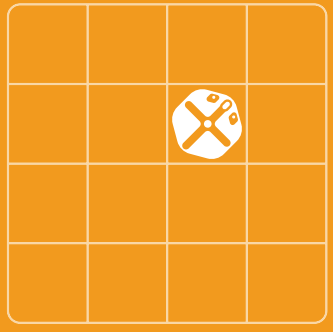
# Drawing with Root

LEARN
3.1

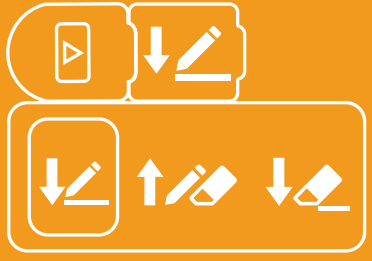
**Objectives**
- Code Root to lower a marker
- Use the Move Block to draw lines with Root



**1** Place Root on your fold-out white board grid.



**2** Take the cap off a dry-erase marker and place it firmly in the center of Root.



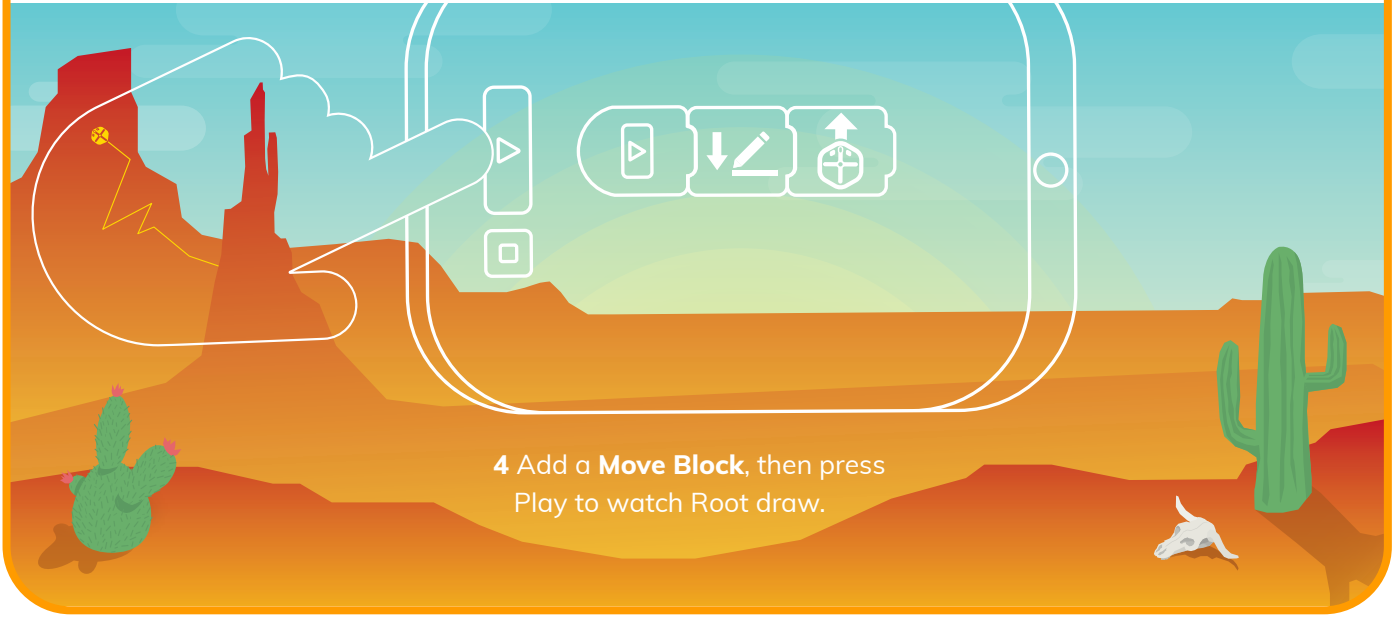
**3** Drag out a **Marker Block** and make sure it is on the *marker-down* setting.

## What You Learned

- You can code Root to lower a marker or pen.
- You can use the **Marker Block** with a **Move Block** to create drawings with Root.

## Explore Further

Can you draw a square using the **Move** and **Turn Blocks**?



