# Arcs: Lesson 7

Understanding the Principle of Arcs

Almost all actions tend to follow an arc or circular path. Arcs occur for one of two reasons: because a limb or appendage is rotating around a joint or because of gravity (if you throw an object forward, gravity pushes it down causing an arc). This is especially true with living beings such as humans and animals and should be recreated in animation to help produce realism. For instance, when a frog jumps it follows a curved path—starting when it leaves the ground, to the top of the jump, then back to the earth.

One great example of arcs caused by gravity can be seen with Lesson 1's bouncing ball (shown here). When the ball hits the ground, it curves up to the top of the bounce before it moves back toward the ground. The ball is moving forward and gravity pushes it toward the ground, causing it to follow a rounded path.
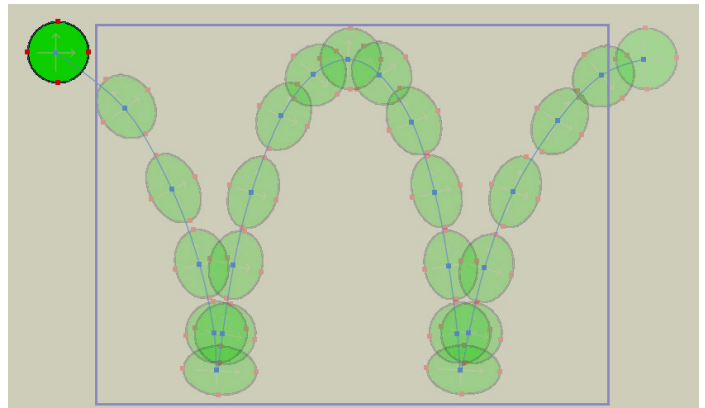
One exception to this principle occurs with mechanical objects, which move in straight lines. In general, you should try to avoid completely linear movement in your animations unless it is mechanical.

Related Project Files

The following related project files are located in the ASCurriculum-Lesson7.zip file that accompanies this course:

• **Basketball.anme** - A basketball object to place into the scene.

• **Bowling Ball.anme** - A bowling ball object to place into the scene.

• **Tennis Ball.anme** - A tennis ball object to place into the scene.

• **Tutorial 7.1.anme** - A final version of the project that you will complete in this lesson.

• **Tutorial 7.1.mov** - A final render of the project that you will complete in this lesson.

• **Tutorial 7.1 How To.mov** - A step-by-step video tutorial of the project that you will complete in this lesson.

Tools Used

• **Scale Layer** tool, **Translate Layer** tool

Tutorial 7: Overview

Here we will create ball bounces using arcs. There are three different types of balls in this lesson, so you can see how objects with different weights and volumes follow different paths.

By default, Anime Studio creates smooth arcs of motion when you change an object's direction of movement with the **Translate Layer** tool. As you create the ball bounces in this lesson, notice how the curvature of the arc changes depending how tight or high the balls' bounces are.
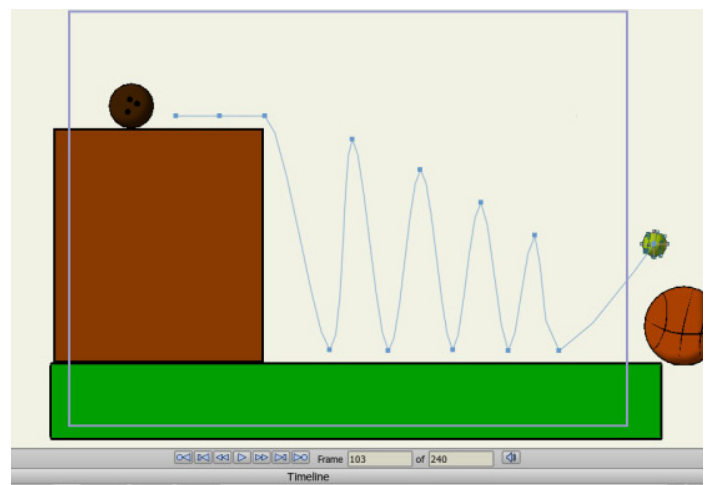
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Tutorial 7: Step-by-Step

Step 1: Start with a Previous Lesson File

To begin, choose **File > Open**. Open the **Tutorial 2.1.anme** project that accompanies these tutorials. You'll reuse the building and ground that you created in this tutorial.

