

# ALGEBRA + CODING

## ONTARIO MATHEMATICS CURRICULUM 1-8

CLASSROOM-TESTED, RESEARCH-BASED LESSONS

In English & French



From the research of GEORGE GADANIDIS, PhD — Western University

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PAGE	MODULES & LESSONS	CURRICULUM EXPECTATIONS
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## LOW FLOOR & HIGH CEILING

Lessons are designed to be accessible with minimal prerequisite knowledge (low floor) while offering students opportunities to understand and experience the beauty of important ideas of mathematics (high ceiling).

A “low floor, high ceiling” design makes Lessons accessible at various grades. For example, we have used the Lessons in the *Infinity + Fractions* Module in Grades 2 and 3 classrooms to cover the content of “area representations of fractions”. We have also used these Lessons in secondary school Calculus to help students understand the concepts of “infinity and limit”.

“Low floor, high ceiling” is another way of saying “differentiated instruction”.

Interestingly, the “low floor, high ceiling” idea comes from the work of Seymour Papert, who developed Logo and was a pioneer in the use of coding in mathematics learning. Papert saw coding as a set of “tools to think with”, which enabled students to exercise personal agency and offered new opportunities of what math they may access and understand.

Elementary teacher comments:

I wish you were here to see the **kids that never do well on assessments**. I’ve **never seen that part of him**. Words coming out were impressive. It can be challenging but a **safe way to learn**.

Grade 3 student comment:

**I’m going to make my own**. I’m not going to copy what’s on the screen. I’m going to do something new. Then I’ll call you and say, “**Watch this!**”

Grade 10 student comments:

It feels like **there’s more space**. You don’t have to do it like everyone else. It lets you go in depth. In regular math class, the teacher teaches you everything. But with coding you’re **more independent**. It’s more of a sense of accomplishment.

## CONTEXT & CONTENT

Lessons have 2 components: (1) grade-specific content that address curriculum expectations and (2) mathematically rich contexts to help students experience content within bigger ideas of math.

Learning is about attention. Rich contexts attract student attention, leading to deeper learning and also to incidental learning (where they learn much more math than what is in their curriculum).

Elementary teacher comments:

My biggest leaning was about **incidental learning**. Coding facilitates that. It has made me **less fearful to go beyond the curriculum**. In Grade 4 you’re only supposed to learn this. Well, what’s stopping us from showing them a little bit beyond that?

## MATH + CODING

The goal of the Lessons is not to teach coding, although, students will learn a lot of coding incidentally.

The goal of the Lessons is to teach math, with coding as a powerful tool.

Coding, used effectively, can change how students learn math and what math they learn.

Elementary teacher comments:

Coding **extends their thinking**, in a natural way. It **freed up their ideas**; students engaged with a “growth-mindset” – trying new things.

Grade 10 student comments:

You think: ‘I’m never going to use this.’ Then you go into coding and actually use it. It’s more like **math in action**. **I like doing math with coding**. You can’t code it unless you **really understand** the math part. It’s more of a **group feeling** in the atmosphere, asking questions and trying to understand. It has **helped me with my collaboration**. I’m more open to work with people.

## IDEAS THAT TRAVEL

*Algebra + Coding, 1-8* is part of an *Ideas that Travel* project led by George Gadanidis (professor at Western) and Janette Hughes (Canada Research Chair at Ontario Tech). We like the focus of the new Ontario grades 1-8 math curriculum on modelling, coding, and mathematical beauty and aesthetics and we want to help bring these to life for students.

George is developing resources on math and on math + coding.



Janette is developing math + making resources (*Make me! Algebra!*). In the meantime, see the lesson plans and resources at Janette's STEAM-3D Maker Lab website: [janettehughes.ca/lab](http://janettehughes.ca/lab)



*Ideas that Travel* is also a classroom research project. The development and refinement of teaching and learning resources will be guided by what we learn from students, teachers and education leaders in the school districts where we work.

## USING THIS RESOURCE

Each "Lesson" in this resource fits on a single page. Lessons are organized in Modules, around themes. Lessons are in English and in French.

Depending on the needs of your students, and your teaching style, the Lessons may be used in a variety of ways. For instance:

1. Pick and use Lessons that meet your students' needs.
2. There is a sequence to the Lessons, however, use your own judgement.
3. A Lesson may be a "script" to guide the general direction of classroom teaching and learning.
4. A lesson may be a handout for students to work on, in pairs, small groups or individually.
5. Laminated Lesson pages may be used in activity centres.
6. Lessons may serve as extensions/remediation.
7. You may share the PDF, or individual pages, with your students, in distance/online learning settings.

## SUPPORT

We offer support resources at [learnx.ca/onmath/support](http://learnx.ca/onmath/support).

We also offer online professional development. Please contact George Gadanidis ([ggadanid@uwo.ca](mailto:ggadanid@uwo.ca)) or Janette Hughes ([janette.hughes@ontariotechu.ca](mailto:janette.hughes@ontariotechu.ca)).

## VERSIONS

As we add more modules and lessons, and as we refine ideas, new versions of this Algebra resource will be created. You will receive an email notice to download each time a new version is posted on our platform.

## COST

The small fee you paid for the current version of *Algebra + Coding, 1-8* gets you all the versions we will create until June 2021. The fee is estimated to cover the cost of maintaining the platform that makes the sharing of this resource possible.

## LICENCE AGREEMENT

**Teacher Licence (\$4).** If you are a grades 1-8 classroom teacher and have purchased this resource from [learnx.ca](http://learnx.ca), you may use it in your grades 1-8 classroom teaching, including printing pages to meet your students' learning needs and sharing the PDF, or individual pages, with your students in distance/online learning.

**School Licence (\$24).** Same as above, for all grades 1-8 teachers in the school.

**District-wide Licence (\$15/school):** Same as above, for all schools in the district.

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## TRADUCTION FRANÇAISE

Bonjour. Je m'appelle Molly Gadanidis, et je traduis ces cours en français. Je suis dans ma deuxième année à l'université d'Ottawa, où j'étudie le développement international et mondialisation dans le régime d'immersion française.

Je n'étais pas dans le régime d'immersion française à l'école, parce que j'ai dû choisir entre le programme des élèves doués en anglais ou le régime d'immersion française (maintenant, je pense que j'aurais dû choisir le français).

J'aime étudier le français, mais à ce moment, je ne suis pas complètement bilingue. Veuillez envoyer un courriel à [ggadanid@uwo.ca](mailto:ggadanid@uwo.ca) si vous avez des suggestions.



Merci!

Molly

Over the last 6 years, I have had the pleasure to spend many days in elementary and secondary school classrooms, doing math + coding, collaborating with educators to develop better ways of engaging students with mathematics.

Listed below are some of the lessons learned.



## 1. DON'T TEACH CODING – TEACH MATH

Coding is a powerful tool for dynamically modelling math concepts and relationships.

*“It’s really neat because it extends their thinking, but in a natural way.” – Grade 3 teacher*

Students will learn to code incidentally, as they use coding in meaningful contexts.

*“My biggest leaning was about incidental learning. Coding facilitates that. I also learned that when you have incidental learning I think the learning is deeper.” – Grade 5 teacher*

Most of the Lessons in this resource give students ready-made code to run, to alter and to understand as they see it in action.

## 2. YOU DON'T HAVE TO BE A CODING EXPERT

Learn along with your students.

Don't be afraid to say, “That’s a good question. I don’t know the answer. Maybe we can find it together.”

