Monday 11/16/15 -- we continue our Scratch journey! In Lesson 2, we will continue to find work with factors. We will learn how to make a tessellation of squares or hexagons. And we will learn to make our uppercase letter into a variable sized letter. This will lead us to fractals!

First Reminder: Save a Copy

I sent you a STARTER VIDEO on SAVE A COPY. Hope you watched it -- http://tinyurl.com/saveacopy34

Second Reminder: Answer Sheet

Have you checked the answers to QUESTIONS 1-12?
Where do you find them? They are on our Shared Class webpage on what is called a second worksheet. Look at the bottom where you see

ANSWER SHEET

You don't send to me. You check your own answers yourself! Okay?

Next Scratch Quick Tip: My Starter Set

Let's begin by looking at what I call my STARTER SET. You will find the file at https://scratch.mit.edu/projects/87247692/ and then you can REMIX it. Now it will be in your library and you can OPEN IT and choose SAVE A COPY each time you begin a program. Notice that I put CLEAR after GO TO so that any and all drawing is erased as the CAT goes back to (0,0) and we have a blank screen. If you put CLEAR before GO TO you can have strange bugs and quirks.
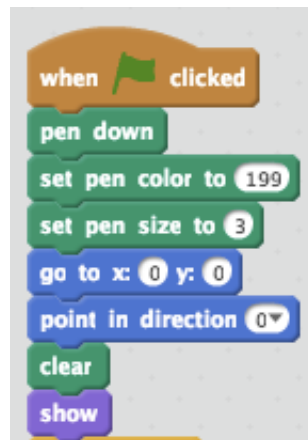
How to use your STARTER SET? Each time you do a NEW program, load up the starter set, then choose SAVE A COPY.

Next Scratch Quick Tip: Backpack

You can also move your STARTER SET to your BACKPACK which is at the bottom of your programming area.

Your BACKPACK in Scratch is very cool. After you get my code or you change it (since you might prefer for the CAT or ARROW to face right) you then drag the code to your BACKPACK located at the bottom of the SCRATCH screen. With this technique, you don't get the arrow each time however, but you can also store the ARROW in your backpack.
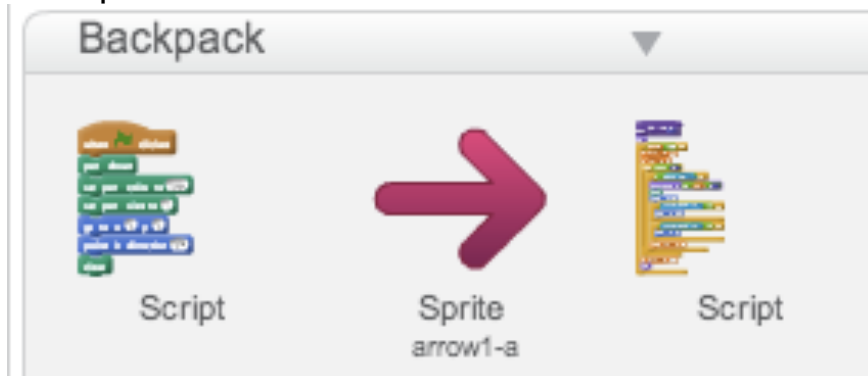
You can open or close your Backpack with the triangle button.

You can delete items from your Backpack by clicking with the SHIFT key. You cannot NAME the items in your Backpack so don't put too many things in it.

Next Scratch Quick Tip: Comments

If you have a PC and use the RIGHT MOUSE CLICK on your programming section. or If you have a Mac and hold down CONTROL and then CLICK on your programming section you can create a yellow POST-IT comment on your screen.

To make this easier, the Scratch team now let's us click on the SHIFT button and then click on the gray space programming section. This is clever so now we can have the same instructions for Mac users and PC users.

Here is a comment I wrote on the CODE from BRD from MA who solved the PERFECT NUMBER challenge which was very hard indeed. You can see the program at https://scratch.mit.edu/projects/86983985 if you wish but the important thing to note is to note the YELLOW sticky note. To DELETE or DUPLICATE a comment you hold down SHIFT and click on the TOP EDGE of the comment.
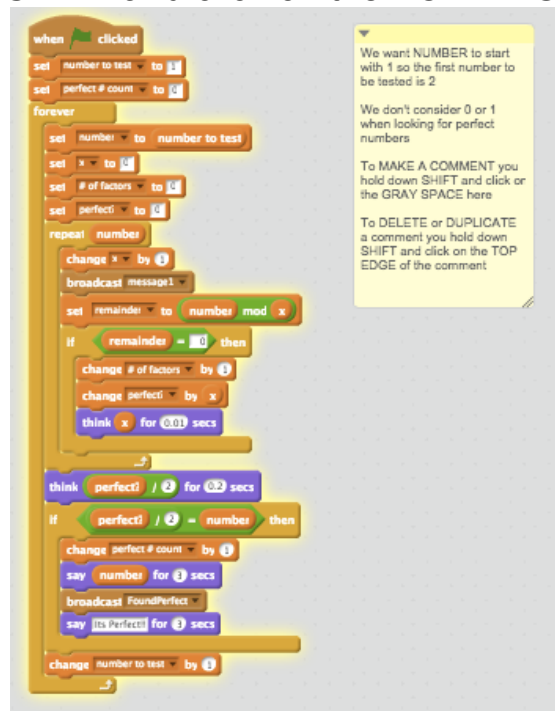
Good programmers document their work by using the comment feature and explaining things well. Companies like hiring "good programmers."

REQUIRED 7 MINUTE VIDEO called Backpack, Comments and Other Tricks
        http://youtu.be/3iWRz-KyLVY (sorry for scratchy audio on this one)
in which I review a few things as well as show REMIX and show you
• getting my first 7 STARTER commands and using your BACKPACK
• the yellow COMMENT feature for notes of your choice
• the video says RIGHT MOUSE click for comment but you can now use SHIFT

Next Scratch Quick Tip: Reviewing 4 Commands

Here are four commands from Lesson 1 most of which should trigger some recognition from you before we begin doing new things. Please make sure you are good to go with all four. Reminder that SHOW means SHOW THE COSTUME which might mean the CAT and/or the SAY or THINK statements.

This next command is useful but we did not talk about it much. The pen thickness of 3 is a little better visually on the screen. The default size is 1. The pen gets insanely thick as you go to size 10 or 20 or beyond.
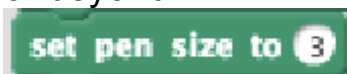
This next command is also useful. It makes the CAT face a certain direction where 0 degrees means FACING UP and 90 degrees means FACING RIGHT.

Here is another one we did not talk about much. It makes the CAT move to a specific location on the screen. Remember that it will LEAVE A TRAIL unless the pen is up.

Another powerful one we did not talk about at all makes the CAT travel to a specific location on the screen and lets you specify the time it takes which can be a decimal as .5 or .1 -- wonderful command! You will love GLIDE if you have not used it yet.
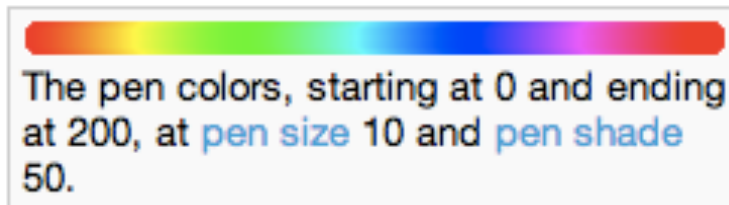
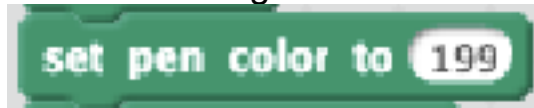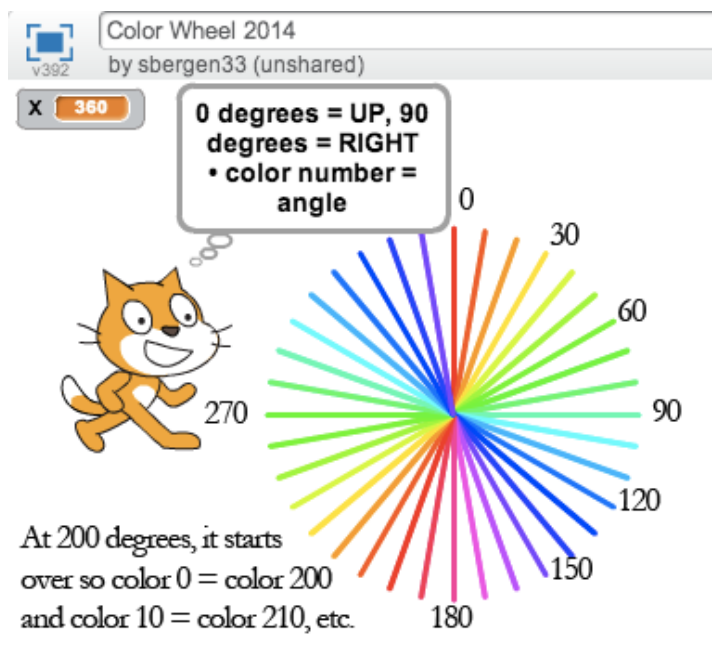Finally, I have told many of you to use SET PEN COLOR to a NUMBER and not the command that SETS to a COLOR. The color chart for each number from 0 to 200 is below on the right.

set pen color to 199

The pen colors, starting at 0 and ending at 200, at pen size 10 and pen shade 50.