In the **Layers** window, highlight the **Brick Right** layer, and click the trash can icon to delete the layer. You'll be asked to confirm the deletion. Repeat this for **Brick Left.** You should now only have the ground and building remaining.

Save your project at this time and name it Lesson7_YourLastName. Make sure that you are in the Lesson 7.1 folder before you choose Save.

Step 2: Import the Balls

You won't have to create the balls in this tutorial; they are already made for you and included on the disc. Choose **Import > Anime Studio Object** and select **Basketball. anme** from the **Lesson 7.1** folder on the disc. Repeat the process, importing **Bowling Ball.anme** and **Tennis Ball.anme** as well.
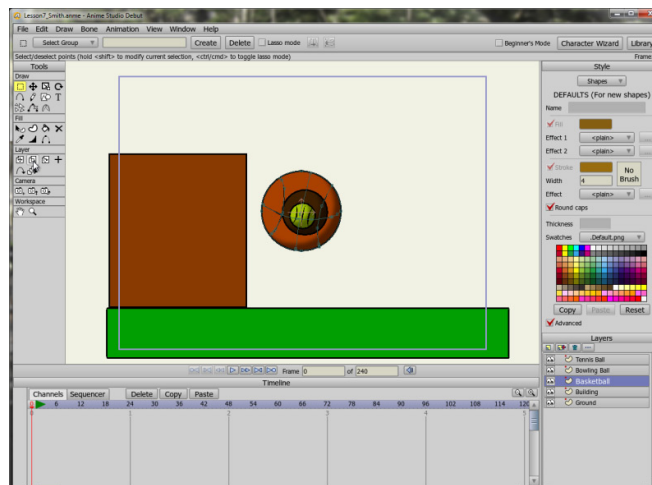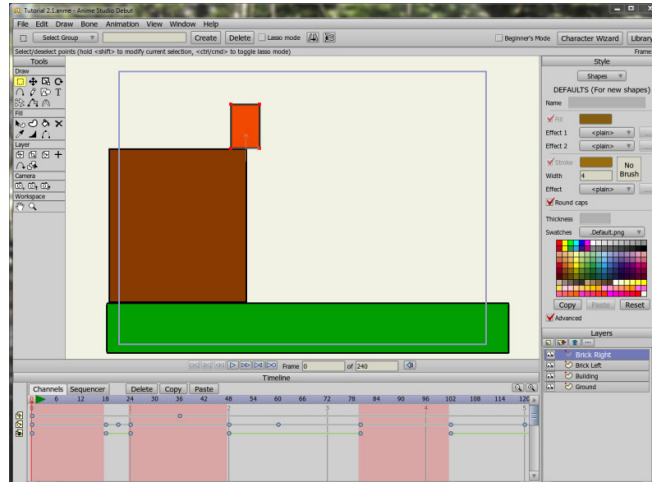
Step 3: Position the Balls

With the **Basketball** layer selected in the **Layers** window, choose the **Scale Layer** tool. Scale the basketball to around 65 percent of its original size, because it's a bit too big for our building.
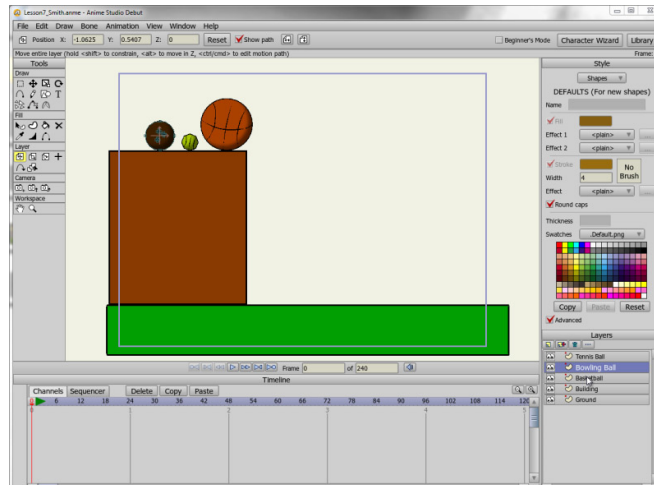
Then position the ball on the top of the building with the **Translate Layer** tool.

