

The Principles of Animation

Squash and Stretch: Lesson 1

Understanding the Principle of Squash and Stretch

Squash and Stretch is a commonly used animation principle applied to moving shapes or characters. It is seen when an object's shape is changed or exaggerated to create more fluid, realistic-looking motion. Squash and Stretch also serves to give the viewer an impression of what the object is made of. For example, more squashing and stretching looks rubbery, organic and flexible (like a living being); less squashing and stretching appears hard and inflexible (like a bowling ball).

One general rule with Squash and Stretch is to change an object's shape without changing its volume. This allows the animator to add flexibility to the animation and allows a character to move to more extreme positions.

Related Project Files

The following related project files are located in the ASCurriculum-Lesson1.zip file that accompanies this course:

- **Tutorial 1.1.anme** - A final version of the project that you will complete in this lesson.
- **Tutorial 1.1.mov** - A final render of the project that you will complete in this lesson.
- **Tutorial 1.1 How To.mov** - A step-by-step video tutorial of the project that you will complete in this lesson.

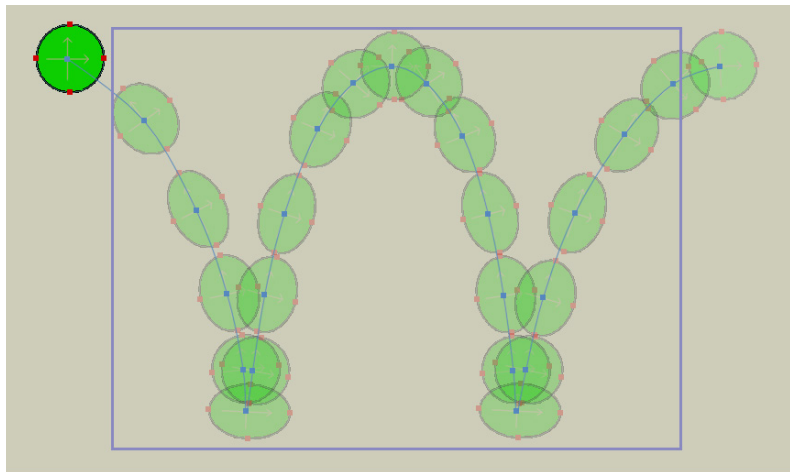
Tools Used

- **Draw Shape** tool, **Rotate Layer** tool, **Scale Layer** tool, **Translate Layer** tool

Tutorial 1: Overview

In this lesson, we'll create a bouncing ball. You'll see how the ball squashes when it hits the ground and stretches as it bounces in the air. Keep in mind that when animating a ball, the weight of the ball is important, since it defines how high a ball will bounce and how much it will squash. Here is what you'll complete in this lesson:

- First, set the main key poses: where the ball will start, where it collides with the ground, and where it will end.
- Next, add in breakdowns to shape the arcs and define the path of the bouncing ball.
- Thirdly, add squashes and stretches to further enhance the way the ball responds to collisions and going up in the air.
- Finally, add rotations to correspond with the angles of the arcs in the path.



Tutorial 1: Step-by-Step

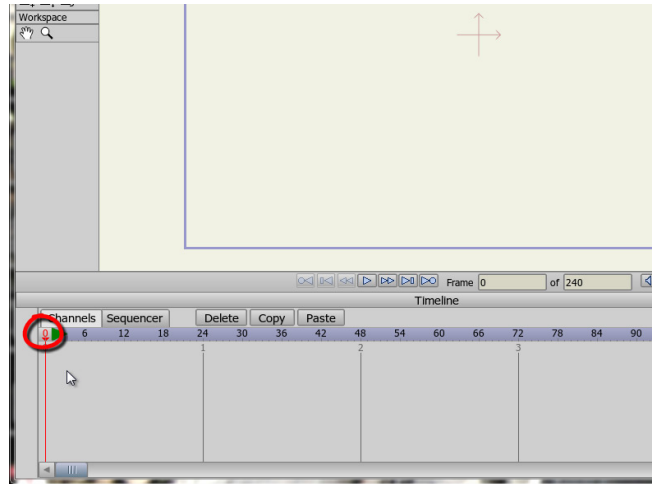
Now that we have the main positions set, you'll want to preview your work. To do that, reset the Frame Counter to 0 and press the PLAY button on the timeline indicator. You'll notice that the ball is travelling along paths that are fairly straight. In reality, a ball bounces along paths that look more like arcs, so we'll refine those next.