REMIX is an important button once you grab a program that someone else has shared. REMIX moves the program into your own library.
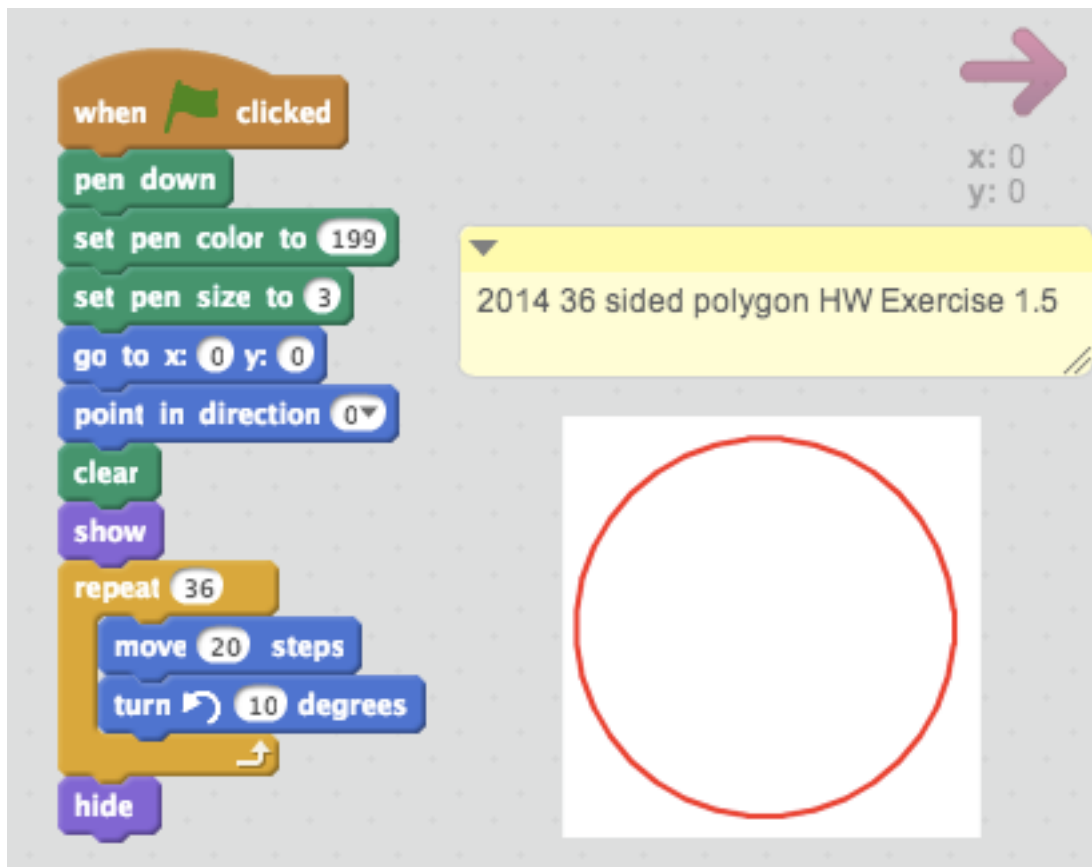
Next Scratch Quick Tip: Color Wheel

Here is a color wheel to help you visualize the color numbers better.

Color Wheel 2014
by sbergen33 (unshared)

X 360

0 degrees = UP, 90 degrees = RIGHT
• color number = angle

0
30
60
90
120
150
180
270

At 200 degrees, it starts over so color 0 = color 200 and color 10 = color 210, etc.

Next Scratch Quick Tip: Color Wheel

If you hold down SHIFT when you click on any command you can get wonderful HELP on that specific command!

Next Scratch Quick Tip: 36 agon

```
when [flag] clicked
pen down
set pen color to 199
set pen size to 3
go to x: 0 y: 0
point in direction 0
clear
show
repeat 36
    move 20 steps
    turn ↺ 10 degrees
hide
```

x: 0
y: 0

2014 36 sided polygon HW Exercise 1.5

Next Scratch Quick Tip: Setting The Zero Point

We saw in lesson 1 how the ink comes out of the back of the cat's neck. What I want to show you now involves how you adjust the zero point of a graphic.

Scripts   Costumes   Sounds
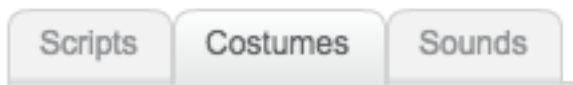
When you click on COSTUMES at the top of the screen -- right between SCRIPTS and SOUNDS -- you can change costumes or use the graphic editor to modify the existing graphic.
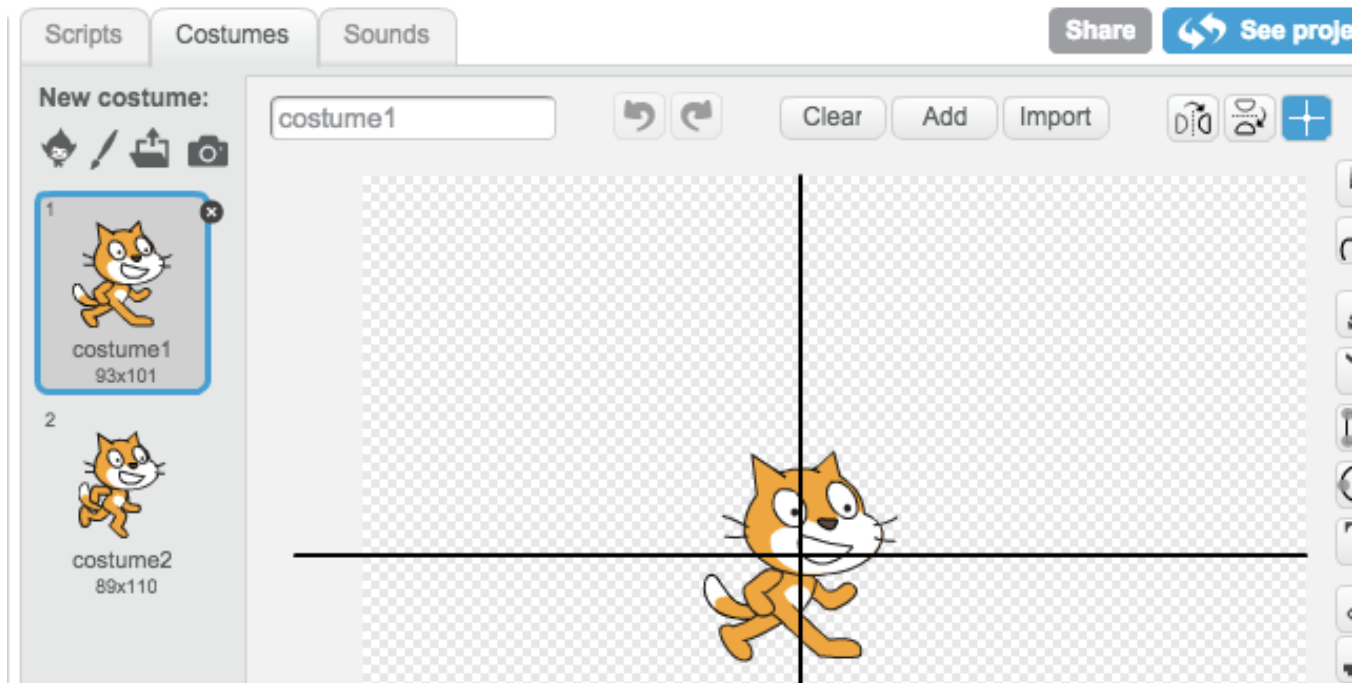
Look at the upper right corner where you see the BLUE PLUS SIGN. This icon allows you to see where the ZERO POINT currently is or you can change it. By zero point, I am referring to the location on the graphic where the ink comes out. You can pick up the zero point (what math teachers call the origin) and move it anywhere you want on the screen, e.g. to the cat's toe like this
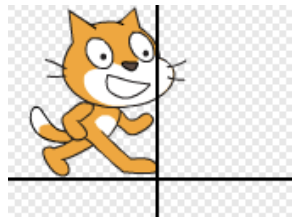
Next Scratch Quick Tip: DUPLICATING CODE

Look at the icons at the top middle

The first icon is a rubber stamper. If you click on the rubber stamper and then click a block of code, you can duplicate it. You can also DUPLICATE a block of code by holding down SHIFT and then clicking on the block.

Next Scratch Quick Tip: RANDOM NUMBERS

Let us introduce the RANDOM command and build on all the ways we can use it with graphics and variables. You will find the random command as the fifth command in the lime green section called OPERATORS

Please note that the OPERATORS section contains options for adding, subtracting, multiplying and dividing two things.
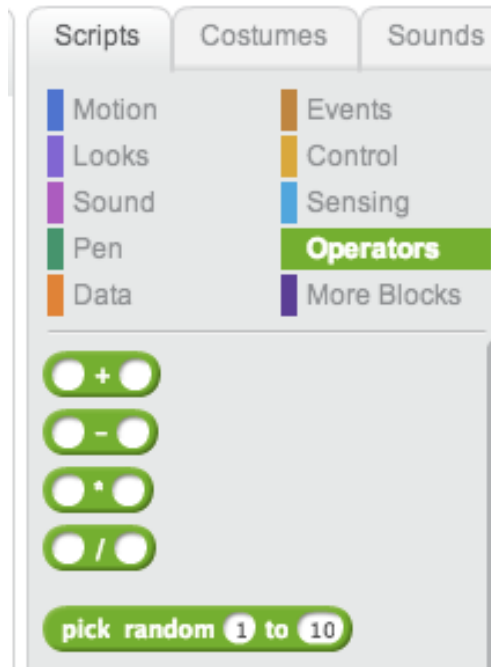
All of these commands in lime green can be put into the "white rectangle" of the orange SET command as some of you have discovered already. When you grab a lime green operator and drag it into the

command, you use the LEFT EDGE of the lime green object as the piece you drop.

Use LEFT EDGE of any Block when you move it into another Block.

Okay, let us see how many questions you can get right without looking back at the first 8 pages.

Question #13: When you look at someone else's program, what do you choose to MAKE THAT PROGRAM go into your Scratch library?

R _ _ _ _

Question #14: Where can you store some CODE or a PROGRAM or even a GRAPHIC so that you can have easy access to it and transfer it when you are in a different program?

B _ _ _ P_ _ _

Question #15: To make a Yellow Sticky Note comment on your program you hold down the S _ _ _ _ key and click on the gray space.

Question #16: Why is it wrong at the start of your program to have a CLEAR command and then below put GO TO (0,0)? What trouble might be caused by doing this?

Question #17: What is the command that is better than GO TO that lets you move to a certain spot on the screen but you can designate how many seconds it takes to get there?

G _ _ _ _

For our first Lesson 2 challenge, I would like you take the UPPERCASE letter you made in Lesson 1 and then SAVE A COPY and CONVERT it to a program that makes the letter variable sized.

Let us do this with a letter such as T and then we will do a more complicated one with a curve.


```
when [flag] clicked
pen down
set pen color to 199
set pen size to 3
go to x: 0 y: 0
point in direction 0
clear
move 100 steps
turn 90 degrees
move 25 steps
move -50 steps
hide
```

100 pixels tall

50 pixels wide

starts facing up from the bottom of the T

Please watch this 9 minute required video - http://youtu.be/a69EtSwMAdQ which I have made into a shorter name for those of you who actually type in the URL: http://tinyurl.com/variableT33
Reminder -- it is much easier to click on the URL on your screen rather than type it in.

To add a variable we need to create one using the DATA category and then MAKE A VARIABLE Then we will need to multiply each of the numbers by that variable -- the 100, the 25 and the -25.

So instead of `move 100 steps` we will have `move 100 * X steps` . Ok?

