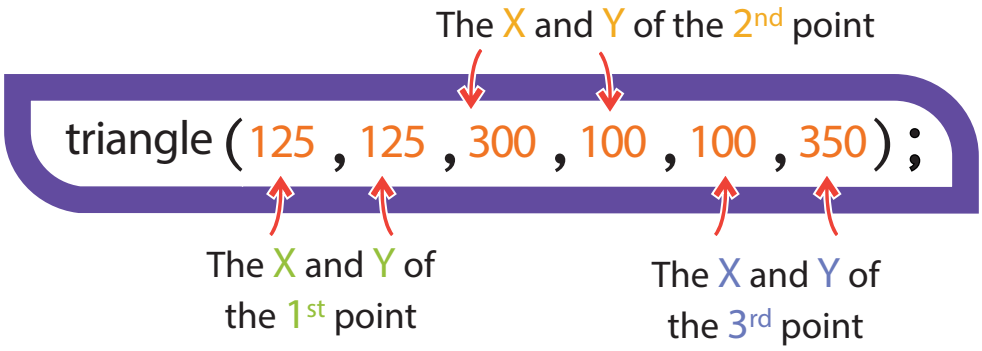
The X and Y position
of the rectangle's center point A



Triangle

Draws the three points of a triangle,
each point will need an X and Y position.





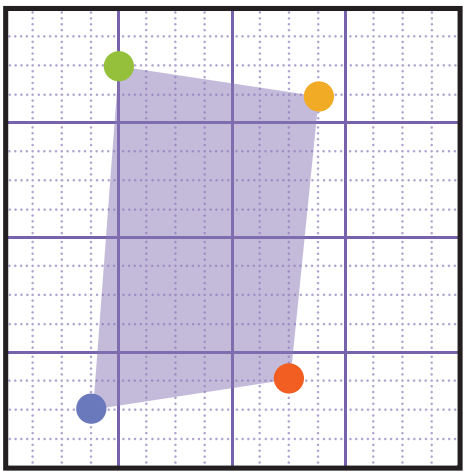
1. Set the values of the 1st vertex on X and Y in the canvas.

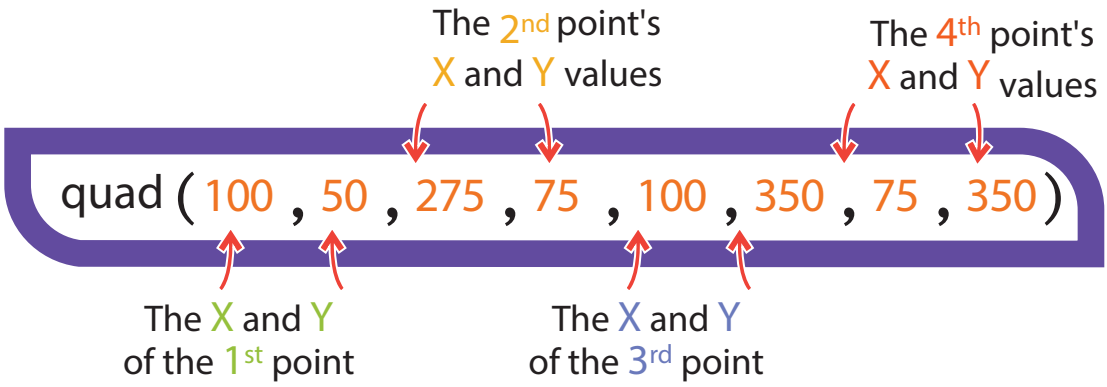
2. Continues by assigning the X and Y for the 2nd vertex.

3. And then the 3rd vertex, set the X and Y in the canvas and the triangle will show up.

Quad

Draws a four sided figure like a rectangle,
except the points can be drawn from anywhere.





1. Set the 1st vertex's X and Y values on the canvas.

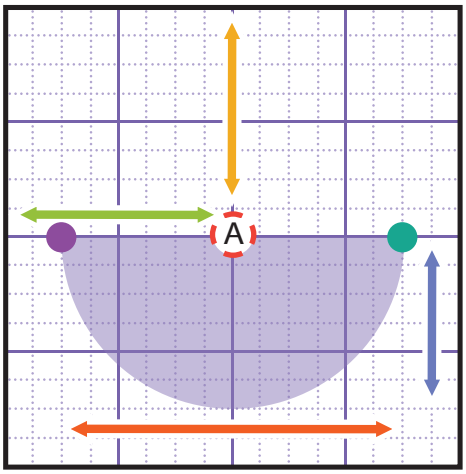
2. Continue by assigning the X and Y values for the 2nd vertex.

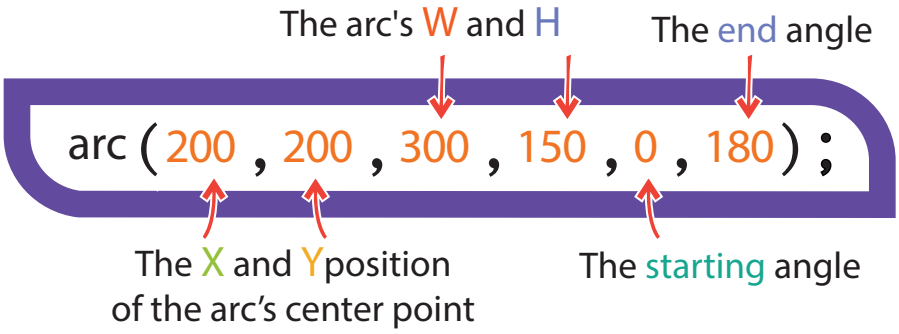
3. Then set the X and Y values for the 3rd vertex.

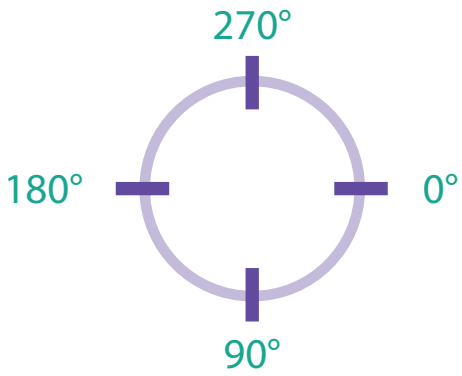
4. Finally, set the X and Y values of the 4th vertex.

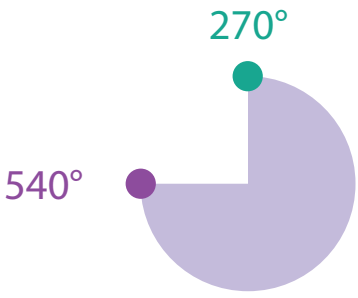
Arc

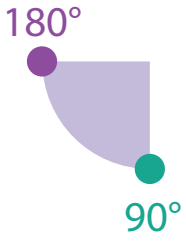
Draws a part of a circle. It will need the X and Y values.
Then width and height as a second pair.
Finally, the starting and end angles.





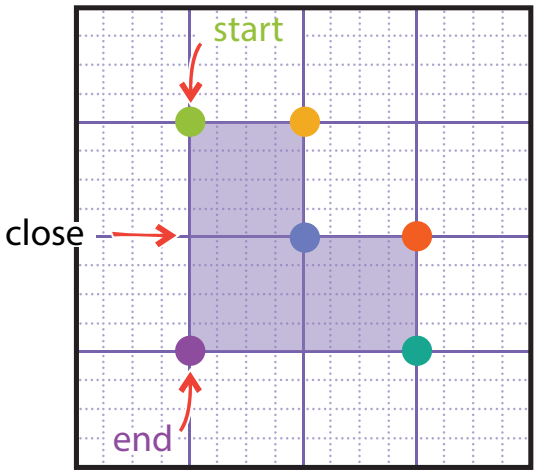






Special Shapes

To draw a custom shape, list all the vertices or points and put them between beginShape( ) and endShape( ).




```
beginShape ( ) ;
vertex ( 50 , 50 ) ;
vertex ( 200 , 50 ) ;
vertex ( 200 , 200 ) ;
vertex ( 300 , 200 ) ;
vertex ( 300 , 250 ) ;
vertex ( 250 , 50 ) ;
endShape ( CLOSE ) ;
```

1st point of X and Y

2nd point of X and Y

3rd point of X and Y

4th point of X and Y

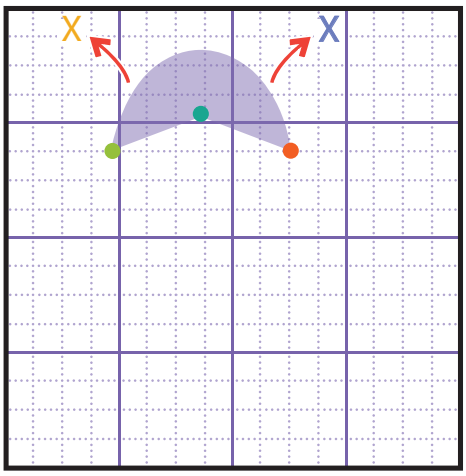
5th point of X and Y

6th point of X and Y

Complex Shapes

BezierVertex

You can use bezierVertex to create shapes with curves. These work similar to bezier but without the first anchor point.




```
beginShape();
vertex(80, 125);
bezierVertex(100, 0, 220, 0, 240, 120);
vertex(160, 90);
endShape(CLOSE);
```

Point of X and Y

Point of X and Y

Center Point 1

Anchor Point

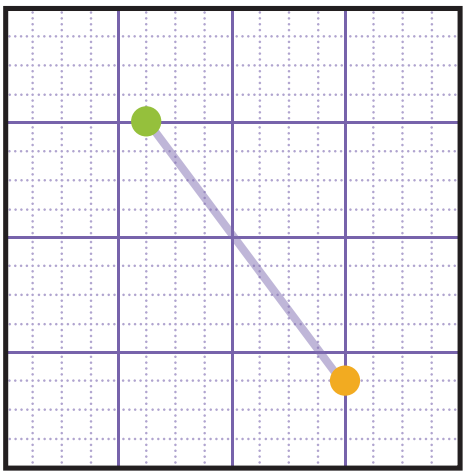
Center Point 2

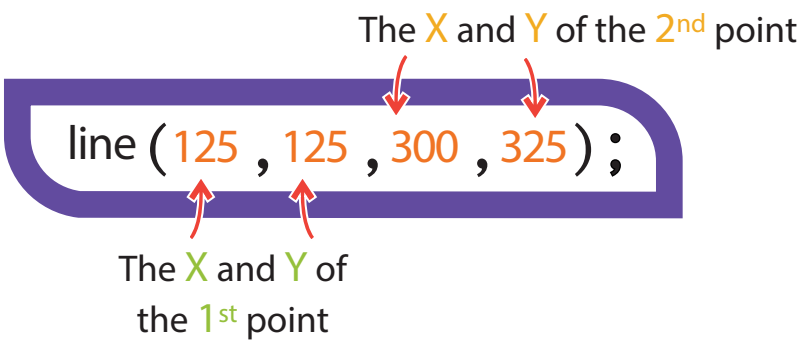
The control points pull the line drawn toward them.

Tip: Make sure you know all your vertex points and plan your pattern first on paper.

Line

Draws a line from one point to another on the screen.



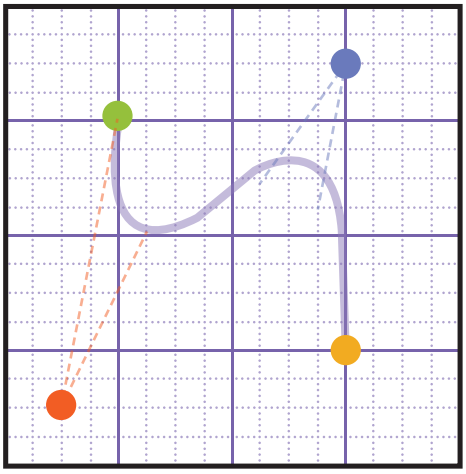


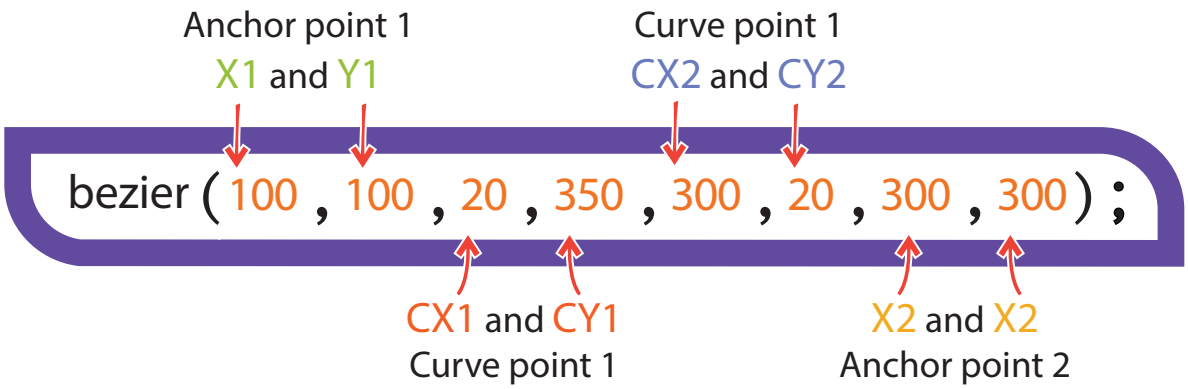
1. Set the values of the 1st point of the X and Y values on the canvas.

2. Continue by assigning the X and Y of the 2nd point.

Bezier

This allows you to make a curved line.



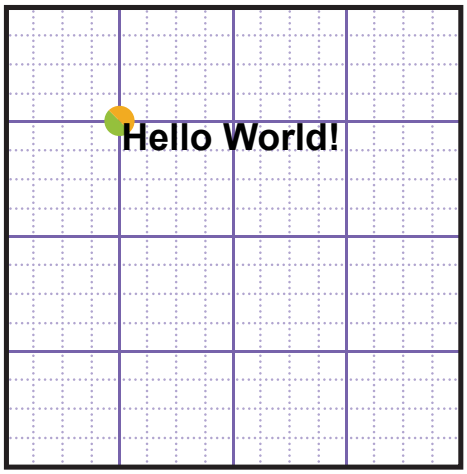


1. Anchor points are where the line starts and ends.

2. Curve points pull the line towards the curve points.

Text

Draws text on the canvas.



Remember text is coloured using fill not stroke. Text acts like shapes.

```
text ( "HelloWorld" , 50 , 100 ) ;
```

What the text says.
Type the text between (" ")

The X and Y position of the start point in the text

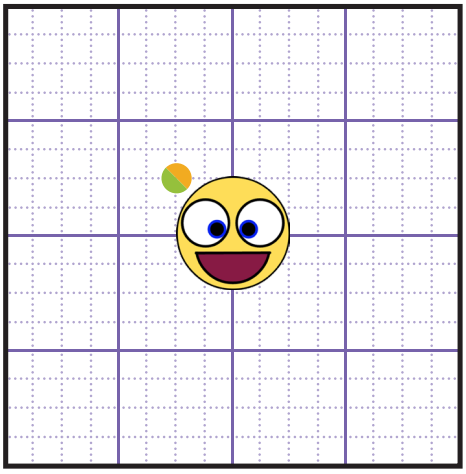
How to Set the Size of Text

This line of code sets the size of any text below it.
The size of the text is determined by a number.

```
textSize ( 14 ) ;
text ( "Hello World" , 50 , 100 ) ;
```

Image

Displays an image on the canvas.