*“It can be challenging but a safe way to learn. Some of them could go beyond what we were showing them. I feel they really surpassed me.” – Grade 3 teacher*

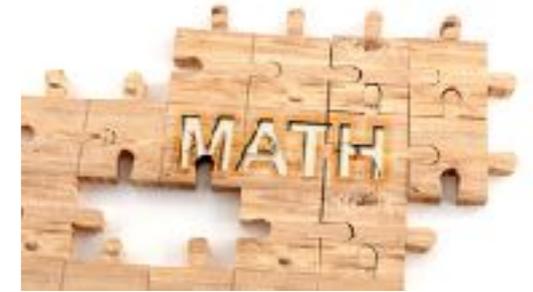


## 3. AIM FOR BIG MATH IDEAS

When modelling math with code, students have easier access to more complex and more interesting math concepts and relationships, some of which may be beyond the curriculum expectations for their grade.

*“I found that sometimes the tasks we might feel initially [to be] difficult, the kids got just like that. It has made me less fearful to go beyond the curriculum. In Grade 4 you’re only supposed to learn this. Well, what’s stopping us from showing them a little bit beyond that?” – Grade 4 teacher*

Bigger math ideas offer opportunities for students to experience conceptual surprise and insight, which capture their attention and help them better learn and understand their grade-specific content.



## 4. SUPPORT STUDENT AGENCY

A coding environment allows students to model ideas and extend what they learn.

Coding can be an empowering experience in a math classroom.

*“I’m going to make my own [code]. I’m not going to copy what’s on the screen. I’m going to do something new. Then I’ll call you and say “Watch this!”” – Grade 3 student*



## 5. GET READY TO BE SURPRISED

Teachers are pleasantly surprised that coding + math appears to be especially beneficial for students that underachieve.

*“I wish you were here to see the kids that never do well on assessments. I’ve never seen that part of him. Words coming out were impressive.” – Grade 4 teacher*



## ABOUT THIS MODULE

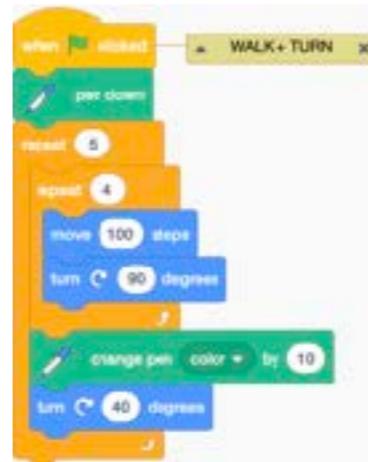
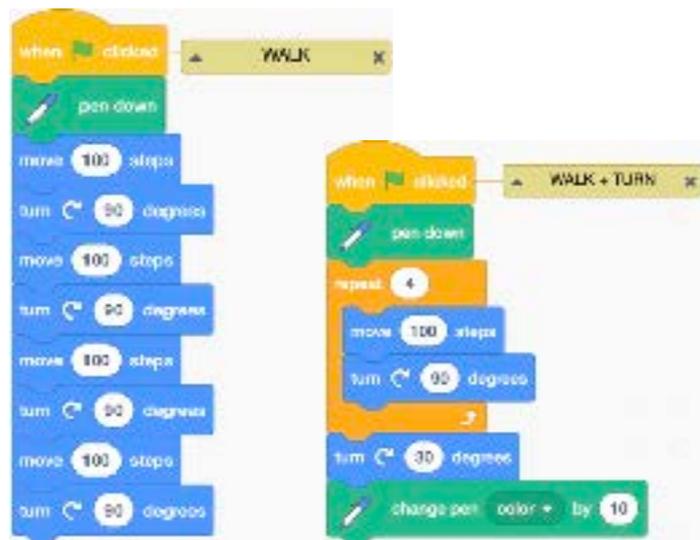
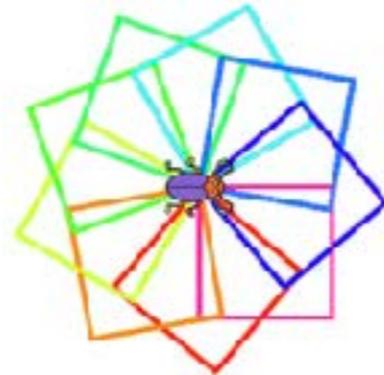
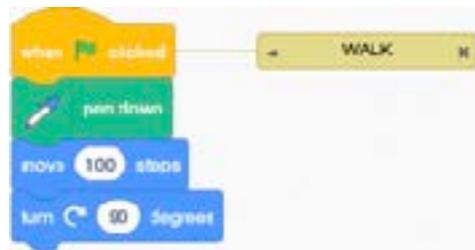
**New to coding?** If you or your students have not used coding before, the Lessons in this Module would be a good introduction to some basic elements of Scratch.

**Need help with this Module?** Happy to set up a Zoom meeting to help. Email me at [ggadanid@uwo.ca](mailto:ggadanid@uwo.ca)

**About these Lessons.** A couple of years ago, I had the pleasure of working with one grades 2-8 teacher in each of the elementary schools of the Wellington Catholic DSB. I visited each classroom 4-8 times and co-taught math and coding lessons.

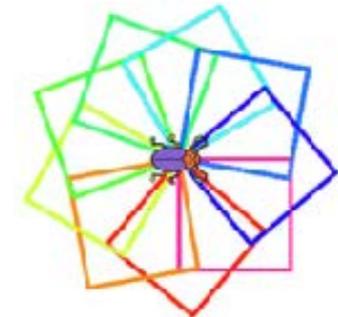
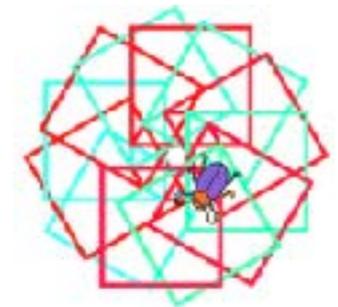
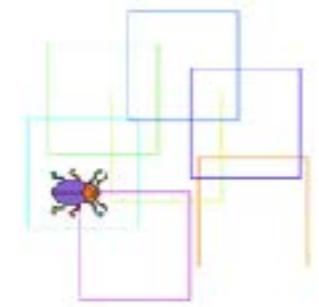
The first activity we did, as an introduction to coding, involved using Scratch to draw patterns with squares and other shapes.

The Lessons in this Module adapt that activity to be even more accessible across grades 1-8.



## LESSONS IN THIS MODULE

- Bug walks a square**
  - Gr.1: C1.2/3.1/3.2; E1.4/1.5
  - Gr.2: C1.2/3.1/3.2; E1.5
  - Gr.3: C1.2/3.1/3.2; E1.4
  - Gr.4: C1.2/3.1/3.2; E1.1
  - Gr.5: C1.1/1.2/3.1/3.2; E1.1
  - Gr.6-8: intro to coding
- Bug walks many squares**
  - Gr.1: C1.2/3.1/3.2; E1.4/1.5
  - Gr.2: C1.2/3.1/3.2; E1.5
  - Gr.3: C1.2/3.1/3.2; E1.4
  - Gr.4: C1.2/3.1/3.2; E1.1
  - Gr.5: C1.1/1.2/3.1/3.2; E1.1
  - Gr.6-8: introduction to coding
- Bug walks squares with repeat**
  - Gr.3: C1.2/3.1/3.2; E1.4
  - Gr.4: C1.2/3.1/3.2; E1.1
  - Gr.5: C1.1/1.2/3.1/3.2; E1.1
  - Gr.6-8: introduction to coding
- Bug walks squares with nested repeat**
  - Gr.4: C1.2/3.1/3.2; E1.1
  - Gr.5: C1.1/1.2/3.1/3.2; E1.1
  - Gr.6-8: introduction to coding