Step 1: Start at Frame 0

To get started, go to File > New to open a new Anime Studio document (.anme file).

Once you open your document, make sure you're on **Frame 0** in the timeline. You can click the numbers in the timeline to move from frame to frame.

Save your file by going to File > Save and naming it Lesson1_YourLastName. It's important to save often to avoid losing your work.



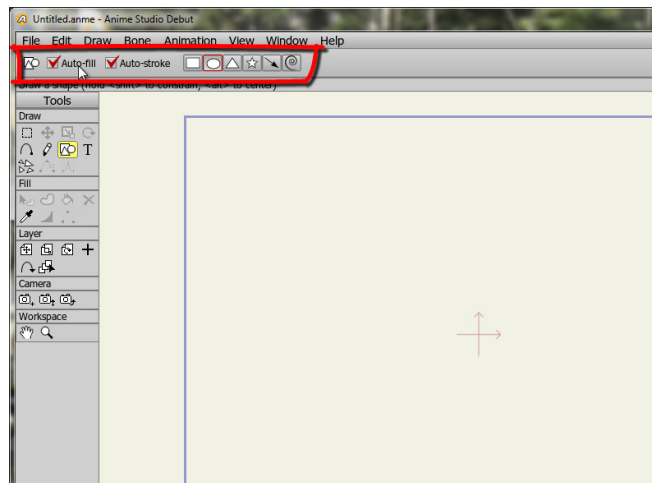
The bottom half of this screenshot displays the timeline in Anime Studio.

Step 2: Set Tool Options



When you use the **Draw Shape** tool, you'll also find it convenient to have the **Auto Fill** option checked. This option automatically fills a closed shape with color as you create it.

Select the **Draw Shape** tool from the **Draw** section of the **Tools** panel. Next, make sure you have the **Oval** shape selected from the Options bar.



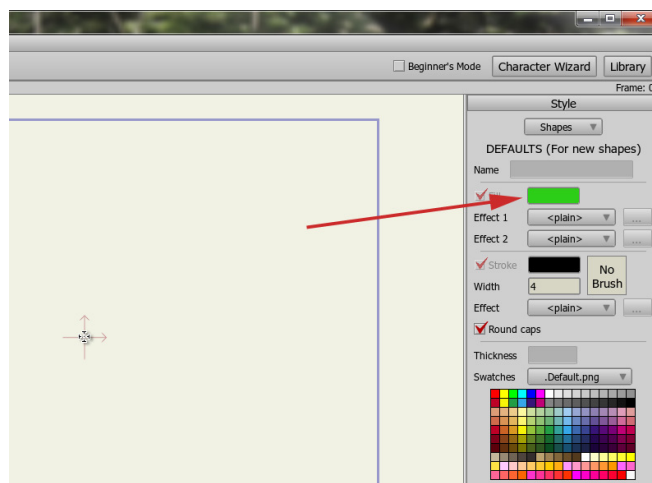
For further information on the **Draw Shape** tool, refer to the Anime Studio Debut Users Manual pdf.

You can access the Users Manual from within the Anime Studio application by going to Help > Help.

The arrow in this screenshot points to the blue rectangle that indicates the visible region of the project. Only objects that are within this rectangle will appear in your final animation.

Step 3: Choose a Fill Color

The default color is set to white when you first start Anime Studio. You can select a different fill color and/or stroke color from the **Style** window at the right side of the interface. Here we'll change the color to green. Double-click the **Fill** field to select a green shade of your choice.



For further information on the **Style window**, refer to the Anime Studio Debut Users Manual.