Scale and position the tennis ball behind the basketball.

Finally, scale and position the bowling ball behind the tennis ball.

Step 4: The Basketball Sequence

Select the **Basketball** layer in the **Layers** window.

Choose **Frame 6** as the current frame, and use the **Translate Layer** tool to move the basketball off the building.
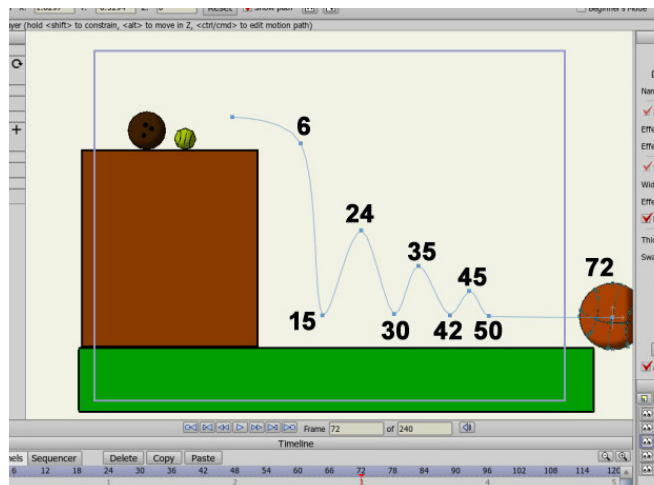
At **Frame 15**, place the basketball on the ground.

The first bounce will go up about half the distance of the fall at **Frame 24** and back down again at **Frame 30**.

The second bounce will again go up half the distance at **Frame 36** and back down at **Frame 42**.

The last bounce, at **Frames 45** and **50**, will again be half as high as the previous bounce. At **Frame 72**, move the basketball off the stage.

Play the animation to see how it looks.

For further information on the **Scale Layer** tool, refer to the Anime Studio Debut Users Manual.

For further information on the **Translate Layer** tool, refer to the Anime Studio Debut Users Manual.

You can find examples of different bouncing ball animations on YouTube™ by searching for words such as "bouncing ball 2D" or "bowling ball bounce." Watching videos of balls bouncing before you animate can help you animate them more realistically.

If you desire, you can refine the arcs by adding intermediate keyframes, using the techniques that we covered in Squash and Stretch Tutorial 1.

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Step 5:
The Tennis Ball Sequence

When tennis balls bounce, they typically squash down. The squash and stretch action of the tennis ball won't be covered in this tutorial, but can add it on your own, using techniques that you learned in Lesson 1 with the bouncing ball tutorial.
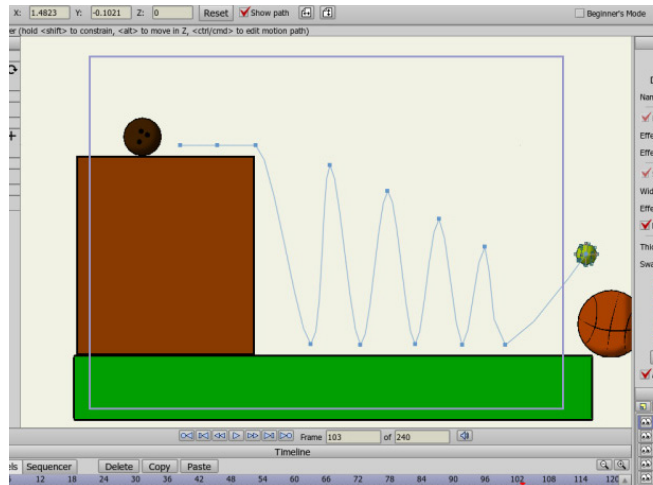
Step 6:
The Tennis Ball Bounce

To create the tennis ball bounce, select the tennis ball layer from the **Layers** window. Make **Frame 42** the current frame. Click the tennis ball with the **Translate Layer** tool, without moving the ball, to add a keyframe. This will keep the tennis ball in its original position until Frame 42.