## CURRICULUM EXPECTATIONS IN THIS MODULE

### Grade 1 Algebra

- C1.2 — create and translate patterns using movements, objects, shapes ...
- C3.1/3.2 — read/alter existing code, including code that involves sequential events

### Grade 1 Spatial Sense

- E1.4 — describe relative locations of objects using positional language
- E1.5 — give and follow directions for moving from one location to another

### Grade 2 Algebra

- C1.2 — create and translate patterns using various representations, including shapes and numbers
- C3.1/3.2 — read/alter existing code, including code that involves sequential and concurrent events

### Grade 2 Spatial Sense

- E1.5 — describe the relative positions of several objects and the movements needed to get from one object to another

### Grade 3 Algebra

- C1.2 — create and translate patterns that have repeating elements, movements or operations ... using shapes, numbers and tables of values
- C3.1/3.2 — read/alter existing code, including code that involves sequential, concurrent and repeating events

### Grade 3 Spatial Sense

- E1.4 — give and follow instructions involving movement from one location to another, including distances and half and quarter-turns

## CURRICULUM EXPECTATIONS IN THIS MODULE

### Grade 4 Algebra

- C1.1/1.2 — create and translate repeating and growing patterns
- C3.1/3.2 — read/alter existing code, including code that involves sequential, concurrent, repeating and nested events

### Grade 4 Spatial Sense

- E1.1 — identify geometric properties of rectangles

### Grade 5 Algebra

- C1.1/1.2 — create and translate repeating, growing and shrinking patterns
- C3.1/3.2 — read/alter existing code

### Grade 5 Spatial Sense

- E1.1 — identify geometric properties of triangles

### Grades 6-8 Algebra

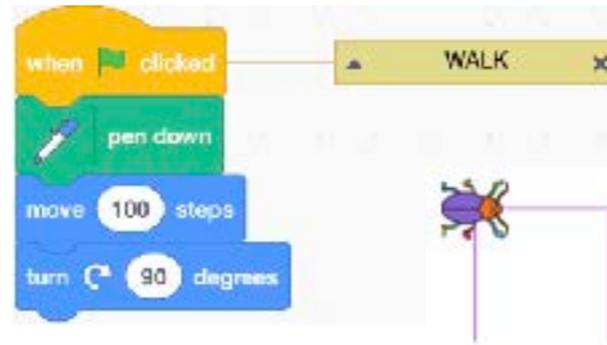
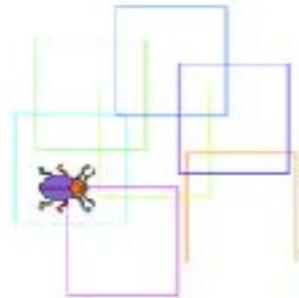
- Introduction to coding

## TEACHING NOTES

### Context

In this Lesson, students move Bug to draw a square, using the code on the right.

They also move Bug to different locations on the Stage using click-drag and draw more squares of different colours.



### Teaching & Learning

**Walk a square.** Start by asking students to work in pairs to design a set of clear instructions for walking a square.

If students say “walk forward”, keep walking and walking.

If they say “turn” or “turn right”, keep turning and turning to the right.

Encourage younger students who may not know “quarter turn” to use visual symbols. For example:

Walk 2 steps  
Turn right

Students may also use cardinal directions

2 steps east, 2 steps south, 2 steps west, 2 steps north

**Quarter turn.** Referring to the turn as a quarter turn seems to work best for most students.

Then, when using Scratch, students will see that will have the same effect.



**Repeating steps.** The Walk code moves Bug 100 steps (pixels).

Students click the WALK code 4 times to draw the square.

Demonstrate how to click and drag Bug to a different location, and draw a new square there.



**Changing pen colour.** Students can also use the COLOUR code to change the pen colour and create square of different colours.

There are 200 different colours available, using numbers 1-200 in the “change pen colour” code block.

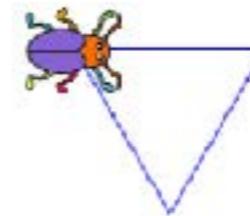
The code skips through these numbers by 10, so the consecutive pen colours used are more distinguishable.



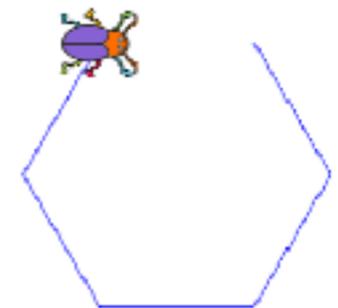
**Playing with code.** Encourage students to “play” with the code. They can change the steps number, to create smaller or bigger squares.

They may also change the turn/degree number to create different patterns and shapes.

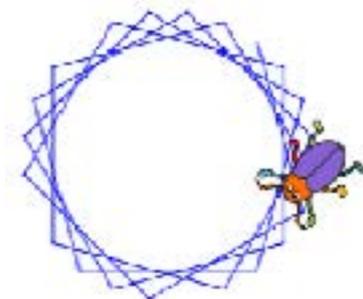
Changing the degrees turned to 60 and clicking the code 6 times would create a hexagon.



Changing the degrees turned to 120 and clicking the code 3 times would create a triangle.



Changing the degrees turned to 75 and clicking the code repeatedly would create this pattern.



## CURRICULUM EXPECTATIONS

### Grade 1 Algebra

- C1.2 — create and translate patterns using movements, objects, shapes ...
- C3.1/3.2 — read/alter existing code, including code that involves sequential events

### Grade 1 Spatial Sense

- E1.4 — describe relative locations of objects using positional language
- E1.5 — give and follow directions for moving from one location to another

### Grade 2 Algebra

- C1.2 — create and translate patterns using various representations, including shapes and numbers
- C3.1/3.2 — read/alter existing code, including code that involves sequential and concurrent events

### Grade 2 Spatial Sense

- E1.5 — describe the relative positions of several objects and the movements needed to get from one object to another

### Grade 3 Algebra

- C1.2 — create and translate patterns that have repeating elements, movements or operations ... using shapes, numbers and tables of values
- C3.1/3.2 — read/alter existing code, including code that involves sequential, concurrent and repeating events

### Grade 3 Spatial Sense

- E1.4 — give and follow instructions involving movement from one location to another, including distances and half and quarter-turns

### Grade 4 Algebra

- C1.1/1.2 — create and translate repeating and growing patterns
- C3.1/3.2 — read/alter existing code, including code that involves sequential, concurrent, repeating and nested events

### Grade 4 Spatial Sense

- E1.1 — identify geometric properties of rectangles

### Grade 5 Algebra

- C1.1/1.2 — create and translate repeating, growing and shrinking patterns
- C3.1/3.2 — read/alter existing code

### Grade 5 Spatial Sense

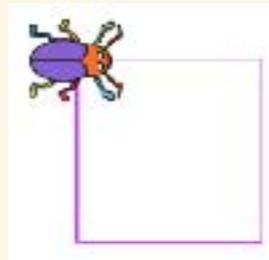
- E1.1 — identify geometric properties of triangles

### Grades 6-8 Algebra

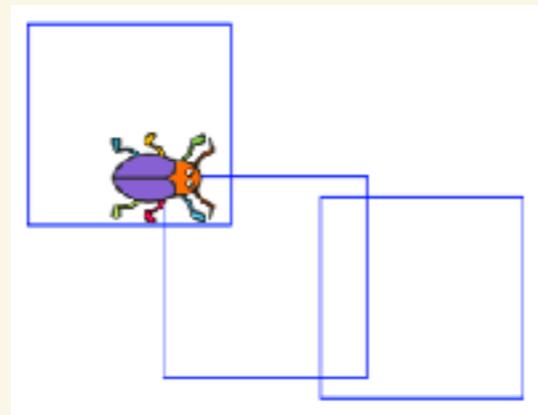
- Introduction to coding

**BUG WALKS SQUARES**

1. Go to [scratch.mit.edu/projects/421870005/editor](https://scratch.mit.edu/projects/421870005/editor)
2. Click the WALK code. What does this code do?



