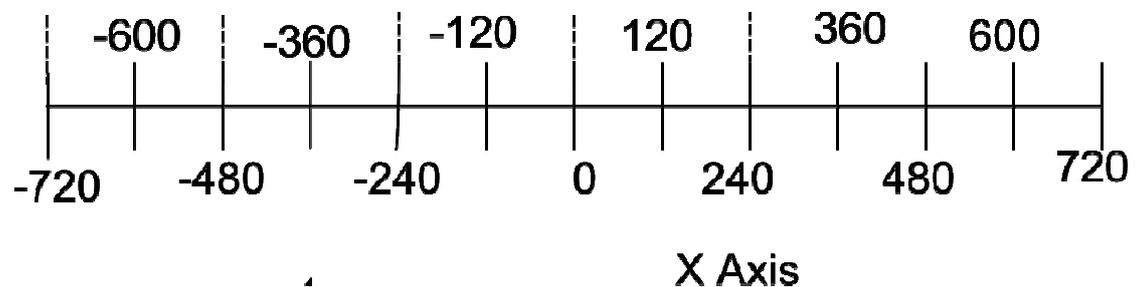


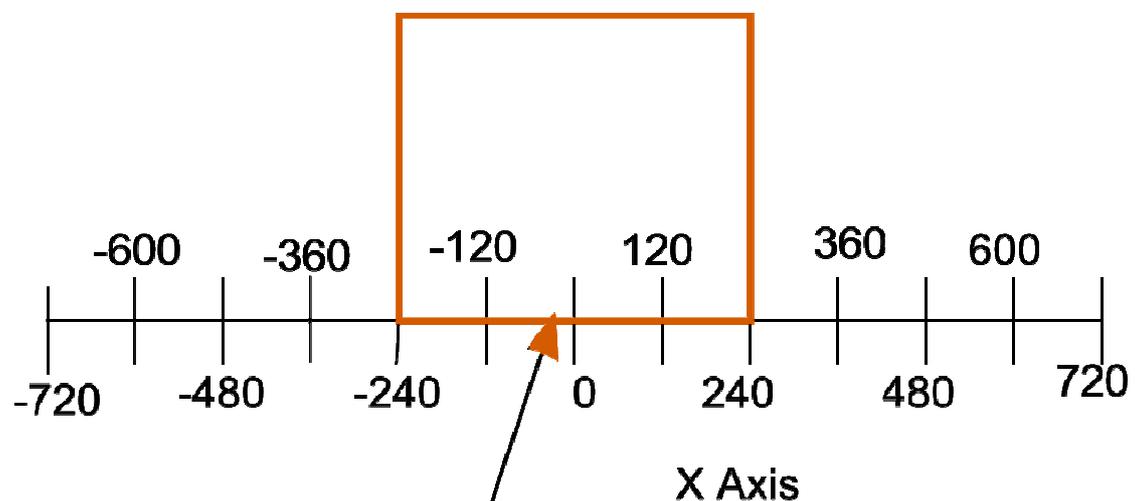
Scratch Programming Lesson 14 Mini Mario Game Part 5 – Scrolling Intro

The trick to have the scrolling platform effect in a Scratch game is to add multiple Platform Sprites. A Platform Sprite is an immobile sprite that looks like a stage background but it can interact with other sprites on stage.

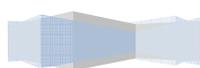
Think of the Stage as a viewable area of an infinitely long strip. This viewable area starts from $x = -240$ and ends at $x = 240$. We will just consider the one-dimensional reference frame and ignore the y -axis for now. The reference frame does not change when sprites move.



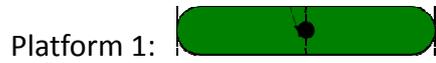
The viewable area also does not change when sprites move.



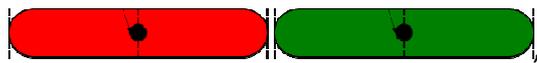
viewable area from $x = -240$ to $x = 240$

