

From Mr. Bergen

sbergen33@gmail.com or 781-953-9699



Scratch 4 Kids • Lesson 1 • p 1
our webpage is <http://tinyurl.com/online4kids>

Monday 11/2/15 -- we begin our Scratch course and Scratch journey! All aboard!

Suggestion? Start a Scratch notebook! Print out this document and put it in your notebook. Start a page in your notebook called QUESTIONS FOR MR. BERGEN

Alternative? Do everything above electronically with a FOLDER on your computer instead of paper

How to Get to Scratch ** Internet Required

To get to Scratch Online you go to <http://SCRATCH.MIT.EDU> or just type SCRATCH into GOOGLE and do a search. Please do not use any other version but please stick with the online version at the <http://SCRATCH.MIT.EDU> website.

Join Scratch

Sign In

At the upper right you will see

Unless you have done so already, you should JOIN and use a simple username that will contain your library of programs that you will share with me. So choose a username you are comfortable with. I believe in Internet Safety and being careful! So I think you should not use your first name or last name but perhaps your 2 or 3 or 4 initials followed by a favorite number.

So if I were in this class mine might be SBB33
Do any of you know why my favorite number is 33?

It is because before you were born I rooted for the Boston Celtics in the 1980s when a basketball player named Larry Bird helped them win 3 championships. His uniform number was 33 and that is why my favorite number is 33. I even live on the 33rd floor in an apartment building in New York City!

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Here is a picture of the real Larry Bird.



URL: http://vignette4.wikia.nocookie.net/nba/images/a/af/Larry_Bird_33.jpg/revision/latest?cb=20120914230835

Notice that I put the web address (nicknamed URL) below the picture.
You should always do that in school.

You should always obey the rule that "when you get a picture or info from the web, you include the URL." I even once wrote a short poem that goes like this:

***You will never get in trouble with your
teachers or your bosses,
If you always remember to cite your sources!***

By the way URL stands for "uniform resource locator."

Here is a picture of me with my two Larry Bird dolls from the 33rd floor!



Yes, one of the two dolls is really old and beat up. My students used to wrestle with it and when I left Boston in 2002, they all signed it. The other doll is in great shape and hardly ever leaves my apartment.

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So that is why my favorite number is 33. How I wish that 33 was a perfect number but sadly, it is not. Do you know what a perfect number is? In Lesson 2 or Lesson 3, we will write a program to find perfect numbers.

In order to find out if 33 is perfect, you need to find its factors below itself.

What goes into 33? What times what equals 33?

Answer: $33 \times 1 = 33$ and $11 \times 3 = 33$

Yes, we care about 1 but not 33 since a perfect number is the SUM of its factors below itself. Since $1 + 3 + 11 = 15$ then 33 is not perfect, even though Larry Bird was a perfect basketball player, better than LeBron James! And if you add the two digits $3 + 3$ you get 6 which is the first perfect number. Why is 6 perfect? Because its factors below itself are 1, 2 and 3. These factors add to 6. That makes 6 so special. It is perfect!

Got it? The first perfect number is 6 because its factors below itself add up to 6. There are very few perfect numbers in existence!

If you love math (like me) and you love numbers (like me) then it is a lot of fun to think of the factors of different numbers. Some people think that if a number is strange then it probably has no factors. They are wrong.

I love the strange number 91 since $7 \times 13 = 91$.

In fact, when my father turned 91 several years ago and barely knew my name, I challenged him to factor 91. He was very good in math and still could figure out that the two factors of the strange number 91 were 7 and 13. So now you know that 91 is not prime since it has factors above 1.

I love the strange number 1001 since $7 \times 11 \times 13 = 1001$

So now you know that 1001 is not prime since it has factors above 1.

What about 360? What are some of its factors?

Is 360 prime? Is 360 perfect?

$360 = 4 \times 90$ so 360 clearly is not prime

360 is also 2×180 and 3×120 and 4×90 .

360 is also 5×72 and 6×60 . 360 is also 8×45 and 9×40 .

360 is also 10×36 and 12×30 and 15×24 .

360 is also 20×18 . Wow! 360 has so many factors!

So the factors of 360 below itself include:

1,2,3,4,5,6,8,9,10,12,15,18,20,24,30,36,40,45,60,72,90,120 and 180.

That's a lot of factors!

These numbers add up to be WAY MORE than 360, so 360 is not a perfect number. In fact, we call it a SUPER-PERFECT number!

But 360 is one of my favorite numbers because it is very close to the number of days in a year. And that might be why the Babylonians chose 360 to be the number of degrees in a circle several thousand years ago.

OPTIONAL LINKS IF YOU ARE INTERESTED IN LEARNING MORE

- <http://mathforum.org/library/drmath/view/59075.html>
- <http://math.stackexchange.com/questions/142735/why-is-a-full-turn-of-the-circle-360-why-not-any-other-number>
- [https://en.wikipedia.org/wiki/Degree_\(angle\)](https://en.wikipedia.org/wiki/Degree_(angle))
- <http://mathcentral.uregina.ca/FAQ/database/qq.09.96/kredo1.html>

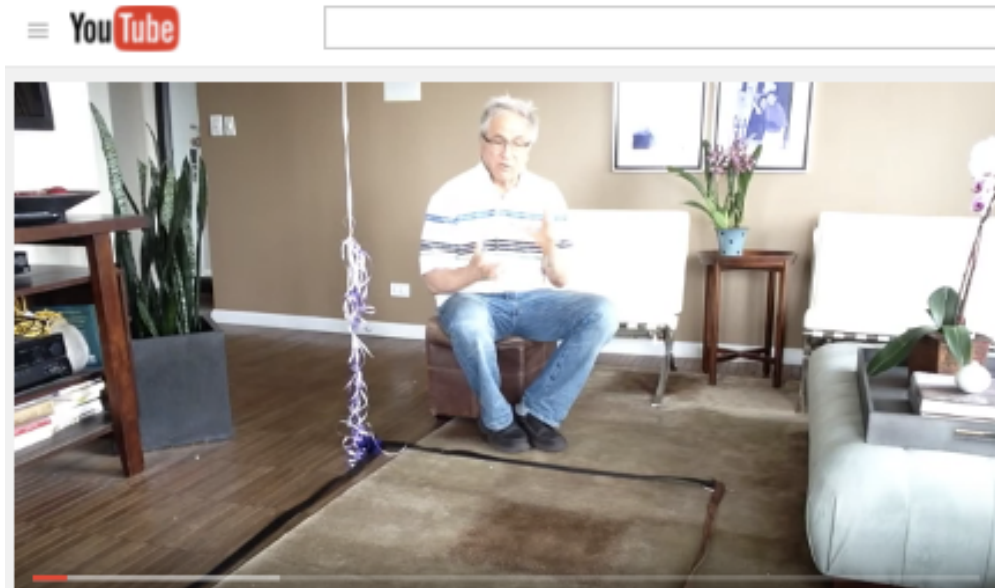
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First required video (9 minutes) is titled Drawing Polygons with Your Feet
<https://www.youtube.com/watch?v=-OZiYQ28oDI&feature=youtu.be>



The URL is also <https://youtu.be/-OZiYQ28oDI>

We will use my clean and pristine Larry Bird Doll in this course to alert you that there is an important question that you need to answer. For now, write the answers in the box or type them onto your computer in some document that you save. But in the next few days, I will post the answers on our webpage so you can check to see if you got them right.