The checkmark means to display the variable on the left side of the stage (where the cat is) and it is the same as clicking the command SHOW VARIABLE. The first two on the left are very important and we will use frequently. The first one called SET assigns a number to the variable (because you don't always want to bother the user to type it in). The second one called CHANGE will be used when we learn to add the numbers from 1 to 100.
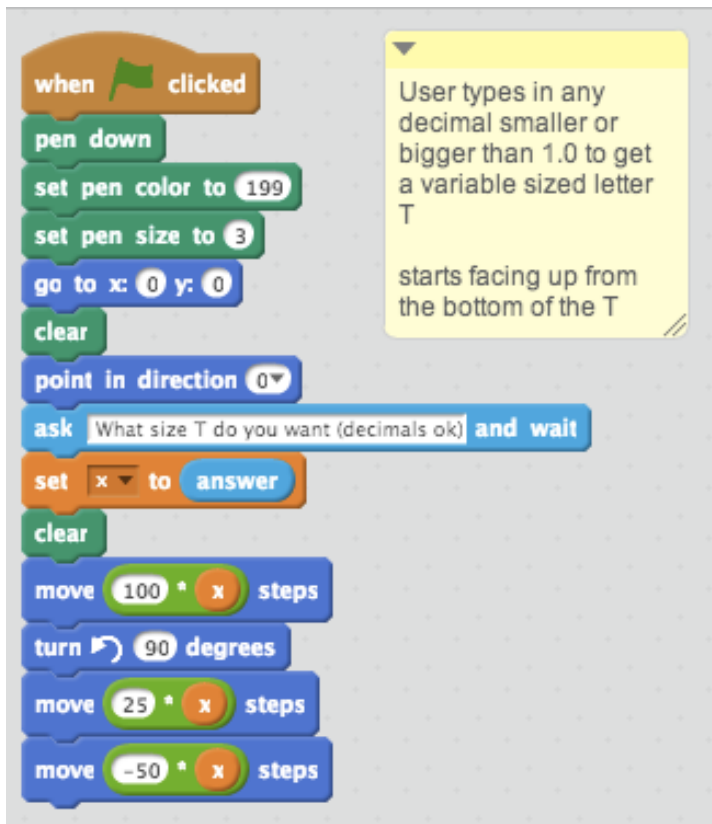
JV Exercise 2.1J: Pick the letter you created in Lesson 1 and modify it so that it makes that letter to be variable sized. Name your program "JV Exercise 2.1J Variable Sized Letter" and share it.

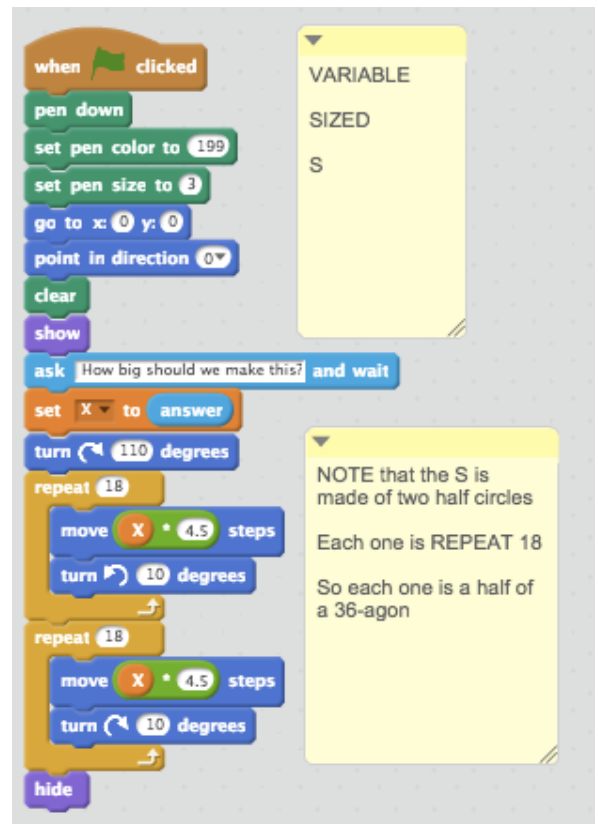Below you will see my code for making a "T" to be variable sized. Note that I use the lime green OPERATORS component that has two circles multiplied. The manipulations and explanations are on the video.

Note: if you used the GO TO command in Lesson 1 to draw the uppercase letter you may have to redo it.

VARIABLE SIZED T

```
when [flag] clicked
pen down
set pen color to 199
set pen size to 3
go to x: 0 y: 0
clear
point in direction 0
ask What size T do you want (decimals ok) and wait
set x to answer
clear
move 100 * x steps
turn 90 degrees
move 25 * x steps
move -50 * x steps
```

User types in any decimal smaller or bigger than 1.0 to get a variable sized letter T

starts facing up from the bottom of the T

VARIABLE SIZED S

```
when [flag] clicked
pen down
set pen color to 199
set pen size to 3
go to x: 0 y: 0
point in direction 0
clear
show
ask How big should we make this? and wait
set x to answer
turn 110 degrees
repeat 18
    move X * 4.5 steps
    turn 10 degrees
repeat 18
    move X * 4.5 steps
    turn 10 degrees
hide
```

VARIABLE
SIZED
S

NOTE that the S is made of two half circles

Each one is REPEAT 18

So each one is a half of a 36-agon

Varsity Exercise 2.1V -- Check out the samples below. Now create your own variable sized word fancier than JV that has at least 3 letters. Name your program "Varsity Exercise 2.1V Variable Sized Word" and share it.

Variable Sized "Hi!" -- https://scratch.mit.edu/projects/87517086

Variable Sized "Sly" -- https://scratch.mit.edu/projects/87518765

Colorful variable sized "S" -- https://scratch.mit.edu/projects/28575012

S-C-R-A-T-C-H (but not variable sized yet)
https://scratch.mit.edu/projects/87555217

Second challenge -- we will make a tessellation with a square. What is a tessellation? It is a repeating pattern with a geometric shape so the same shape is drawn over and over again.

The word tessellation has 2L's and 2S's. Learn to spell it right, please! In fact, it also has 2 T's and 2 E's but that is kind of a joke.

Please watch this 8 minute video called **A Square Tessellation**
Click on: https://www.youtube.com/watch?v=QTPgzmyUk18&feature=youtu.be

or shortcut if you are typing it in http://tinyurl.com/squaretess33

The video begins with my starter program and a square at the top of the next page.
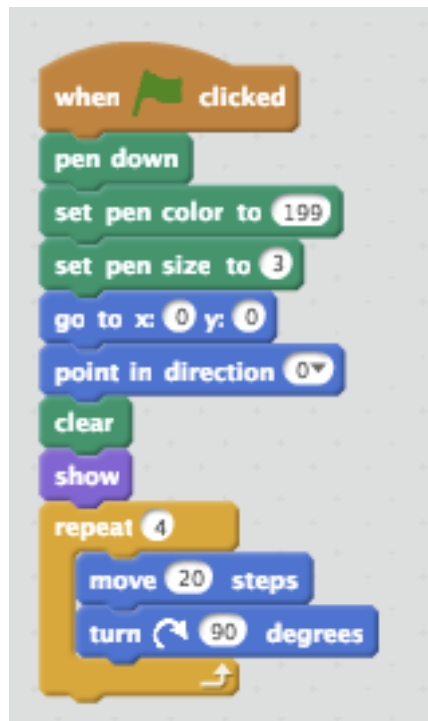
Are you good? Does everything above make sense?

Now we are going to change the 4 to be a RANDOM NUMBER between 4 and 8. Stay tuned. This will seem hard and confusing at first! No one said that coding and programming is easy. Sometimes you need to be confused at first before you "see the light."


The RANDOM command is lime green and you can pick a random number in any range. So the SPRITE goes around the square more than 4 times but it still is a square. But then we turn 90 degrees the OTHER WAY so now it is ready to draw a second square next to the first one. This second square will be ADJACENT to the first one but it might be on the North side or the South side or the East side or the West side. We don't know since it is random!

Our improved script is below but is not a tessellation yet!
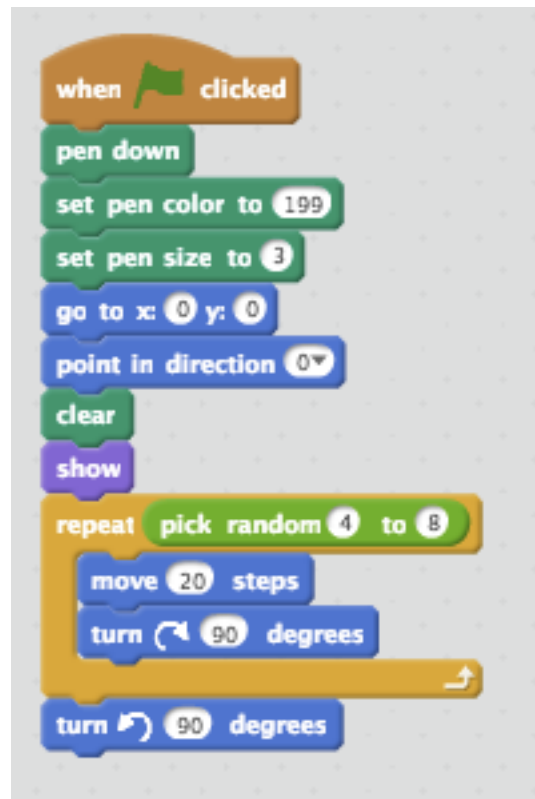
We need to put the last 5 steps in a FOREVER loop. Once we do so, we have our tessellation. Yes, we do! On the right is the beginning of the tessellation after I let it run for about 2 minutes.
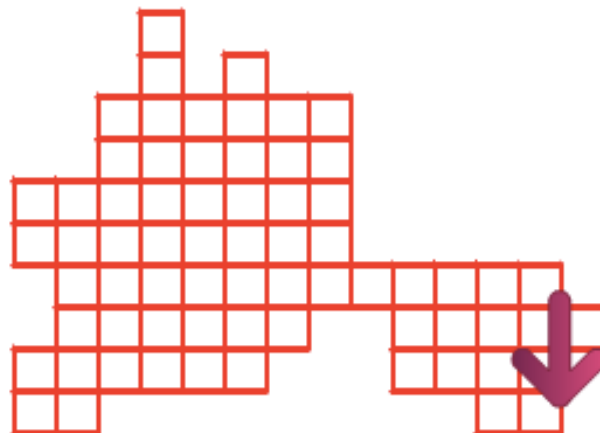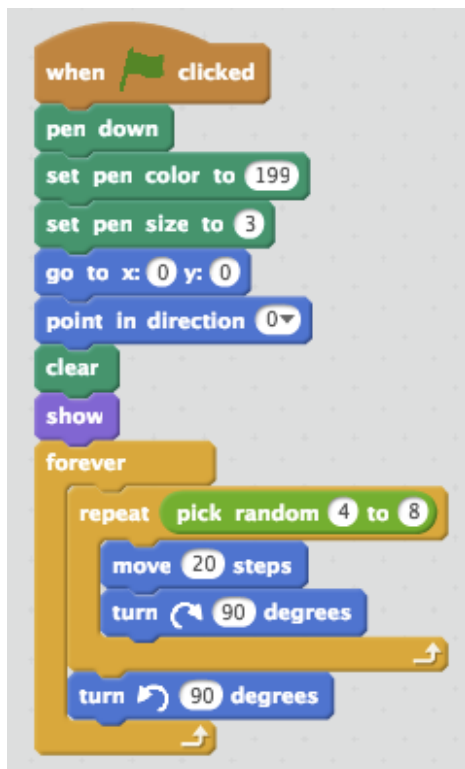
This is cool and fun to watch, but when it hits one of the edges, everything goes bad! Scratch does funky things on the edges of the stage. So we need to be smart and prevent it by SENSING if it hits the edges.

