Graph Editor

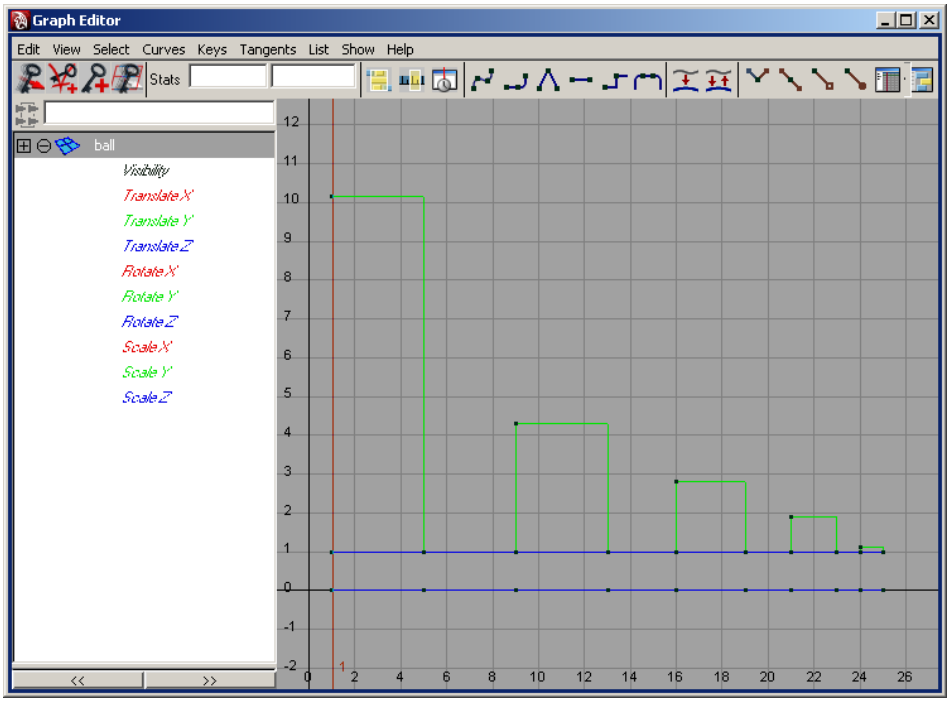
To open the Graph Editor:

- From the main menu bar, select Windows > Animation Editors > Graph Editor
- from the view menu bar, select Panels > Panel > Graph Editor

The Graph Editor is a graphical representation of the animated attributes in your scene, shown as animation curves. The Graph Editor lets you manipulate animation curves and keys within a graph view of a scene.

Navigating the Graph Editor

To access the Graph Editor, go to **Window → Animation Editors → Graph Editor**. Now select the ball to bring up its information. The Graph Editor should look something like this:



If not, click on  or use the **f** key. As the editor's name implies, the main window displays the ball's keyframe information in the form of a graph. The x-axis corresponds to frames and the y-axis corresponds to attribute values. The dark red vertical bar represents the current frame, similar to the time slider in the timeline. The black dots represent attribute keyframes and the lines connecting them, also known as "animation curves", define how the keys interpolate.

Graph Editor navigation works exactly like camera navigation. Hold down **Alt** and drag the mouse while using either the center mouse button to pan or the right mouse button to zoom. Also as with the camera, rolling the scroll wheel will zoom. You can select attribute keys by clicking on them or using marquee selection, and delete them using **Delete**.

As you may have done previously, clicking on  will frame the window around all of the currently displayed animation curves. If no keys are selected in the graph, you can also hit **f** to do this. If there are keys selected, **f** will frame the selected keys.  frames the window based on the timeline's range, and  centers the existing framing on the current time.

To move selected keys, hit **w** to choose the move tool then middle click and drag. You can also hold down **Shift** before moving to lock the move either horizontally or vertically, allowing you to edit only the key's frame or edit only its attribute value. To scale selected keys, hit **r** to choose the scale tool then middle click drag in the direction you want to scale. Note that the keys will scale relative to where the mouse pointer was when the scale operation was initiated. Scaling can be useful for quickly changing the extremity of an animation, such as altering how high a ball bounces.