Question #1: what is the URL (web address) for Scratch?



Question #2: what is the first perfect number and why?
Hint: it is below 10

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HW 1.0 -- Once you create your Scratch name, please type your username on our SHARED WEBPAGE. This is super important. My username is sbergen33 so the URL for seeing my shared programs is <https://scratch.mit.edu/users/sbergen33>

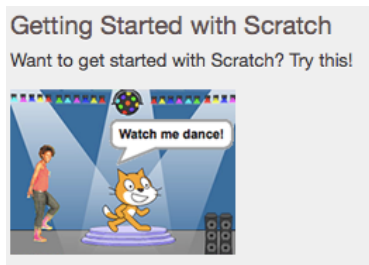
If your user name is mps then the URL for seeing your shared programs is scratch.mit.edu/users/mps -- got it?

Where is our shared webpage? It has a URL of

[**http://tinyurl.com/online4kids**](http://tinyurl.com/online4kids)

and you will find your CODE INITIALS on it. If you don't see them, please email me ASAP and I will fix.

To make a new program you choose CREATE from the main menu then FILE and NEW. At first, you will encounter a tutorial called GETTING STARTED WITH SCRATCH that is excellent. Please watch it if it pops up!



Once you click the X to get rid of the tutorial, you are ready to write your own program. Or you can choose NEW under the FILE menu. Please SHARE every HW problem and use the assigned name. Sharing is easy using the [Share](#) button at the top right of any program. When it takes you to the screen where it asks for INSTRUCTIONS and NOTES and CREDITS, just skip those things!

Here is the next of my videos to watch. I have used this video with teachers as well since I also teach Scratch to teachers!

[**http://tinyurl.com/sc008sc**](http://tinyurl.com/sc008sc) (7 minute video) making a square (or triangle) and learning to use the interface



Question #3: A square has 4 angles, each one is ____ degrees and so the SUM of the 4 angles is _____. At each corner when drawing a square in SCRATCH, you turn ____ degrees, so 4 turns make 360 degrees.

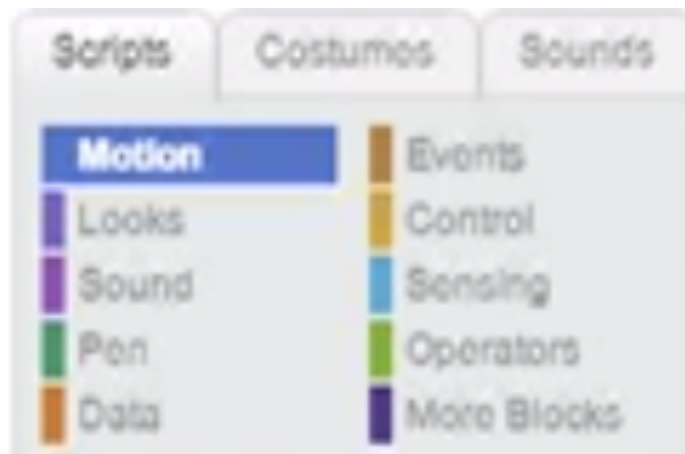
Here is the next video to watch

<http://tinyurl.com/sc026sc> 2 chunks in Scratch (3 minute video) to show how the ink comes out of the back of Cat's neck



The left hand side with the cat is where your program will run. It is called the STAGE. The middle area shows the commands in smorgasboard style that you drag onto the right side where you build your program. Notice the 10 colorful categories at the top of the middle area. When you

click on each of the 10 categories, you will see the specific programming commands of that type below.



Each type (MOTION, LOOKS, SOUND, PEN, etc.) has a different color and in a few weeks, you will get used to finding what you are looking for. Please observe for now the 3 TABs above called SCRIPTS, COSTUMES and SOUNDS. We will use COSTUMES later in this lesson.

You take blocks out of the middle area and drop them into your programming area on the right. You can snap the blocks together or keep them separate for a while when thinking and planning. If you snap them together, then clicking any one (usually the top) will execute the program. You can separate them after they are snapped together. Our first challenge is to draw a square.

To run the program after you build the script, click on the first line of the script.

To delete the entire program or any individual commands, drag from the programming area into the middle area.

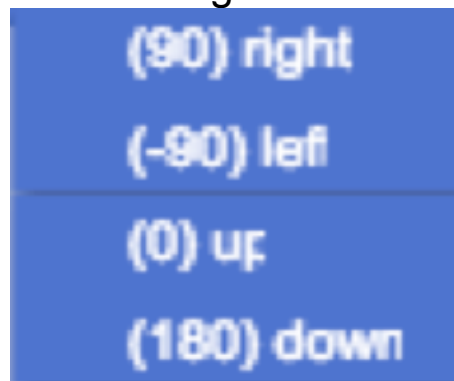
To clear the screen where the CAT is, use the CLEAR command at the start of your program. CLEAR is in the PEN category which is green. To separate a stack, grab any block from the middle and the ones below it will come with you.



The CLEAR command "erases the stage" but does not move the CAT back to its starter location. To do that, you need the command.



Also, you might want the CAT to reorient and face the same angle as when it started. To do that, you need the command which makes the CAT point to the right. Here are the 4 directions



Let us pause for a bit and make sure you can answer these questions.



Question #4: if your user name is JAD33, then what is the URL for seeing the SHARED PROGRAMS for this person?



Question #5: what are the coordinates of the exact middle point of the stage?