3. Click on the WALK code until Bug draws a square.
4. Click and drag Bug to a different place on the Stage.
5. Use the WALK code to draw another square.
6. Click and drag Bug to a different place on the Stage.
7. Use the WALK code to draw another square.

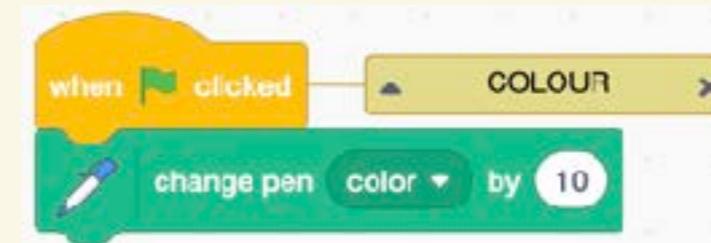


8. You might create something like this:

9. Click on the ERASE code. What does this code do?

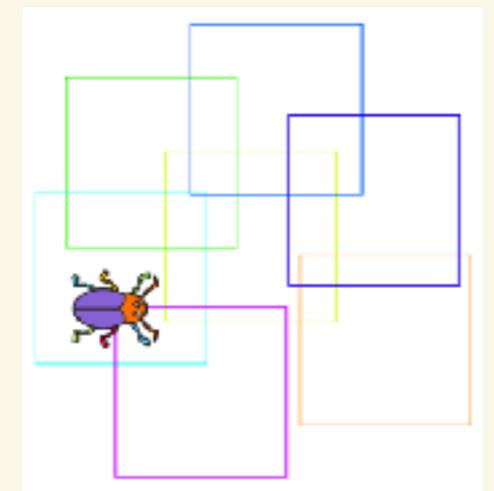


10. Use the WALK code to draw a square.
11. Click on the COLOUR code to change the Pen colour.



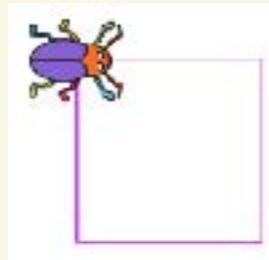
12. Click and drag Bug to a different place on the Stage.
13. Repeat #10 and #11 to draw more squares with different colours, as shown on the right.

14. Help Bug create more math art with colourful squares.



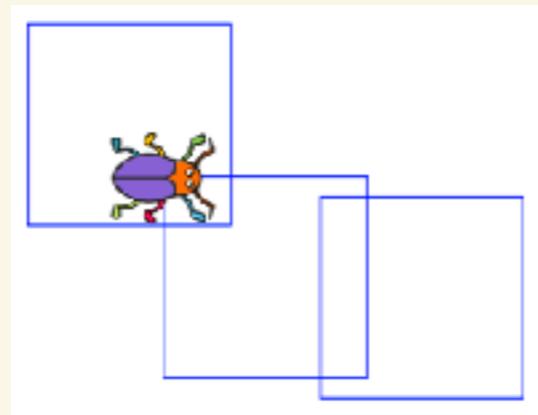
## LA BESTIOLE MARCHE DES CARRÉS

1. Allez sur [scratch.mit.edu/projects/421870005/editor](https://scratch.mit.edu/projects/421870005/editor)
2. Cliquez le code WALK. Qu'est-ce que ce code fait ?



3. Cliquez le code WALK jusqu'à la bestiole dessine un carré.

4. Cliquez et traînez la bestiole à un endroit différent sur l'étage.
5. Utilisez le code WALK pour dessiner un autre carré.
6. Cliquez et traînez la bestiole à un endroit différent sur l'étage.
7. Utilisez le code WALK pour dessiner un autre carré.



8. Vous pourriez créer quelque chose comme ceci :

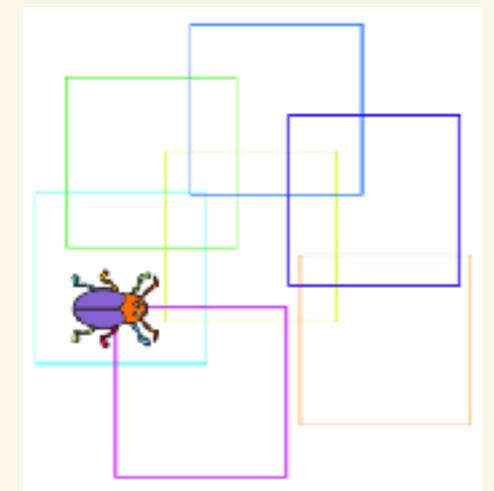
9. Cliquez le code ERASE. Qu'est-ce que ce code fait ?



10. Utilisez le code WALK pour dessiner un carré.
11. Cliquez le code COLOUR pour changer la couleur du stylo.



12. Cliquez et traînez la bestiole à un endroit différent sur l'étage.
13. Répétez #10 et #11 pour dessiner plus des carrés avec des couleurs différentes, comme montré au gauche.
14. Aidez la bestiole à créer plus d'art mathématique avec des carrés colorés.



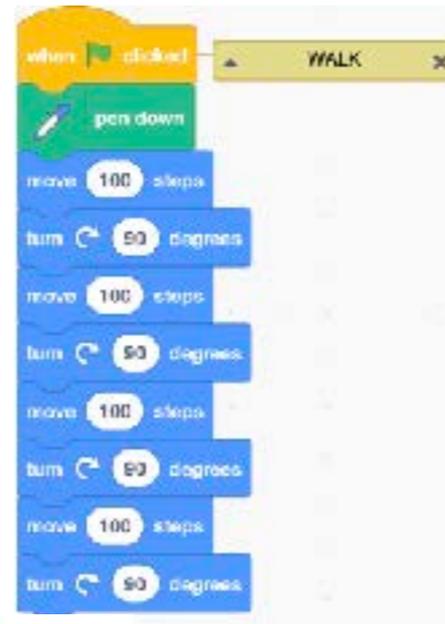
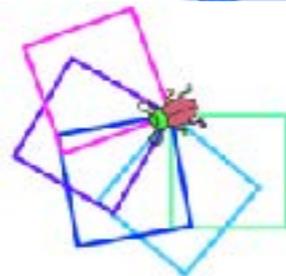
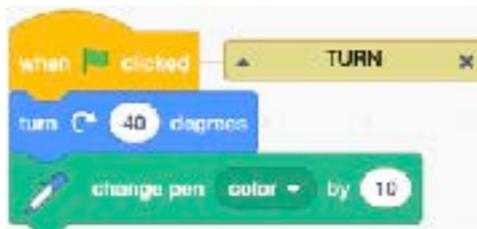
## TEACHING NOTES

### Context

In this Lesson, students start with code that draws the whole square.

They also move Bug to different locations on the Stage using click-drag and draw more squares of different colours.

They also use code that turns Bug 40 degrees after drawing the square, which leads to a spiral square pattern.



### Teaching & Learning

**Walk a spiral square pattern.** Have students walk a spiral square pattern, and verbalize the process: walk a square, turn a little to the right, walk a square, turn a little to the right and so forth.

**Repeat block.** Some students may notice the repeat block and ask if they can use it to make the code simpler or shorter. Encourage them to try this.



**Combining code blocks.** Some students may ask if the WALK and TURN blocks could be combined, as shown on the right.

This should be valued. Ask the student to share what they have in mind. Run and test the code.