The image's W and H

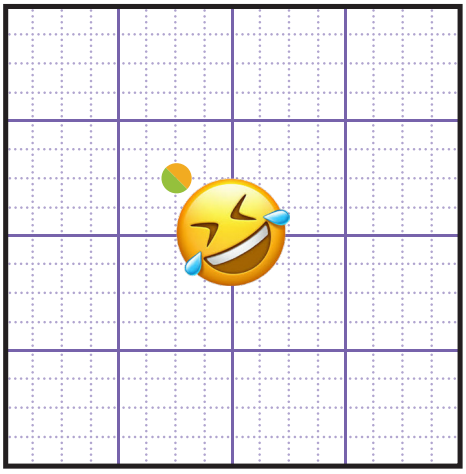
```
image ( getImage ( " avatars / sub-sampling " ) , 150 , 150 , 100 , 100 ) ;
```

The X and Y of the image

1. To add or change an image, go to the Hatch library and copy the text under the image. Paste this between the (" ") .

Internet Image

Displays an image on the canvas taken from Internet.



The image's W and H

```
image(loadImage("URL"), 150, 150, 100, 100);
```

The X and Y of the image

1. To add or change an image from Internet, go to your browser and search for an image that you would like to use. The format of the image has to be an image or gif file.

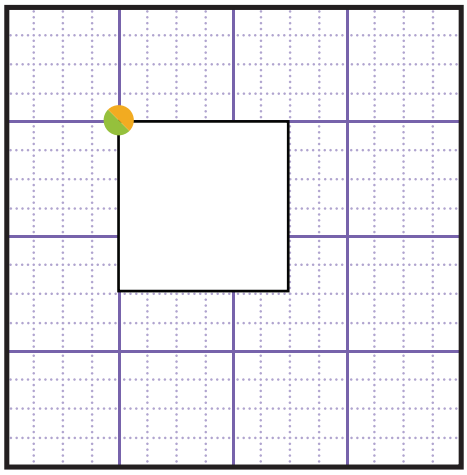
2. Once you found the image, open the image in a new tab and copy the URL. Come back to Hatch Studio and paste the URL in between the ("").

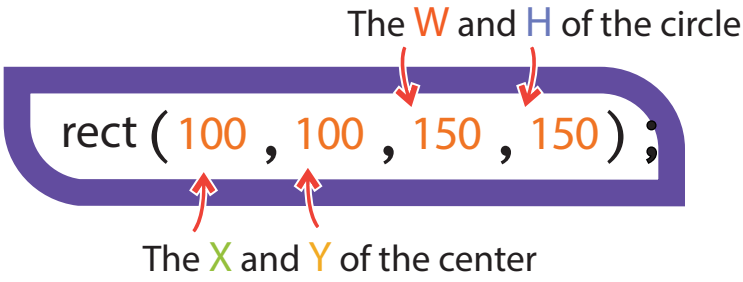
Rect Mode

These change the starting location of what is being drawn.

rectMode ( );

The default mode for rectangles draws them from the top left corner.





This is the normally drawn rectangle.
This is rectMode(CORNER) ;

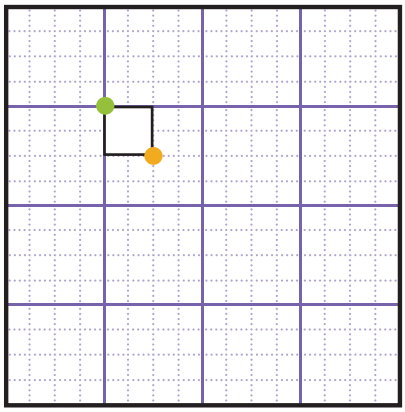
Rect Mode

These are the other possible options for rectMode.

```
rectMode ( CORNERS ) ;
rect ( 100 , 100 , 150 , 150 ) ;
```

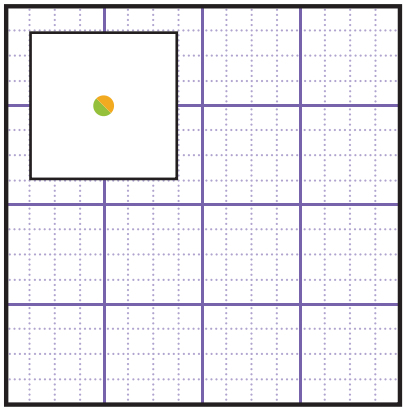
The X and Y of the 1st point

The X and Y of the 2nd point



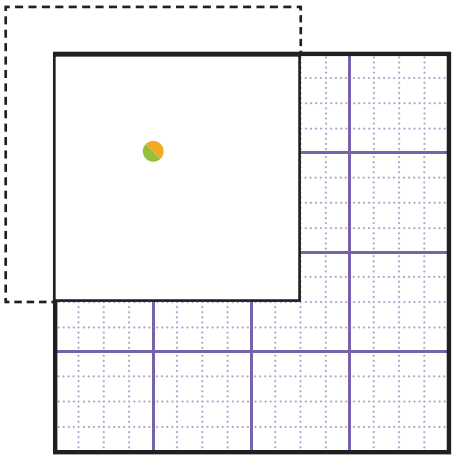
```
rectMode ( CENTER ) ;
rect ( 100 , 100 , 150 , 150 ) ;
```

The X and Y position is the center point



```
rectMode ( RADIUS ) ;
rect ( 100 , 100 , 150 , 150 ) ;
```

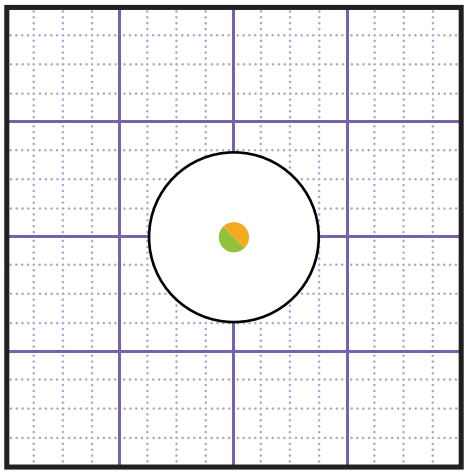
The X and Y position is the center point



Ellipse Mode

ellipseMode ( );

The default mode for ellipse is CENTER.
This draws an oval from the center point.



The W and H of the circle

```
ellipse ( 200 , 200 , 200 , 200 ) ;
```

The X and Y of
the center point

This is ellipseMode(CENTER) ;

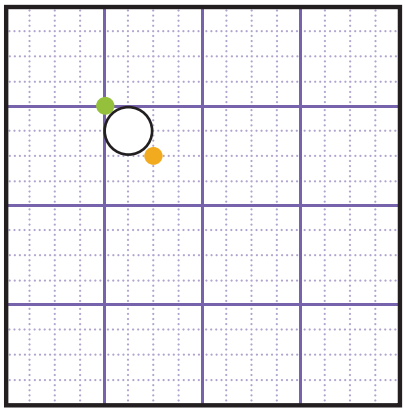
Ellipse Mode

These are the other possible options for ellipseMode.

```
ellipseMode ( CORNERS ) ;
ellipse ( 100 , 100 , 150 , 150 ) ;
```

The X and Y of the 1st point

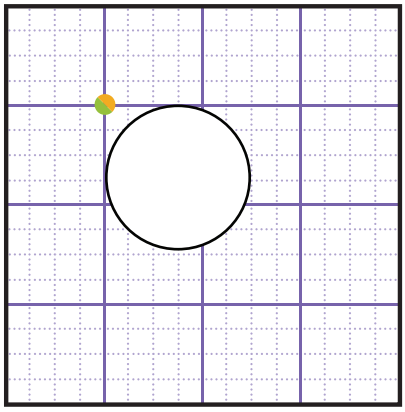
The X and Y of the 2nd point



```
ellipseMode ( CORNER ) ;
ellipse ( 100 , 100 , 150 , 150 ) ;
```

The X and Y of the 1st point

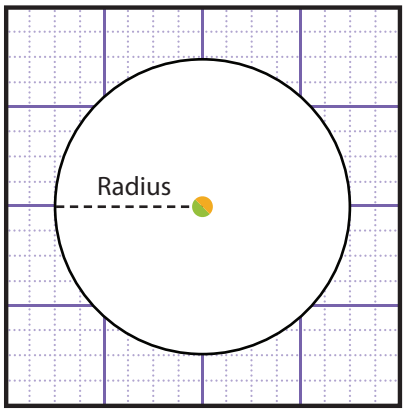
The W and H of the circle



```
ellipseMode ( RADIUS ) ;
ellipse ( 100 , 100 , 150 , 150 ) ;
```

The X and Y of the center point

1/2 the W and H size of the oval

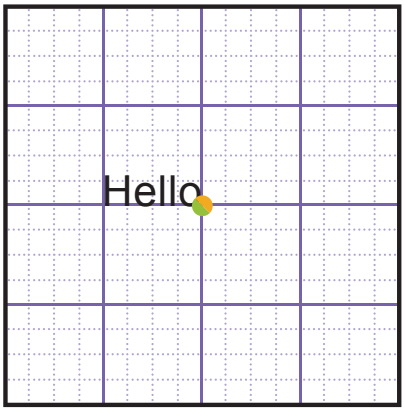


Text Align

You can choose the location where text starts to be drawn from using textAlign. You can use RIGHT, LEFT or CENTER.

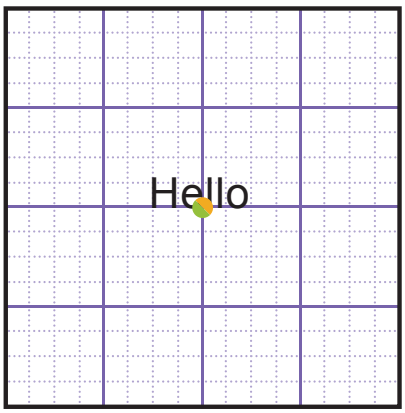
```
textAlign ( RIGHT ) ;
textSize ( 100 ) ;
text ( "Hello" , 200 , 200 ) ;
```

The X and Y of the right bottom corner



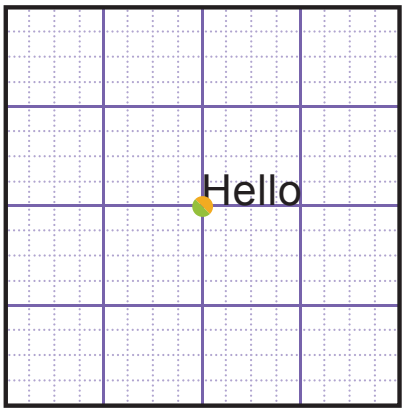

```
textAlign ( CENTER ) ;
textSize ( 100 ) ;
text ( "Hello" , 200 , 200 ) ;
```

The X and Y of the center point




```
textAlign ( LEFT ) ;
textSize ( 100 ) ;
text ( "Hello" , 200 , 200 ) ;
```

The X and Y of the left bottom corner



Doing

Commenting

Commenting code makes it easier to read and understand, this is really important when doing group work!

//makes a comment
//any text after "//" will not run.

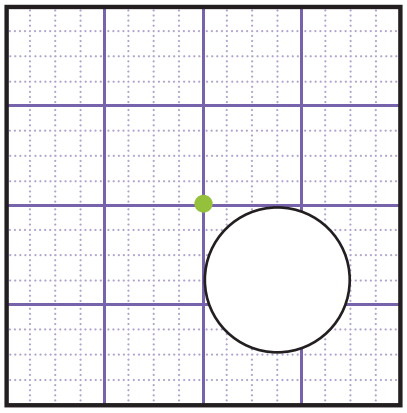
Comment Sections

/* Allows you to comment out several lines of code.
This is a quick way to remove code, without deleting it

EX.

```
//draw a circle   ← Not running
ellipse (200 , 200 , 150 , 150);
/* ellipse (25 , 25 , 25 , 25 );
   rect (100 , 25 , 25 , 25 );
*/
```

Not running



Only the ellipse at 200 , 200
will show on the canvas.

Doing

Functions

Creating a Function

Functions help organize and contain code into sections. Below shows how to define a function.

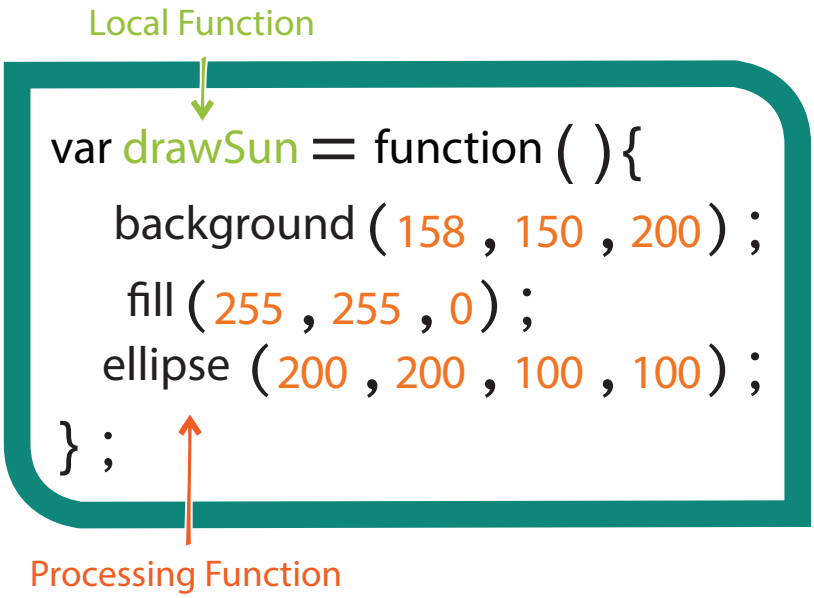
```
var NameOfFunction = function (parameters) {
    // the function's code lives here
};
```

1. Start with the var keyword.
2. Define the name of your function.
3. Set your named function equal to the function keyword.
4. Write the parameters in between the brackets.
5. Place the code that will be executed by the function between two curly brackets and end it with a semicolon.

Doing

Functions

Local Vs. Processing Function



Local Function

Created by the programmer (You!) as a specific collection of code needed for this particular project.

Processing Function

Developed as part of the programming language.
A useful function that the computer already knows and can be used in any project.