Here is the code that makes it stop when it hits an edge

The only new command is the light blue TOUCHING command. This is called a SENSOR command, since it senses when the sprite is touching the edge. You are a person with senses. You can see. You can smell. You can touch. In Scratch, a sprite can SENSE when it touches an edge but it can also SENSE when it touches a color or touches another sprite.

My son has a dog (half basset and half beagle, so we call him a bagel) who can SENSE when he is near a dog store. It is amazing. He pulls me toward the store even if it is night and the store is closed. My son's dog is named Brady (after Tom of course) and I think of him as my grand-dog!

Using SENSING COMMANDS is the key to creating games!

Sadly, our tessellation will not be perfect this week. In lesson 3, we will learn more and make our tessellation do a better job at the edges! It will then become a beautiful and complete tessellation.

Here is your second homework challenge.

JV Exercise 2.2J -- Create a SQUARE TESSELLATION -- Use a random command so that each square is a different color. Name your program "JV Exercise 2.2J Square Tessellation" and share it.

Varsity Exercise 2.2V -- Create a HEXAGON TESSELLATION -- Use a random command so that each hexagon is a different color. Name your program "Varsity Exercise 2.2V Hexagon Tessellation" and share it.

Hint: use the same strategy and same code as I did with the square. But of course the inside angles are not 90. So when you turn opposite after one hexagon is complete, you won't be turning 90 degrees, but you will be turning the angle that swings all the way around.
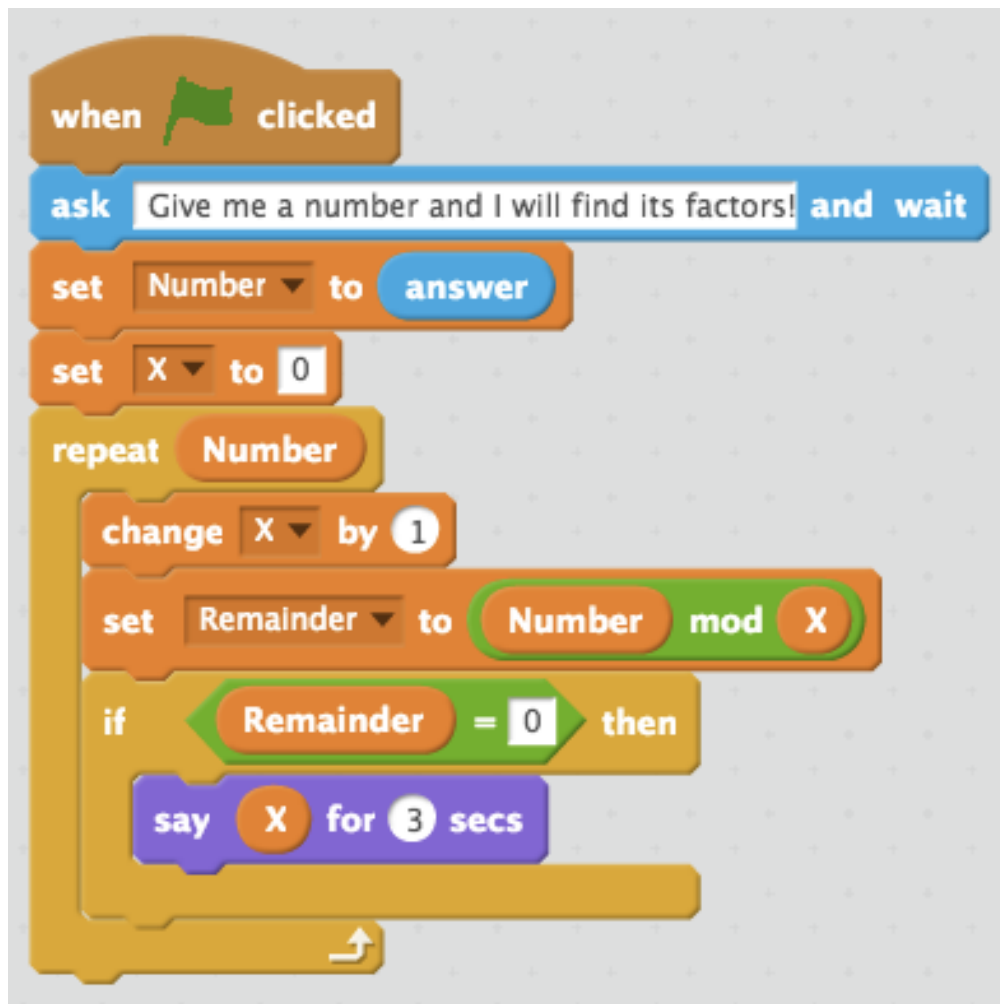
Here are some more tessellations all on the web. They are amazing!
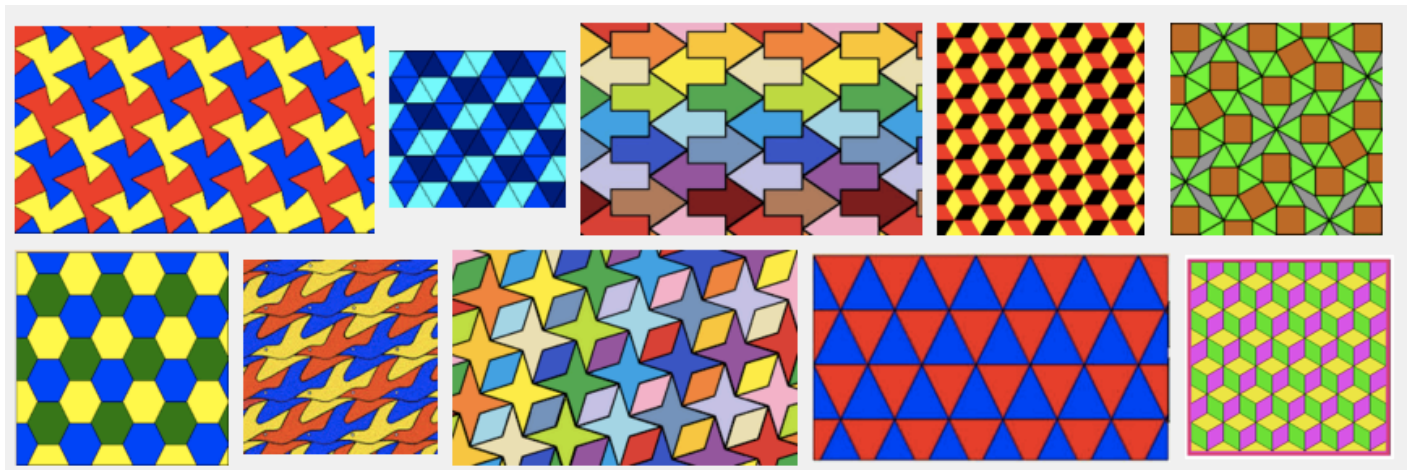
The key concept of a tessellation is that the 1 or 2 shapes that fit together are repeated over and over again, staying the same size!

Finding the SUM from 1 to X
(X just means any number)

Do you remember the end of lesson 1 where I had a program to find the factors of a number?

This week we are going to change it to add up the numbers from 1 to any specified number.

For example, what is the sum of the numbers from 1 to 5?
Answer: 15 since 15 = 1 + 2 + 3 + 4 + 5
Now for a trick!

What's the biggest number in the list? Answer: 5
What comes after 5 in the number "alphabet"? Answer: 6
Multiply 5 x 6 and then divide by 2. You get 15. Coincidence?

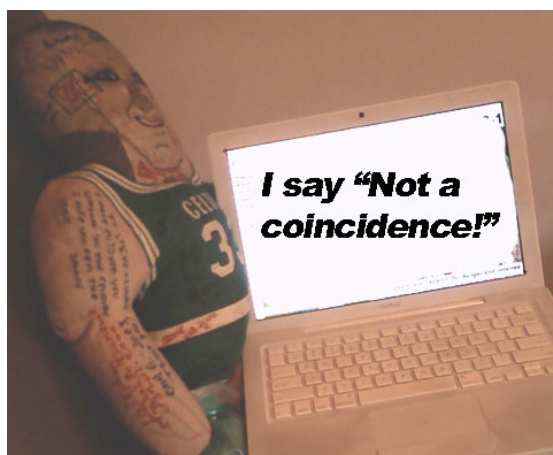For another example, what is the sum of the numbers from 1 to 10?
Answer: 55 since 55 = 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10
Now for the trick again!
What's the biggest number in the list? Answer: 10
What comes after 10 in the number "alphabet"? Answer: 11
Multiply 10x11 and then divide by 2. You get 55. Coincidence?

JV Exercise 2.3J -- Watch this 12 minute video below and learn how I take apart the program above and make it find the sum. Then go ahead and write the code, saving the program as "JV Exercise 2.3J -- Sum from 1 to X." Share it!

Varsity Challenge 2.3V: Write the code without watching the video. Yikes -- this is a tough challenge. Not sure if I could do it. Good luck! Save the program as "Varsity Exercise 2.3V -- Sum from 1 to X." Share it!

Here is the video called **Finding Sum from 1 to X.**
Click on https://www.youtube.com/watch?v=vlj2mjPYB4c&feature=youtu.be
or if you are not clicking on the URL but you are typing it in (not fun)
http://tinyurl.com/sum1tox33

Final Challenge: Creating a Quiz Game with 5 Questions for the Basic 11 Trick (11x42) or 10 Questions for the Advanced 11 Trick (11x 48)

JV Exercise 2.4J -- Write a 5 question quiz on the BASIC 11 TRICK and give the USER 5 different special treats when the USER gets 1 right or 2 right or 3 right or 4 right or 5 right. Save the program as "JV Exercise 2.4J -- The Basic 11 Trick." Share it!