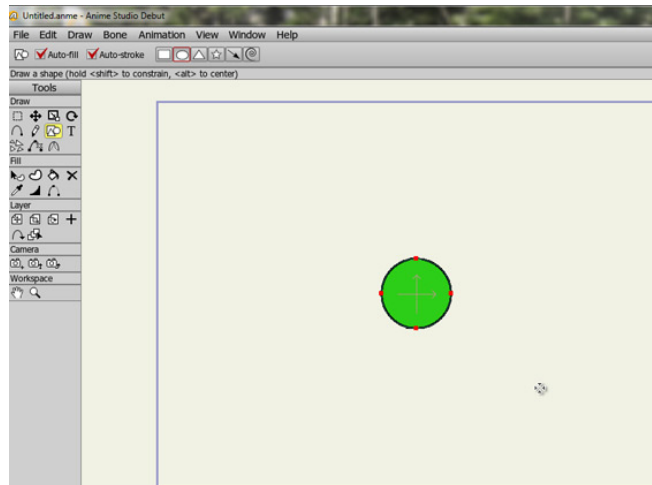
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Step 4: Draw a Ball



With the **Draw Shape** tool selected, press the **Shift** key while you drag a circle shape in the center of the stage.

The **Shift** key constrains the shape to a perfect circle. The **Alt** key centers the circle at the point you first clicked.



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

Step 5: Drag the Ball Off the Stage



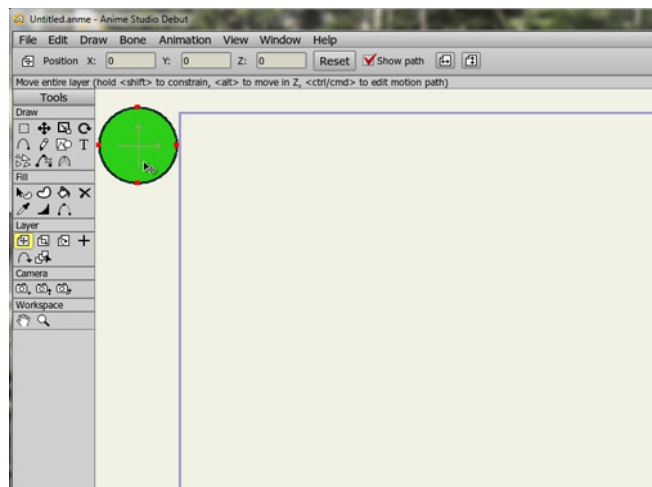
Now select the **Translate Layer** tool from the **Layers** section of the toolbox. Drag the ball to the upper left corner of the screen so that it's off the stage.

We don't want the ball to move until it reaches **Frame 5**. To accomplish this, position the timeline indicator at **Frame 5** to make it the current frame. Then right-click on the timeline and choose **Add Keyframe**.

You cannot set the first keyframe in the timeline unless you have started animating first. There are two ways to set the first keyframe without moving the object or animating it:

1: Click and drag the cursor in the timeline to **Frame 5**. Then select the Translate Layer tool and click on the **Reset** button at the top.

2: Move to frame 5. Then using the Translate Layer tool, click anywhere on the screen (without moving the object), and it will add a keyframe at Frame 5.



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

Do not worry about adding rotation and scale just yet. It's important to get the general motion down first.

Step 6: Set Main Positions

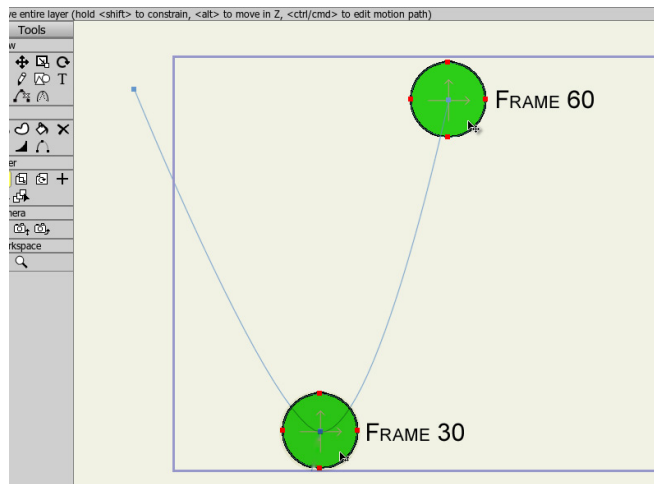


Now we'll set the main positions for the bouncing ball. It will bounce on the floor twice as it goes from the left side of the screen to the right. First, move the timeline indicator to **Frame 30**.