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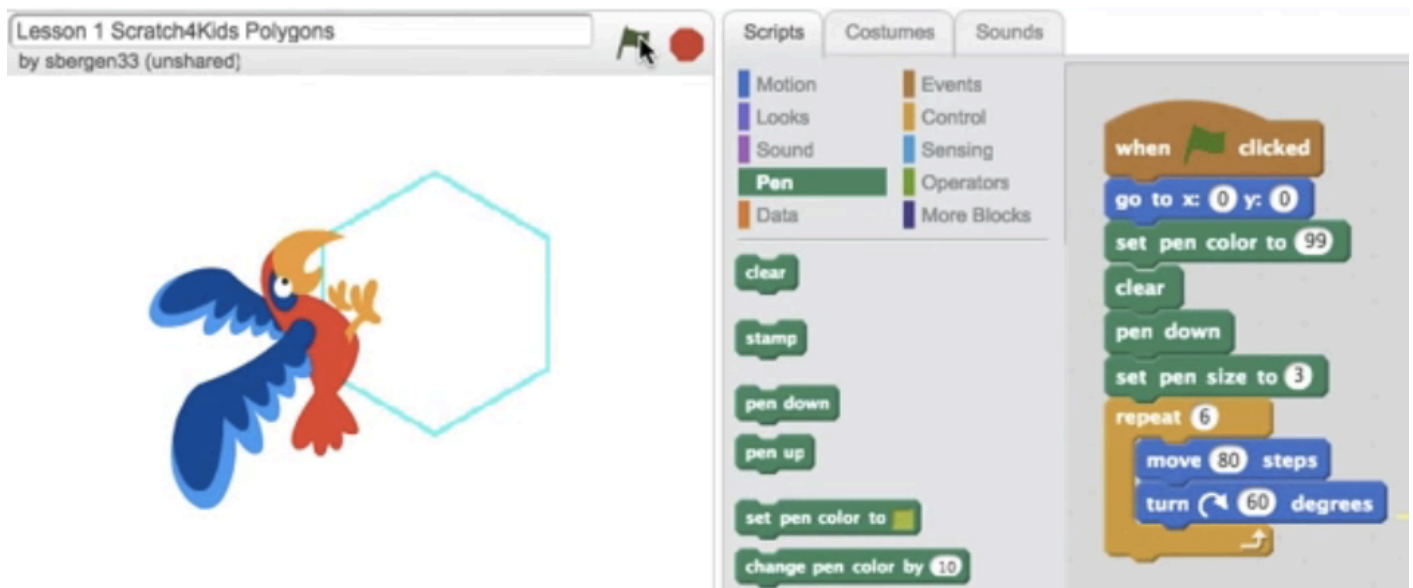
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Finally, if your cat is moving but not leaving ink, you might need to fix this

with the  command.

Here is the next required video to watch called POLYGONS IN SCRATCH

<https://www.youtube.com/watch?v=tAlog0bAek0&feature=youtu.be>



URL is also <https://youtu.be/tAlog0bAek0>

This video also contains my bad joke (I didn't make it up)

*What do math teachers
call a dead parrot?*

The Homework Exercises are called JV and Varsity.

JV are easier.

Varsity are harder.

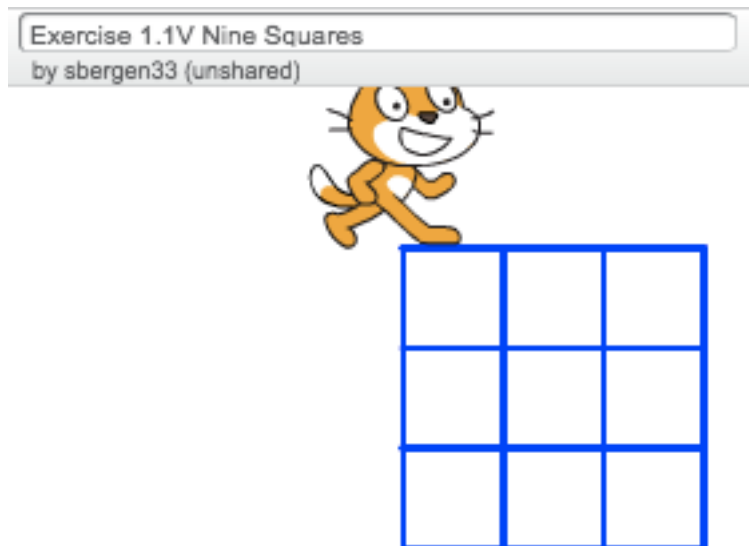
You are required to do either JV or Varsity not both.

But if you want to do both, you are allowed. That is what Larry Bird would do! Each time you do one, you must go to our CLASS WEBPAGE and put a word or a few words in the correct column next to your initials.

JV Exercise 1.1J -- Draw a small square that is 133 wide and 133 tall. Name your program "JV Exercise 1.1J One Square." Share it!

Varsity Exercise 1.1V -- Draw a Tic-Tac-Toe Board of 9 squares that looks like this, with each square being 50x50. Name your program "Varsity Exercise 1.1V Nine Squares." Share it!

Varsity by the way is hard! Larry Bird made JV basketball before he made the Varsity team!

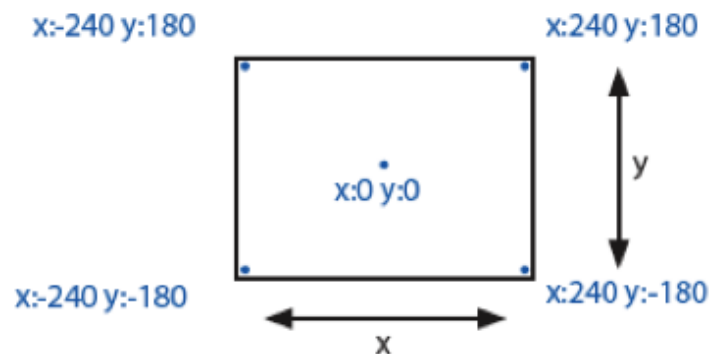


Programming is like playing with clay or building a sand castle at the beach. It is great to try things and fine to make mistakes. Each mistake you make will lead to some good realization that will get you better. I promise you that one little mistake can cause the program to not succeed and when that happens, it is normal to be frustrated. But the joy of

programming is that when you see the light -- whether you figure it out yourself or because someone helps you, the logic is so wonderful!

Here are the dimensions of the Stage (480 x 360 pixels with 0,0 in the middle). The screen is 480 pixels wide and 360 pixels tall. A pixel is a tiny dot on the computer screen. So you can say the Scratch screen is 480 dots wide and 240 dots tall. The center dot is (0,0).

You may not think it important now to know these numbers of 480 x 360 but trust me that it will be relevant later in the course and you can always come back to Lesson 1 to see these important numbers. Try to memorize these numbers: 480 x 360.



Question #6: The stage has a width of ____ pixels and a height of ____ pixels. The center point is (0,0). Where you would find each of these four points in relationship to (0,0)?