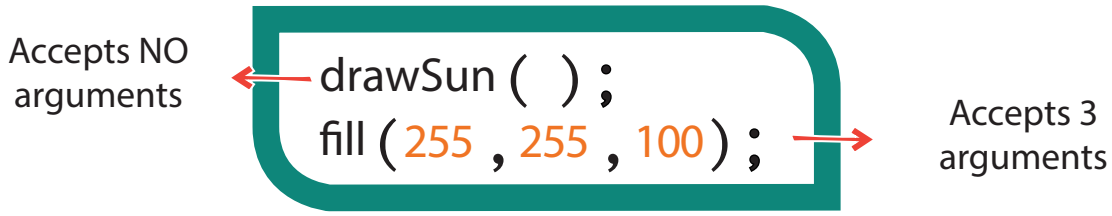
Note: Check Out Draw Function for an example

Doing

Functions

Calling a Function

Functions only perform the code inside of them when they are called.



Calling a Function Inside a Function

If you want to add animation to your projects, call functions within a draw, keyPressed or mouseClicked style of function. This are reserved functions.

```
var draw = function ( ){
    background (255 , 0 , 128) ;
} ;
```

Draw Function

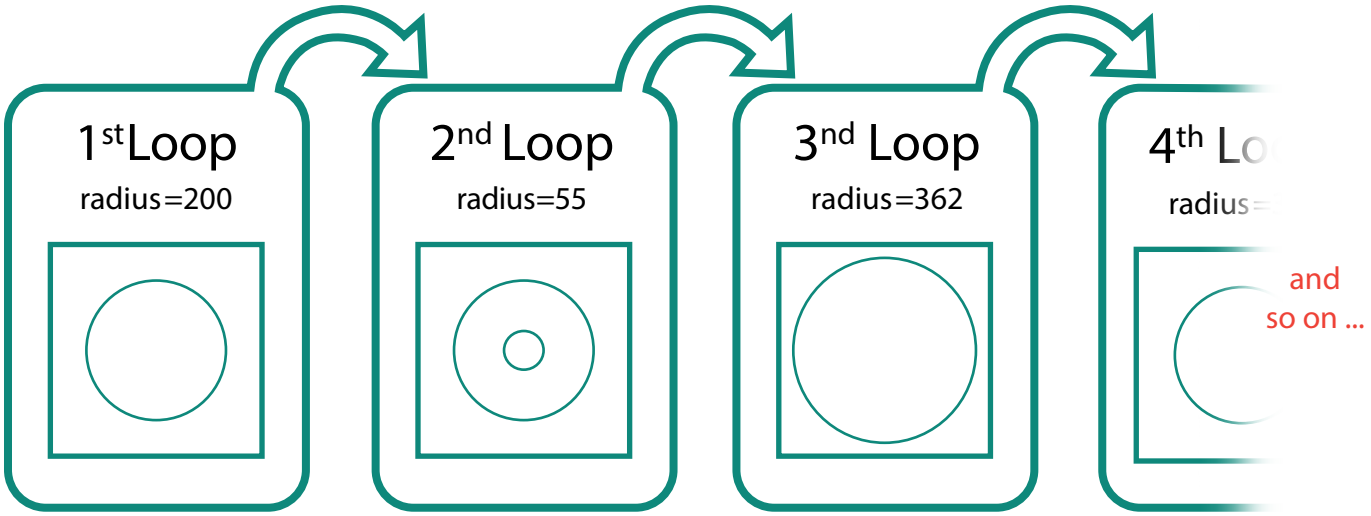
Imagine the draw function like drawing or pulling out of a box, not like drawing a picture.

How does the Draw Function Work?

The draw function allows you to animate shapes, images and colours by redrawing the canvas 60 times per second.

This code will draw circles continuously. They will be drawn on top of each other with a random radius.

```
var draw = function ( ){
    var radius = random ( 0 , 400 ) ;
    ellipse ( 200 , 200 , radius , radius ) ;
} ;
```



Doing

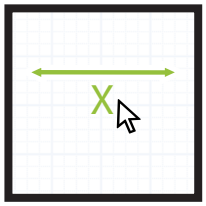
Mouse Position

Horizontal Position of the Cursor

The keyword mouseX always contains the current horizontal position at the mouse cursor location.

```
mouseX;
```

The right and left position of the

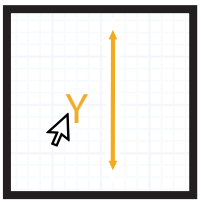


Vertical Position of the Cursor

The keyword mouseY always contains the current vertical position at the mouse cursor location.

```
mouseY;
```

The up and down position of the



Using mouseX and mouseY

The keyword mouseX and mouseY act as variables and are used as parameters.

```
var draw = function( ){
    background(255,0,128);
    line(0,0,mouseX,mouseY);
};
```

Doing

Mathematics

Assignment Operators

Assignment Operators set or change a value to a different value. These are usually used to change the value of a variable.

Examples

=	assignment	*=	multiplies a variable
+=	adds the value	/=	divides a variable
-=	subtracts the value	++	increment
		--	decrement

```
var num = 1 ;

num += 3 ;
```

Num is assigned a value of 1

Num has 3 added to it.
Num is now 4.

Doing

Mathematics

Arithmetic Operators

Arithmetic operators are used like normal math.
These are often used to change a value in a parameter.

Examples

+	addition	*	multiplication
-	subtraction	/	division
		%	modulus

```
var num = 2 ;

point(0, num*10)
```

Num is assigned a value of 2

The point created have an X value of 0 and a Y value of 20.

The value for num does not change

Doing

Mathematics

Comparison Operators

These check to see if something is true or false.
These are often used in if statements and for loops.

Examples

>	is greater than	>=	is greater than or equal to
<	is less than	<=	is less than or equal to
&&	and	===	is equal to
||	or	!==	is not equal than

```
var num = 1;
if (num < 2) {
    fill(0);
}
```

Num is assigned a value of 1

The code checks if num is smaller than 2.
If it is the fill is changed to black.

Doing

Random

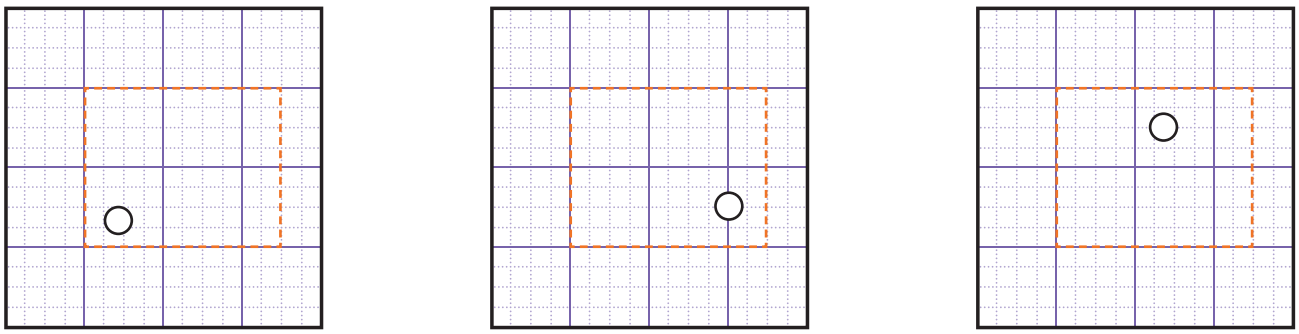
Random allows the program to randomly pick a value from a range.

random( )

Instead of writing a number of variables use random

```
ellipse ( random ( 100 , 250 ) , random ( 100 , 300 ) , 30 , 30 ) ;
```

This could become any of these or any in-between



The random only applies to the x location and y location.

Random

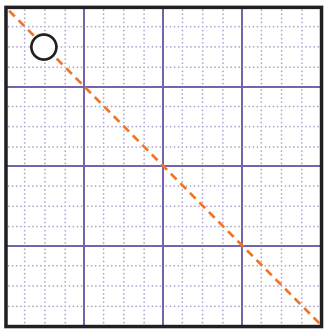
User created random variables will have the same value through the program.

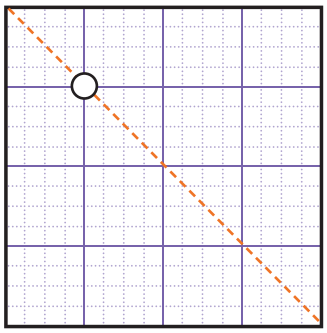
Random in Variables

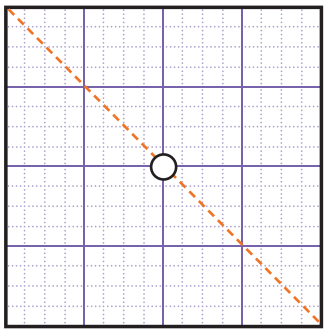
Instead of writing a number of variables use random

```
var ran = random(0, 255);
ellipse(ran, ran, 30, 30);
```

This means a value from 0,255 will be assigned to "ran".







When you declare them inside a function all values will be random, outside will be the same.

Doing

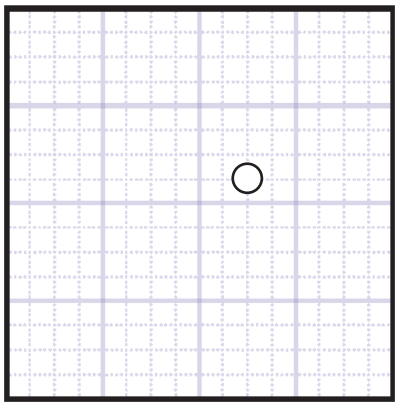
Random

What if you want something to look random, but always actually be the same?

randomSeed( )

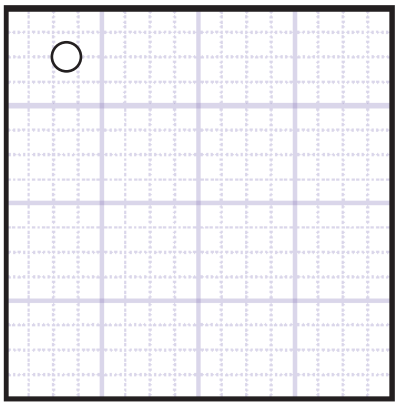
Ever used Minecraft? A seed value determines what version of a map will be made!

```
randomSeed ( 124 ) ;
ellipse ( random ( 124 , 255 ) ,
          random ( 124 , 255 ) ,
          30 , 30 ) ;
```



This will always produce.
Try it yourself!

```
randomSeed ( 4 ) ;
ellipse ( random ( 0 , 255 ) ,
          random ( 0 , 255 ) ,
          30 , 30 ) ;
```



This will always produce.
Try it yourself!

Doing

Conditionals - If

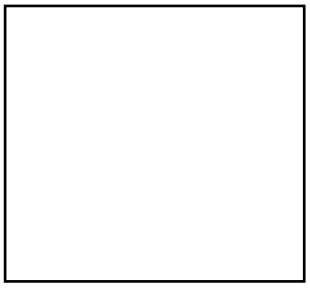
"If" statements check if something is true or false. If it is true something happens, if false it doesn't.

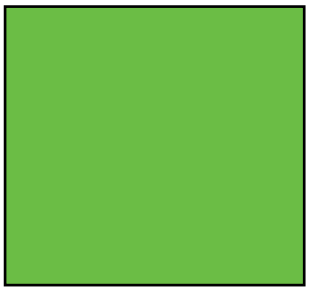
Real World Example

If you are hungry then go get some food.
If you are not hungry you would not need to get food.

Coding Example

```
var randomNum = random ( 0 , 1000 );
  if ( mouseX > 500 ) {
  random ( 100 , 200 , 0 );
}
```





This code randomly picks a number from 0 to 1000. If the number is bigger than 500 the screen will turn green. If not, the screen will stay white.

Doing

Conditionals - If

Else code runs when all if statements and else if statements are false.

Real World Example

I want to wear a shirt, but a sweater is ok, after that a coat is ok. However, if I have nothing else I need to go shopping.

Coding Example

```
var randomNum = random (0 , 1000);
if (randomNum > 500) {
    background (100 , 200 , 0);
  } else if (randomNum < 300) {
    background (255 , 0 , 0);
  } else {
  image (getImage ("creatures/winston"));
}
```

randomNum = 800

If the number is not bigger than 900 or smaller than 500 Winston appears

Conditionals - Else If

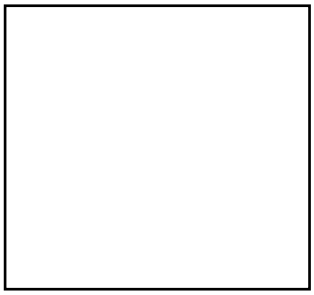
Else if statements works with an if statement.
If the first condition is true, this code runs.
If it is false, the next if else statement will check if it is true.
You can have multiple if else statements.

```
var randomNum = random ( 0 , 1000 ) ;
if ( randomNum > 500 ) {
    background ( 100 , 200 , 0 ) ;
  } else if ( randomNum < 300 ) {
    background ( 255 , 0 , 0 ) ;
}
```

Coding Example

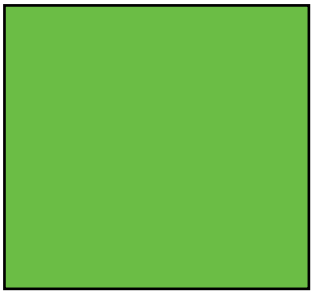
1. This checks if the number is bigger than 500.
If it is, then it is red.
2. If not, it checks if it smaller than 300.
if it is, it is green.

randomNum = 400



randomNum = 200

randomNum = 600



Doing

Conditionals - Else If

It is important to make sure all of your conditions are different than the previous ones.

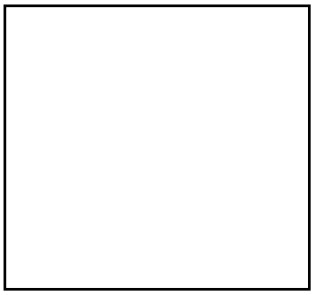
```
var randomNum = random(0, 1000);
if (randomNum > 500) {
    background(100, 200, 0);
} else if (randomNum > 600) {
    background(255, 0, 0);
}
```

All if statements connected to else if statements should be indented in the same lines.