Varsity Exercise 2.4V -- You must learn the basic 11 trick on page 19 and the advanced 11 trick on page 33. Write a 10 question quiz that has 5 basic 11 questions and 5 advanced 11 questions. Give the USER different special treats when the USER gets 1 right or 2 right or 3 right or 4 right or 5 right and so on! Save the program as "Varsity Exercise 2.4V -- The Advanced 11 Trick." Share it!

Do not begin on 2.4J or 2.4V until you read the next few pages and watch all the videos!

First required video for everyone to watch (JV and Varsity) and then answer the questions How to multiply by 11 in your head

Required 3 minute Video at http://tinyurl.com/11trickbasic

Now see if you can do these math problems in your head?

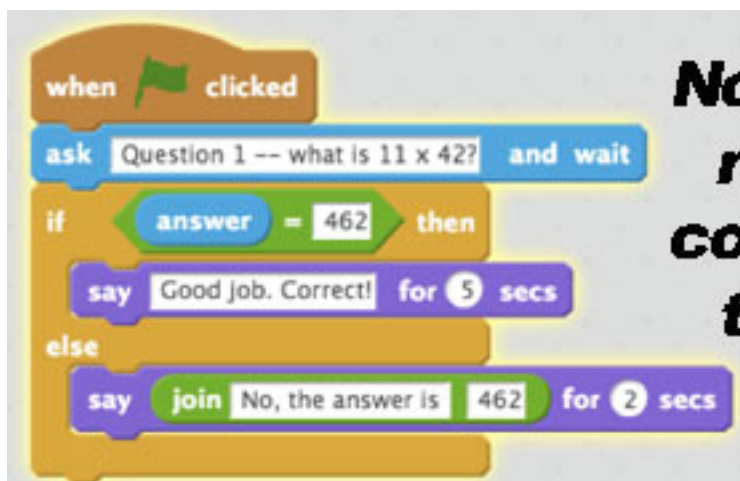Question #18: What is 11x42? Explain step by step as if you were talking to the Larry Bird Doll.

Question #19: What is 11x63? Just the answer this time. No need to explain again.

Question #20: What is 11x81? Just the answer this time. No need to explain again.

Notice that I have made the two digits of the second number (42, 63 or 81) to add up to less than 10! This is important.

The JV challenge to write a SCRATCH QUIZ PROGRAM that quizzes someone on what I call the basic 11 trick, when the second number has digits that add to less than 10. We need to start with this sample code.

when [green flag] clicked
ask [Question 1 -- what is 11 x 42?] and wait
if < answer = [462] > then
    say [Good job. Correct!] for (5) secs
else
   say (join [No, the answer is] [462]) for (2) secs

Notice the yellow rim around the code. This means the program is running.

Everyone needs to please watch this 17 minute video that shows more details. **A Quiz Program with Treats**

To watch video, click on https://youtu.be/Ug1vrk9pEeI

or you are typing it in -- http://tinyurl.com/quizprogram33

• The JOIN command came from the lime green OPERATORS. It lets you have 2 things "glued together" -- notice that I have a SPACE after "No, the answer is " or else the answer would appear as **No, the answer is462**. This is a common BUG -- lack of space in a JOIN command.

say join No, the answer is 462 for 2 secs   WE HAVE A BUG HERE SINCE THERE IS NO SPACE AFTER "is"
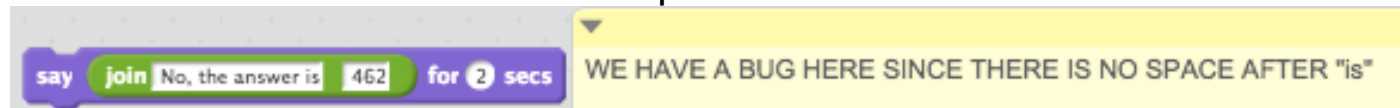
• As you learned in lesson 1, the light blue ASK command proposes the question and the result goes into the VARIABLE called ANSWER. The fancy IF ELSE command can be found in the yellow CONTROL section. Sometimes we use the basic IF command and sometimes in programming we use the fancy IF command with the ELSE.

Got it? Now we need to have 5 questions in our quiz and a counter to keep track of how many the USER has gotten correct.

Having a COUNTER is very important. We need to go to DATA then MAKE A VARIABLE that you can call C or you can call COUNTER.

We need to set the variable at the very top to be zero. This is important!

set COUNTER to 0

When you use a variable, good programmers frequently set the variable to something at the top of their programs.
We call this "initializing the variables."

Then when the USER gets the question correct, we need to add 1 to the COUNTER.

```
change COUNTER ▼ by 1
```

This gets done each time the user gets it right!
Here is the revised program. Study it! Does it make sense?

```
when 🏳 clicked
clear
set COUNTER ▼ to 0
show
ask Question 1 -- what is 11 x 42? and wait
if  answer = 462  then
    say Good job. Correct! for 1 secs
    change COUNTER ▼ by 1
else
    say join No, the answer is 462 for 1 secs
```

How to give the user treats?

You need to create a NEW SPRITE for each treat and then you will need the BROADCAST command. This type of code will be below your 5 questions. The BROADCAST command allows one sprite to tell another sprite when to begin.

```
if  COUNTER = 1  then
    broadcast message1 ▼

if  COUNTER = 2  then
    broadcast message2 ▼
```
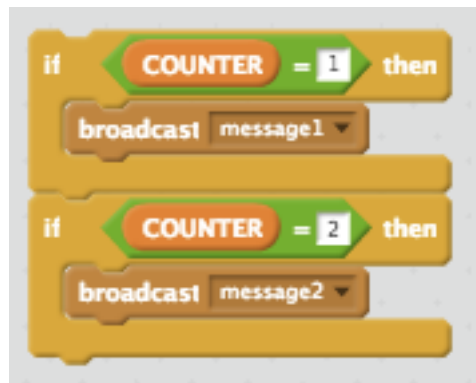
First let us create the other sprites. Below the stage at the bottom left, you will find this section.

New sprite:

These icons let you create a new SPRITE
-- from the library
-- by painting it
-- from a file on your computer
-- from your camera on your computer (if you have one)
After you create 5 new sprites, the bottom left of your screen will look like this and your stage will be a mess!

Sprites   New sprite:

Cat   Ballerina   Basketball   SB Drawing   LB DOLL
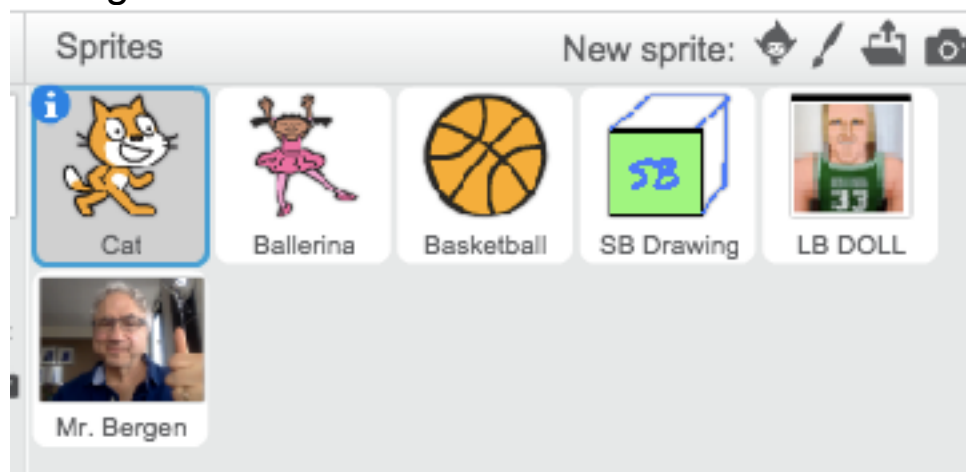
Mr. Bergen

Notice how I did a drawing (SB Drawing), I got a picture from my computer (LB Doll) and I took a picture from my camera (Mr. Bergen)

To change the name you click on the SPRITE and then you click the

BLUE I in the CIRCLE   and go to INFO.

Since your stage is a mess, you need a green flag program in each SPRITE that says