The timeline indicator is the red line with the inverted triangle that is on your currently selected frame. To move the timeline indicator, you can either drag the inverted triangle to the new position (Frame 30) or just click once on the number 30 on the timeline. You can also type the number of the frame into the frame counter (FRAME XX of 240) and hit the enter key to advance to that frame. To be sure that you are in the proper frame, look at the Frame Counter. It should now read **Frame 30 of 240**.

Use the **Translate Layer** tool to drag the ball to the bottom of the stage, positioning it about one-quarter of the way into the scene.

Next, click to select **Frame 60** and move the ball to the top of the stage close to the center.



Generally an appropriate time amount for a ball to bounce 1 or 2 times is 120 frames. However, depending on the volume, speed, rubber consistency and weight of the ball you're animating, you may desire more or less frames.

Note: When you click on a frame and then move an object in the scene, a keyframe will automatically be added.

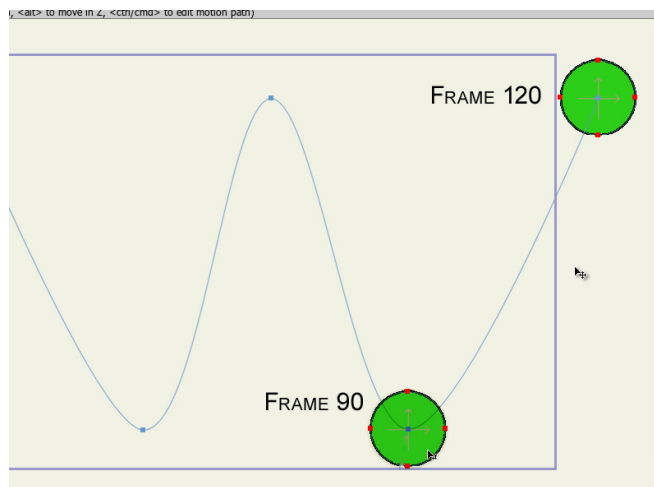
Step 7: Set Main Positions

(continued)



For the second bounce to the floor, click to select **Frame 90**, and move the ball to the lower-right area of the scene, as shown in the screenshot to the right. Finally, click to select **Frame 120**, and move the ball to the top again, this time positioning it outside to the right of the stage.

Now let's set the maximum number of frames for this project. This will keep the ball bouncing only between frames 0 and 120. To do that, reset the Frame Counter to 0 and type the number 120 into the second box. Press ENTER. You should now see that the blue bar on the timeline extends only to **Frame 120**.



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Step 8: Shape the Arcs

Now that we have the main positions set, you'll want to preview your work. To do that, reset the Frame Counter to 0 and press the PLAY button on the timeline indicator. You'll notice that the ball is travelling along paths that are fairly straight. In reality, a ball bounces along paths that look more like arcs, so we'll refine those next.

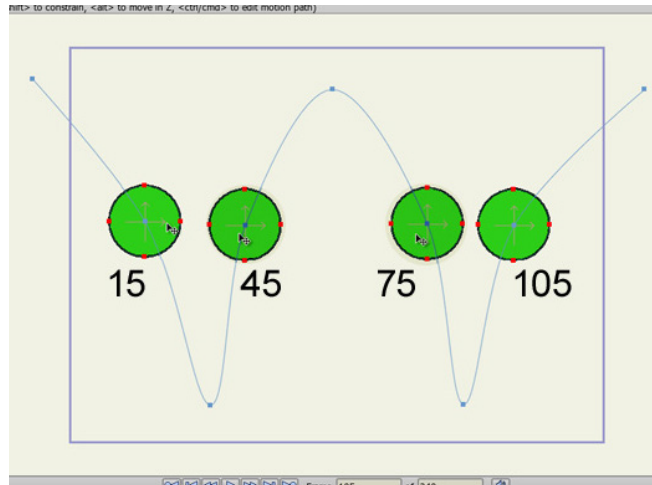


Move to **Frame 15** and use the **Translate Layer** tool to move the ball toward the right, making the first arc.

At **Frame 45**, drag the ball toward the left.

At **Frame 75**, drag the ball toward the right again.

Finally, at **Frame 105**, drag the ball toward the left again. Now you have your arcs!