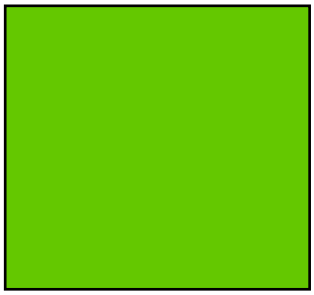
It would never turn red because the if statement would be true every time the else if statement would be true

Coding Example

randomNum = 400



randomNum = 800



Doing

Conditionals Examples

Conditionals work like YES or NO questions. These are some additional examples of conditionals

```
if ( question ) {
    ( response )
}
```

```
if ( weather is raining ) {
        take an umbrella
}
```

```
if ( weather === raining ) {
        take an umbrella
}
```

```
if ( my age is older than 16 ) {
        I can drive
} else if ( my age is less than 16 ){
        I can walk
}
```

```
if ( age > 16 ) {
        I can drive
} else if ( age < 16 ) {
        I can walk
}
```

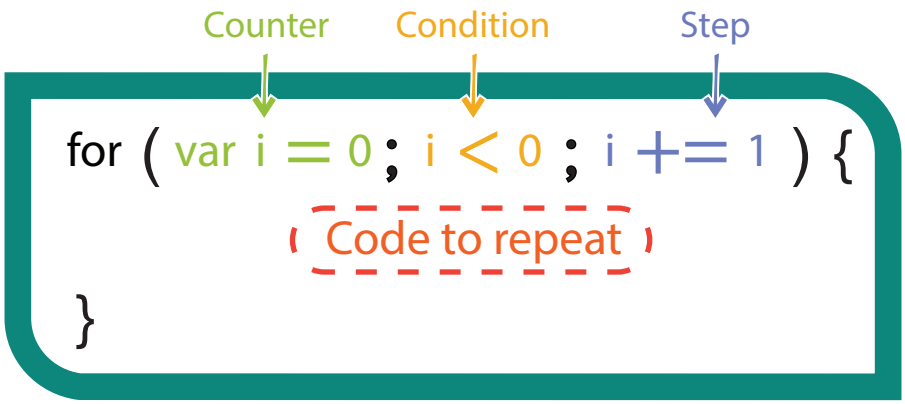
```
if ( weather is not raining
    and today is Saturday ) {
        take weather bottle
        play soccer outside
}
```

```
if ( weather !== raining
    &&& today === Saturday) {
        take weather bottle
        play soccer outside
}
```

Doing

For Loop

For loops let you repeat parts of your code multiple times.



Counter

This sets the initial counter value

Condition

When the counter meets the condition the code stops

Step

How the counter changes every time the code is repeated

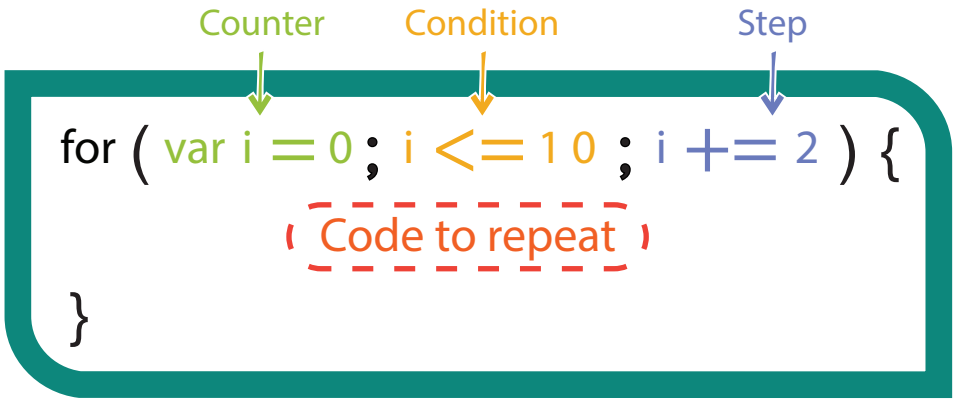
1. This loop will repeat 5 times

```
for ( var i = 0; i < 5 ; i += 1 ) {
        Code to repeat
}
```

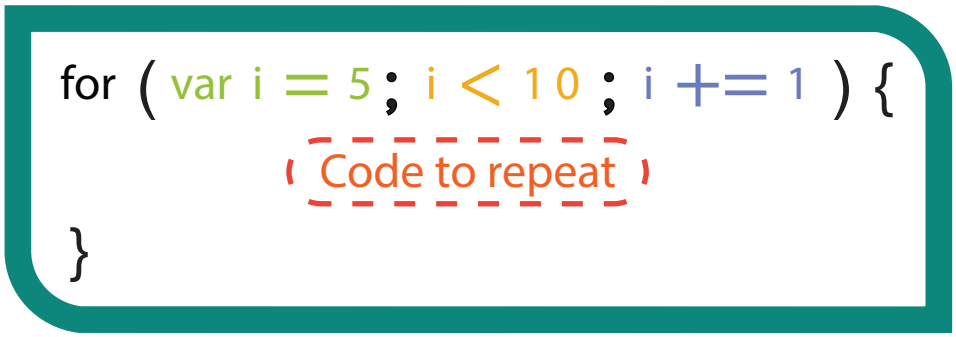
Doing

For Loop

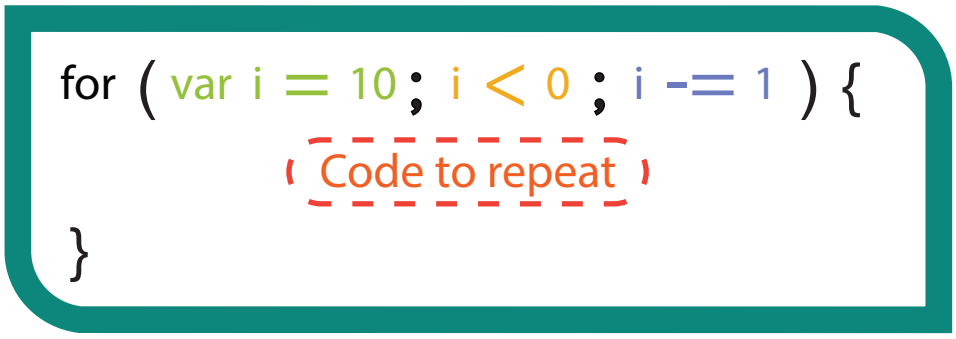
2. This loop will repeat 6 times



3. This loop will repeat 5 times

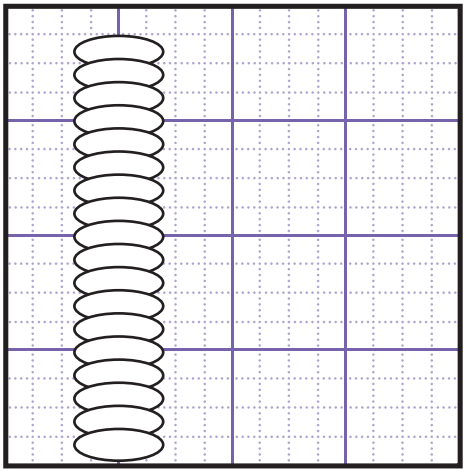


4. This loop will repeat 10 times



While Loop

This type of loop runs while the statement is true.



```
var i =10;
while (i < 100) {
      ellipse (130 , i*4 , 80 , 30) ;
      i = i + 5 ;
}
```

While loops often use booleans like true or false to check a condition.

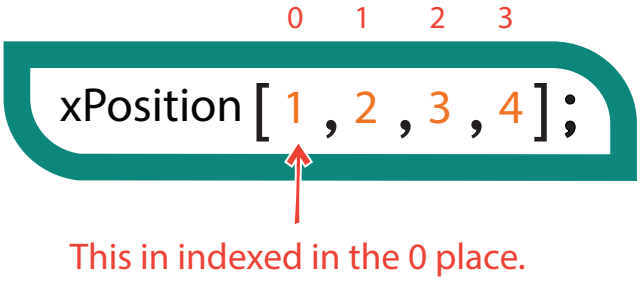
Doing

Intro to Arrays

Arrays allow you to store and access information easily.
You can store anything in an array that you could store in a variable!

Create an Array

We create arrays with square brackets [ ];
Below is an array that has 4 numbers stored inside it.



Values in an array start at 0 and count up.
The place a value is in the array is called the index value.

Doing

Array Types

Arrays with Information

These are arrays with information added by the coder.
This section shows you how to create an array with words.

```
var names = [ "Steve" , "Tom" , "Laura" ];
```

Don't forget your quotations around strings and images.

This section is an array with numbers.

```
var nums = [ 1 , 2 , 3];
```

Empty Arrays

An empty array creates a place for information to be stored. This information is pushed into the array during the program.

```
var name = [ ];
```

Doing

Changing Arrays

Arrays allow you to store a list of items.

```
var xPosition = [ 0 , 20 , 100 , 300 ];
                  0    1     2     3
```

items

index

Item

Arrays can hold any variables like numbers and words

Index

Every variable gets a unique number to keep track of its position in the list

1. Changing an item

```
[ 0 , 20 , 5 , 300 ]
  0    1   2    3
```

items

index

```
xPosition [ 2 ] = 5 ;
```

2. Adding an item

```
[ 0 , 20 , 5 , 300 , 20 ]
  0    1   2    3    4
```

items

index

```
xPosition.push ( 20 ) ;
```

3. Removing an item

```
[ 0 , 20 ,  , 300 , 20 ]
  0    1     2    3
```

items

index

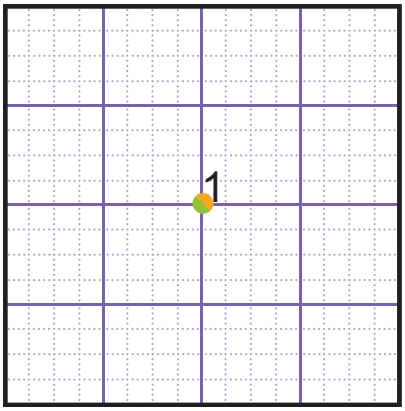
```
xPosition.splice ( 2 , 1 ) ;
```

Doing

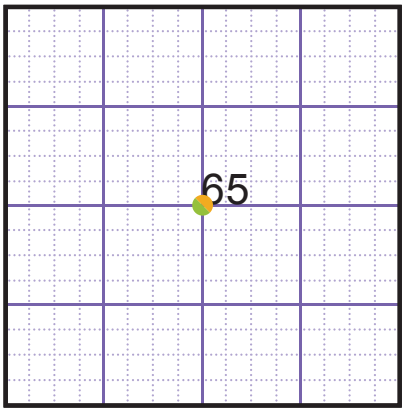
Accessing Arrays

To access a specific value in an array we use [ ] next to the name of the array.
This will get indexed value from the array.

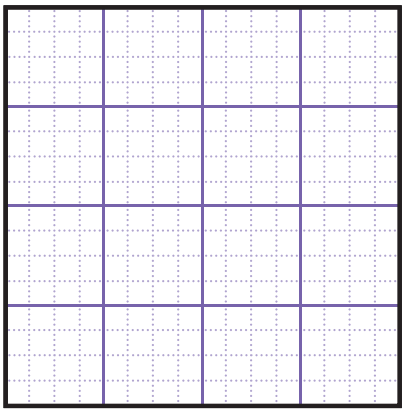
```
var array = [ 1 , 2 , 3 , 65 ];
text ( array [ 0 ] , 200 , 200 );
```




```
var array = [ 1 , 2 , 3 , 65 ];
text ( array [ 3 ] , 200 , 200 );
```




```
var array = [ 1 , 2 , 3 , 65 ];
text ( array [ 4 ] , 200 , 200 );
```



This value would be blank as there is no value stored in index 4.

Doing

Array Length

Arrays can be used in loops and in programs to allow the user to move onto the next item. It is often important to know the length of the array.

Array.length

We can find the length of the array by adding .length to any array.

```
var number = [ 1 , 2 , 3 , 65 ];
```

For this array, number.length would equal 4.

```
varvalues= [ 1 , 2 , 3 , "P" , index];
```

For this array, value.length would equal 6.

Doing

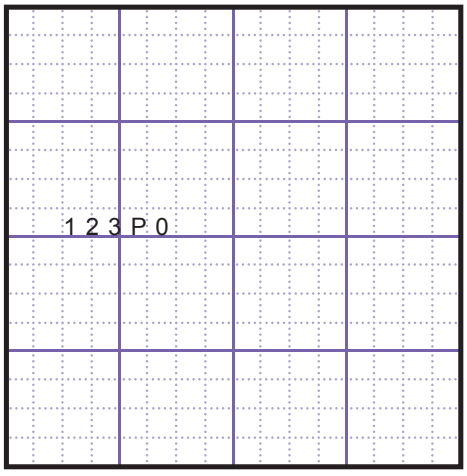
Using Array

This an array with multiple types of data.
It has 3 numbers, a string, and a stored variable.

```
var array = 0;
var values = [ 1 , 2 , 3 , "P" , index];
```

Use array.length to adapt code if your array size changes
or you want to add it to code that may change

```
for (var i = 0; i < array.length; i ++) {
 text (array[index] , 50+i* 20 , 200);
    index ++ ;
}
```



The for loop will work even if the array has more or less
values stored in it! Adaptive code is awesome!

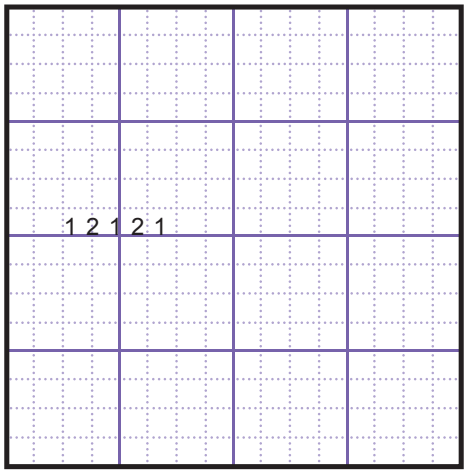
Doing

Array Patterns

We can use multiple keywords to make arrays function in different ways

```
var index = 0;
var array = [ 1 , 2 , 3 , "P", index];
textSize (20) ;
for (var i = 0; i < array.length; i ++) {
  text (array [ i n d e x ] , 50+i* 20 , 200);
    index ++ ;
    if (index === 2) {
   index =0;
     }
}
```

The code still only runs 6 times, which is array.lenth



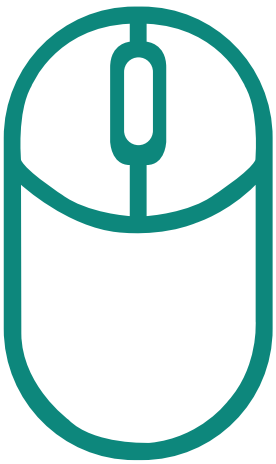
This makes it easy to set up patterns that happen in your projects and let users select specific choices.

Doing

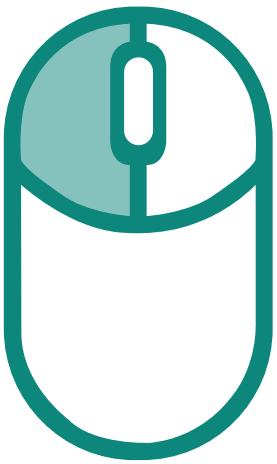
Mouse Functions

mouseClicked vS. mousePressed vS. mouseReleased

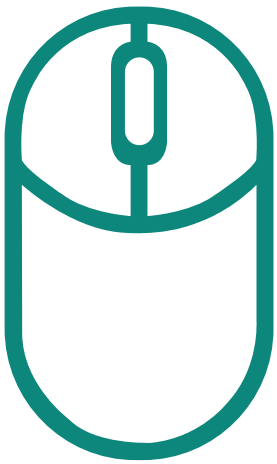
mouseClicked is almost like mousePressed, It only works after you let go out the mouse. mouseReleased works when the mouse button is let go.