**4** Add a **Move Block**, then press Play to watch Root draw.

BUILD 3.A

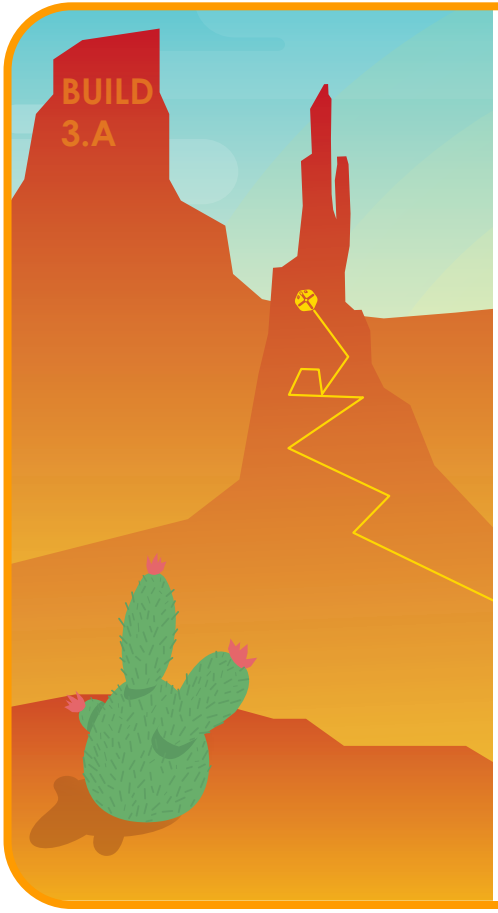
# Write Your Initials

## Challenge

- Use the **Turn**, **Move**, and **Marker Blocks** to program Root to write your first initial.
- For an added challenge, code Root to write both your first and last initials.
- Hint: Plan what you will code first, by drawing your initials in block letters. Try drawing arrows to guide you.

Check the *Writing with Root* card for tips and sample letters










Tip: Remember to edit the **Marker Block** to the Marker Up setting to move to a new letter.

## Check for Understanding

- I can code Root to write something by moving, turning, and using a marker.