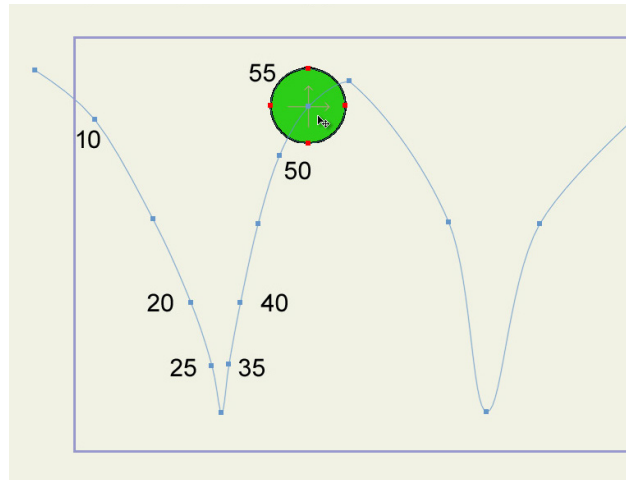


Step 9: Add Intermediate Keyframes



To refine the shape of the arcs, we'll add additional keyframes at about every fifth frame. We'll speed through them in this tutorial, but they are all accomplished with the **Translate Layer** tool as you've already completed.

Start with **Frames 10, 20, and 25**. **Frame 30** is done so we'll skip to **35**, then **40**. Skip **45** (it's done) and go to **Frame 50**, then **55**. The first arc is complete.

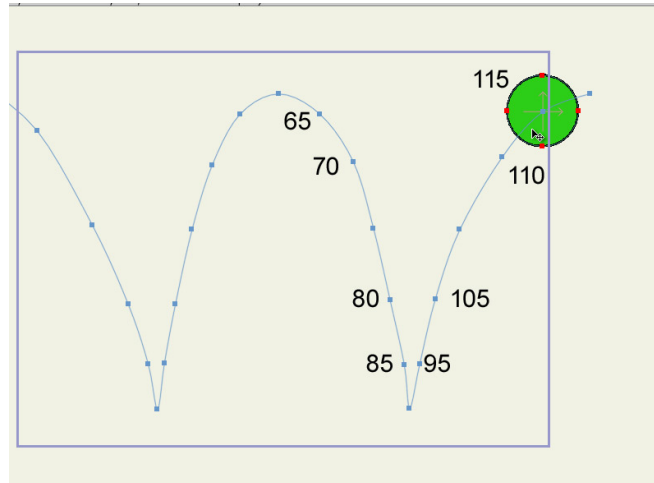


Remember, to add additional **Keyframes**, position your mouse on the timeline (light blue bar with the light blue dots on it) at the frame you want to work with. Right-click (Windows) or Control-click (Mac) and choose **ADD KEYFRAME** from the menu.

Step 10: Intermediate Keyframes (continued)



Now adjust **Frames 65, 70, 80, and frame 85**. Skip to **95, 100, 110, and 115**. Now both arcs are complete.



In order to **use the drawing tools** on a frame other than Frame zero, you have to instruct Anime Studio to allow it. In the menu, choose **Anime Studio Debut (or Edit) > Preferences** and click the **Options** tab if it is not displayed. Uncheck the “**Enable Drawing Tools Only on Frame 0**” option.

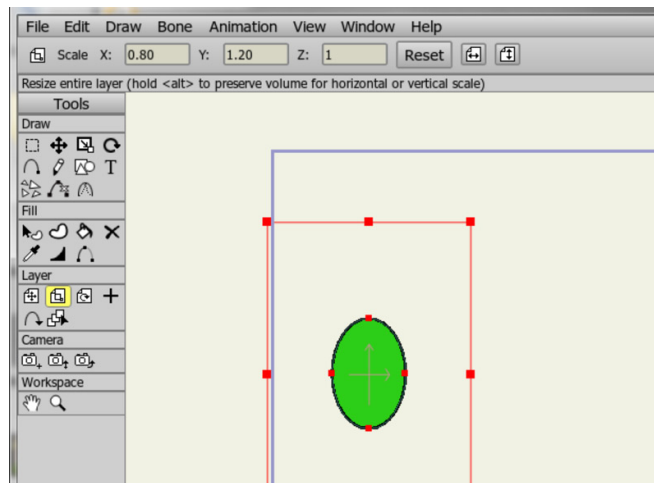
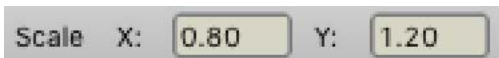
Step 11: Stretching the Ball



And now the subject of our tutorial: Squash and Stretch. In Anime Studio, you’ll use the **Scale Layer** tool to squash and stretch the ball as it bounces.