Select **Frame 48** and move the tennis ball about halfway off the building. At **Frame 54**, place it on the edge of the building. At **Frame 60**, place the tennis ball on the ground, moving it farther to the right of the building.
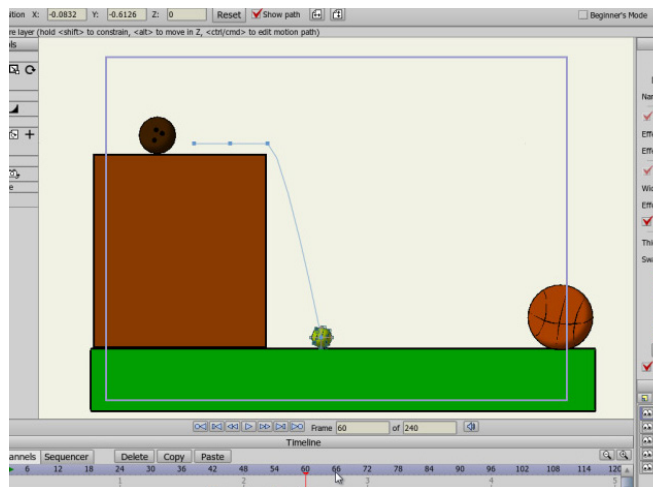
Step 7: The Tennis Ball Bounce (continued)

The first bounce will be very high, almost as high as the original bounce. Move to **Frame 66**, and drag the tennis ball up almost as high as the top of the building, moving it about the same distance to the right as when it fell.

At **Frame 72,** place it on the ground, again moving it farther toward the right.

The second bounce will be at **Frames 78** and **84** (6 frames apart), but will be slightly lower than the first bounce.

The third bounce happens a little faster (4 or 5 frames apart) at **Frames 89** and **93**, and it will be lower still.

The fourth bounce will go up and down at **Frames 97** and **100** (3 frames apart) and will yet again be slightly lower than the previous bounce.

At **Frame 103**, bounce up and off the stage. Play the animation again and you'll see two balls bouncing very differently.
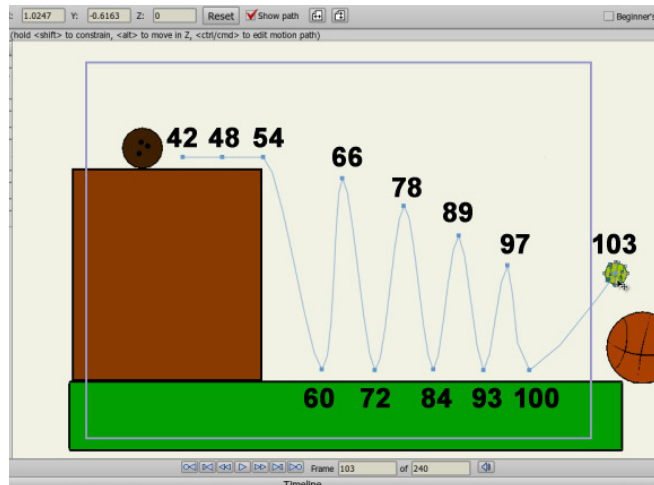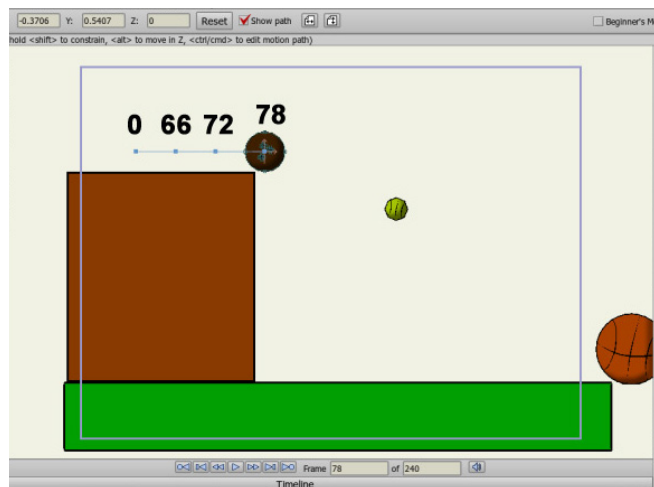
Step 8: The Bowling Ball

Now, let's think about that bowling ball. It is quite heavy, and not subject to bounce very much at all. It should also fall with almost no arc.