(0,33) can be found _____

(-33,0) can be found _____

(33,33) can be found _____

(33,-33) can be found _____

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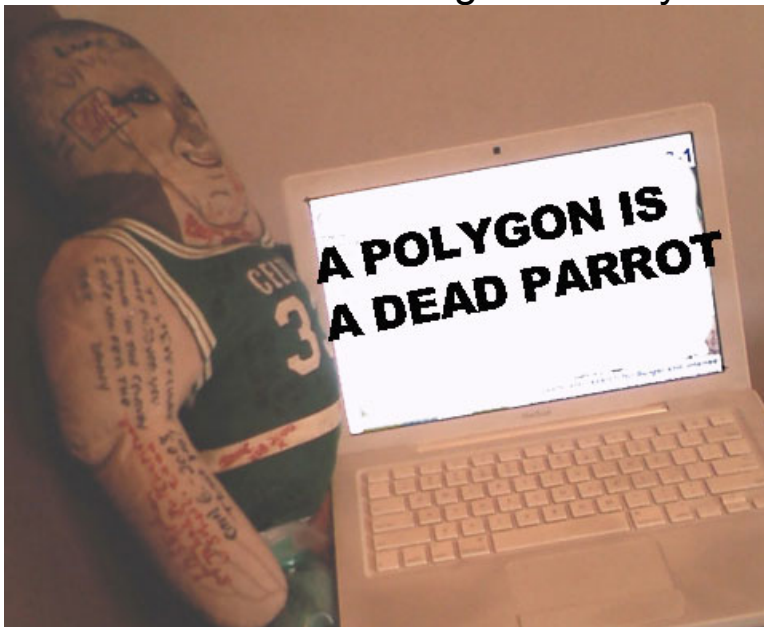
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In this first week, I want you to gain comfortable skill with writing, modifying and preserving our first few programs on Scratch

What is a polygon? Here is the answer I got from my Larry Bird doll:



No Larry, that is a silly joke ("polly gone") and not the right answer!

A polygon is a geometric shape with many sides.

If it has 3 sides, it is called a triangle.

If it has 4 sides, it is called a quadrilateral.

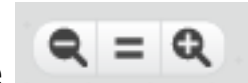
If it has 5 sides, it is called a pentagon.

If it has 6 sides, it is called a hexagon.

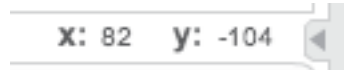

If it has 7 sides, it is called a heptagon.

If it has 8 sides, it is called an octagon. And so on.

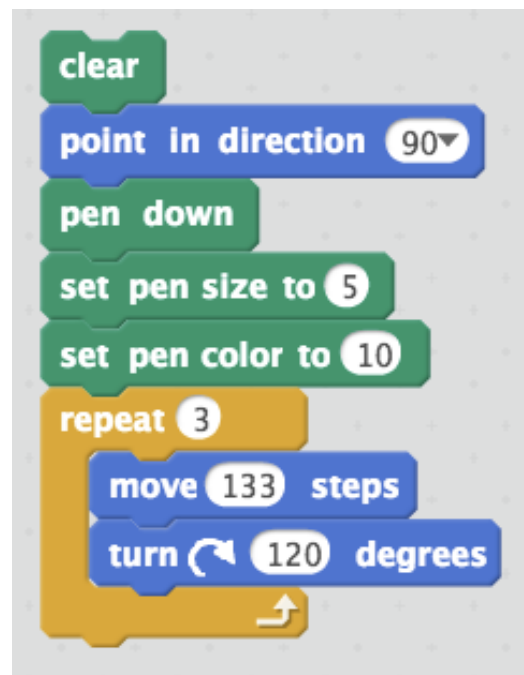
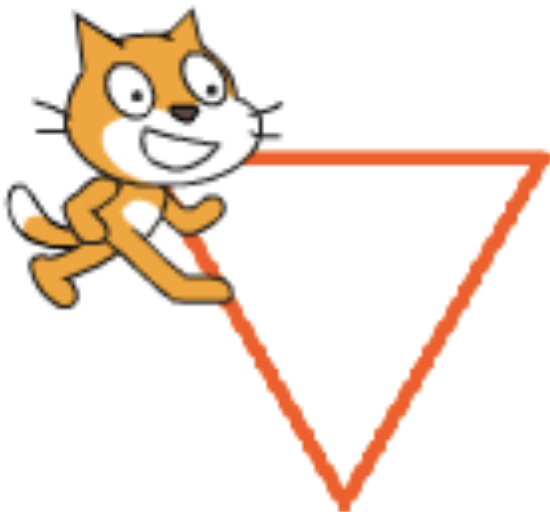
You all know that a square has 4 equal sides and 4 equal angles of 90 degrees. So this program should make sense. You will find the brown REPEAT command in the BROWN section called CONTROL. You will find the blue MOVE command and the blue TURN command in the BLUE section called MOTION.



Observe that at the bottom right of the screen you will see which magnifies or demagnifies the programming commands. Also observe that to the bottom right of the STAGE you will see

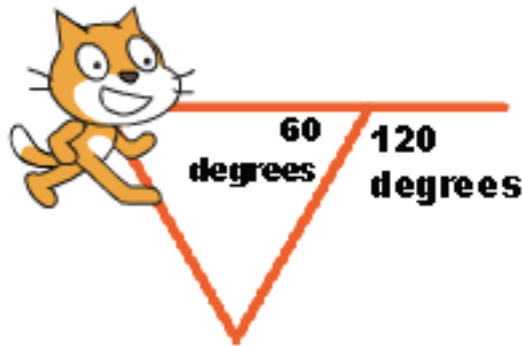
 which shows the coordinates of the CAT using the back of its neck as the coordinate point. To the right of the coordinates, you see the little triangle  that gives you a larger programming area and makes the stage area smaller.

Next, let us talk about equilateral triangles. This refers to a triangle that has 3 equal sides and 3 equal angles.



Notice that the cat is turning 120 degrees at each corner even though the inside angle of the triangle is 60 degrees. This can be confusing. The cat

starts off facing to the right and goes 133 pixels. It then turns more than a right angle to make the second side of the triangle. Maybe this picture can help you



It shows where the CAT would go if it went straight. But it does not go straight. It turns 120 degrees and draws the second side of the triangle. That is why the turn is 120 degrees even though the inside of the triangle is 60 degrees. Got it? Let's see if you can fill in these blanks on the next Larry Bird question!



Question #7: An equilateral triangle has 3 equal

angles, each one is ____ degrees and so the SUM of the 3 angles is _____. But when you draw this triangle in SCRATCH, you need to turn _____ degrees at each corner so there are 3 turns of ____ each which make a total of 360 degrees.

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Hope you are doing well and practicing. Let us move on to a pentagon with 5 sides.

JV HW Exercise 1.2J -- Draw a pentagon where each side is 133 pixels.. Please name your program "Exercise 1.2J Pentagon " Share it!

Varsity HW Exercise 1.2V -- Draw 3 pentagons where each side is 33 pixels. Please name your program "Exercise 1.2V Pentagon " Share it!