Select the **Translate Layer** tool from the Layers section of the toolbox. Move to **Frame 15**. You’ll perform the first stretch here. Press the **Alt** key while you move the bottom center-point of the bounding box down so the ball keeps its volume.

While you scale, keep your eye on the **Scale X** and **Scale Y** values in the Properties bar. You will not see them change until you release the mouse button. Please note, you’ll use the same X and Y scale values for the three other frames where the ball is in mid-air. You can manually enter values that are easier to remember. Here we’ll change the **X** to **.8** and **Y** to **1.2**.

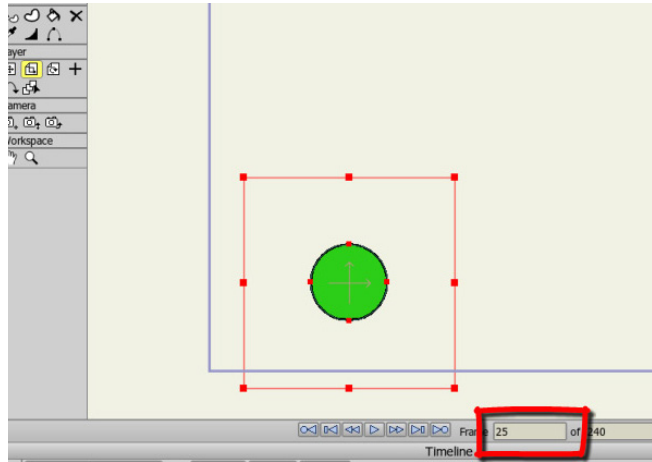


The **Rotate Layer** and **Scale Layer** tools are now built into the **Translate Layer** tool. First, choose the T tool and then move your cursor to a point on the bounding box. Placing your cursor on a bounding box will activate the **Scale Layer** tool, while placing your cursor just outside a corner bounding box will activate the **Rotate Layer** tool.

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Step 12: Prepare for the Squash

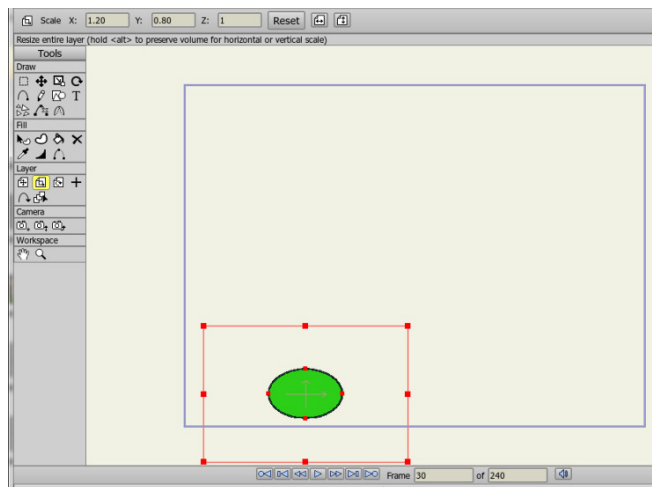
Just before the ball hits the ground, we want it to be in its round shape so that the stretch won't affect the squash. So at Frame 25, return the X Scale and the Y Scale values to 1.



Step 13: Squashing the Ball



At Frame 30, when the ball hits the ground, you want it to squash. We'll keep the values similar to the stretch, but we'll switch the X and Y around. So at Frame 30, set the X value for the squash to 1.2 and the Y value to .8.



Step 14: Complete the First Bounce

With one-half of the bounce done, you should have a pretty good idea of how to do the remaining ones.