The animation curves are colored based on the attribute list to the left for quicker identification. In general, red identifies *x* based attributes, green identifies *y* based attributes, blue identifies *z* based attributes, and black is used for miscellaneous attributes such as Visibility. By default the graph displays all of a selected object's curves. To isolate a single curve click on one of the attributes in the list. To figure out which attribute a given curve belongs to, select at least one of its keys and a small box will appear next to the appropriate attribute in the list.

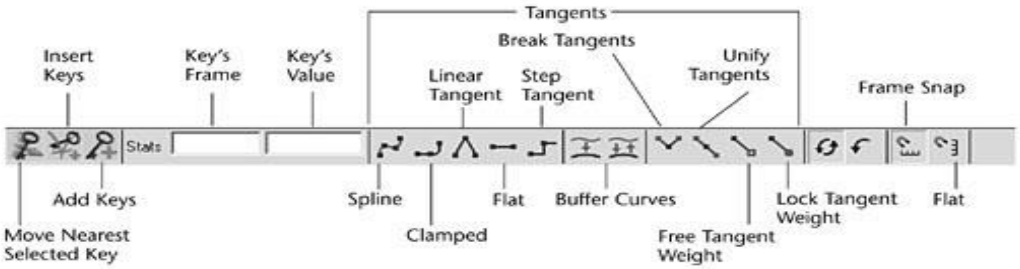
Graph Editor Tangents

Tangents describe the entry and exit of curve segments from a key. This menu operates on the shape of curve segments around selected keys. Note that these settings affect only existing animation curves segments' tangents.

Tip:

If the Graph Editor is displayed in a panel, you can also edit tangents using the marking menu. In the Graph Editor, press 

+ s +  -click to display the marking menu.



Spline

Specifying a spline tangent creates an animation curve that is smooth between the key before and the key after the selected key. The tangents of the curve are co-linear (both at the same angle). This ensures that the animation curve smoothly enters and exits the key. When animating fluid movement, a spline tangent is an excellent place to start. You use a minimum number of keys to achieve your look.

Linear

Specifying a linear tangent creates an animation curve as a straight line joining two keys. If the in tangent type is linear, the curve segment before the key is a straight line. If the out-tangent type is linear, the curve segment after the key is a straight line. When animating the color of a heating element on a stove, you would use linear to achieve that gradual change in color from charcoal gray to burning hot red.

Clamped

Specifying a clamped tangent creates an animation curve that has the characteristics of linear and spline curves.

The keys' tangents will be splines unless the value of two adjacent keys are very close. In this case, the out tangent of the first key and the in tangent of the second key will be interpolated as linear.

When animating a skeleton in a walk-cycle, you may notice a slipping of the pelvic and foot joint position. This occurs because the value of the keys on the curve are either the same or close to (within tolerance of) the value of the other. Maya assigns a default spline tangent to describe what occurs between these keys. This is why you get the joint positions slipping.

By setting the tangent type to clamped for these keys, the slipping is corrected and the tangents becomes a combination of linear and spline.

In the Maya environment preferences, Clamped is the default tangent type.

Stepped

Specifying a stepped tangent creates an animation curve whose out tangent is a flat curve.

The curve segment is flat (horizontal), so the value changes at the key without gradation.

The light from a strobe light turns on and off. To create a strobe-like effect, you would use a step tangent.

Stepped Next

FBIK animation keys use the stepped next tangent type by default. This tangent type differs from regular Stepped tangents in that its interpolation values jump immediately to that of the next key, rather than holding the value of the current key until the next key is reached.

Flat

Sets the in and out tangents of the key to be horizontal (with a slope of 0 degrees). When a ball reaches its ascent, it hangs in the air for a brief time before starting its descent. You can create this effect by using a flat tangent.

Fixed

Specifying a fixed tangent allows a key's tangents to remain unchanged as the key is edited.

When animating a ball, you may find the ball isn't falling from a desired height, yet its impact with the floor and everything else is perfect. Using a fixed tangent lets you change the height of the ball while retaining the tangent's angle. This is somewhat different from Edit > Keys > Bake Simulation.

This process is useful when you want to:

- Edit a single animation curve instead of all the contributing attributes that affect the behavior of a single attribute, for example, an object affected by a driven key or an Expression.
- Add keys to an existing curve

Plateau

Plateau tangents ease animation curves in and out of their keyframes like spline tangents, but also flatten curve segments that occur between equal-valued keyframes like clamped tangents. The plateau tangent normally behaves like a spline tangent, but ensures that the minimum and maximum values along a curve are all at keyframes.