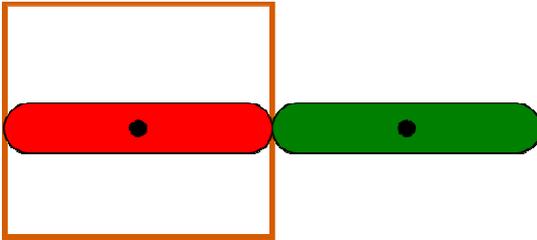
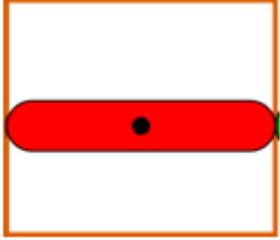
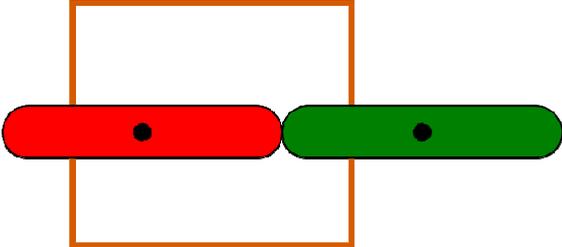
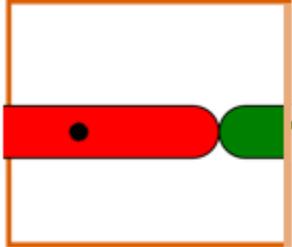
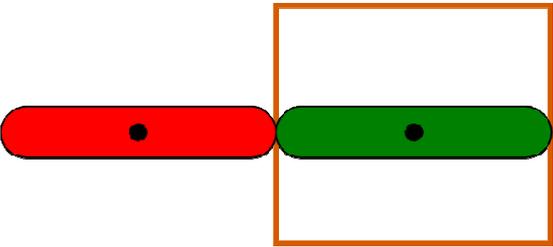
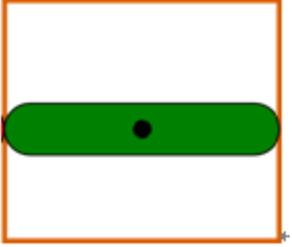


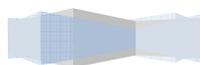
To illustrate how scrolling works, let's use these two platform sprites that each spans 480.



Line them up side by side, starting from the left edge of the Stage (the viewable area):



	The Whole Strip	What's Shown on Stage
Before Scrolling		
Scroll to the right by 120		
Scroll to the right by 480		

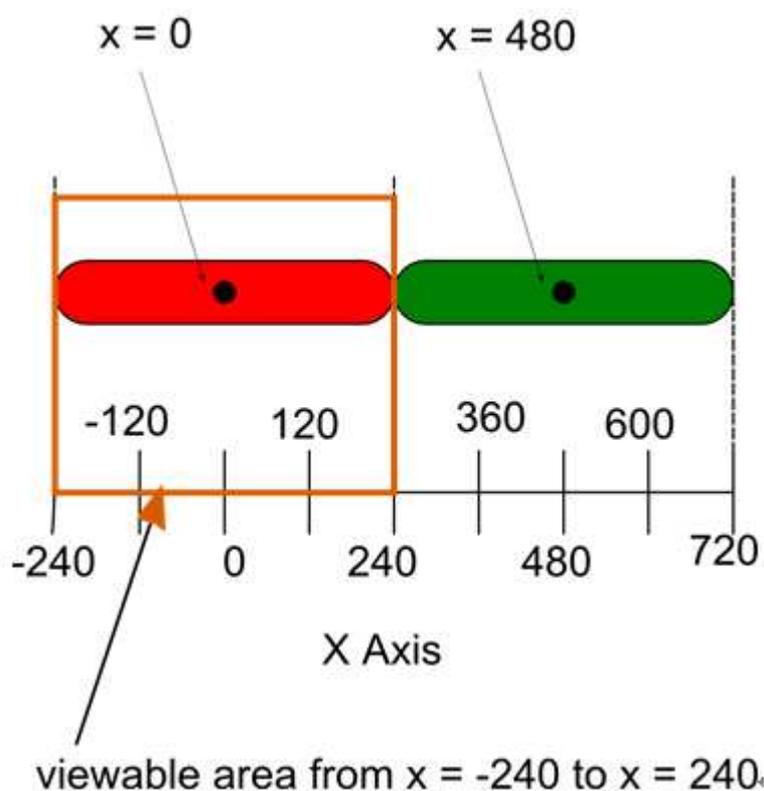


When the game first starts, the red platform's center is located at $x = 0$ and takes up space from $x = -240$ to $x = 240$; the green platform's center is located at $x = 480$ and takes up space from $x = 240$ to $x = 720$. Both have width of 480.

$$240 - (-240) = 480 \quad \leftarrow \text{width of the red platform sprite}$$

$$720 - 240 = 480 \quad \leftarrow \text{width of the green platform sprite}$$

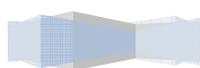
The orange box represents the Stage and only area inside the orange box is viewable. The Stage is 480 in width (x-axis) and 360 in height (y-axis). Only the x-axis is shown because we will only be scrolling left or right.