## Blocks

- Move
- Turn
- Marker

Sample letters

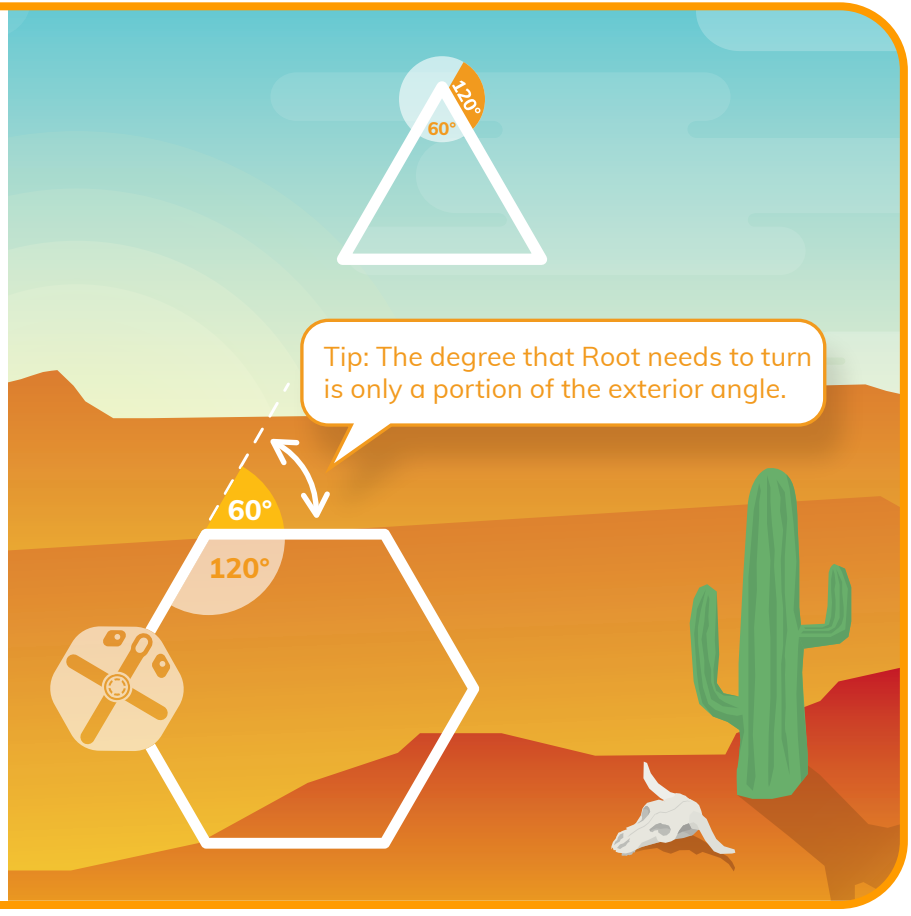
A B C D E F G H I J K

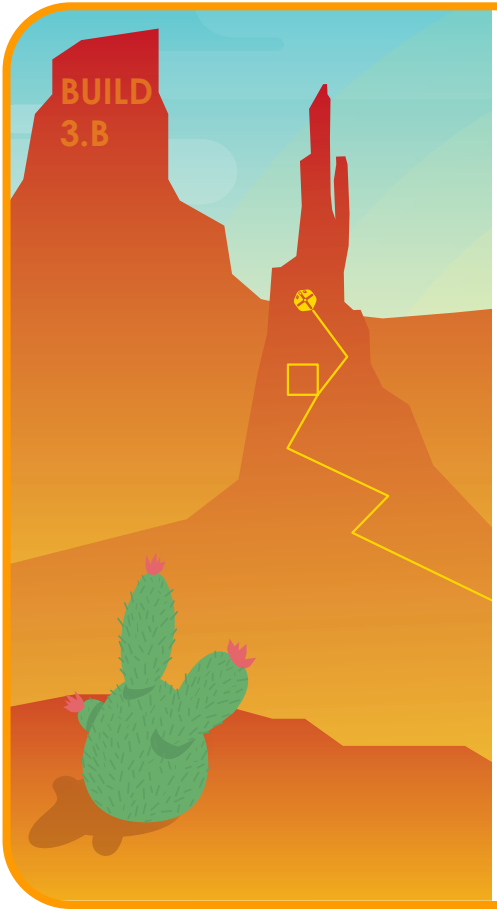
BUILD 3.B

# Drawing Shapes

## Challenge

- Use the **Turn**, **Move**, and **Marker Blocks** to code Root to draw a simple shape.
- How many sides does your shape have? Drag out a **Move Block** for each side.
- Root will need to turn after it draws each side. Add a **Turn Block** between each **Move Block**.
- What direction is Root facing and what angle does Root need to turn in order to draw your shape?










Tip: You learned how to use the *Simulator* and the *Stepper* in Root's coding app (learn 3.4). Use these tools to test your code.

## Check for Understanding

- I can code Root to draw a shape by moving, turning, and using a marker.

## Blocks

- Move
- Turn
- Marker

BUILD TIPS

# Writing with Root

- It's helpful to draw your letter out by hand first. Plan where Root will start and when Root needs to turn left or right.
- Use these letters as a guide, or design your own letters.
- In Level 1 of Root Coding, you can edit the **Turn Block** to change the angle that Root turns in increments of 15°.
- The alphabet to the right only uses angles that are multiples of 15°.

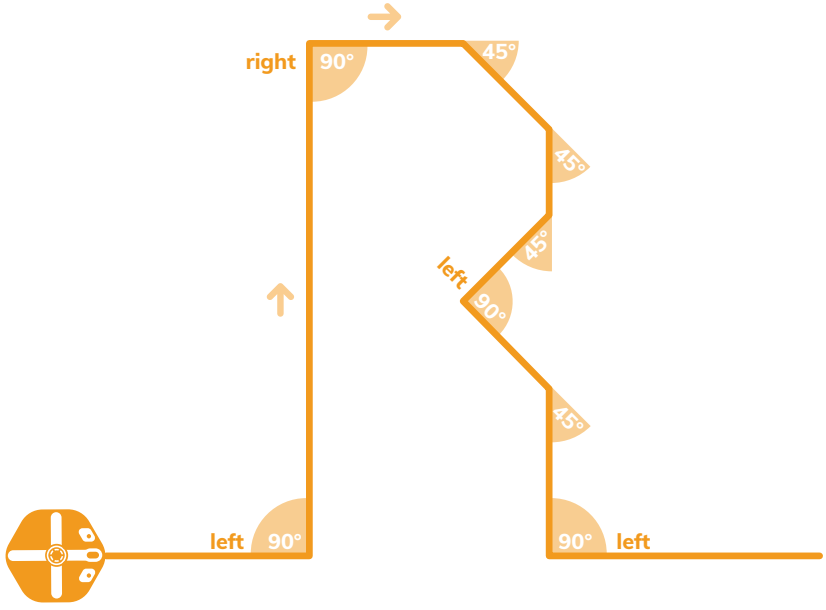



Follow Root for more tips!