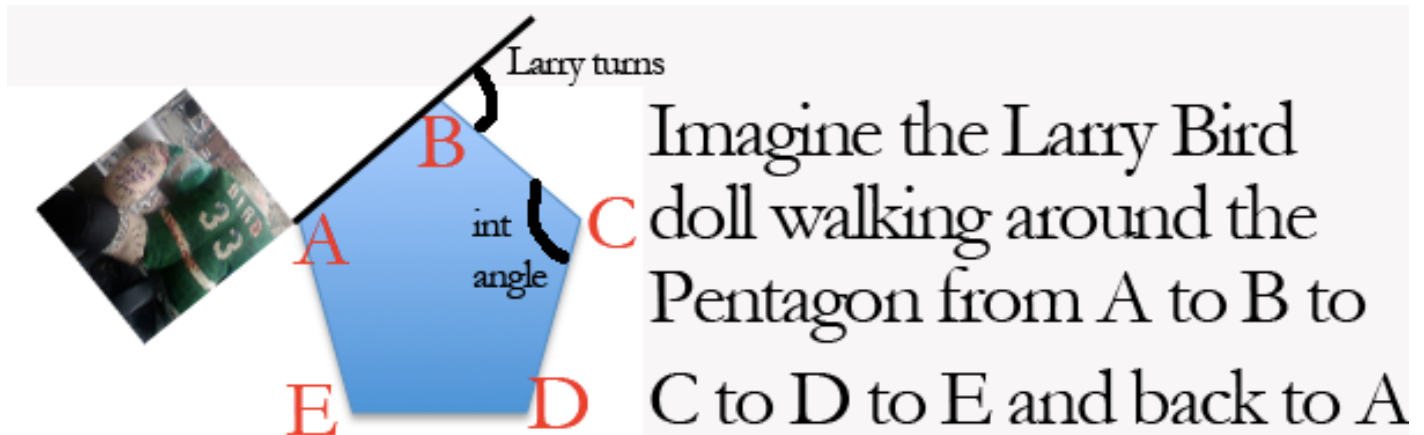


Too bad these 3 pentagons don't fit together nicely. Do you see that extra space? That makes me very sad! If they fit together, we would have the beginning of a tessellation. Yes, that's a big word but it means a geometric pattern usually with polygons that fit nicely together. We need to make one in Lesson 2 or else I will be not be happy.

Before we start, let us talk about a pentagon that has 5 equal sides and 5 equal angles. There is some HARD MATH that we need to understand!

You may not instantly know that a regular pentagon has 5 equal sides of 108 degrees but here's the trick that you will one day pass on to your students. If you draw a pentagon by walking it with your body, you need to make 5 turns that add up to 360 degrees since you return to where you started. Since 5 goes into 360 exactly 72 times then the angle you turn each time is 72 degrees. This is called the exterior angle as you see

below where it says and this means the interior angle is $180 - 72$ or 108 degrees.



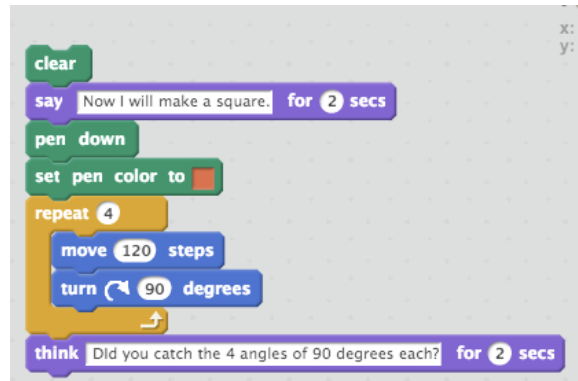
Let me try with an example to make this clear, since many of you as teachers will have to explain this to your students one day! As Larry walks to each of the 5 corners of the pentagon and turns, the angle his body turns at each corner is called the exterior angle. You can see it marked at point B. Larry does this 5 times and gets back to his starting point, having turned his body 5 times on his walk. Since he ends up where he started, the total trip was 360 degrees. Since he made 5 equal turns, then each one is $360 \div 5$ or 72. Since the exterior angle was 72 that means the interior angle must be 108. Got it?

One more example, just in case or just to reinforce. If you walk thru a regular octagon ("regular means equilateral and equiangular") you are turning 8 times. Since the total is still 360 degrees, then each turn of your body is $360/8$ or 45 degrees. So each exterior angle is 45 degrees, which makes each internal angle of the regular octagon into 135 degrees.

Now I will show you an enhanced program for doing the square. A common mistake is to not put the pen down or sometimes not have a color that is viewable. I love the way the REPEAT command snaps around other commands or you can just drop it and move a block of commands into its "mouth."

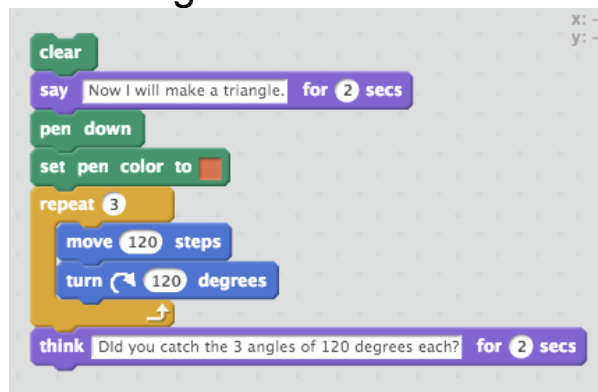
The purple SAY command and purple THINK command are in the LOOKS section.

The green PEN DOWN and SET PEN COLOR commands are in the PEN section. The SET PEN COLOR command can be quirky so beware. As you will read later, that is why many people prefer the SET PEN COLOR to a NUMBER command.



Now let us modify a few things to get a triangle. Do you like the SAY and the THINK commands? I use them a lot and love them! Just make sure you use good quality English with no spelling or grammar mistakes!

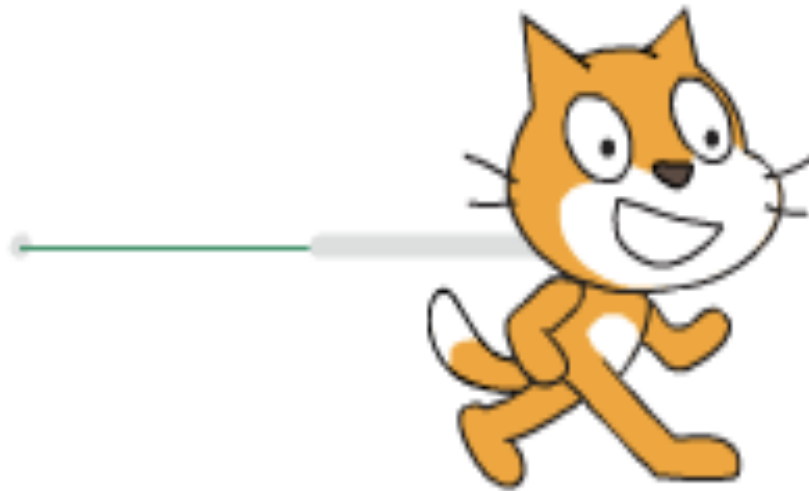
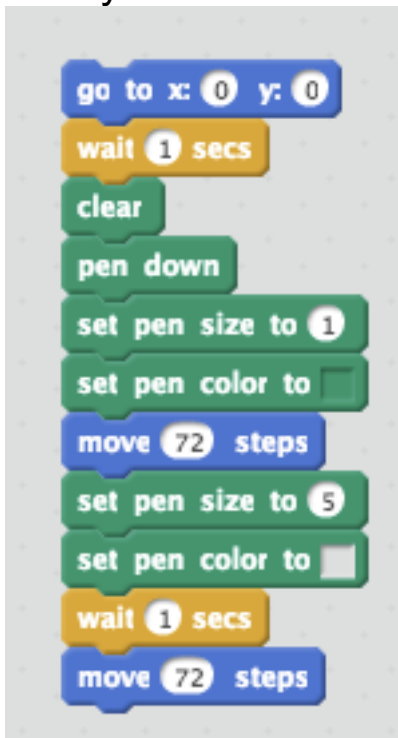
Below you will see the solution for a triangle so feel free to try it first before you look. Remember from before that when your body walks a triangle, you are making 3 equal angles that add up to 360, so each exterior angle must be 120 degrees.