If we let `STAGE_WIDTH` be a global variable for the width of the Stage, and `PLATFORM_INDEX` be a local variable of each platform sprite, which specifies where the platform is on the strip, then we can represent the starting positions for both sprites as `PLATFORM_INDEX * STAGE_WIDTH` (`*` is the multiplication sign).

$$\text{STARTING_POSITION}_{\text{RED}} = \text{PLATFORM_INDEX} * \text{STAGE_WIDTH} = 0 * 480 = 0$$

$$\text{STARTING_POSITION}_{\text{GREEN}} = \text{PLATFORM_INDEX} * \text{STAGE_WIDTH} = 1 * 480 = 480$$



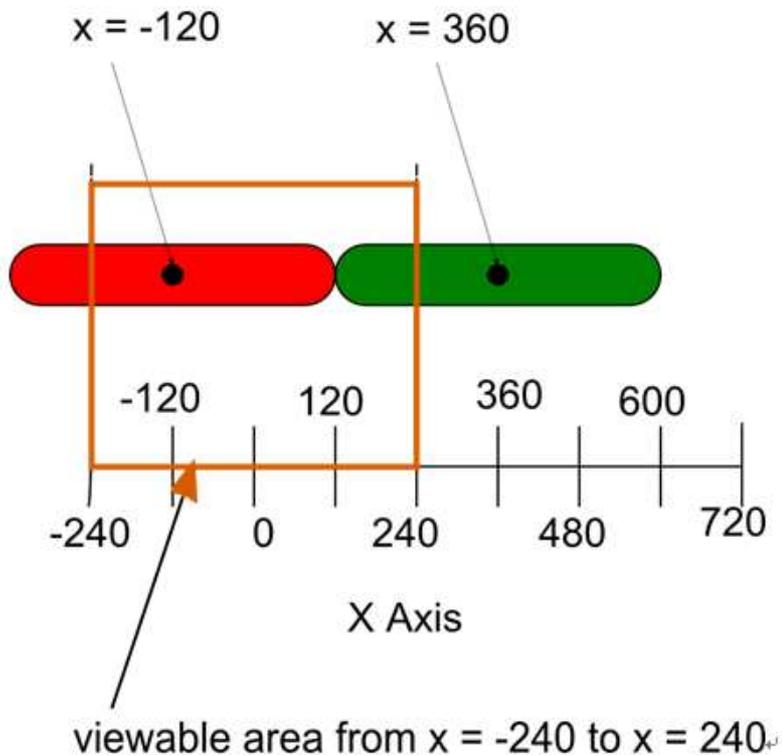
Imaging you are driving a car and are moving forward (scrolling to the right). Though the car is moving forward, but looking from inside the car, the landscape is moving backward relative to you.



In the same way, to move forward from the user's perspective, we move the platforms backward. Therefore, if the user scrolls to the right by 120, then the positions for both platform sprites should be:

$$\text{POSITION}_{\text{RED}} = \text{STARTING_POSITION}_{\text{RED}} + \text{SCROLL_X}_{\text{PLATFORM}} = 0 + (-120) = -120$$