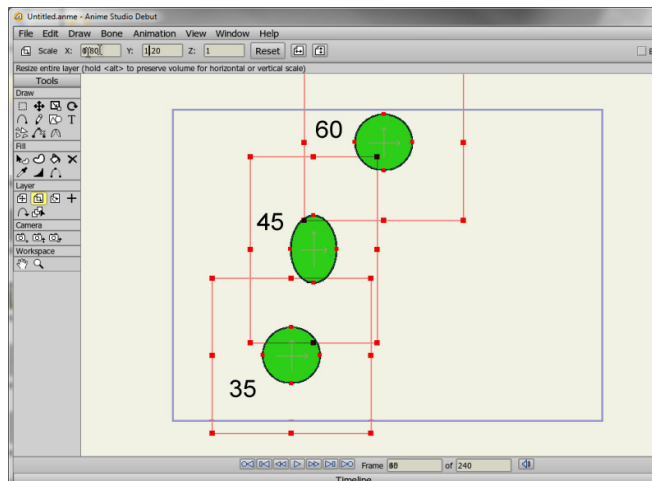
NOTE: In the steps that follow, for Normal scale, set both X and Y to 1. For Stretch, set X to .8 and Y to 1.2. For Squash, set X to 1.2 and Y to 1.8.



At Frame 35 you want the ball to be round. Set X and Y scale values to 1.

Stretch at Frame 45.
(X Scale = .8, Y Scale = 1.2)

Normal scale at Frame 60.
(X Scale = 1, Y Scale = 1)

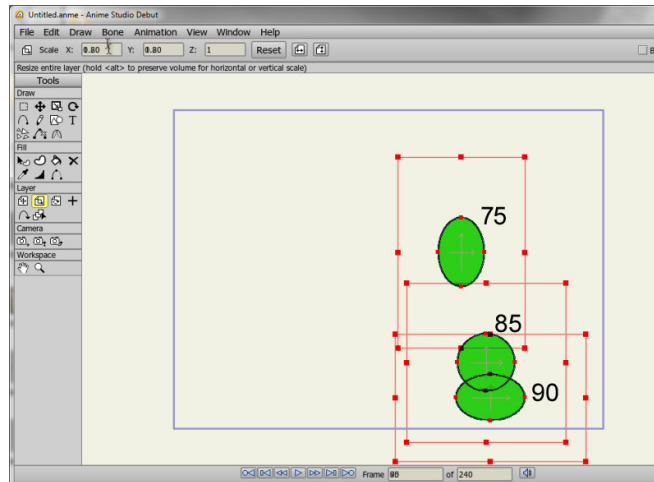


Note: A perfect circle has X Scale = 1, Y Scale = 1 coordinates and is also referred to as "Normal Scale" in this lesson. You can view and edit the coordinates of an object by selecting it with the **Scale Layer** tool.

Step 15: The Second Bounce



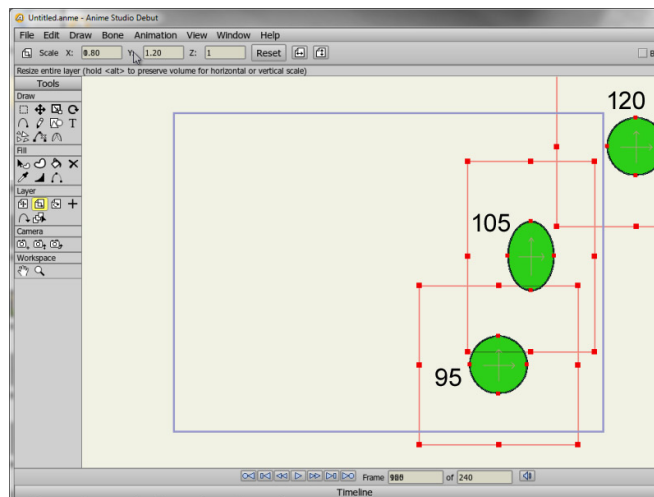
- Stretch at Frame 75.
(X Scale = .8, Y Scale = 1.2)
- Normal scale at Frame 85.
(X Scale = 1, Y Scale = 1)
- Squash at Frame 90.
(X Scale = 1.2, Y Scale = .8)



Step 16: The Second Bounce (continued)