when   clicked
hide
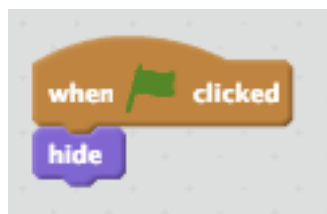
You can drag this script to each of the other four sprites to save time.
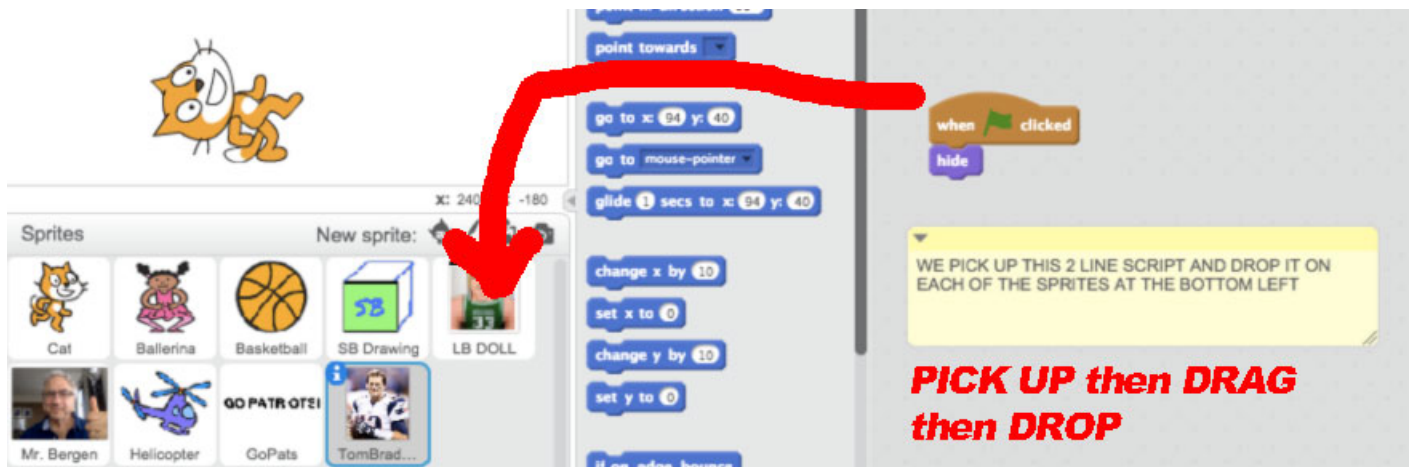
Now it is time to make EACH SPRITE APPEAR for a few seconds if the USER gets 1 right or 2 right and so on.
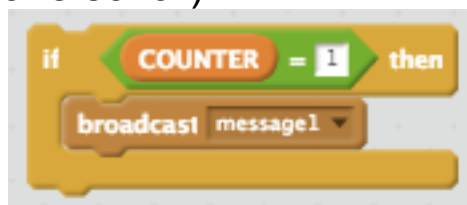
Here is the code for LB DOLL that will happen when the COUNTER = 1.
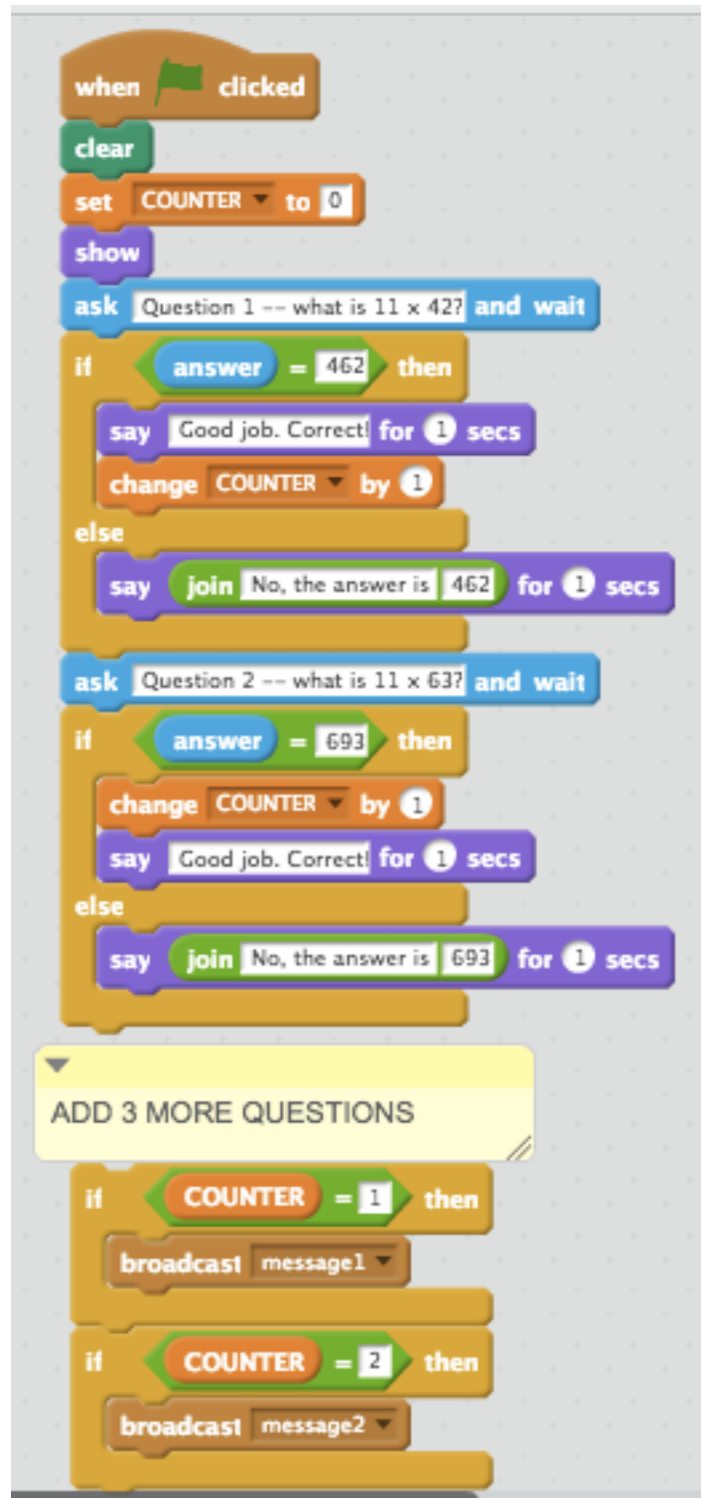

Where did MESSAGE1 come from?
It is an EVENT just like WHEN GREEN FLAG CLICKED. You will find this in the brown section and can even name the messages.

Now I go back to my CAT program and add this logic after all the questions (we have just one so far).

Got it? The cat broadcasts "MESSAGE1" and the LB DOLL listens and does some work when it receives "MESSAGE1."
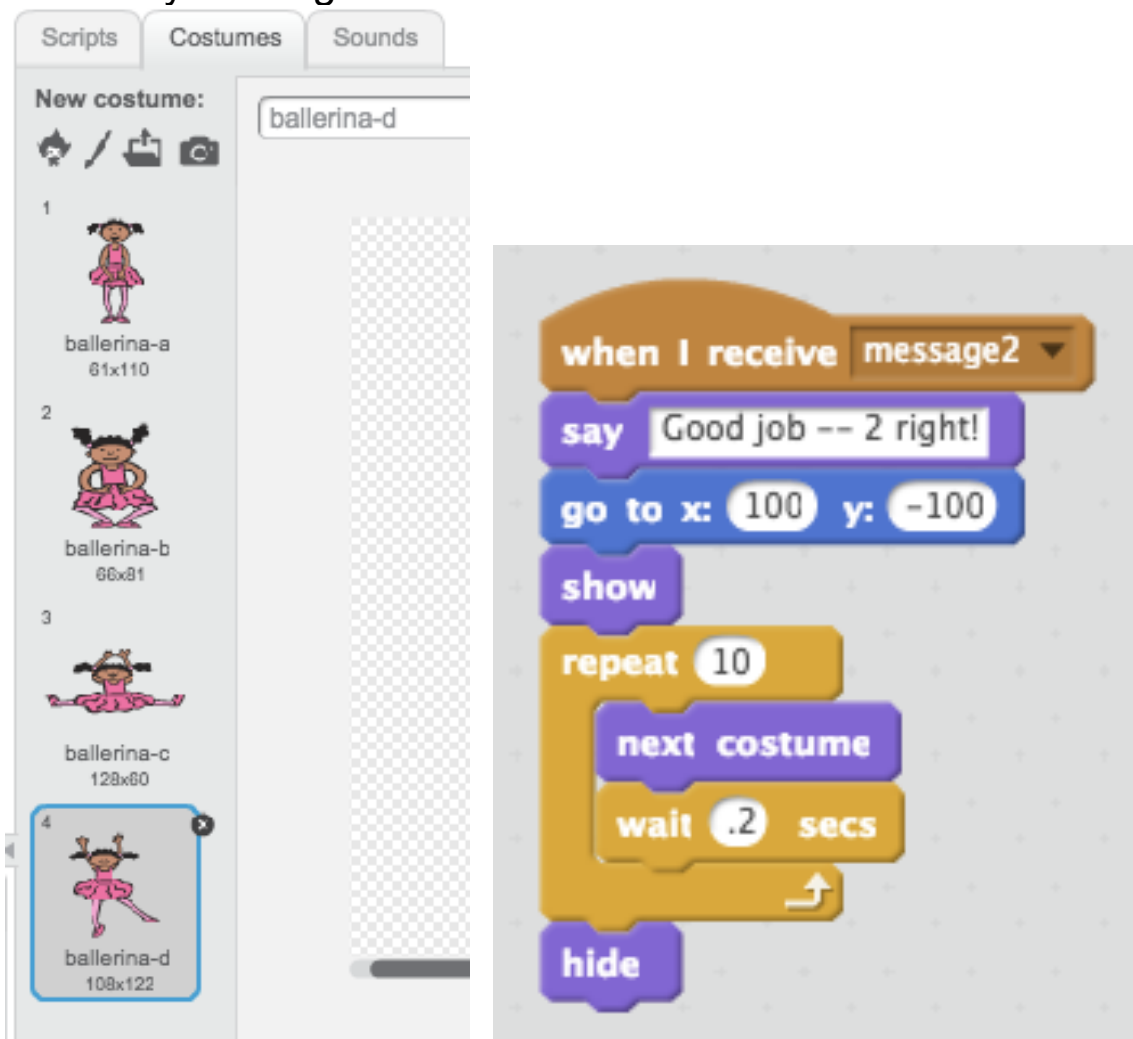
So now I would love for you to be creative and have 5 different sprites do 5 different things.

Here are some ideas & things to do for treats.

First idea: Costume Animation

Costume Animation: the ballerina has different costumes. You can see the costumes by clicking on the COSTUME button

So your sample program for the BALLERINA might be on the right. You can change the X,Y location of course and change the # of REPEATS and # of SECONDS to wait. But you will have a dancing ballerina!
You can animate any sprite and are not required to use the ballerina. Just make sure the sprite you choose has multiple costumes!

Another idea: Sprite Moving

A different kind of animation involves your sprite moving. Here is sample code for making my basketball move!
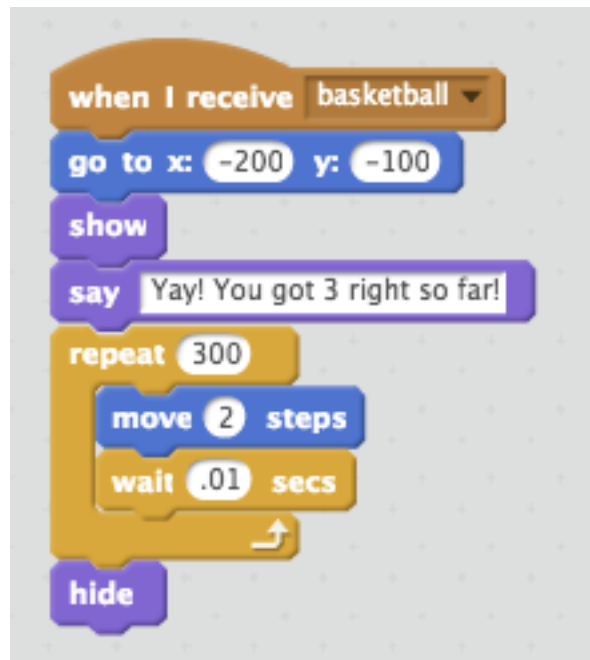
Another idea: a Word or Word Phrase moves

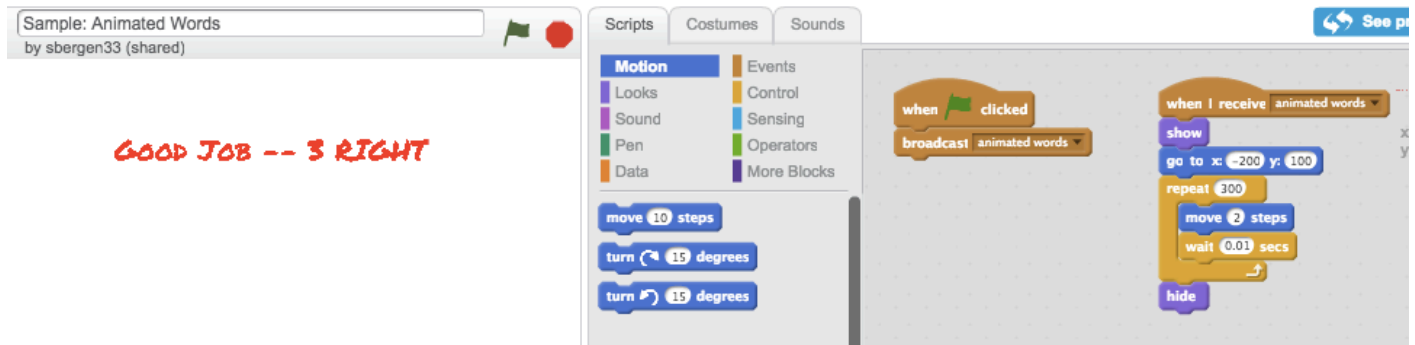You create a NEW SPRITE and you PAINT a word on the COSTUME SCREEN like this

You then use the same type of script as in basketball above.
Now the word scrolls across the screen.