Here is what the THINK command does. Notice the "think" bubble that appears for a designated number of seconds if you like. You gotta love the cute bubble!



Okay, let us write one more program that illustrates where the ink comes out of the cat. The GO TO command is new but reasonably intuitive, sending the cat back to the origin of the x-y coordinate grid. My rationale for the two WAIT commands is because I want the user to see each step slowly instead of it happening magically.

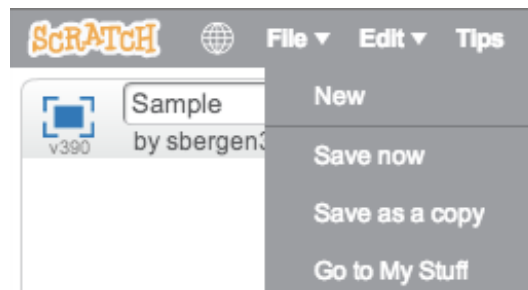



On the right above you see the result of the program with the ink coming out of the back of the cat's neck. The cat used thin green ink (pen size 1) for the first 72 steps (one inch) and thick gray ink in (pen size 5) for the next 72 steps.

JV HW Exercise 1.3J -- Pick an uppercase letter of the alphabet that has no curves and write a Scratch program to create the letter so that it is 100 pixels tall and 50 pixels wide. Please name your program "JV Exercise 1.3J Uppercase Letter." Share it!

Varsity HW Exercise 1.3V -- Pick an uppercase letter of the alphabet that has curves (B,C,D,G,J,O,P,Q,R,S,U) and write a Scratch program to create the letter so that it is 100 pixels tall and 50 pixels wide. Please name your program "Varsity Exercise 1.3V Uppercase Letter." Share it!

Try your best to avoid the use of the GO TO command within the code for your uppercase letter. Why? This will make it harder for you in lesson 2 when we make your letter to be of variable size. Instead, use PEN UP and MOVE and PEN DOWN if you need to move from one location to another.



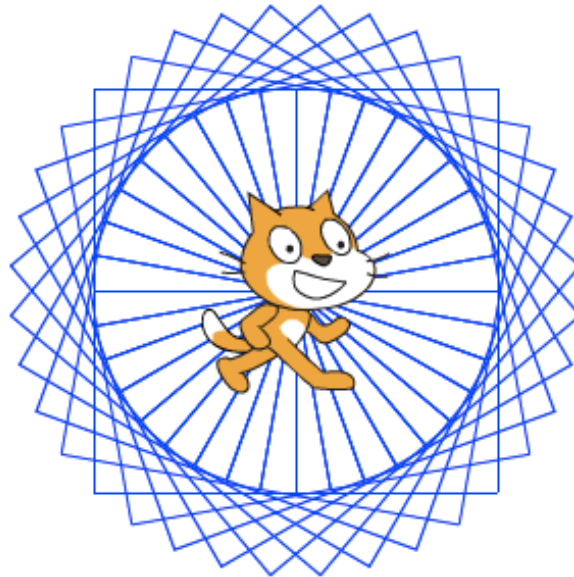
Your program lives in MY STUFF which corresponds to this icon  the next time you come back to SCRATCH and your account. Even cooler is the fact that when you look at any program in your MY STUFF library, you can SHARE or UNSHARE any of your programs. If you modify a SHARED PROGRAM there is nothing you need to do. The revised program will be the one that others will see.



By the way, later in this PDF, I show you how to change the CAT to a POINTER that makes it easier to debug programs and see which way you are facing.

On the next page is a tough challenge that stumps most people, but believe it or not you know enough programming to do it!

Super Varsity Challenge: Write the program for this design that appears to be 36 squares. If you try it -- even if you don't succeed, please name your program "Super Varsity Exercise 1.3S Spinning Squares." Share it!



Each time you access a program from someone else, you can either RUN it or you can REMIX it. If you REMIX it, you can save it in your library and modify it.

By the way, when you look at someone's library, you are seeing only the programs that the user has chosen to SHARE. The owner of the account chooses to SHARE or UNSHARE any program. Please share your programs! No downside and lots of upside in a course like this.

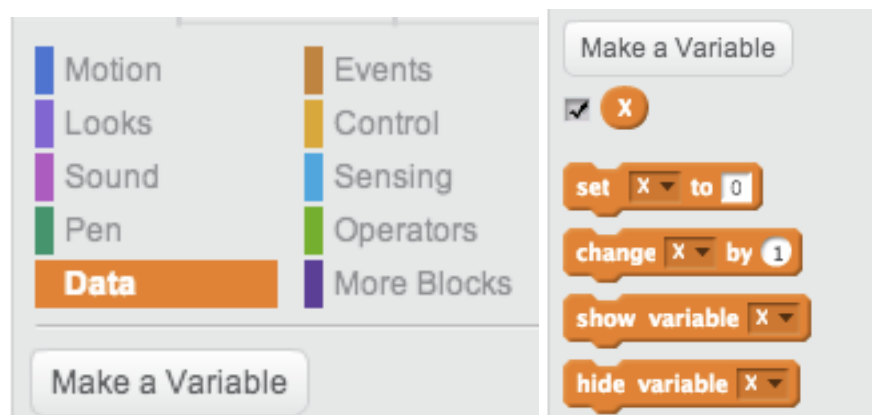
Okay, I hope you are doing fine. We are now marching forward with one new concept, a few more commands and one more challenge.

A variable is an important part of programming. It is also an important part of pre-algebra, algebra and math in general. Math people like to call variables X, Y, Z, T, and C or use a letter that stands for a word, e.g. T for Total or C for counter. Computer people like to use actual short words for

variables such as COUNTER or TOTAL or HOWMANY. Different strokes for different folks; we all have our preferences!


Below is the first sample program that uses a variable to draw a square of variable size.


Here are the new ORANGE commands under DATA:




When you make a variable, you get this new set of 4 commands that you see on the right. The important ones are the SET command and the CHANGE command.