Two versions that students may suggest are shown below.



## CURRICULUM EXPECTATIONS

### Grade 1 Algebra

- C1.2 — create and translate patterns using movements, objects, shapes ...
- C3.1/3.2 — read/alter existing code, including code that involves sequential events

### Grade 1 Spatial Sense

- E1.4 — describe relative locations of objects using positional language
- E1.5 — give and follow directions for moving from one location to another

### Grade 2 Algebra

- C1.2 — create and translate patterns using various representations, including shapes and numbers
- C3.1/3.2 — read/alter existing code, including code that involves sequential and concurrent events

### Grade 2 Spatial Sense

- E1.5 — describe the relative positions of several objects and the movements needed to get from one object to another

### Grade 3 Algebra

- C1.2 — create and translate patterns that have repeating elements, movements or operations ... using shapes, numbers and tables of values
- C3.1/3.2 — read/alter existing code, including code that involves sequential, concurrent and repeating events

### Grade 3 Spatial Sense

- E1.4 — give and follow instructions involving movement from one location to another, including distances and half and quarter-turns

### Grade 4 Algebra

- C1.1/1.2 — create and translate repeating and growing patterns
- C3.1/3.2 — read/alter existing code, including code that involves sequential, concurrent, repeating and nested events

### Grade 4 Spatial Sense

- E1.1 — identify geometric properties of rectangles

### Grade 5 Algebra

- C1.1/1.2 — create and translate repeating, growing and shrinking patterns
- C3.1/3.2 — read/alter existing code

### Grade 5 Spatial Sense

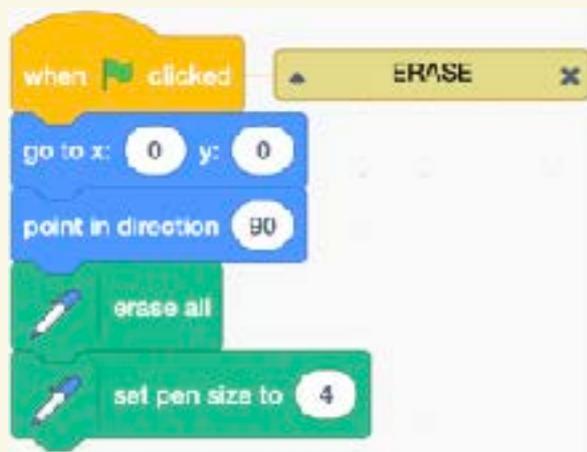
- E1.1 — identify geometric properties of triangles

### Grades 6-8 Algebra

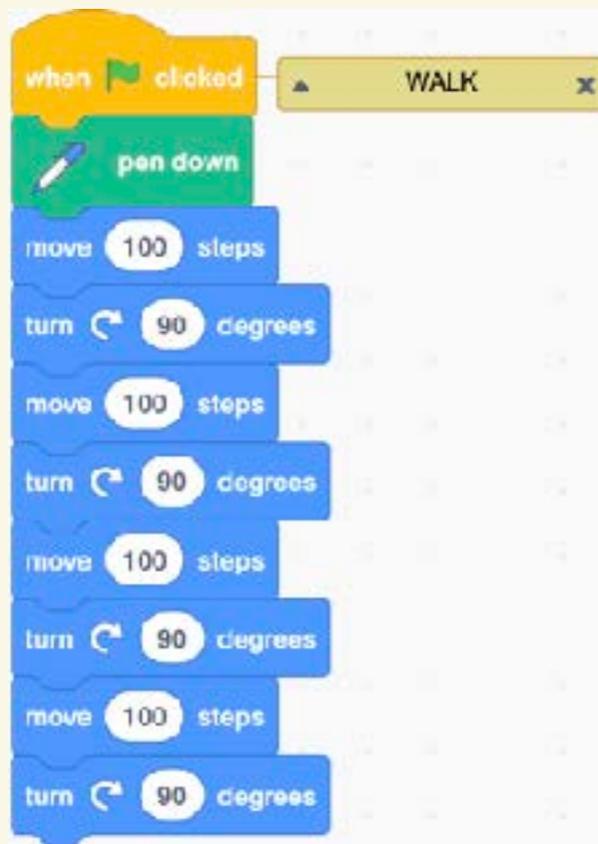
- Introduction to coding

## BUG WALKS A PATTERN OF SQUARES

1. Go to [scratch.mit.edu/projects/421881362/editor](https://scratch.mit.edu/projects/421881362/editor)
2. Click on the ERASE code.



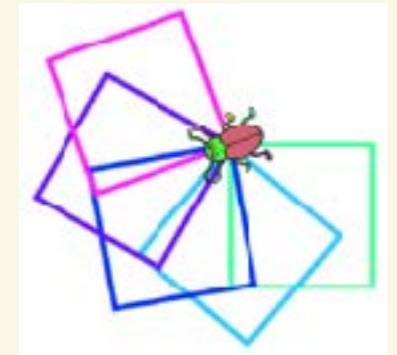
3. Click on the WALK code.



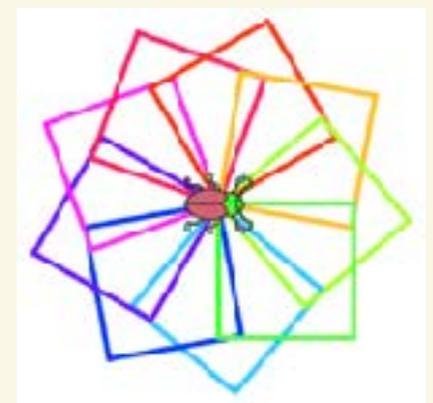
4. Click on the TURN code.



5. Repeat steps #3 and #4, over and over, to create a pattern like this.



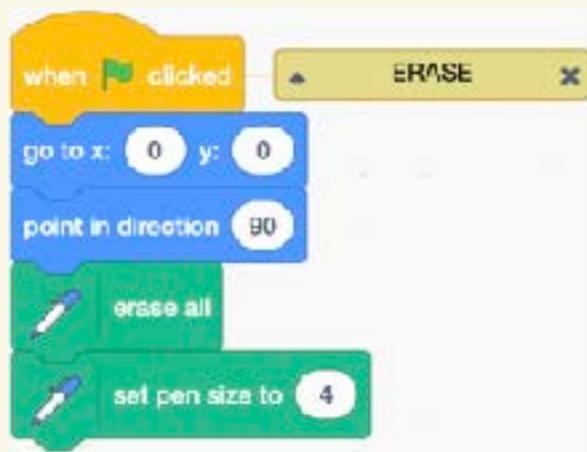
6. Continue repeating steps #3 and #4 until the pattern is complete.



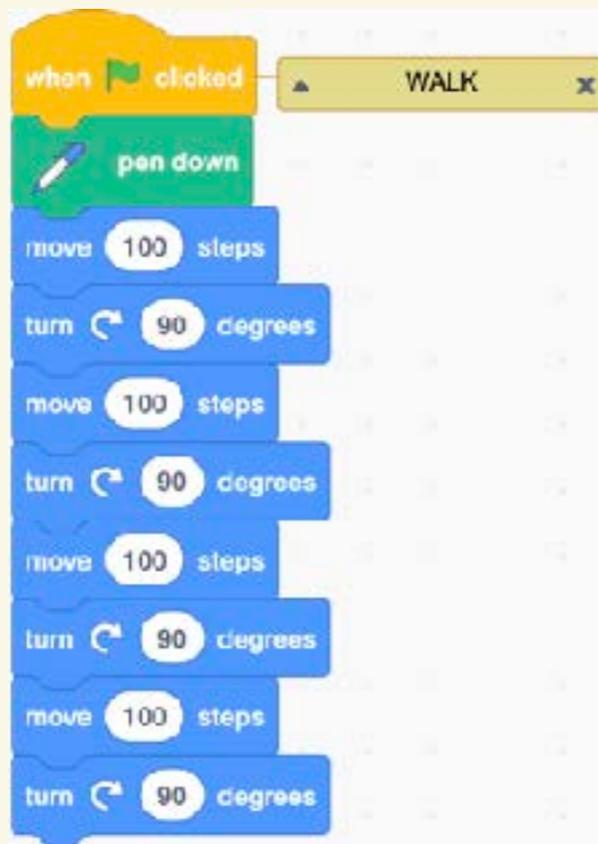
7. Change the turn angle in the TURN code.
8. Continue repeating steps #3 and #4 to create a new pattern.
9. What have you learned?
10. What else do you want to know?