See my sample at https://scratch.mit.edu/projects/87551579 if you want.
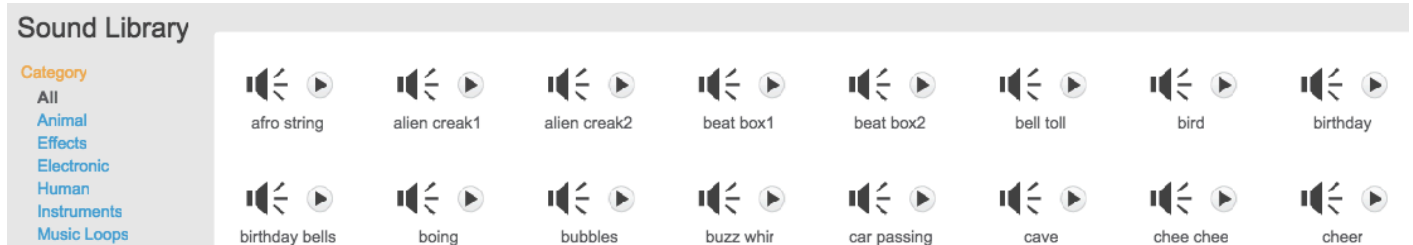
Another idea: Changing the Background

You create several NEW BACKGROUNDS at bottom left of the screen
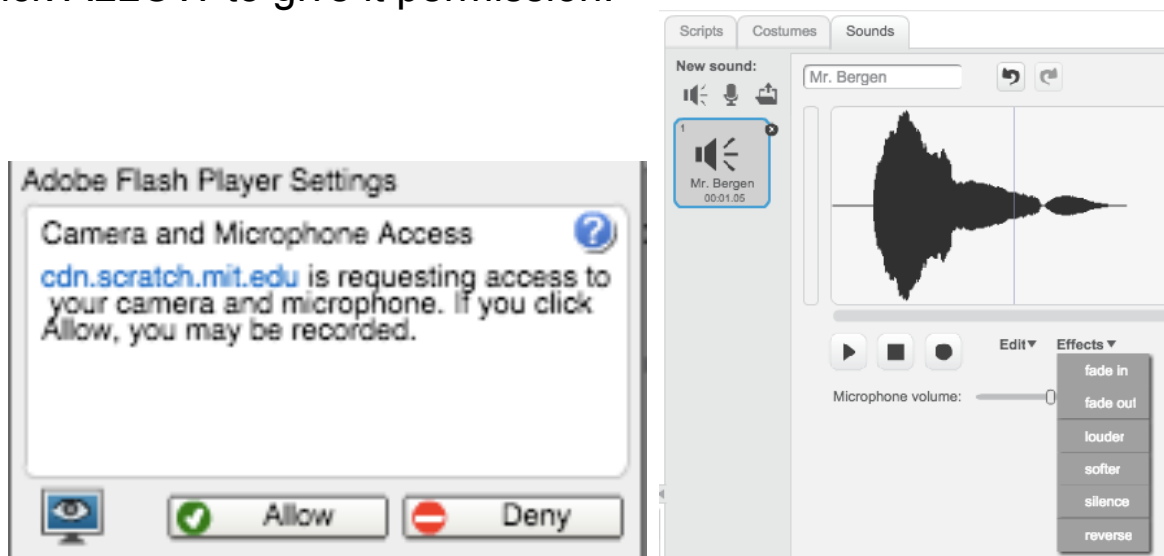and then have a script that changes from one background to the next.
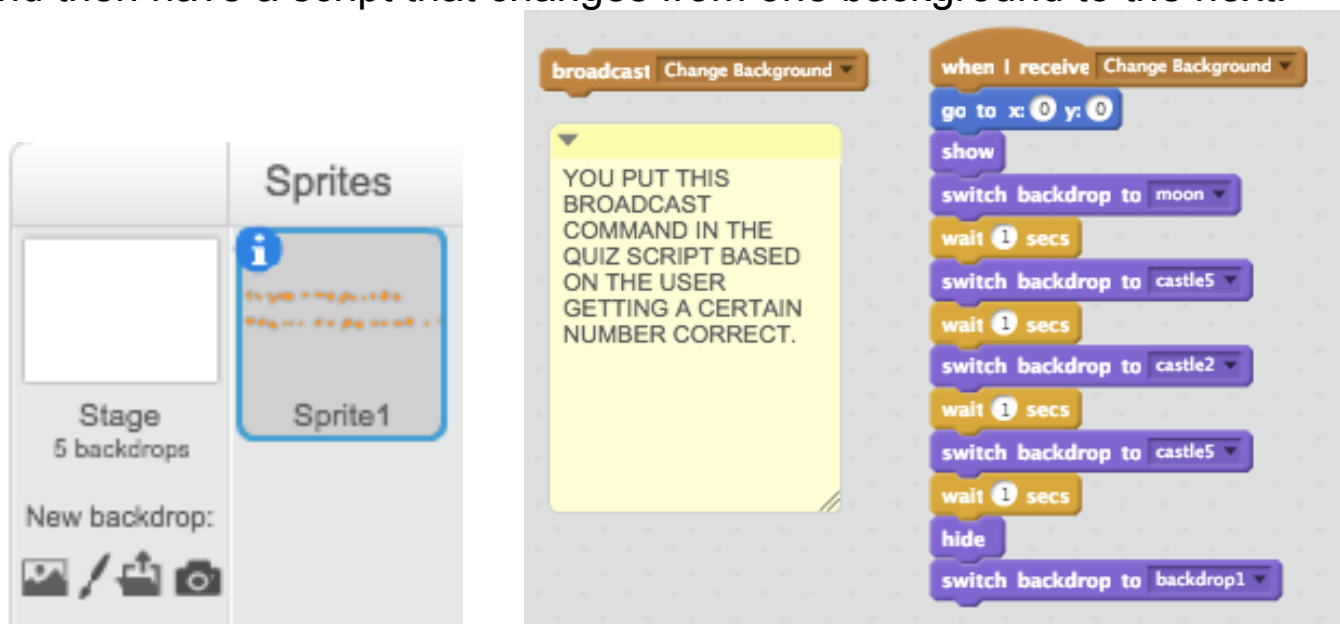
See my sample at https://scratch.mit.edu/projects/87860372 if you want.
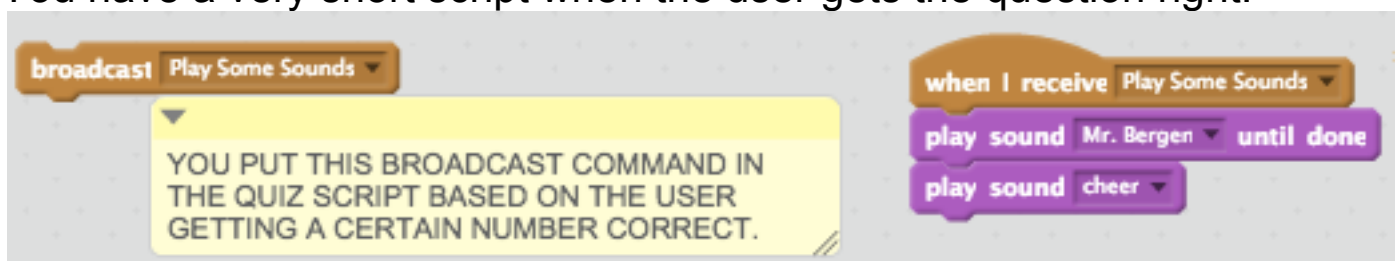
Another idea: Adding Sounds

You create a NEW SPRITE and you ADD A SOUND from the SOUND LIBRARY.

Or you can record your own voice if your computer has a microphone and you click ALLOW to give it permission.
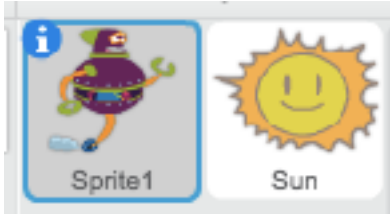

You have a very short script when the user gets the question right.