Below you can see that I am adding the starter command with the green

flag  so that my program runs when you click the green flag. The first and only use of a variable in this program occurs when you see the ORANGE DATA command called SET SIZE TO ANSWER. Using the DATA option, I created a variable called SIZE. This automatically displays at the top left of the screen where your program is executed.

Now here is the important thing. When you use the BLUE ASK command, the result always goes into the BLUE temporary variable called .

This is not a user choice. The variable  is a special location in Scratch and always corresponds to what was entered via the last ASK.

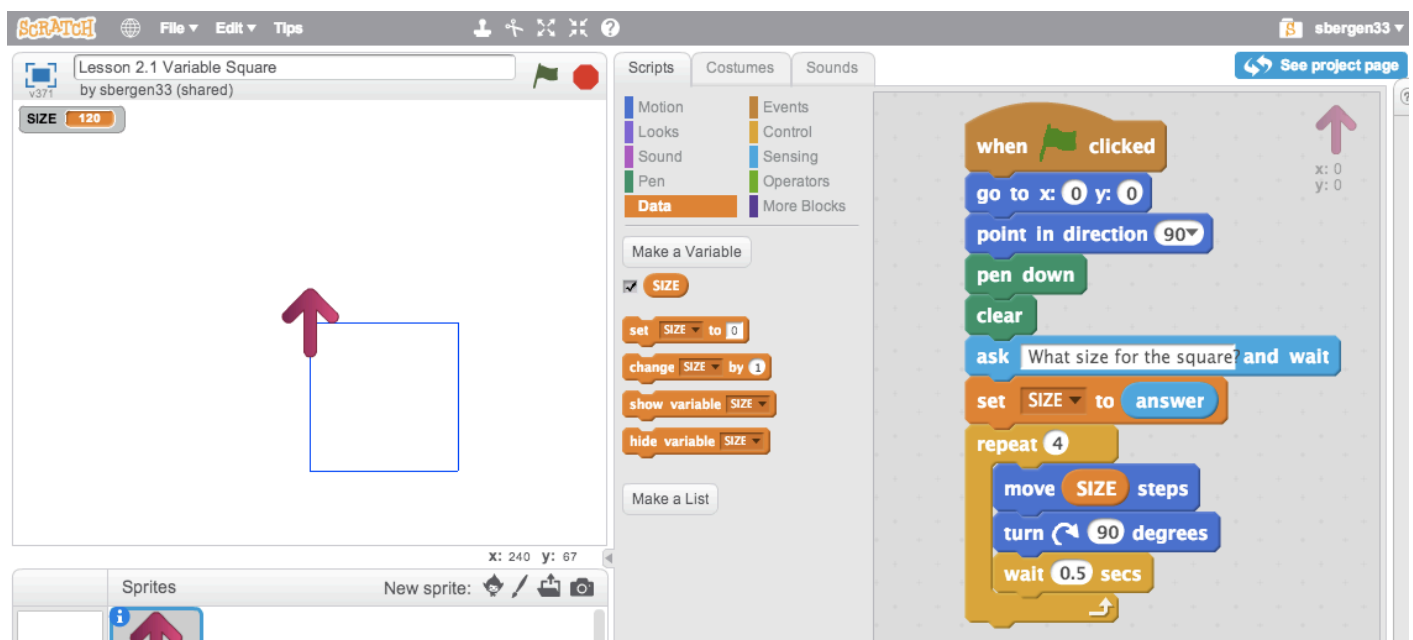
So as a programmer, the standard thing to do is to use the SET command to move ANSWER into a more permanent variable, in this case SIZE. Got it? I hope so, but like anything else, you need to do it yourself from scratch and then repeat it a few times to practice. Think BLUE and ORANGE. The blue command called ASK allows the human to interact with the program and puts the result into the ANSWER variable which you will see right in the blue SENSING set of commands. Meanwhile the ORANGE DATA section is where you make or rename your variables.

- [Arrow and Variable](#) • 9 minutes

<http://youtu.be/YhzaZrO84oo>

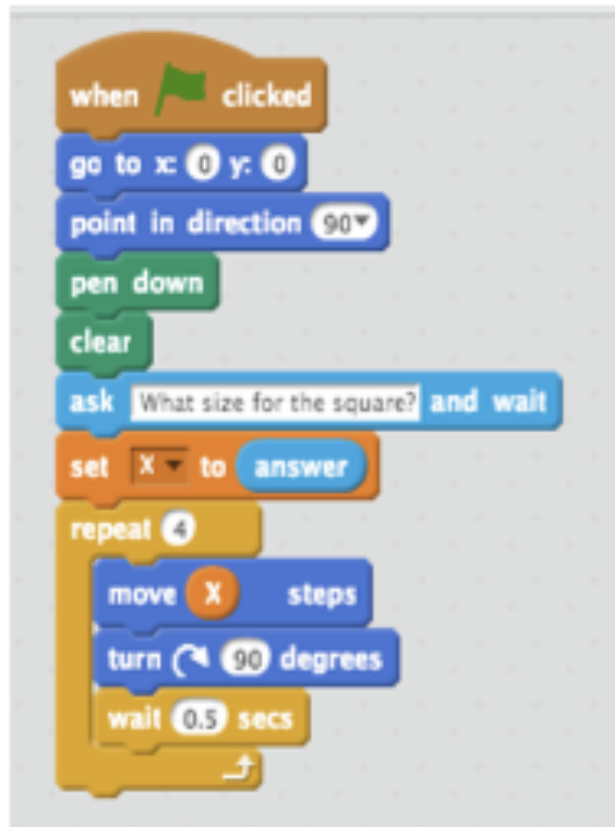
- [Change Cat to Arrow](#) • 6 minutes

<http://youtu.be/JT2qnciGVJc>



Please notice that I have changed the CAT to a RED arrow pointer which I find much more useful in terms of the themes of directionality. I will show you below and also on video how to do this using COSTUMES. Also notice my personal preference of using WAIT to slow down the action a bit so you can see each side being drawn. And yes, you can use decimals like .5 to wait half of a second.

This program below is the exact same program using the variable X instead of the variable SIZE. The ability to rename the variable in DATA is wonderful. I want you to see both styles (math teacher and computer teacher) so you can decide what your own personal preference is when using variables. It is great that you can RENAME a variable and it renames it everywhere!



To RENAME a variable, you go to the DATA section and then SHIFT CLICK on the variable.

Now let's talk about changing the CAT to my favorite icon, the arrow. If you click on the blue icon below called CHOOSE COSTUME FROM LIBRARY



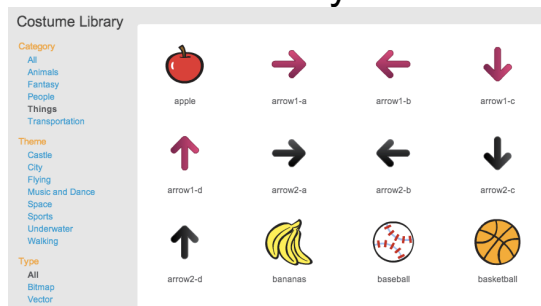
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you get access to dozens of replacements for the CAT. They are organized by category on the left and my favorite category is THINGS.