Select the **Bowling Ball** layer in the **Layers** window, and move to **Frame 66**. Use the **Translate Layer** tool to move the bowling ball a little less than halfway off the building. At **Frame 72**, move it to the right a little more. At **Frame 78**, move it off the edge of the building.
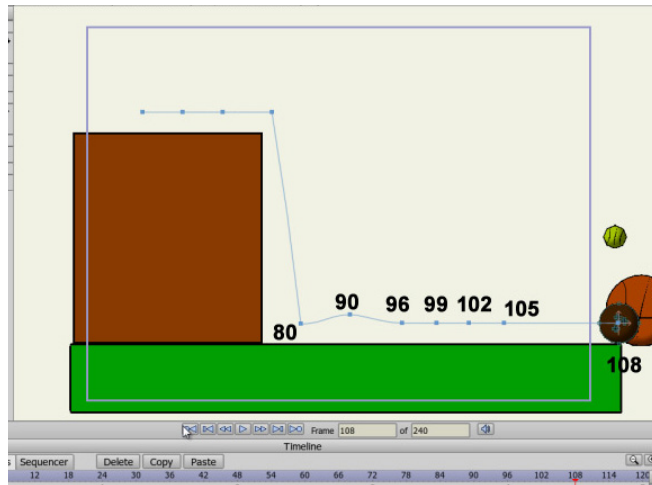
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Step 9: The Bowling Ball
(continued)

 At **Frame 80**, place the ball on the ground making the ball fall almost straight down. Move ahead to **Frame 90** and move the ball toward the right of the stage, elevating it very slightly off the ground. At **Frame 96**, move it about the same distance to the right, and place the ball on the ground. At **Frames 99**, **102** and **105**, move the ball to the right with no bounce. Finally, move the ball off the stage at **Frame 108**. Again, play the animation to see the result.
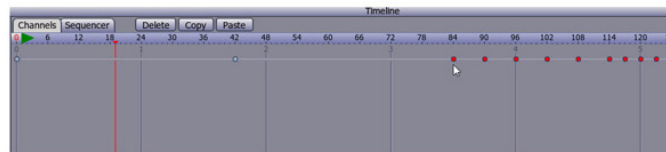
Step 10: Adjusting Keyframes

Remember that the more space there is between the keyframes the slower an object will move. You can select multiple keyframes at a time and adjust the spacing until it's more to your liking. First, select the entire group of keyframes and slide them farther to the right or left. Then, omit the first keyframe from the selection and move the rest. You might also want to press the Play button to preview the timing before you complete the remaining keyframes. Save your project once you're happy with your timing.
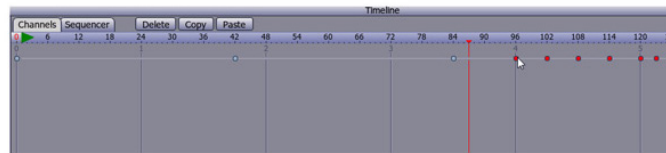
When you have completed your project, you can eliminate excess frames before you render your animation in either of two ways:

- Type the number of the final frame into the frame counter. In this case enter **108** and press **Enter**.

- Select **File > Export Animation** and enter the number of the final frame into the **End Frame** box that appears. In this case, you would enter **108** into the **End Frame** box and press **OK** to continue.
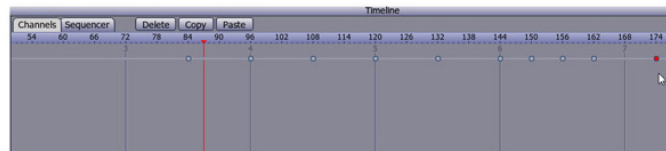
Once you have removed any excess frames, render your project to complete this lesson. Great work!

You can also see the result of your work without the arcs in view. To do that, uncheck the **Show Path** box at the top of the screen (when you are in the **Translate Layer** menu).

Select a range of keyframes

Slide the group to the right

Continue adjusting until there is more space between keyframes