Not Pressed



Pressed



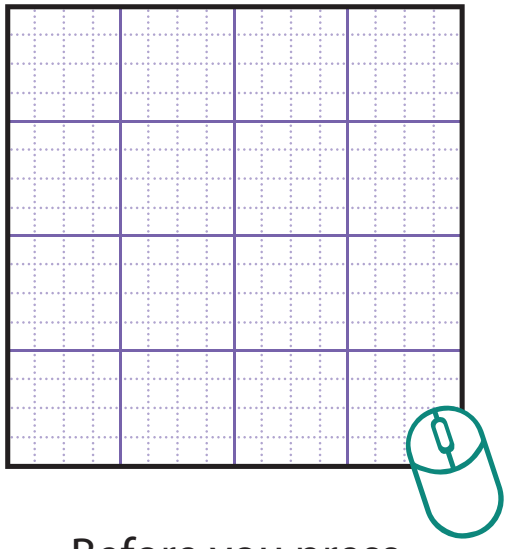
Clicked and Released

Mouse Functions

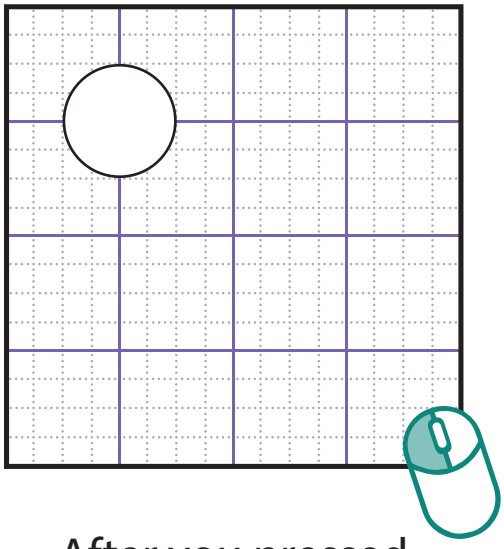
mousePressed

This makes whatever is in the function happen once after each time the mouse is pressed.

```
var mousePressed = function ( ) {
  ellipse ( 100 , 100 , 100 , 100 );
};
```



Before you press the mouse



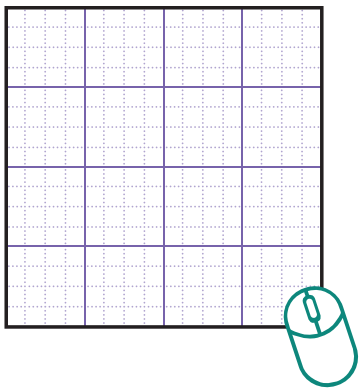
After you pressed the mouse

Mouse Functions

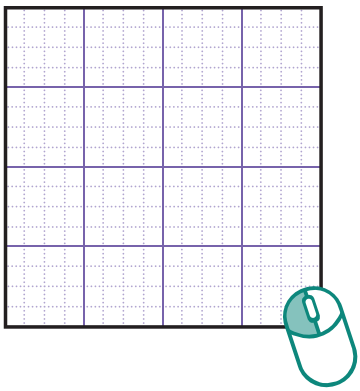
mouseClicked

The code inside the mouseClicked function will run whenever the mouse button is pressed and released.

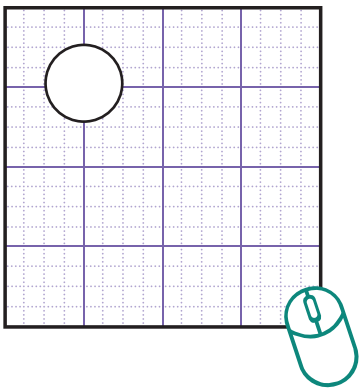
```
var mouseClicked = function ( ) {
  ellipse ( 100 , 100 , 100 , 100 );
};
```



Before you press



While you press



After you let go

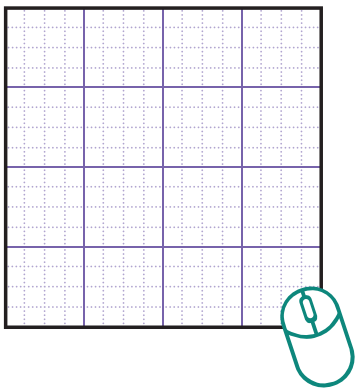
The mouse needs to be pressed during the program for this function to work.

Mouse Functions

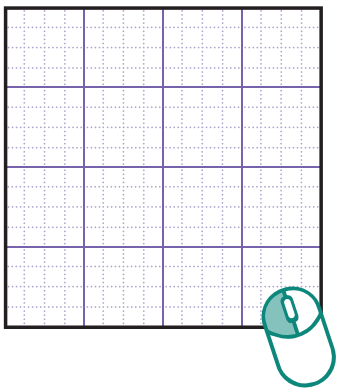
mouseReleased

This works almost the same as mouseClicked. It only responds to the release component.

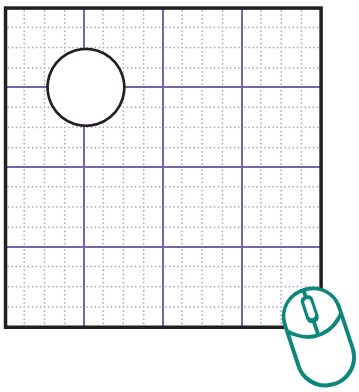
```
var mouseReleased = function ( ) {
  ellipse ( 100 , 100 , 100 , 100 );
};
```



Before you press



While you press



After you let go

The mouse does not need to be pressed during the program for this function to work.

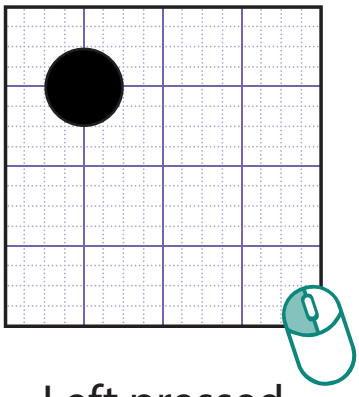
Doing

Mouse Functions

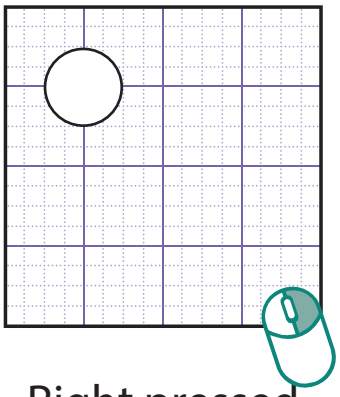
mouseButton( )

This allows something to happen when a specific mouse button is pressed.

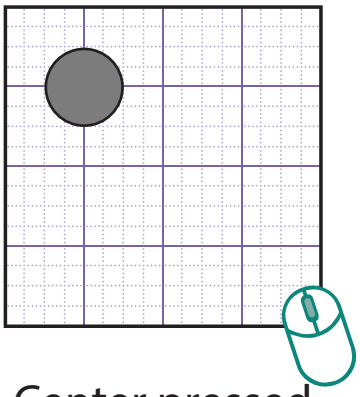
```
var draw = function ( ) {
  ellipse ( 100 , 100 , 100 , 100 );
    if ( mouseButton === LEFT ){
    fill ( 0 );
  } else if ( mouseButton === RIGHT ){
    fill ( 255 );
  } else if ( mouseButton === CENTER ){
    fill ( 125 );
  }
};
```



Left pressed



Right pressed



Center pressed

Doing

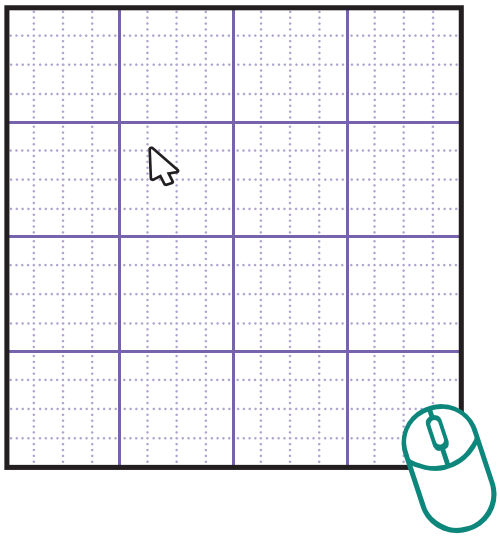
Mouse Functions

mouseMoved( )

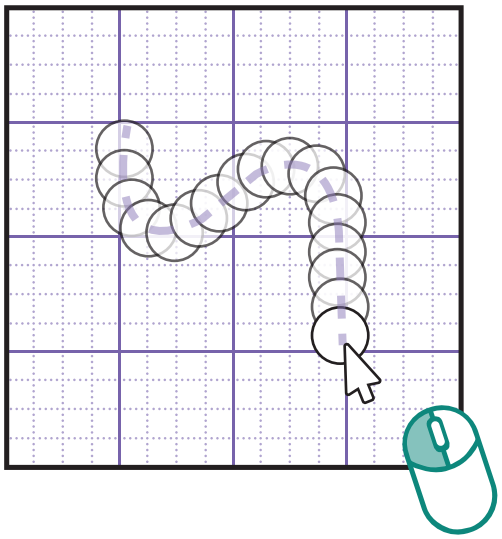
This function runs every time the mouse is moved.

```
var mouseMoved = function ( ) {
  ellipse ( mouseX , mouseY , 50 , 50);
};
```

These allows the ellipse to move with the mouse



Before the mouse is moved



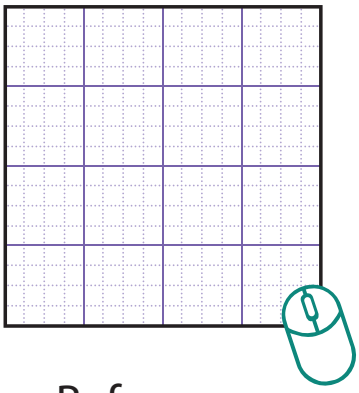
While your press

Mouse Functions

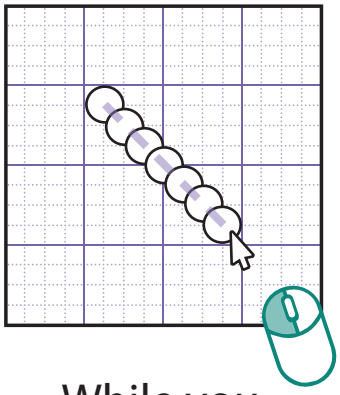
mouseDragged ( )

This has the function run once every time the mouse moves while it is pressed,

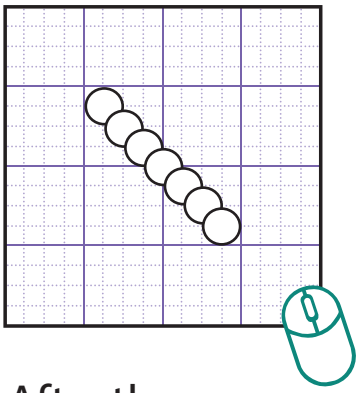
```
var mouseDragged = function ( ) {
  ellipse ( mouseX , mouseY , 50 , 50 );
};
```



Before you pressed



While you press the mouse and it is moved



After the mouse is moved

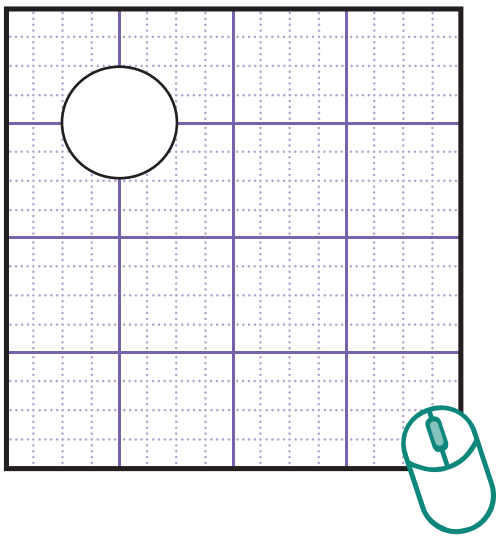
Mouse Functions

mouseScrolled ( )

This calls the function when the user scrolls with their mouse.

// This pulls the page up and down using a middle bottom or 2 fingers.

```
var mouseScrolled = function ( ) {
  ellipse ( 100 , 100 , 100 , 100 );
};
```



This is shown when the mouse is scrolled

Doing

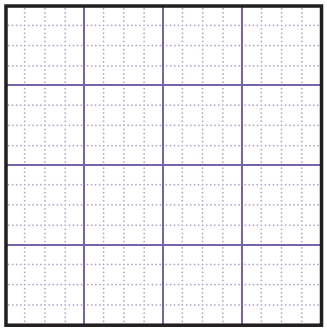
Keyboard Functions

You can use functions to check if they keyboard is being used.

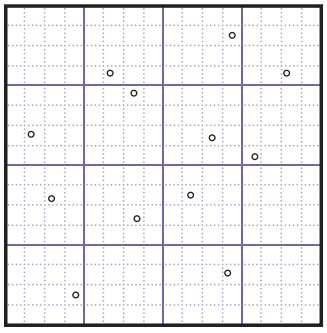
KeyPressed

The contents of the keyPressed function runs while any key is pressed down.

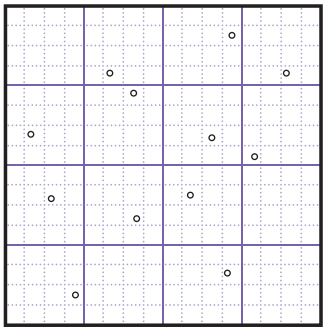
```
var keyPressed = function ( ) {
  ellipse ( random ( 0 , 400 ) , random ( 0 , 400 ) , 10 , 10 );
};
```



When key Clicked



When KeyPressed for 5 seconds



When Released

When you declare them inside a function all values will be random, outside will be the same.

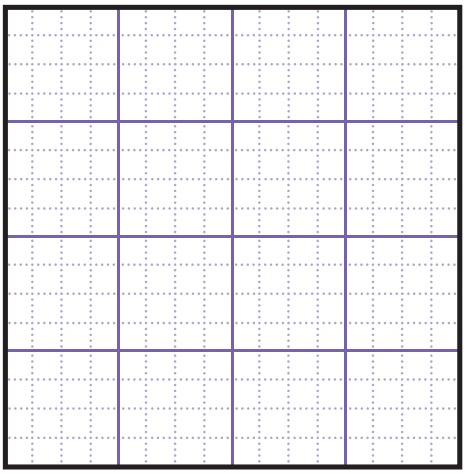
Doing

Keyboard Functions

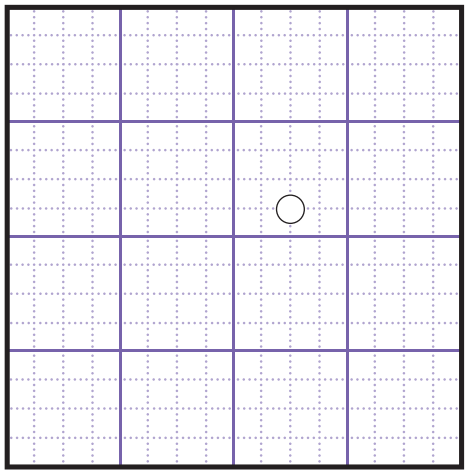
KeyReleased

The contents of the KeyReleased function runs when any key is release.

```
var keyReleased = function ( ) {
  ellipse ( random ( 0 , 400 ) , random ( 0 , 400 ) , 25 , 25 );
};
```



When keyPressed



When a key is let go

This will work only when the key is let go.