See my sample at https://scratch.mit.edu/projects/ 87861364 if you want.
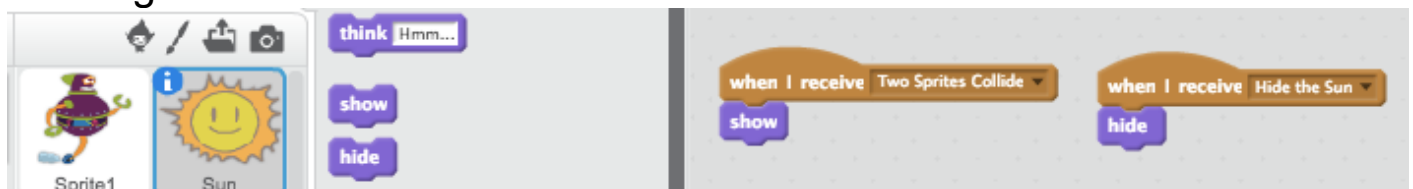
Another idea: Making 2 Sprites Crash

You can create 2 NEW SPRITEs and make one of them move randomly on the screen. When it collides with the other one, the script ends. In my sample, I created 2 sprites

SPRITE1 has this script that makes it start at upper left of the stage and GLIDE randomly to a new spot on the screen until it touches the SUN. When it touches the SUN, the REPEAT script is over, SPRITE1 then hides and a message is sent to the SUN sprite.
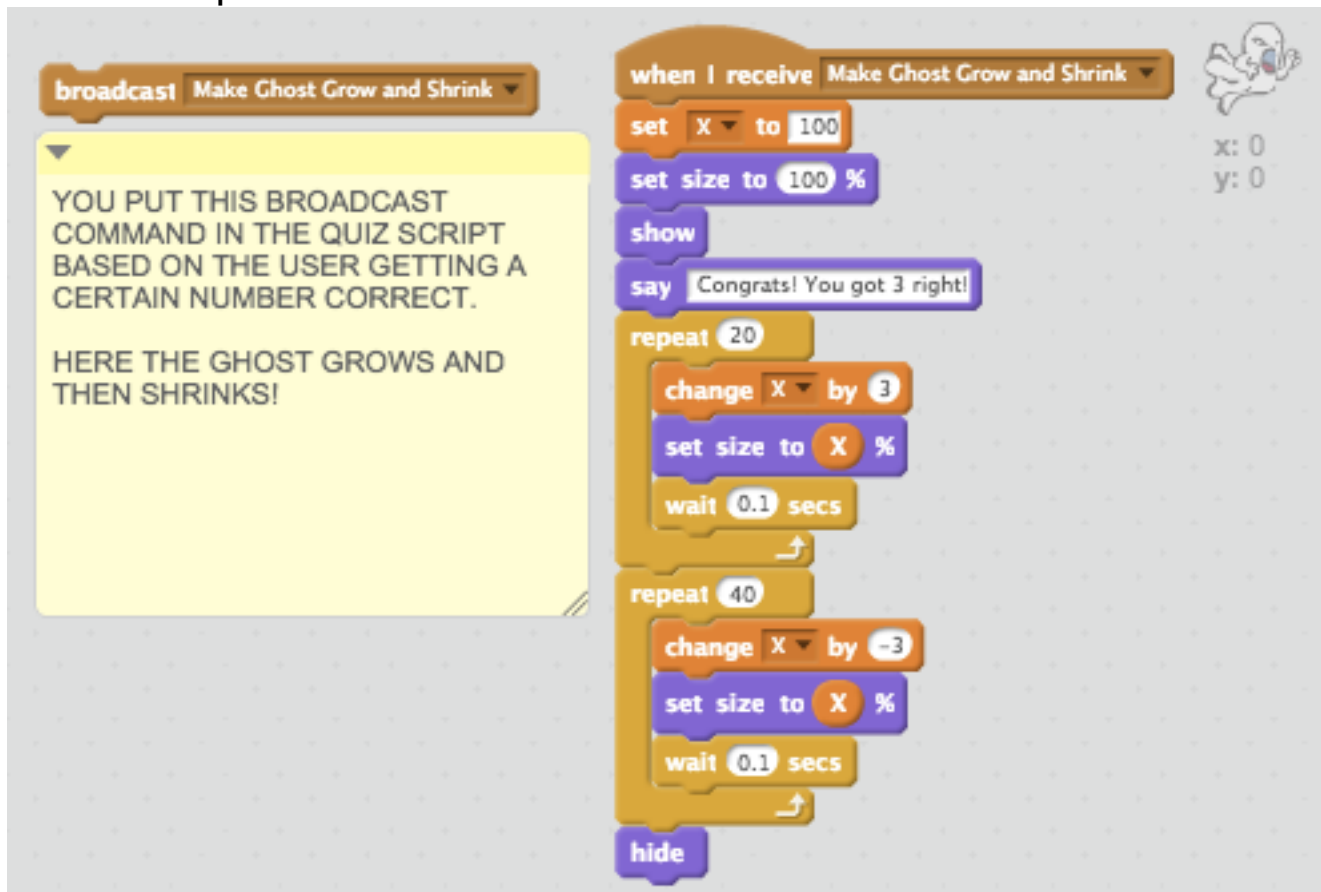

Here is the script for the SUN sprite, making it hide when it receives the message HIDE THE SUN.

See my sample at https://scratch.mit.edu/projects/ 87862324 if you want.

Another idea: Making a Sprite Grow or Shrink

You create a NEW SPRITE and you then use a SCRIPT like this one to make the sprite GROW or SHRINK.

broadcast Make Ghost Grow and Shrink ▼

YOU PUT THIS BROADCAST COMMAND IN THE QUIZ SCRIPT BASED ON THE USER GETTING A CERTAIN NUMBER CORRECT.

HERE THE GHOST GROWS AND THEN SHRINKS!

when I receive Make Ghost Grow and Shrink ▼
set X ▼ to 100
set size to 100 %
show
say Congrats! You got 3 right!
repeat 20
  change X ▼ by 3
  set size to X %
  wait 0.1 secs
repeat 40
  change X ▼ by -3
  set size to X %
  wait 0.1 secs
hide

x: 0
y: 0

See my sample at https://scratch.mit.edu/projects/ 87863401 if you want.
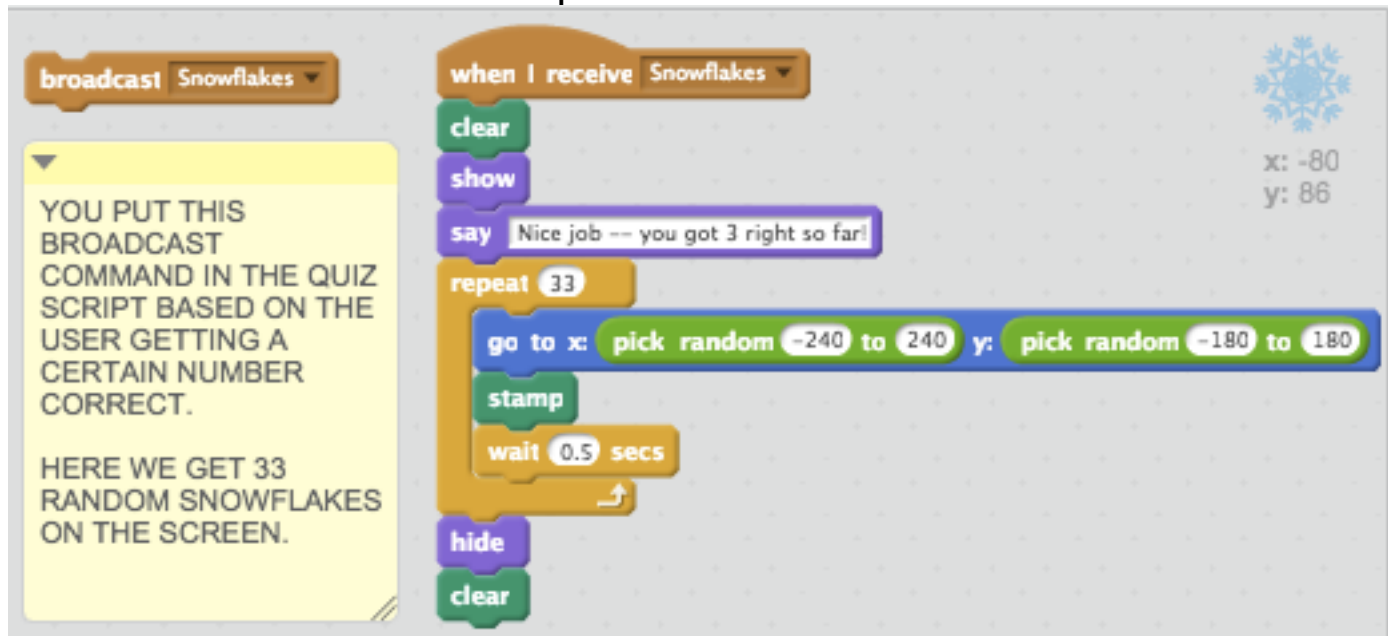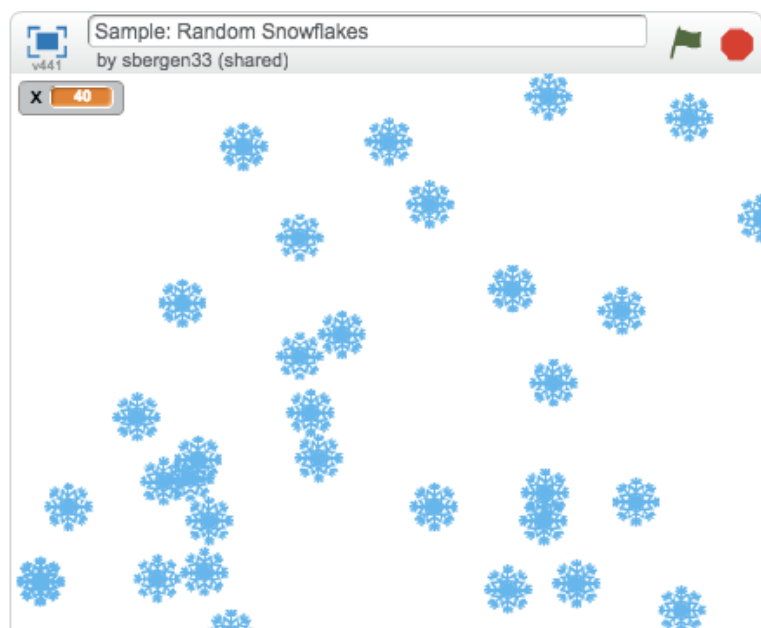
Last idea: Making Snowflakes with Stamp

You can make random SNOWFLAKES appear on the screen with the STAMP command that "stamps the costume" onto the screen.


```
broadcast Snowflakes

YOU PUT THIS
BROADCAST
COMMAND IN THE QUIZ
SCRIPT BASED ON THE
USER GETTING A
CERTAIN NUMBER
CORRECT.

HERE WE GET 33
RANDOM SNOWFLAKES
ON THE SCREEN.

when I receive Snowflakes
clear
show
say  Nice job -- you got 3 right so far!
repeat 33
    go to x: pick random -240 to 240  y: pick random -180 to 180
    stamp
    wait 0.5 secs
hide
clear

x: -80
y: 86
```

See my sample at https://scratch.mit.edu/projects/87864101/ if you want.

Sample: Random Snowflakes
by sbergen33 (shared)

VARSITY VERSION
Please watch this video on the harder version of the 11 trick --
http://tinyurl.com/11trickharder

Now see if you can do these math problems in your head?

Question #21: VARSITY ONLY What is 11x48? Explain step by step as if you were talking to the Larry Bird Doll.

Question #22: VARSITY ONLY What is 11x93? Just the answer this time. No need to explain again.

Question #23: VARSITY ONLY What is 11x86? Just the answer this time. No need to explain again.

END OF LESSON 2 -- ALL HW DUE by SUNDAY NIGHT 11/30