SIDE 2

# Writing with Root

- Edit the **Move Block** or add additional **Move Blocks** to change how far Root moves forward after each turn.
- Use the **Marker Block** to raise and lower the pen between letters and when crossing letters like T, A and H.
- For angles over 180° use two **Turn Blocks** whose angles add up to the number of degrees you want Root to turn.






This is the beginning of the code sequence that Root needs to create the letter R.




# Make Root Respond to Touch

LEARN
2.4

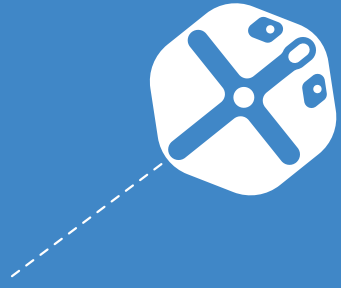
**Objectives**
- Understand that robots have different types of sensors
- Code Root to respond when its touch sensors are pressed
- Code Root to respond with different actions when different zones are touched

**1** Drag out a **When Touch Block**.
**2** Add a **Move Block**.




**3** Press Play.

**4** Now touch the top of Root to see Root drive forward.



**5** Press Stop.

**6** Edit the **When Touch Block** so only the front 2 zones are active.

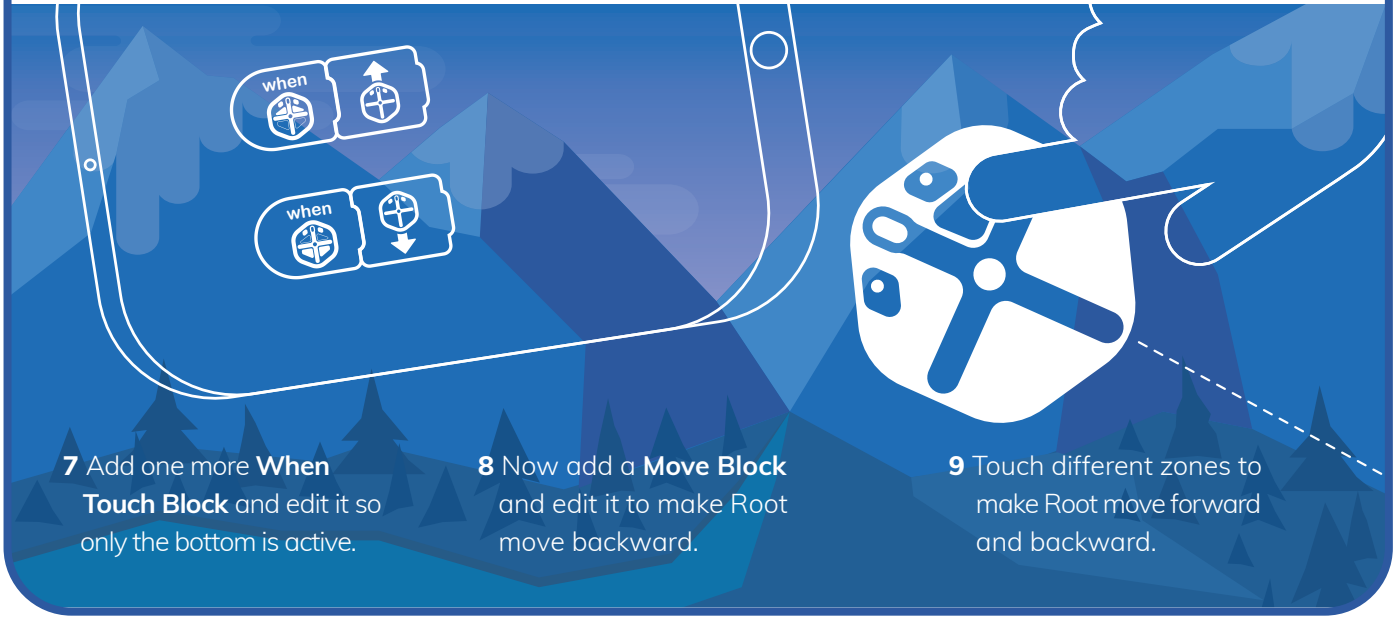


## What You Learned

- Root has multiple sensors that can be coded to trigger different responses.
- Root has 4 touch sensors, each of which can be coded for a different response..

## Explore Further

Code Root to do different things when you touch Root's bumpers and each zone on top of Root.