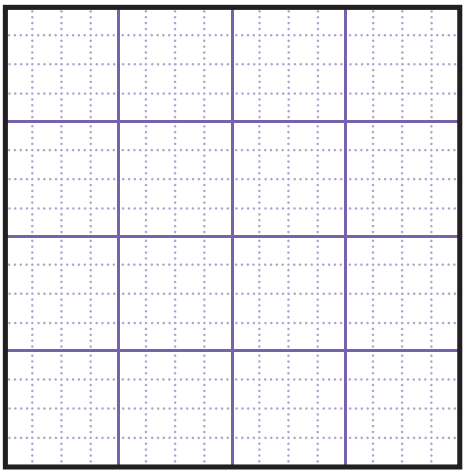
Doing

Keyboard Functions

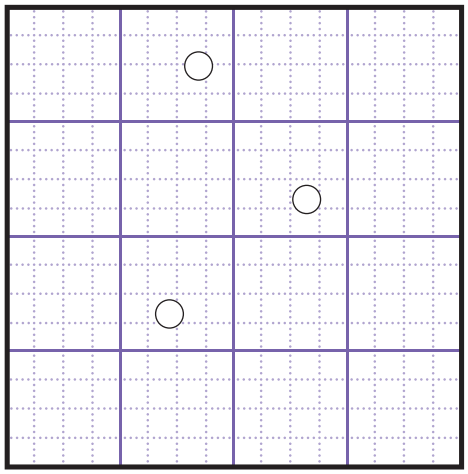
Key Typed

This works similarly to KeyReleased. It does need the user to press and released a key for it to work.

```
var keyTyped = function ( ) {
  ellipse ( random ( 0 , 400 ) , random ( 0 , 400 ) , 25 , 25 );
};
```



When keyPressed



When a key is let go

This only works when the key is pressed and let go.

Doing

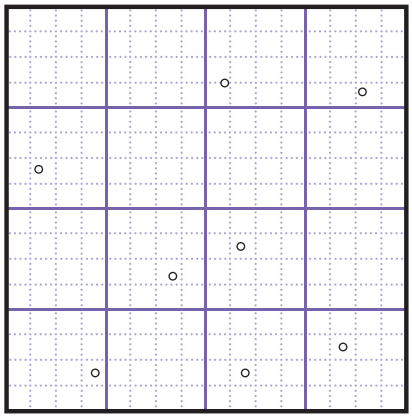
Keyboard Functions

You can use specific key is a key _____ function.

Key Codes

You can use keyCodes (numbers that represent specific keys) or word that detect special keys.


```
var keyPressed = function ();
  if (keyCode === 49) {
  ellipse (random (0 , 400) ,
           random (0 , 400) ,
           10 , 10);
}
```

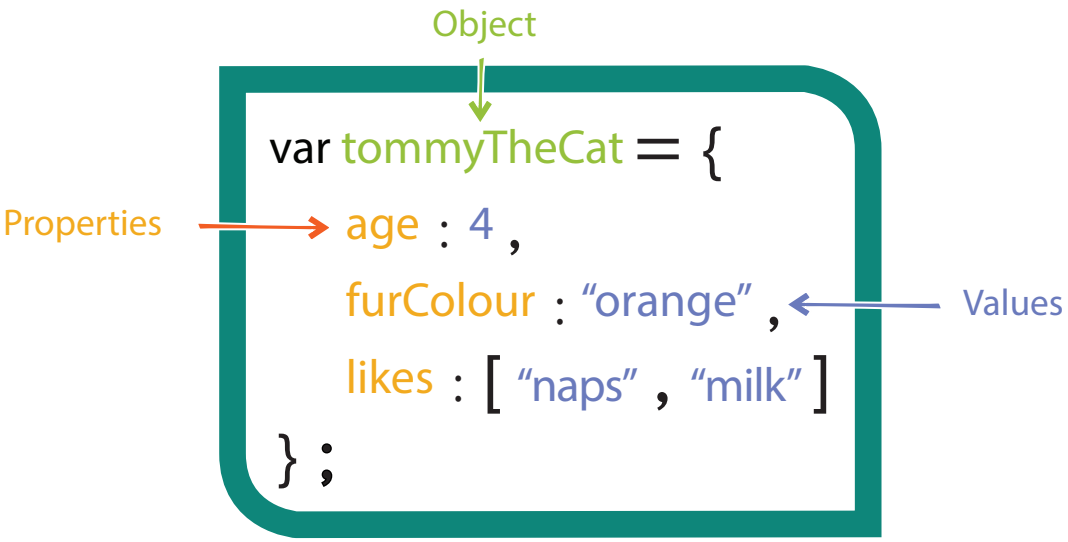


Dots will draw when "1" is pressed.

Doing

Object Literals

An object can be anything that may have multiple values, and these values will be what describes each property.



Accessing Object Properties

To access an object we use dot notation.
This is how we edit objects.

```
text (tommyTheCat.age , 200 , 200 );
```

The number 4 will be display in the canvas

Modifying an Object Literal

Use dot-notation.

```
tommyTheCat.age = 5 ;
```

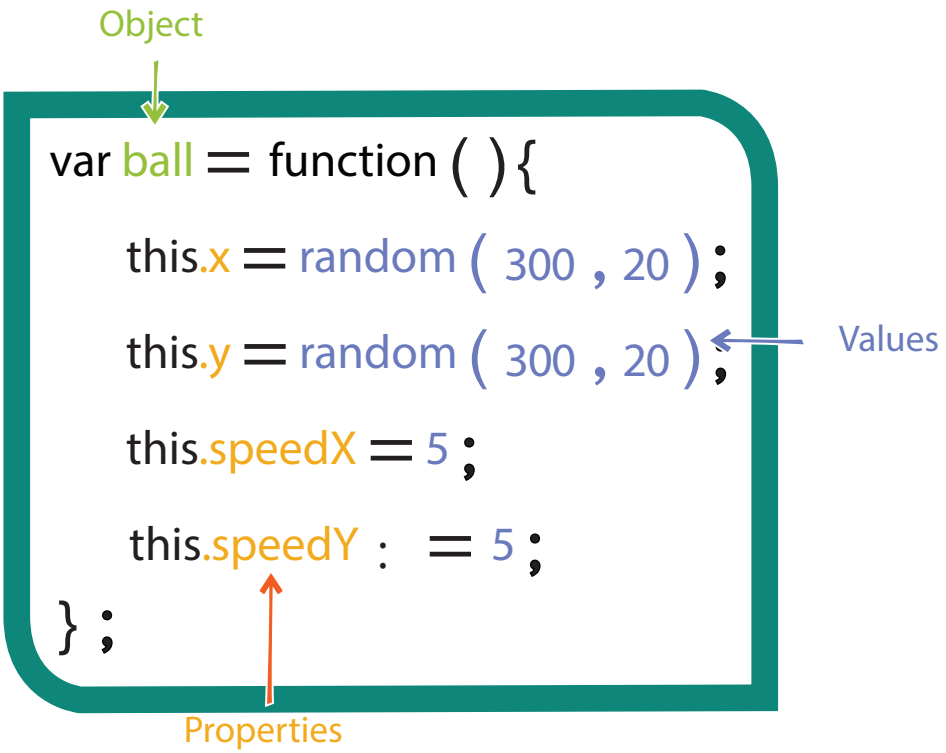
Changes tommy's age to 5

Doing

Object Prototypes

Object Prototype

This creates more than one instance of an object.



Constructors

Constructors are used to make a new instance of the object. Object Prototypes act like functions so they need brackets when constructed.

```
var myBall = new ball ( );
myArray.push ( new ball ( ));
```

Doing

Using Objects

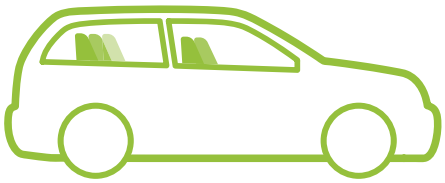
Let's say you want to create many cars in your project.
We can make them one at a time using objects.

Object

```
var car = {
    wheels : 4 ,
    seats : 5 ,
    colour : random(0,255) ,
             random(0,255) ,
             random(0,255) ;
} ;
```

Values

Properties



This car was randomly selected to be green because the colour is random

Part 1

Prototypes allows you to make a pattern to create multiple objects, you only change...

```
var car = {
```

To

```
var car = function ( ){
```

How do you use it? With a constructor.
This will build your new types of cars!!

Doing

Using Objects

Part 2

Now imagine you want to make a sports car!
You already know how it will look and you want to set the variables when you create it! It still follows a pattern of a car and has wheels, seats, and a colour.

You want it to have 4 wheels, 2 seats and be yellow!
Create it using the code below.

```
var sportscar = new car ( 4 , 2 , "yellow" );
```


You can not use the code above because the properties have not been written in the code.

Using Objects

Part 3

Let's say you want to create a van style of car. When you initially create it, it will be based of a normal car.

```
var van = new car( );
```

Vans are usually bigger. It should have 7 seats.
We will change the value of seat by doing the following.

```
var.seats = 7;
```

Now your van style car has 7 seats!

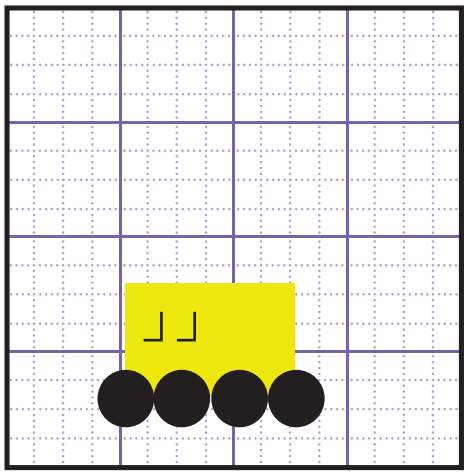
Doing

Using Objects

Part 4 - Code this yourself!

```
var Car = function ( wheels , seat , rgb ){
    this.wheels = wheels;
    this.seats = seats;
    this.color = rgb;
};

var sportscar = new Car ( 4 , 12 , [ 255 , 255 , 0 ] );
    noStroke ( ) ;
    fill ( sportscar.color [ 0 ] , sportscar.color [ 1 ] , sportscar.color [ 2 ] );
    rect ( 100 , 200 , 150 , 100 ) ;
   for ( var numWheels = 0 ; numWheels < sportscar.Wheels ; numWheels ++ ) {
    fill ( 0 ) ;
    ellipse ( numWheels * 50 + 100 , 300 , 50 , 50 ) ;
};
    for ( var numSeats = 0 ; numWheels < sportscar.Seats ; numSeats ++ ) {
    stroke ( 0 ) ;
    line ( numSeats * 30 + 115 , 250 , numSeats * 30 + 130 , 250 ) ;
    line ( numSeats * 30 + 130 , 225 , numSeats * 30 + 130 , 250 ) ;
};
```



Doing

Object Methods

Objects with Functions

Object methods are functions that affect or act on an object. These are declared like other properties and can be used in object literals or object prototypes.

Object Literal Method

This method will act on the car object literal.

```
var car = {
    x : 10 ,
    move : function ( ) {
    car.x += 1
    } ,
} ;
```

Object Methods

Object methods are functions that affect or act on an object. Each object created with the prototype will be linked to the object method created.

Object Prototype Method

This method will act on the car object literal.

```
var cars = function ( ) {
    this.x= 10 ;
    this.move= function ( ) {
    this.x += 1
     } ;
} ;
```

Cursor

You can change the cursor seen on the canvas with cursor( );

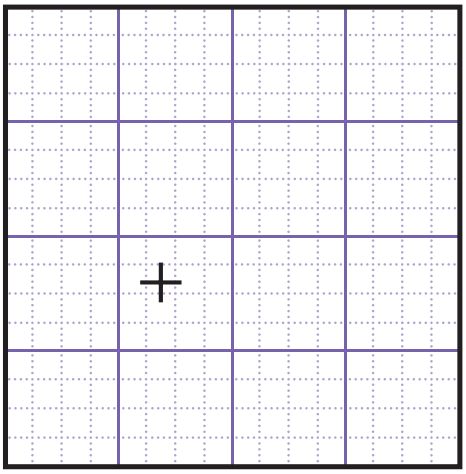
There are different types of cursors add the one you want as the parameter.

MOVE	
ARROW	
CROSS	
HAND	
TEXT	
WAIT	

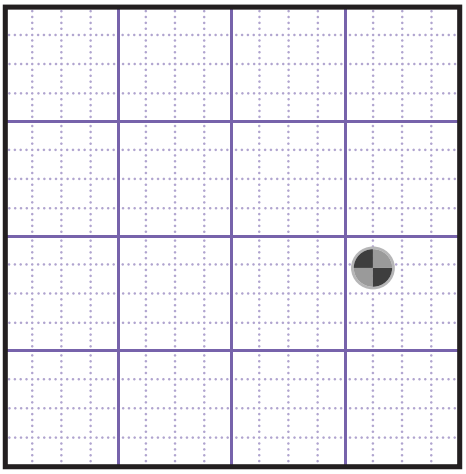
Make sure that you use capitals.

Cursor

Using Cursor( );



When mouseX
is > 100



When mouseX
is not > 100

```
var draw = function ( ) {
  if ( mouseX > 100 ){
    cursor ( WAIT )

  }else {
    cursor ( CROSS )
  }
};
```

Switch

This works like an if else statement. You create cases that are the parameters in the switch( );

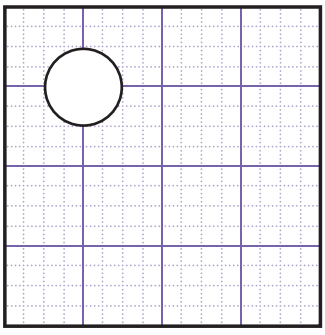
This is the "1" button

This is the "2" button

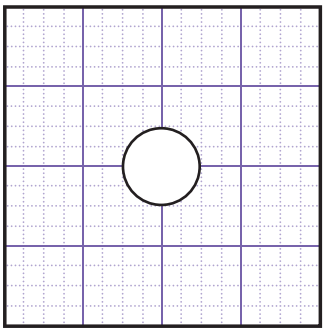
This is all other keys

```
var circle = function ( ) {
  switch ( key + 0 ){
    case 49 ;
    ellipse ( 100 , 100 , 100 , 100 );
    break ;
    case 50 ;
    ellipse ( 200 , 200 , 100 , 100 );
    break ;
    default ;
    ellipse ( 300 , 300 , 100 , 100 );
  }
};
```

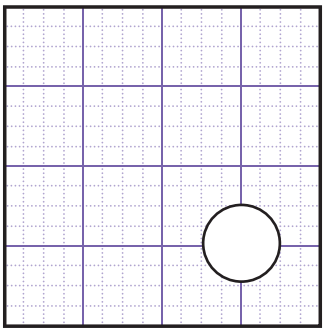
You need to include break on non-default cases.