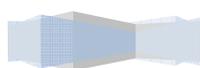
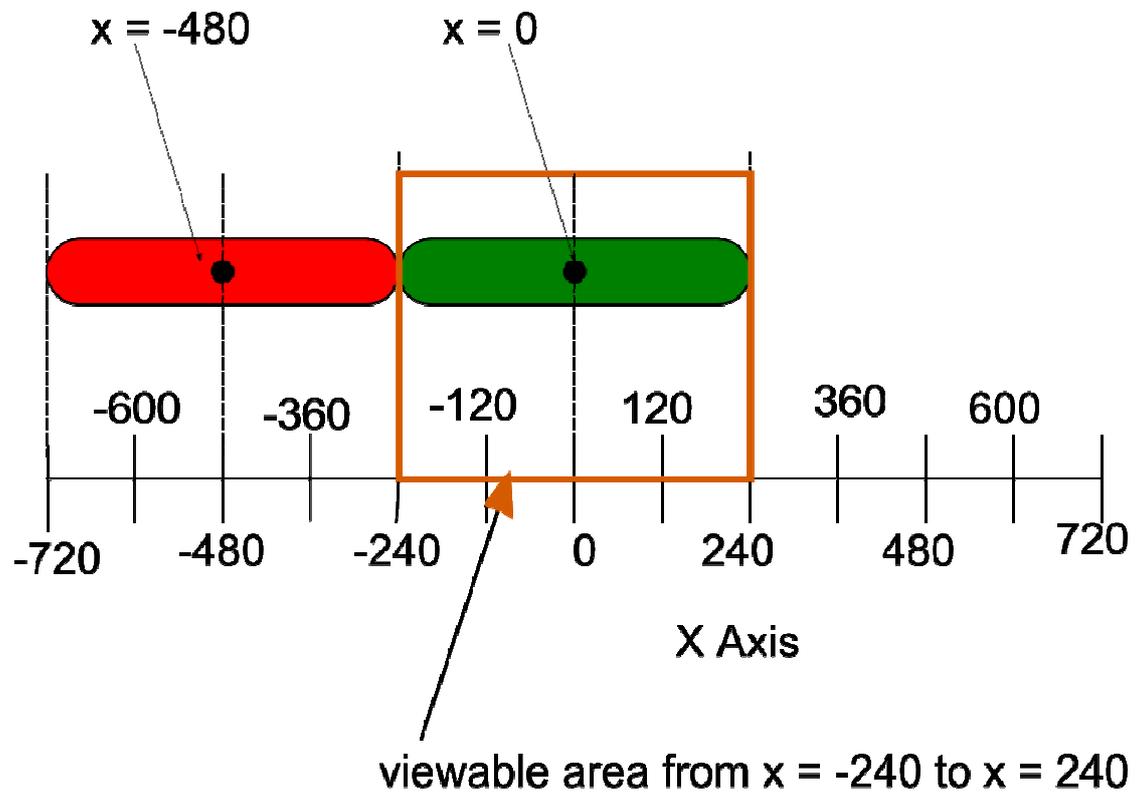
$$\text{POSITION}_{\text{GREEN}} = \text{STARTING_POSITION}_{\text{GREEN}} + \text{SCROLL_X}_{\text{PLATFORM}} = 480 + (-120) = 360$$



Moreover, if the user scrolls to the right by 480, then the positions for both platform sprites should be:

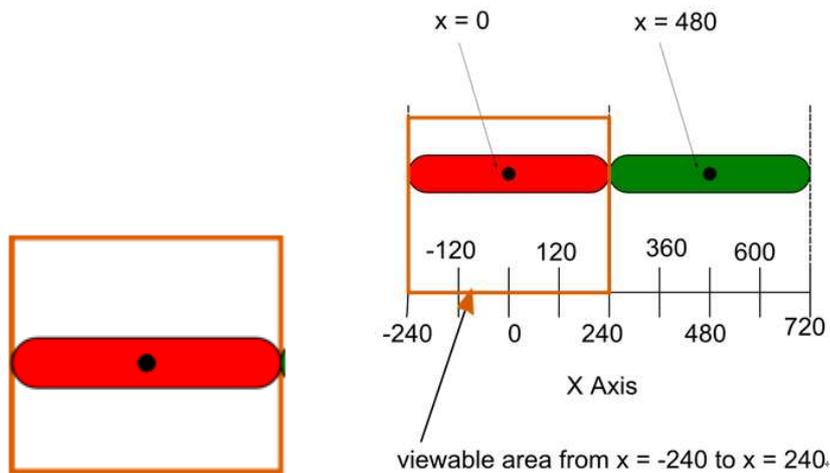
$$\text{POSITION}_{\text{RED}} = \text{STARTING_POSITION}_{\text{RED}} + \text{SCROLL_X}_{\text{PLATFORM}} = 0 + (-480) = -480$$

$$\text{POSITION}_{\text{GREEN}} = \text{STARTING_POSITION}_{\text{GREEN}} + \text{SCROLL_X}_{\text{PLATFORM}} = 480 + (-480) = 0$$