The arrow pointing to the RIGHT is the one I like, either arrow1-a or 2-a. This is the arrow for which the ink that comes out matches your intuition.

JV HW Exercise 1.4J -- Draw a variable sized triangle where the user can specify the size of each side. Please name your program "Exercise 1.4J Variable Sized Triangle." Share it!

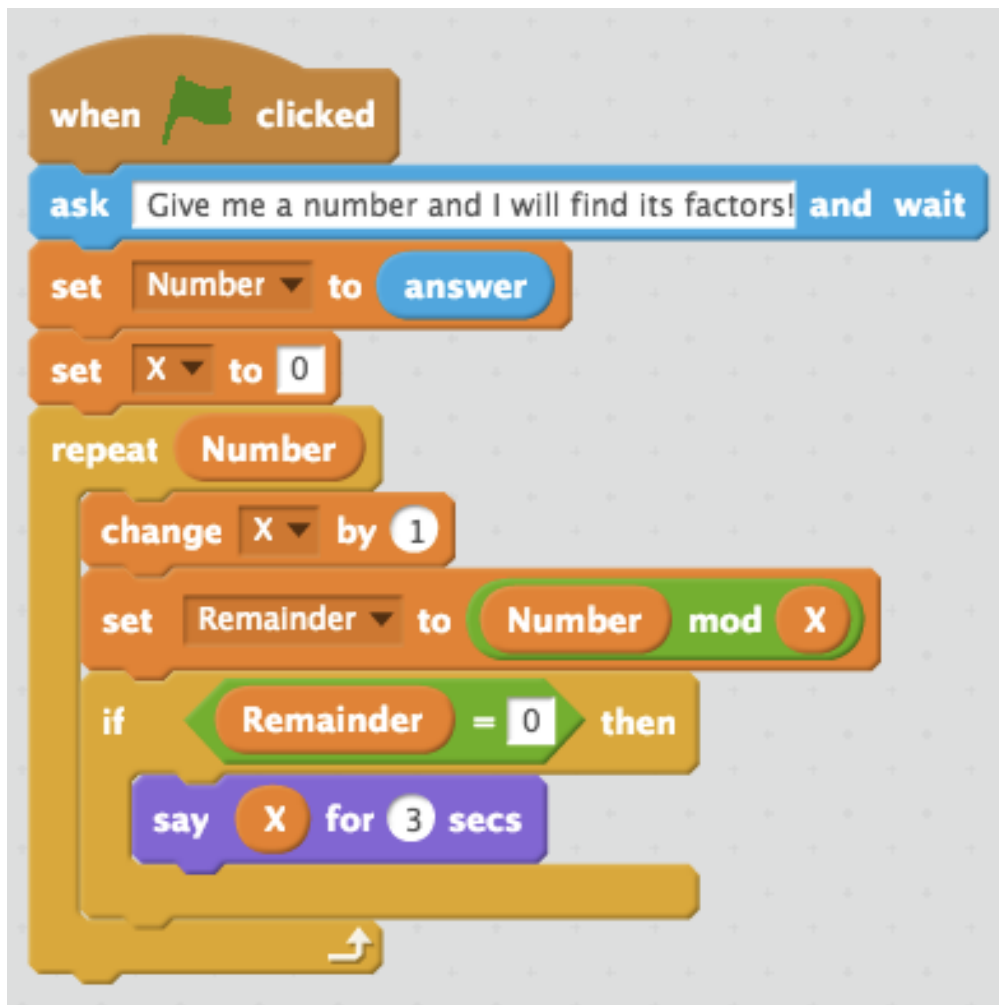
Varsity HW Exercise 1.4V -- Draw a variable sized double star which is also known as the Star of David or a Jewish Star. The user can specify the size of each side. Please name your program "Exercise 1.4V Variable Sized Double Triangle." Share it!



I still have this bag from my Bar Mitzvah many years ago – notice the Jewish star which is a tough Scratch challenge to get accurate!

Hint for tough Varsity challenge. After you draw the first triangle, you need to PEN UP then move somewhere before you PEN DOWN and draw the second triangle. You should not use GO TO because that will mess you up with VARIABLE SIZE. You need to use a magic number (lots of trial and error perhaps) to move to the correct location. Good luck!

Finally, we end this week with a program to find factors of a number.



Study the CODE above and then watch this 15 minute video below. When you are done with watching the video, answer the questions below.

<https://youtu.be/E7NgkStBYxQ>





Question #8: What variable in this program represents the number that we are finding the factors of?



Question #9: Why does $\text{REMAINDER} = 0$ means that X is a factor of NUMBER?



Question #10: What is the SCRATCH command in this program that finds the remainder when you divide a big number by a smaller one?



Question #11: What is $33 \text{ MOD } 5$? Explain!



Question #12: What is $33 \text{ MOD } 16$? Explain!

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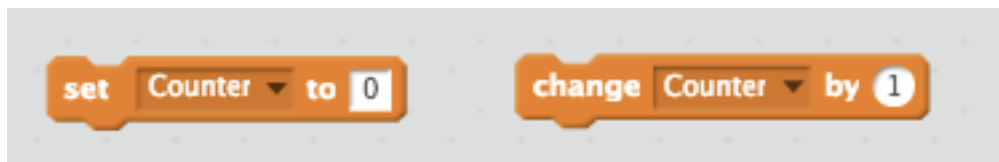
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Final Homework Problem and Final Page

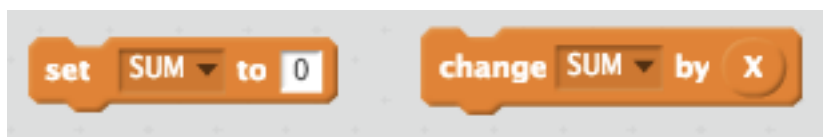
JV HW Exercise 1.5J -- After studying the program, wake up on another day and try to recreate it without looking at the original. Use the THINK command instead of SAY. Share it!

Varsity HW Exercise 1.5V-- Add another variable such as COUNTER to the program that counts how many factors it finds. Then have an IF statement at the end that checks if COUNTER = 2 and says "You Found a PRIME Number" if it is 2. Share it!

Hint: you need to set the COUNTER to be 0 in the header and then increase the COUNTER by 1 each time you find a factor within the IF statement.



Super Varsity HW Exercise 1.5S-- Do the Varsity version and then add yet another variable that ADDS up the SUM of all the factors below the number. Share it!



Reminders to students and sponsors:

- 1) You can schedule appointments via email
- 2) If you choose to text me at 781-953-9699 please include name
- 3) When we screenshare via PC or Mac, you will need this link

<http://get.teamviewer.com/Summercore>

END OF LESSON 1 • LESSON 2 will be sent on Monday 11/16