If 1 is pressed



If 2 is pressed



If anything pressed

Break will also stop loops (for and while) if you want the code in a loop to stop write break;

Using Trigonometry

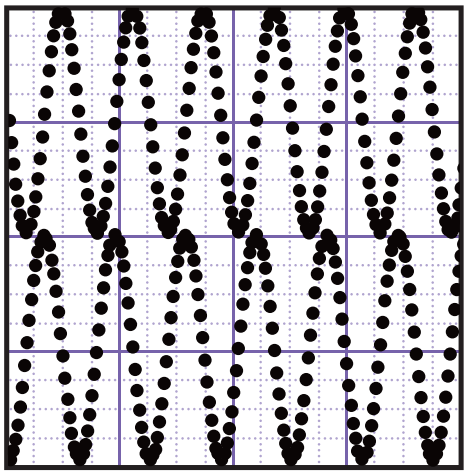
There are several trigonometry functions!
This is a part of math. These let you animate in way patterns! We don't normally use them like in math.

Sin and Cos

These are both wavy functions! Sin starts at $(0, 0)$ and Cos starts at $(1, 0)$

Sin
This is the sine function

Cos
This is the cosine function

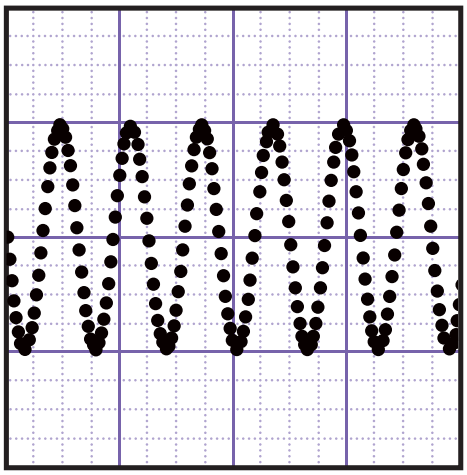


Sin and cos make a value increase to 1 then decrease to -1.
This happens forever!

Using Trigonometry

Use this to draw a moving picture!

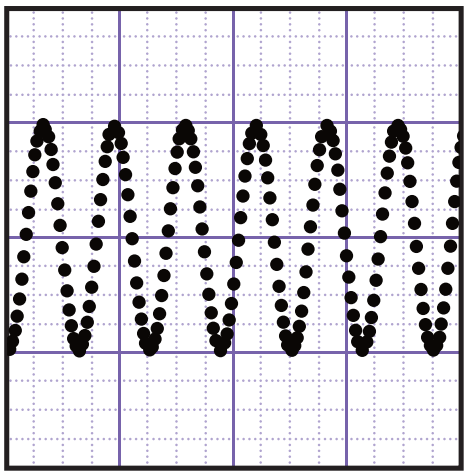
Sin



```
var x = 0;
fill(255);
background(255);
frameRate(255);
var draw = function() {
    background(255);
  ellipse(x, sin(x)+200, 10, 10);
    x += 0.1;
};
```

Using Trigonometry

Cos



```
var x = 0;
fill (255);
background (255);
frameRate (255);
var draw = function () {
    background (255);
  ellipse (x , cos (x)+200 , 10 , 10);
    x += 0.1;
};
```

Prompt

If you want the user to type text for your program you can use prompt. Prompt has two parameters. The first writes the question the user would see, the second has a possible answer already inputted.

```
prompt("1","2");
```

```
var mouseClicked = function() {
    background(255,255,255);
    var name = promt("Write Your First Name",
                     "Hatch Student Name");
    text(255,200,250);
};
```

The box below would appear on the screen. What ever is written by the user, will be stored in the variable name

NOTE: Prompt works better in mouseClicked function compared to in draw functions. Draw functions keep calling the prompt and your program become difficult to use.

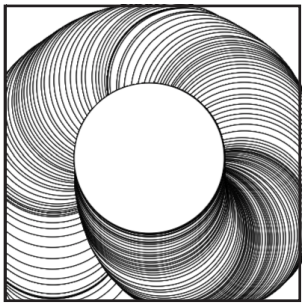
Frame Rate

Normally we want our program to run quickly and smoothly. The base frame rate is 60 frames per second. You can change it using frameRate.

Changing the FrameRate

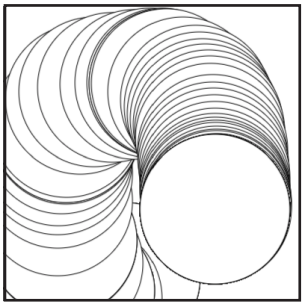
Increasing the frame rate will not change the way the program runs significantly.

```
var draw = function ( ) {
    frameRate ( 120 ) ;
    ellipse ( mouseX , mouseY , 200 , 200 ) ;
} ;
```



Decreasing the frame rate will make the program seem like it is skipping or slow.

```
var draw = function ( ) {
    frameRate ( 10 ) ;
    ellipse ( mouseX , mouseY , 200 , 200 ) ;
} ;
```



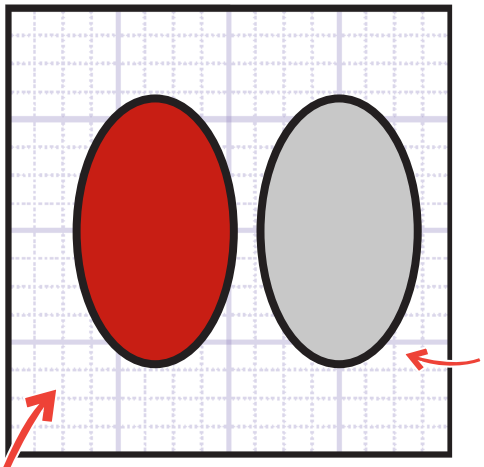
Pull Color

You can extract a section of colour using the keywords red, green, blue.

red( ); Example

red( ); will extract the red value from a colour, In fill this would be fill(255,0,0);

When all values are the same fill. The colour will appear gray!



Fills with the value from the red in all arguments. (200,200,200) or (200)

```
var r = color(200, 30, 20);
    fill(r);
    ellipse(135, 200, 150, 225);
    var redValue = red(r);
    fill(redValue);
    ellipse(300, 200, 150, 225);
};
```

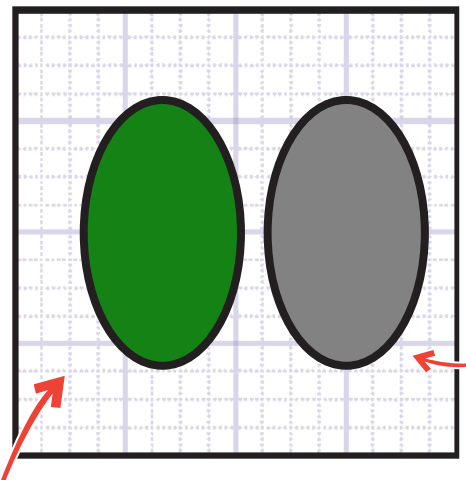
Pull Color

You can extract a section of colour using the keywords red, green, blue.

green( ); Example

green( ); will extract the red value from a colour, In fill this would be fill(255,0,0);

When all values are the same fill. The colour will appear gray!



Fills with the value from the green in all arguments. (130,130,130) or (130)

```
var g = color(20, 130, 20);
  fill(g);
  ellipse(135, 200, 150, 225);
  var greenValue = green(g);
  fill(greenValue);
  ellipse(300, 200, 150, 225);
};
```

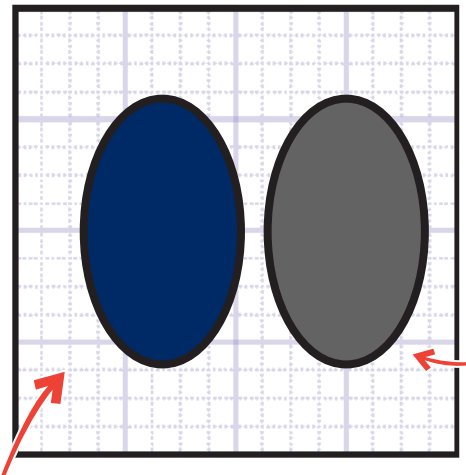
Pull Color

You can extract a section of colour using the keywords red, green, blue.

blue( ); Example

blue( ); will extract the blue value from a colour, In fill this would be fill(255,0,0);

When all values are the same fill. The colour will appear gray!

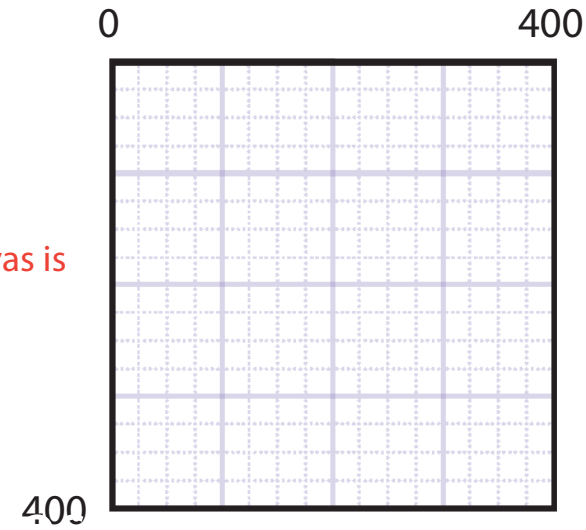


Fills with the value from the blue in all arguments. (100,100,100) or (100)

```
var b = color(20, 40, 100);
  fill(b);
  ellipse(135, 200, 150, 225);
  var blueValue = blue(b);
  fill(blueValue);
  ellipse(300, 200, 150, 225);
};
```

Canvas

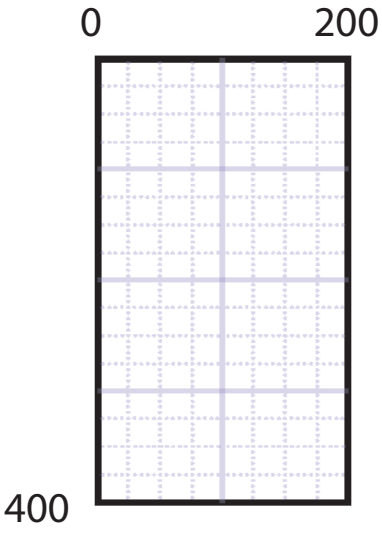
The canvas is where you see your code. It is a type of Matrix, this is a 2D Array.



Our normal Canvas is 400 by 400

You can change the size of the canvas using the size keyword.

```
size ( 200 , 400) ;
```



Matrix Changes

Change the Canvas

You can change the size, location and orientation of objects by changing the canvas.

Canvas Changing keywords

```
rotate ( degrees ) ;
```

Rotate the canvas in degrees

```
translate ( x , y ) ;
```

Translate the canvas in pixels

```
scale ( multiple ) ;
```

Change the scale with a number.

Bigger than 1 will increase the size,
smaller than 1 will decrease the size.

Canvas Reseting keywords

```
resetMatrix ( ) ;
```

Removes all canvas changes

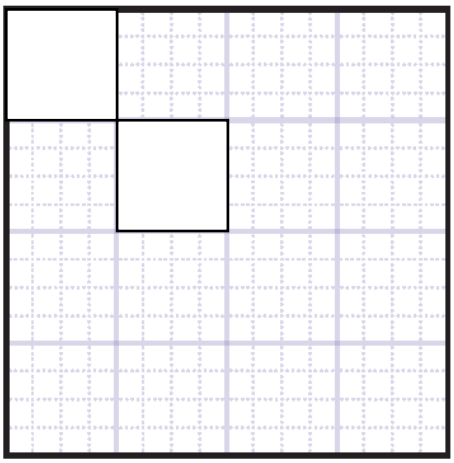
```
pushMatrix ( ) ;
popMatrix ( ) ;
```

Removes all canvas changes between the push and pop.

Rotate the Canvas

Using rotate will rotate the matrix.
The matrix is also known as the Canvas.

```
for (var i=0; i<5; i++) {
    rect(0,0,100,100);
    rect(100,100,100,100);
};
```

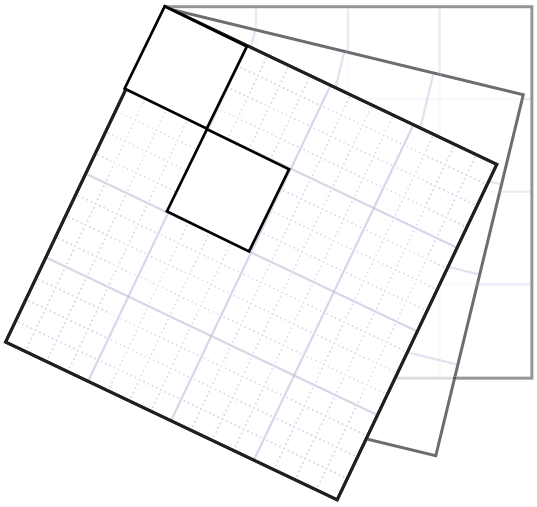


You can only see the two rectangles as the loop draws them on top of each other.

How it works

We can add rotate into the for loop to rotate the canvas.

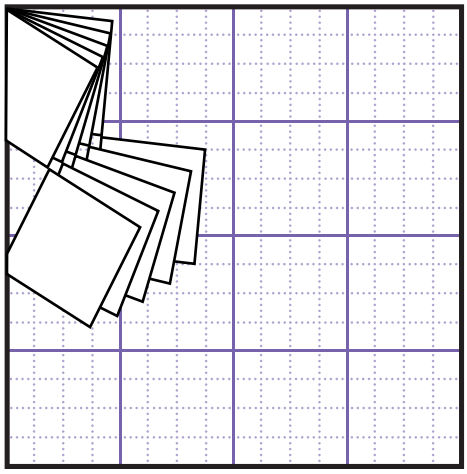
```
rotate(6);
```



The canvas or Matrix rotates around the (0,0) point on the canvas.

Rotate Example

Code to Rotate



The second square looks like it is rotating in a big circle.
This is because the canvas or matrix is rotating not the square.

```
for (var i = 0; i < 5 ; i ++) {
    rotate(6);
    rect(0 , 0 , 100 , 100);
    rect(100 , 100 , 100 , 100);
} ;
```

This will rotate and print each square. The loop runs 5 times and 5 squares are printed!