### LA BESTIOLE MARCHE UN MOTIF DES CARRÉS

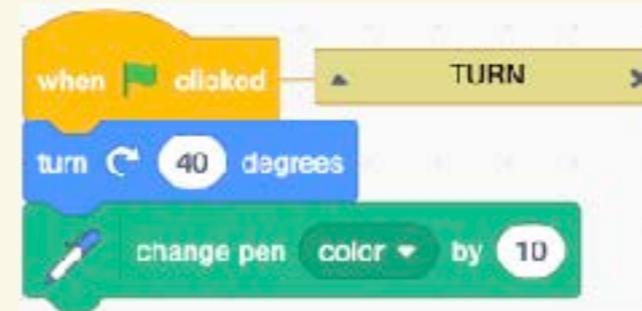
1. Allez sur [scratch.mit.edu/projects/421881362/editor](https://scratch.mit.edu/projects/421881362/editor)
2. Cliquez le code ERASE.



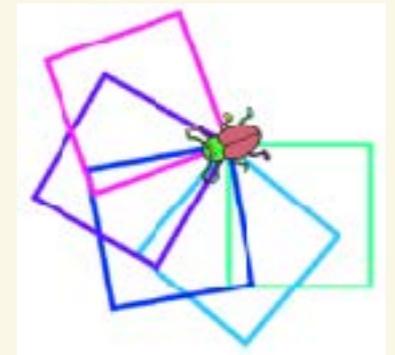
3. Cliquez le code WALK.



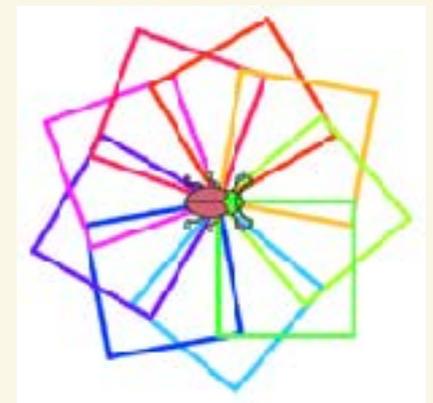
4. Cliquez le code TURN.



5. Répétez les étapes #3 et #4, encore et encore, pour créer un motif comme ceci.



6. Continuez répéter les étapes #3 et #4 jusqu'à ce que le motif est complet.



7. Changez la direction de l'angle au code TURN.
8. Continuez répéter les étapes #3 et #4 pour créer un nouveau motif.
9. Qu'est-ce que vous avez appris ?
10. Quoi d'autre voulez-vous apprendre ?

## TEACHING NOTES

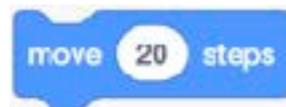
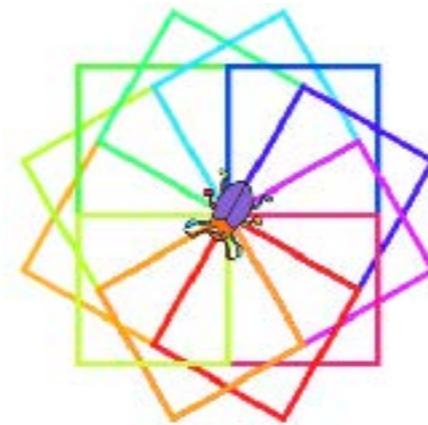
### Context

In this Lesson, students start with code that draws the whole square using a repeat block. The code also turns the square 30 degrees.

By clicking on this code repeatedly, students draw a spiral squares pattern.



```
when clicked
  pen down
  repeat 4
    move 100 steps
    turn 90 degrees
  turn 30 degrees
  change pen color by 10
```



```
move 20 steps
```

Students also add a `move 20 steps` code block and notice the effect.

### Teaching & Learning

**Editing code.** Ask students to edit the code to create variations.

Have students present their edited code, and explain how the pattern is created by the code.

**Nested repeat block.** Some students may notice the repeat block used in the code they are given and ask if they can use another repeat block so they don't have to repeatedly click on the code.

Encourage students to try this.

Have students share and discuss their edits.

The nested repeat blocks would look like as shown below.



```
when clicked
  pen down
  repeat 10
    repeat 4
      move 100 steps
      turn 90 degrees
    turn 30 degrees
  change pen color by 50
```

Ask students to suggest why a repeat block within another repeat block is called "nested".

## CURRICULUM EXPECTATIONS

### Grade 3 Algebra

- C1.2 — create and translate patterns that have repeating elements, movements or operations ... using shapes, numbers and tables of values
- C3.1/3.2 — read/alter existing code, including code that involves sequential, concurrent and repeating events

### Grade 3 Spatial Sense

- E1.4 — give and follow instructions involving movement from one location to another, including distances and half and quarter-turns

### Grade 4 Algebra

- C1.1/1.2 — create and translate repeating and growing patterns
- C3.1/3.2 — read/alter existing code, including code that involves sequential, concurrent, repeating and nested events

### Grade 4 Spatial Sense

- E1.1 — identify geometric properties of rectangles

### Grade 5 Algebra

- C1.1/1.2 — create and translate repeating, growing and shrinking patterns
- C3.1/3.2 — read/alter existing code