- Normal scale at Frame 95.
(X Scale = 1, Y Scale = 1)
- Stretch at Frame 105.
(X Scale = .8, Y Scale = 1.2)
- And at Frame 120, reset it to normal size.
(X Scale = 1, Y Scale = 1)



Step 17: Rotating the Ball to the Path

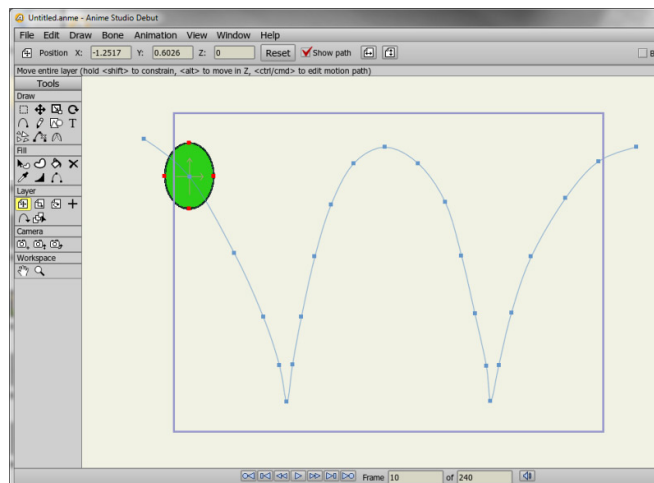


Click the **Translate Layer** tool to display the path beneath the shape on the selected frame.



Then switch to the **Rotate Layer** tool to tweak the rotation of the ball on the path. Check the rotation of the ball on each of the keyframes.

First we'll look at **Frame 15**. Notice how the ball appears straight up and down, and not aligned on the path at all. Use the **Rotate Layer** tool to fix that.



The **Rotate Layer** and **Scale Layer** tools are now built into the **Translate Layer** tool. First, choose the T tool and then move your cursor to a point on the bounding box. Placing your cursor on a bounding box will activate the **Scale Layer** tool, while placing your cursor just outside a corner bounding box will activate the **Rotate Layer** tool.

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Step 18: Rotating the Ball to the Path (continued)

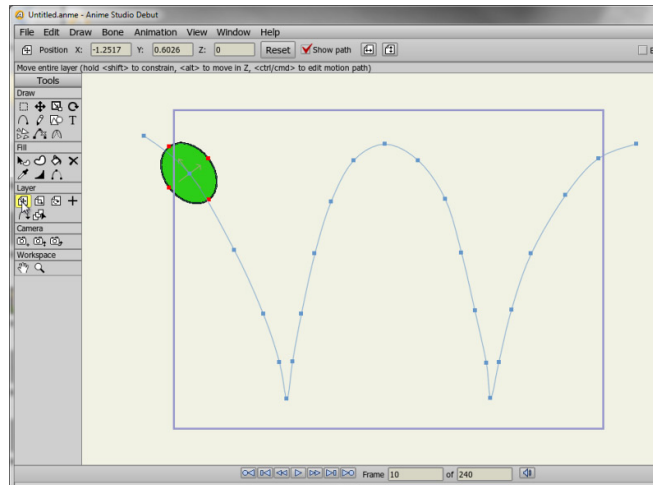


When the **Rotate Layer** tool is selected, the path may disappear. Check the Show path box in the header to always see the path.



Show path

Continue going back and forth between the **Translate Layer** tool and the **Rotate Layer** tool to get it right.



Step 19: Finishing the Project



The remaining Keyframes are done in pretty much the same manner. After your shapes are done, press the **Play** button to review your work. To review it in a frame-by-frame view, reset the counter to 0 and use the **Right Arrow** key to advance forward and the **Left Arrow** key to go back.

Continue to tweak your shapes until you're happy and then save your project.

Now we will export/render our animation so you can view it in popular movie players, such as Flash® and QuickTime®. Go to **File > Export Animation** and enter **Start Frame 1** and **End frame 120**. The end frame represents the last frame in your animation. Choose your output format such as QuickTime Movie, Flash [SWF] or Windows-only AVI and click **OK** to render your animation.

You can also upload your animation to YouTube™ or share it on Facebook® by selecting either option from the **File** menu.

Great job!