**7** Add one more **When Touch Block** and edit it so only the bottom is active.

**8** Now add a **Move Block** and edit it to make Root move backward.

**9** Touch different zones to make Root move forward and backward.

BUILD 4.A

# Design a Shape Wheel

### Challenge

If Root draws a simple shape, turns slightly, then repeats those steps over and over, it ends up drawing a pattern we'll call a *shape wheel*.

- Start by coding Root to draw a simple shape, like a square.
- Add a **Turn Block** to change Root's angle.
- Use a **Boomerang Block** to repeat the previous steps until you create a circular pattern.

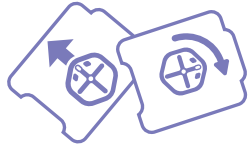












Now create a different shape wheel by changing the angles Root turns and the distance Root moves.

## Check for Understanding

- I can code Root to repeat actions using the **Boomerang** and **When Boomerang Blocks**
- I can use **Move** and **Turn Blocks** together with loops to create a pattern drawing with Root

## Blocks

- Move
- Turn
- Marker
- Boomerang
- When Boomerang

# Drawing With Root




## Summary

In this group of Learn and Build activities, learners will:

- Code Root to raise and lower its marker and eraser.
- Edit the Move and Turn Blocks with greater precision, using specific distances and angles to draw letters with Root.

## Activities

### Write Your Initials

Code Root to lower a marker and draw letters using Turn and Move Blocks.

### Extension Activity

Code Root to write your name, editing the Marker Block to raise and lower a marker or pen between each letter.

# Drawing With Root



## Coding Concepts

**Actuator**

A mechanical component that controls or moves something. Root's marker holder is an actuator that can raise and lower a marker or pen.

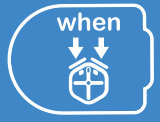
**Parameter**

Further defines or customizes a function. Use the editor for the Marker Block to specify whether Root's marker holder or eraser is raised or lowered.

## Tip

Direct your students to the Letter Drawing Card to create more complex and legible letters and gain a deeper understanding of geometry.

# Touch Interaction




When Bump




When Touch



Wait

## Summary

In this group of Learn and Build activities, learners will:

- Use Wait Blocks to time actions.
- Code Root to respond when the four zones on top of Root are touched and when the two bump sensors on the front of Root are pressed.

## Activities

Engage with coding through a variety of activities:



**Build a Touchbot**
Code Root to move forward, back-ward, left, and right, in response to touching or bumping.



**Touchbot Gameboard**
Code Root to navigate around obstacles and light up in response to landmarks. Then turn Root into a touchbot and complete the course again.

# Touch Interaction



## Coding Concepts

**Sequencing**
The order in which instructions, or blocks of code, are performed. The sequencing of Light and Wait Blocks in Learn 2.1 is essential in coding Root to blink its lights slowly.

**Conditional Statement**
Blocks of code that only run under certain conditions. When you code Root as a touchbot, your code only runs when you touch or bump Root.

**Event**
A circumstance that triggers a response.

**Sensor**
Sensors detect and respond to input from the physical world.

## Tip

To get the hang of new coding vocabulary, model its use while interacting with Root.

For example: “In order to turn Root into a touchbot, you will code Root to respond when its touch and bump **sensors** are engaged.”

# Loops and Patterns




When Boomerang



Boomerang

## Summary

In this group of Learn and Build activities, learners will:

- Use Boomerang Blocks to repeat chunks of code, and use this tool for creating drawings and composing music.
- Code Root to repeat an action a specific number of times.
- Create loops that repeat forever.
- Interrupt forever loops with events.



## Activities

**Design a Shape Wheel**
Code Root to draw a simple shape repeatedly, rotating slightly in between each time, so it creates a circular patterned design.



**Stop on Your Favorite Color**
Code Root to flash its lights in a pattern until you tap the bumper, stopping Root on your favorite color.

# Loops and Patterns



## Coding Concepts

**Loop**
A sequence of code that runs over and over again.

**Forever Loop**
A sequence of code that repeats continuously. Create a forever loop by placing a Boomerang Block at the end of a line of code that starts with a When Boomerang Block of the same color (L4.3).

**Function**
A piece of code Root can run over and over again. A Line of code starting with a When Boomerang Block is a *function* that can be called on using Boomerang Blocks.

**Function Call**
A piece of code that triggers a function to run. Boomerang Blocks define when code attached to a matching When Boomerang Block should run.

## Tip

Group 4 Learn and Build activities provide opportunities to link coding concepts to music and geometry through creative interdisciplinary projects.