### Grade 5 Spatial Sense

- E1.1 — identify geometric properties of triangles

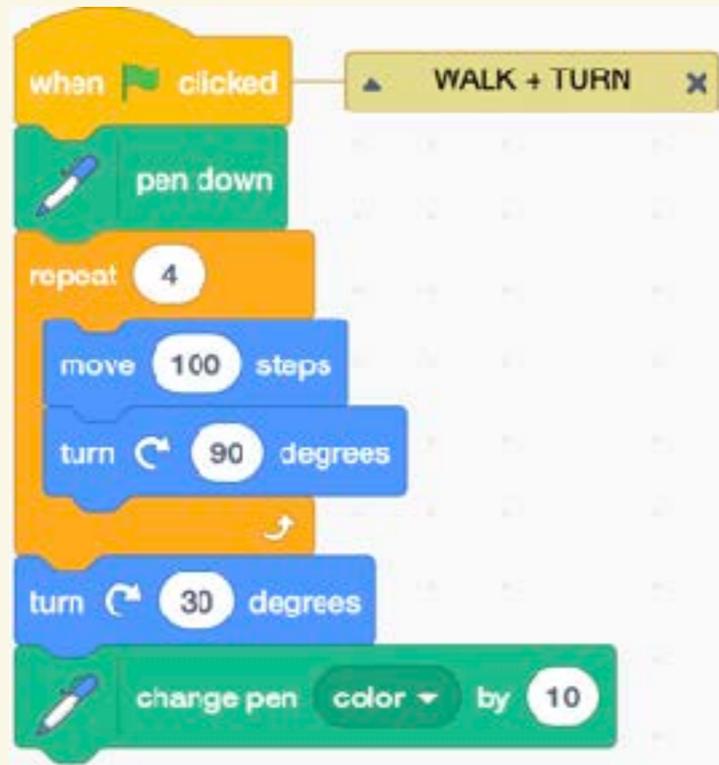
### Grades 6-8 Algebra

- Introduction to coding

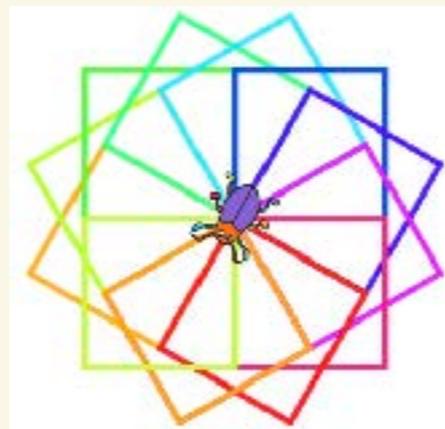
# 3. Bug Walks Squares with Repeat

## BUG WALKS SQUARES WITH REPEAT

1. Go to [scratch.mit.edu/projects/421900037/editor](https://scratch.mit.edu/projects/421900037/editor)
2. Click on the ERASE code.
3. Click on the WALK + TURN code.



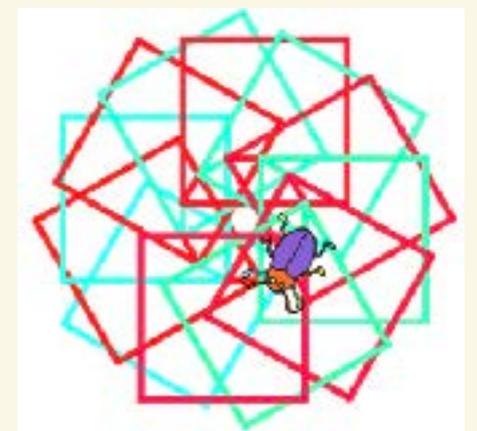
4. What does the WALK + TURN code do?
5. Click on WALK + TURN until you get a pattern like this.
6. How many times do you have to click WALK + TURN to complete the pattern?



7. Add a  code block to the WALK code as shown below.

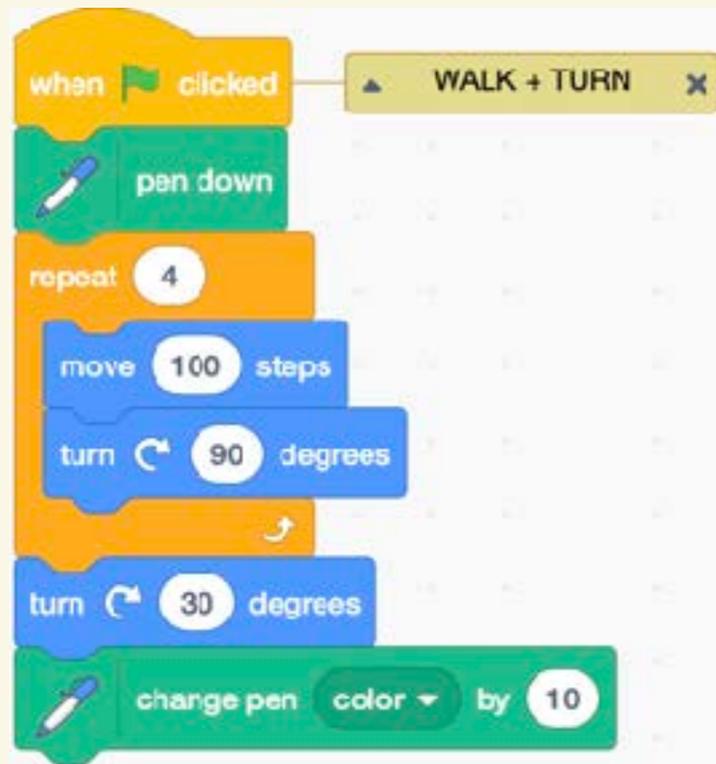


8. Click on the ERASE code.
9. Click on WALK + TURN until you get a pattern like this.
10. How is this pattern different?
11. Help Bug create more math art with squares patterns.

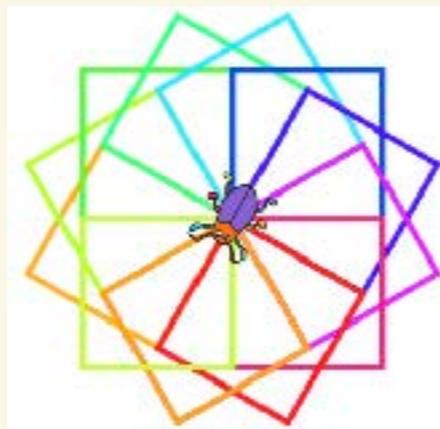


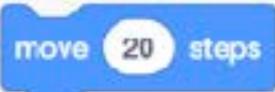
## LA BESTIOLE MARCHE UN MOTIF CARRÉ AVEC LA RÉPÉTITION

1. Allez sur [scratch.mit.edu/projects/421900037/editor](https://scratch.mit.edu/projects/421900037/editor)
2. Cliquez le code ERASE.
3. Cliquez le code WALK + TURN.



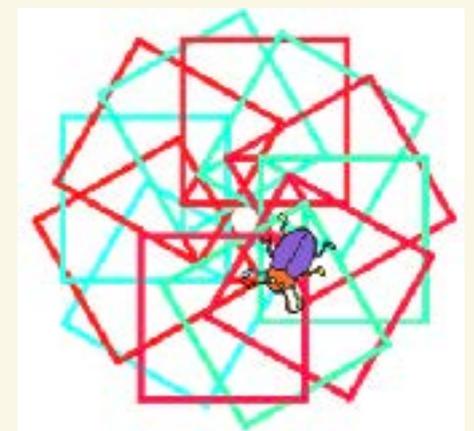
4. Que fais le code WALK + TURN ?
5. Cliquez WALK + TURN jusqu'à vous arrivez au motif comme ceci.
6. Combien de fois devez-vous cliquer WALK + TURN pour finir le motif ?



7. Ajoutez le bloc du code  au code WALK comme montré en dessous.



8. Cliquez le code ERASE.
9. Cliquez WALK + TURN jusqu'à vous arrivez au motif comme ceci.
10. Comment est-ce motif différent ?
11. Aidez la bestiole à créer plus d'art mathématique avec des motifs carrés.

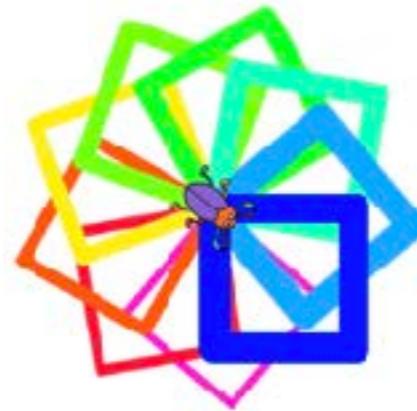


# 4. Bug Walks Squares with Nested Repeat

## TEACHING NOTES

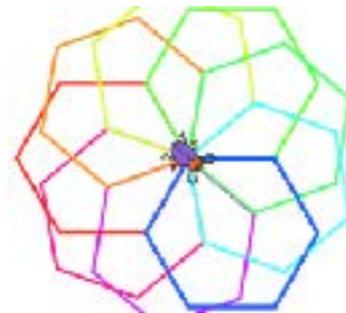
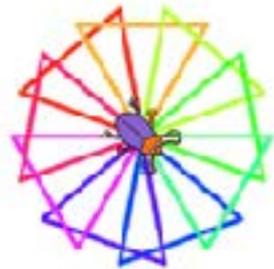
### Context

In this Lesson, students use a nested repeat block (a repeat block within a repeat block). They also increase the pen size with each square drawn to get a pattern like the one on the right.