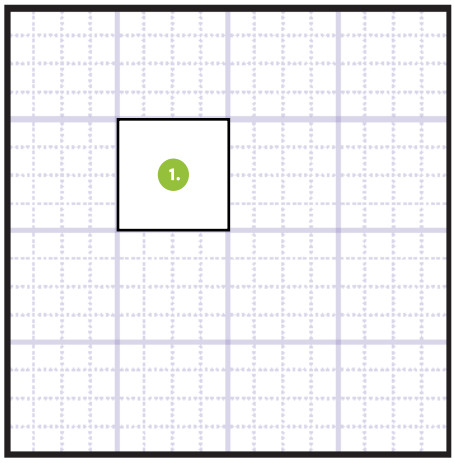
Translate

You can also move or edit the canvas.
You can change the Matrix using the translate, rotate and scale functions.

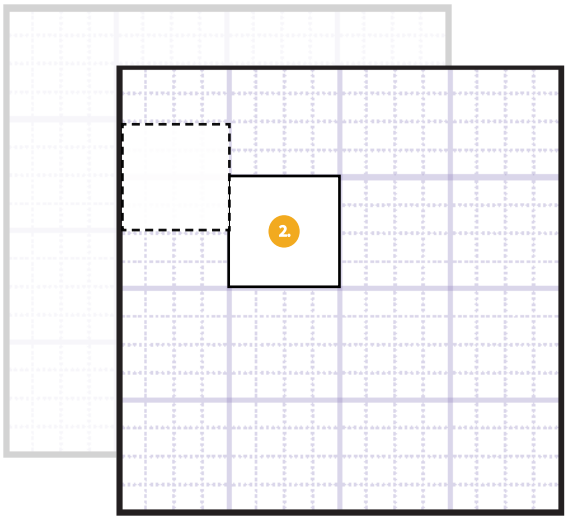
Translate

Translate moves the canvas in the X and Y direction.

1.
```
rect ( 100 , 100 , 100 , 100 ) ;
```



2.
```
translate ( 100 , 50 ) ;
rect ( 100 , 100 , 100 , 100 ) ;
```



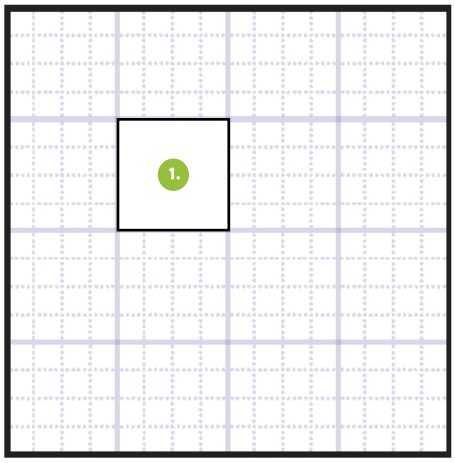
Scale

You can also change the size of the canvas and make objects look bigger or smaller.

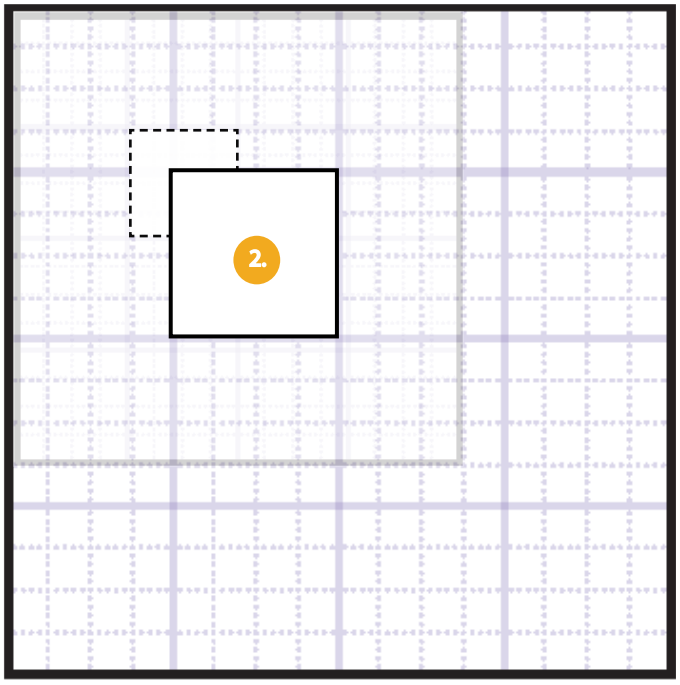
Scale

Scale makes the canvas larger starting from the lop left corner.

```
1. rect ( 100 , 100 , 100 , 100
```



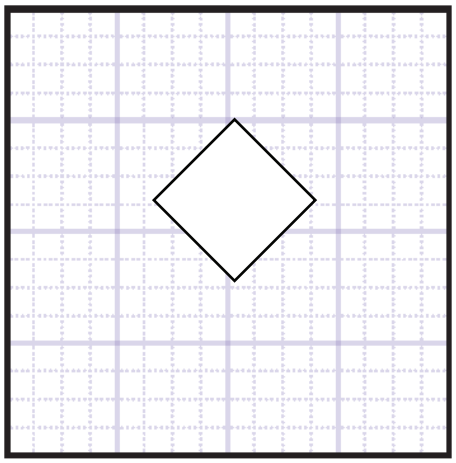

```
2. scale ( 1.5 ) ;
   rect ( 100 , 100 , 100 , 100
```



Reset Matrix

Reset Matrix removes all changes currently impacting the matrix.

```
translate(255, 100);
rotate(45);
rect(0, 0, 100, 100);
rect(0, 0, 100, 100);
```

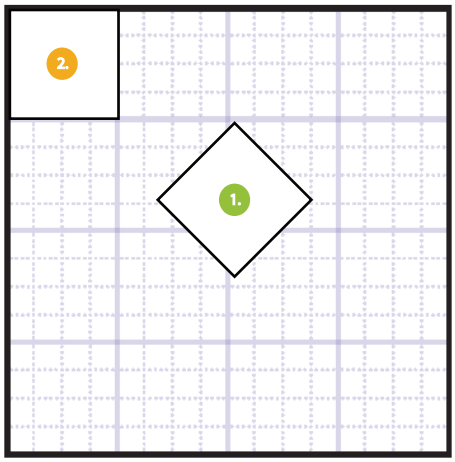


All lines following Matrix change impact in all following lines!

resetMatrix( );

Even if both rectangles have the same parameters they can act differently!

```
translate(255, 100);
1. rotate(45);
rect(0, 0, 100, 100);
resetMatrix( );
2. rect(0, 0, 100, 100);
```

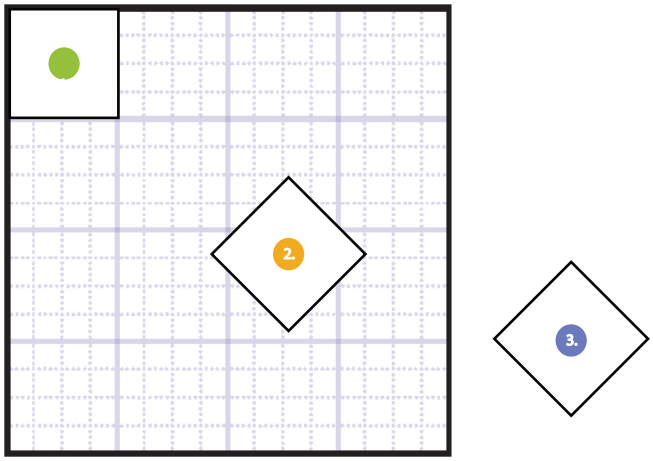


You can set the top value as the second argument

Push/Pop Matrix

Using push and pop matrix allows you to move specific things on your canvas.

```
1. rect(0, 0, 100, 100);
   translate(255, 150);
2. rotate(45);
   rect(0, 0, 100, 100);
3. rect(300, 300, 100, 100);
```



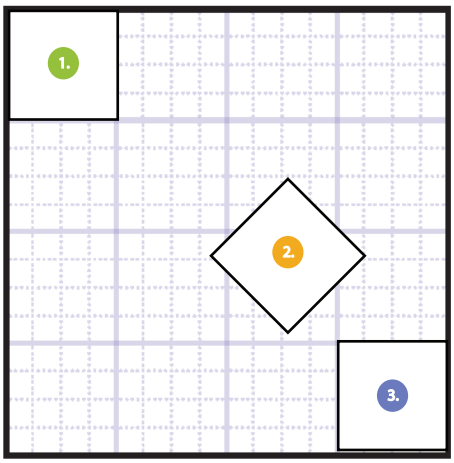
Both rectangles 2. are 3. ated and translated.

Push and Pop Matrix ( );

Only the orange section impacted by the Matrix Changes

```
1. rect(0, 0, 100, 100);
   pushMatrix( );
   translate(255, 150);
   rotate(45);
   rect(0, 0, 100, 100);
   popMatrix( );
3. rect(300, 300, 100, 100);
```

2.



Convert

Translating Variables

Translating code from other languages is an important skill. You can also try to convert syntax from Hatch.js to Hatch.py

Variables

TYPE	PARAMETERS
boolean	true, false
float	decimal numbers
int	whole numbers

If you use processing documentation you will need to redefine your variables.

```
int
```

To

```
var
```

```
color red = color ( 26 ) ;
```

To

```
var red = color ( 26 ) ;
```

Convert

Pseudocode to Code

Moving to Pseudocode can be hard!
You need to learn how to convert ideas into code!
The pseudocode is the written format of code.

Code Blocks in Pseudocode

This is the text that is directly used in the TWYS.
These are the specific numbers or keywords used in the TWYS.

Set the fill colour to `71, 173, 12`

These are code blocks.

Create a `draw` function.

Set the background colour to `0, 130, 196`

The indentation shows that **background** is inside the draw function.
This can help you think about if you need curly brackets!

Convert

Pseudocode to Code

Translate Pseudocode to Code

Use these steps to help you if you are having trouble!

1. What are the keywords or functions in the pseudocode.
2. What is the syntax of the keyword or function.
3. What numbers / parameters should I use.

Set the fill colour to `71, 173, 12`

Using the Steps

1. The keyword for this line is fill.
2. The syntax for this word is fill(#, #, #);

```
fill (71 ,173 ,12 );
```

Convert

Pseudocode to Code

Pseudocode Translation Examples

Having trouble with a specific line of pseudocode?
Use these examples to help you translate pseudocode!

CODE TYPE	PSEUDOCODE	TWYS
Shapes	Draw an ellipse at the position 50 , 50 with the size 50 , 50.	ellipse(50 , 50 , 50 , 50) ;
Variable	Declare a variable box and assign it to the value 0	var box = 0 ;
Colours	Set the fill value to red	fill(255 , 0 , 0) ;
Draw Function	Create a draw function	var draw = function() { } ;
If Statement	Create and if statement that triggers when mouseX is less than 150	if(mouseX < 150) { } ;

You may want to use other Reference Manual Page and past project to help!

Convert

Pseudocode to Code

Pseudocode Translation Examples

Having trouble with a specific line of pseudocode?

CODE TYPE	PSEUDOCODE	TWYS
Loops	Create a for loop that begins with counter i equal to 0, and for each loop where i is less than 400, i increases by 1	for(var i=0 , i<0 , i++) ;
Object	Create Box as an object	var Box(255 , 0 , 0) ;
Images	Draw the image "starwars/c3po" at position 10, 10 with a size of 100, 100	image(getImage ("starwars/c3po"), 100, 100) ;
Mouse	At position mouseX	mouseX

You may want to use other Reference Manual Page and past project to help you with other specific examples!

Convert

TWYS to Pseudocode

Pseudocode Translation Examples

Having trouble with a specific line of pseudocode?

CODE TYPE	PSEUDOCODE	TWYS
Array	Create an array myNums and assign it a list of numbers between 1 and 3	var myFoods = [1, 2, 3];
Translate	Translate the canvas by 100, 100	translate(100, 100);
Modes	Set the ImageMode to Center	imageMode(CENTER);
Random	Set to a random number between 1 and 100	random(1, 100);

You may want to use other Reference Manual Page and past project to help you with other specific examples!

Convert

JS to Python

Big Difference Between JS and PY

JS

1. Bad indentation will break your project in Py.

PY

```
var draw = function ( ) { el
lipse (100 , 100 , 100 , 100 ) ; }
```

Looks wrong,
but it will function.

```
def draw
ellipse ( 100 , 100 , 100 , 100 ) ;
```

Looks wrong,
but it will not function.

2. Less brackets and semicolons in PY

```
var draw = function ( ) {
ellipse (100 , 100 , 100 , 100 ) ;
} ;
```

Looks wrong,
but it will function.

```
def draw ( ) ;
ellipse ( 100 , 100 , 100 , 100 ) ;
```

Looks wrong,
but it will not function.

3. You must call global variables

If you use global variable in your project you need to tell the program you will use them in this specific function in Py.

```
def draw():
    global chompSpeed, pacMouth, pacMouthClose
```

Convert Processing Docs

Using the processing.js or processing.py documentation maybe hard. Here are some tips to help you understand how to use this in the Hatch Studio.

Void

Void is just how to define a function in the Hatch Studio we use var _____ = function( );

Processing.js

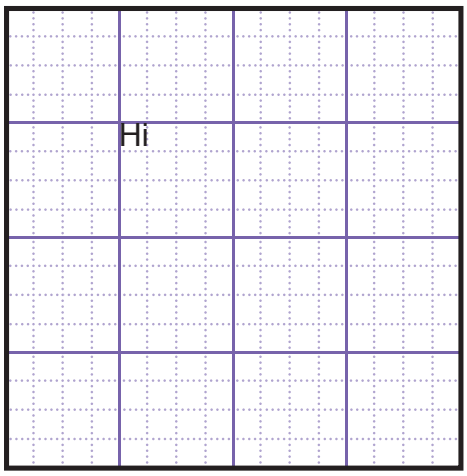
```
void draw ( ) {
    text ( "Hi" , 100 , 100 ) ;
}
```

Note there is NO semicolon

Hatch Studio

```
var draw = function ( ) {
    text ( "Hi" , 100 , 100 ) ;
} ;
```

For a general processing.js IDE



For the Hatch Studio IDE

Both will show this!

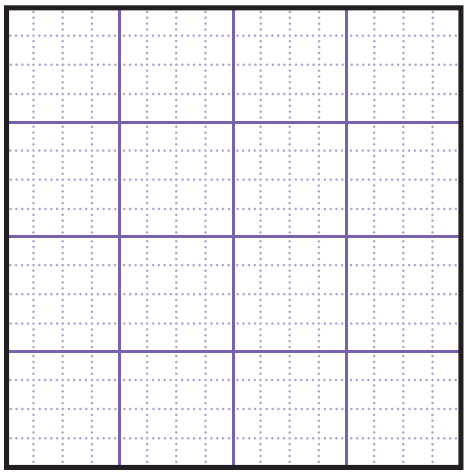
Convert Processing Docs

In processing.js normally you need to call a canvas ad set up the background. Hatch does this for you.

Setup

To convert to processing.js to use in another compiler you will need to set up a canvas.

```
void setup ( ) {
      size ( 400 , 400 ) ;
      size ( 400 , 400 ) ;
}
```



This would create the base canvas used in the Hatch IDE