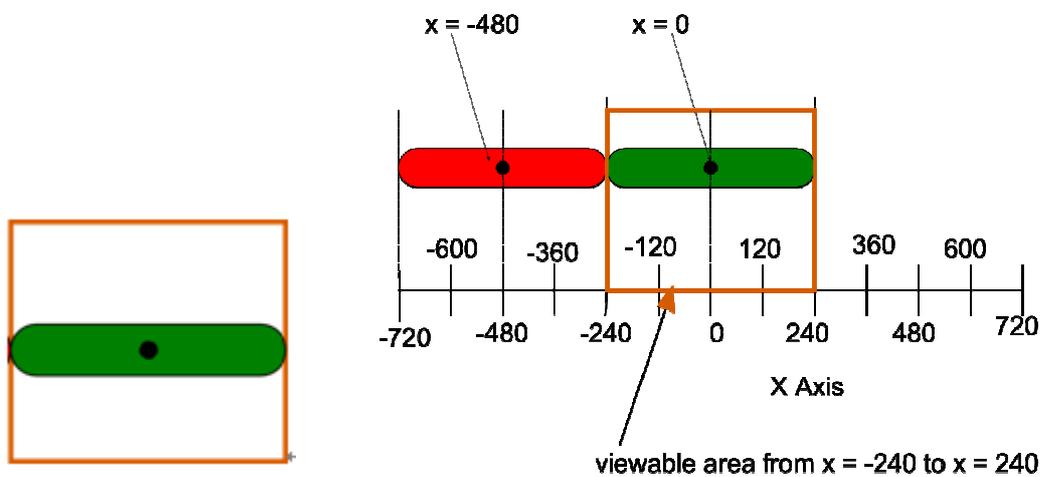


We also need to hide a platform sprite if its center is larger than 480 or smaller than -480.

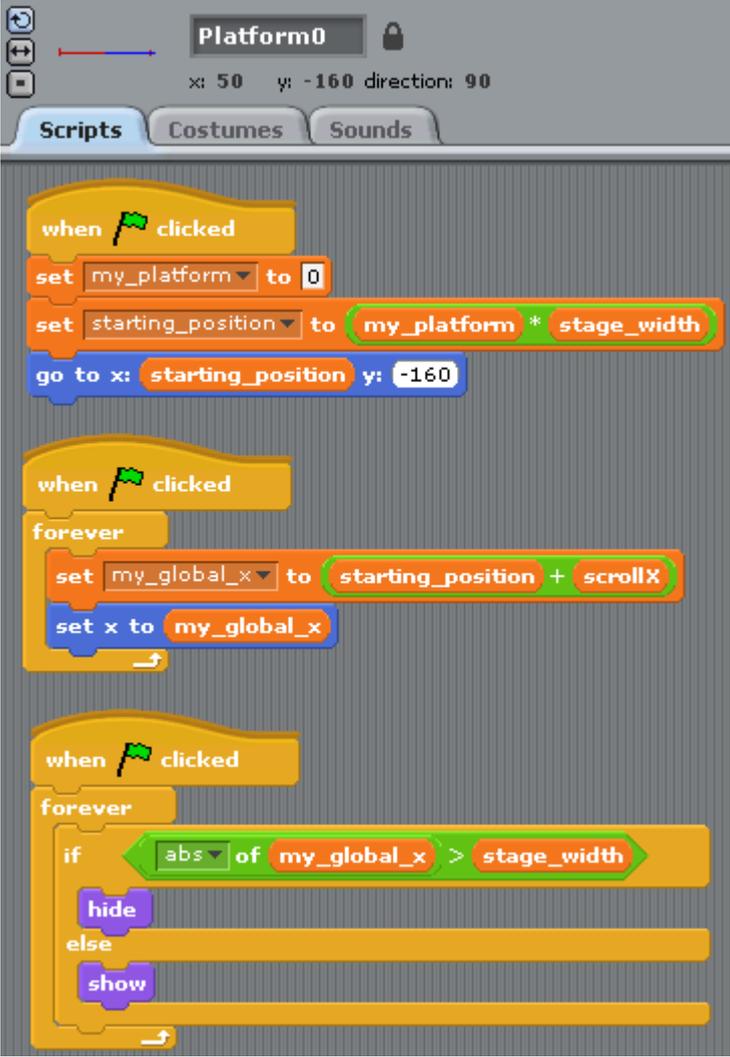
When the game first starts, the green platform is hidden because its center is at 480.



After scrolling to the right by 480, the red platform is hidden because its center is now at -480.

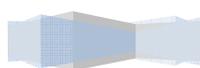


Now we are ready to put the scripts together. Below is the script for the red platform or Platform0.



The image shows the Scratch Scripts area for a sprite named 'Platform0'. The sprite's current position is x: 50, y: -160, and its direction is 90. The Scripts area contains three event-driven scripts:

- Script 1:** Triggered by 'when clicked', it sets 'my_platform' to 0, calculates 'starting_position' as 'my_platform * stage_width', and moves the sprite to x: starting_position, y: -160.
- Script 2:** Triggered by 'when clicked', it enters a 'forever' loop that sets 'my_global_x' to 'starting_position + scrollX' and then sets 'x' to 'my_global_x'.
- Script 3:** Triggered by 'when clicked', it enters a 'forever' loop with an 'if' condition: 'abs of my_global_x > stage_width'. If true, it calls 'hide'; otherwise, it calls 'show'.



The green platform or Platform1 has exactly the same script as the red platform or Platform0, except that its my_platform is 1 instead of 0.