### Teaching & Learning

**Other shapes.** Ask students to work in pairs to have Bug walk triangles or hexagons, as show below. They may want to reduce the number of steps for each side for the hexagon, so it better fits on the Stage.



```
when clicked → WALK + TURN x
pen down
repeat 5
  repeat 3
    move 100 steps
    turn 120 degrees
  change pen color by 10
  turn 40 degrees
```

```
when clicked → WALK + TURN x
pen down
repeat 5
  repeat 5
    move 100 steps
    turn 60 degrees
  change pen color by 10
  turn 40 degrees
```

## CURRICULUM EXPECTATIONS

### Grade 4 Algebra

- C1.1/1.2 — create and translate repeating and growing patterns
- C3.1/3.2 — read/alter existing code, including code that involves sequential, concurrent, repeating and nested events

### Grade 4 Spatial Sense

- E1.1 — identify geometric properties of rectangles

### Grade 5 Algebra

- C1.1/1.2 — create and translate repeating, growing and shrinking patterns
- C3.1/3.2 — read/alter existing code

### Grade 5 Spatial Sense

- E1.1 — identify geometric properties of triangles

### Grades 6-8 Algebra

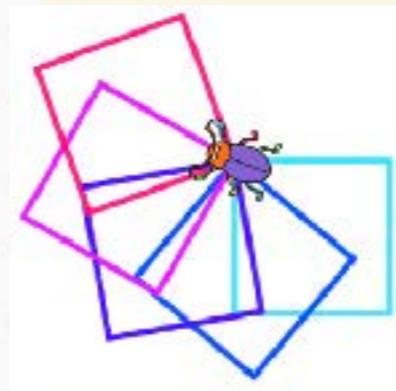
- Introduction to coding

# 4. Bug Walks Squares with Nested Repeat

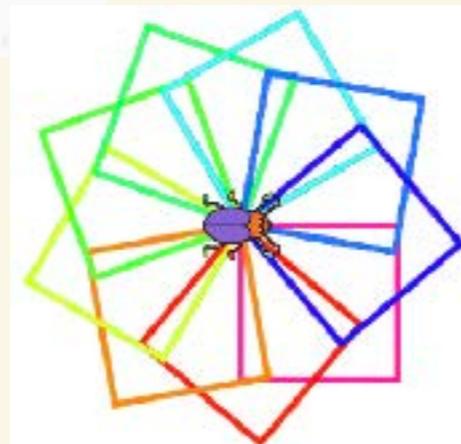
## BUG WALKS WITH NESTED REPEAT

1. Go to [scratch.mit.edu/projects/421910828/editor](https://scratch.mit.edu/projects/421910828/editor)
2. Click on the ERASE code.
3. Click on the WALK + TURN code.

```
when green flag clicked
  pen down
  repeat 5
    repeat 4
      move 100 steps
      turn 90 degrees
    change pen color by 10
  turn 40 degrees
```



4. Edit the code to complete the pattern.
5. What does “nested” mean?



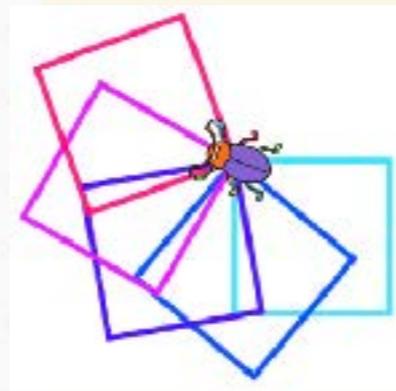
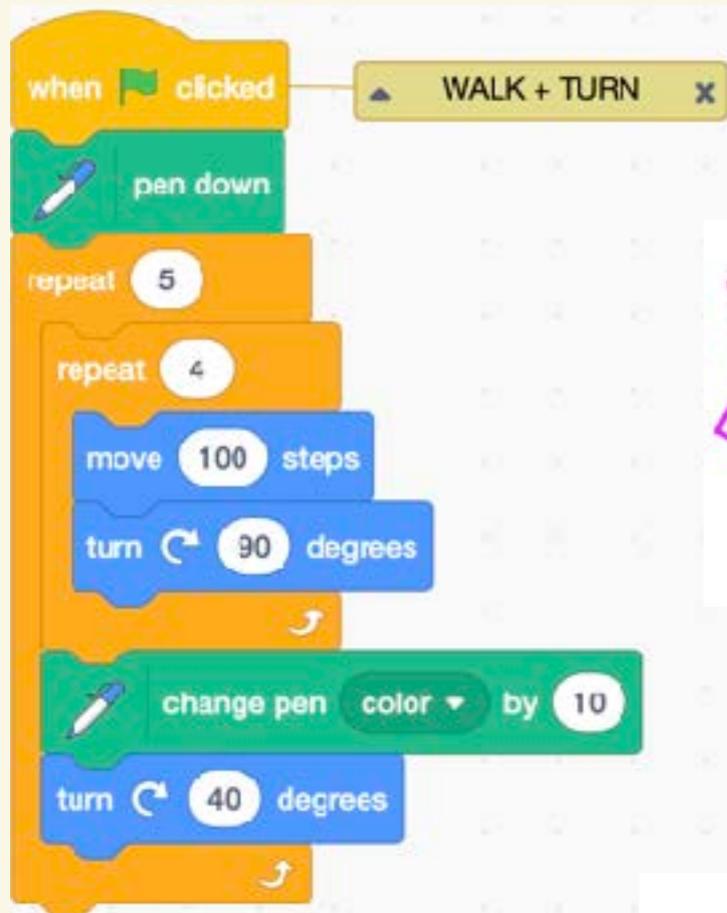
6. Add  to the WALK + TURN code, as shown below.

```
when green flag clicked
  pen down
  repeat 5
    repeat 4
      move 100 steps
      turn 90 degrees
    change pen color by 10
    change pen size by 2
  turn 40 degrees
```

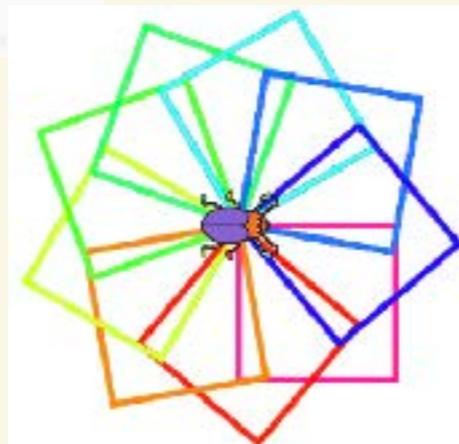
7. Click on the ERASE code.
8. Click on the WALK + TURN code.
9. Edit the WALK + TURN code to help Bug draw new patterns.

### LA BESTIOLE MARCHE AVEC DES RÉPÉTÉS EMBOÎTÉS

1. Allez sur [scratch.mit.edu/projects/421910828/editor](https://scratch.mit.edu/projects/421910828/editor)
2. Cliquez le code ERASE.
3. Cliquez le code WALK + TURN.



4. Modifiez le code pour compléter le motif.
5. Que signifie le mot "emboîté" ?



6. Ajoutez  au code WALK + TURN, comme montré en dessous.



7. Cliquez le code ERASE.
8. Cliquez le code WALK + TURN.
9. Modifiez le code WALK + TURN pour aider la bestiole à dessiner des nouveaux motifs.