Plateau tangents are useful when you want the positions of your keyframes to be exact, because they ensure the maximum and minimum values ('hills and valleys') of the curve do not extend past their keyframes. For example, picture an animation of a ball rolling off a table, falling to the floor, and then rolling on the floor. With spline tangents, the ball falls through the floor, then comes back up to the floor. With plateau tangents, the ball will not fall through the floor. The tangents guarantee that your animation will not wander beyond the values you keyframed.

To do this, if a spline tangent would produce a minimum or maximum between two keyframes, the plateau tangent flattens the keyframes in question. Keyframes at local minimum and maximum points along the curve are also flattened. Finally, the first and last keyframe along a curve are always flattened if they have plateau tangents.

Auto

Auto tangents clamp curve values between frames to a maximum or minimum point based on the adjacent keyframe values. Auto tangents are the default type for new keys (set as the **Default in tangent** and **Default out tangent** in your Animation (Settings) preferences).

Specifying Auto tangents creates an animation curve where the first and last keyframes have flat tangents, and keyframes in between do not overshoot the neighboring keyframe value. This type of curve prevents issues with interpenetration of closely animated objects that can occur with other tangent types, such as Spline.

In Tangent menu

Lets you specify a type of tangent for the In Tangent only. The In Tangent defines the type of curve segment that comes before a key.

Note: You can also set the Default In Tangent for new keys in the Preferences window. See Default In Tangent.

Out Tangent menu

Lets you specify a type of tangent for the Out Tangent only. The Out Tangent defines the type of curve segment that comes after a key.

Note: You can also set the Default Out Tangent for new keys in the Preferences window. See Default Out Tangent.

Break Tangents

Allows manipulation of the in and out tangent handles individually so you can edit the curve segment entering or exiting the key without affecting its opposite handle.

Unify Tangents

Causes the manipulation of an in or out tangent handle to affect its opposite handle equally. Unify Tangents retains the relative position of the tangent handles even after tangents are individually adjusted (by editing tangents separately after choosing Keys > Break Tangents).

Lock Tangent Weight

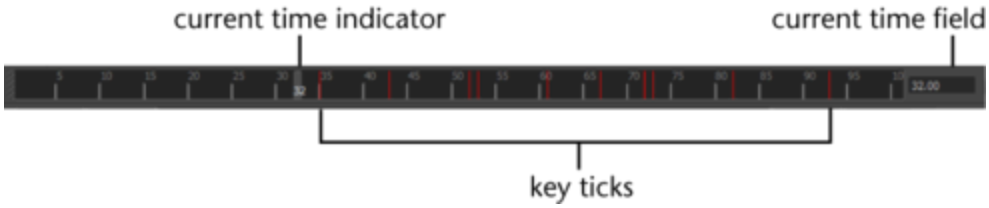
Specifies that when you move a tangent, only its angle can be changed. This forces the associated curve segment to retain the weight of the tangent. This applies only to weighted curves.

Free Tangent Weight

Specifies that when you move a tangent, its angle and weight can be changed. This allows the weight of a tangent to be adjusted as well as the angle. This only applies to weighted curves.

Time Slider

The Time Slider controls the playback range, keys, and breakdowns within the playback range.



The Current Time Indicator is a gray block on the Time Slider. You can drag it to move forward and backward in your animation.

By default, dragging in the Time Slider updates only the active view. All views can be set to update by changing the Playback settings to Update View All in the Time Slider preferences (Window > Settings/Preferences > Preferences).

Note: See Customize the Time Slider if you want to change the colors and opacity of elements in the Time Slider.

Key ticks

Key Ticks are red (by default) marks in the Time Slider that represent the keys you set for the selected object. Breakdowns are a special type of key displayed as green marks in the Time Slider. See Breakdowns.

The visibility of Key Ticks can be turned off or on in the Preferences window. You can also set the size and color of the key ticks displayed in the Time Slider. See Customize the Time Slider.

Time units

The ruler markings and associated numbers on the Time Slider display time. To define the playback rate, select the desired Time unit in the Settings preferences (Window > Settings/Preferences > Preferences). Maya defaults to measuring time as 30 frames per second.

Note: By default, Maya plays your animation in seconds. You can change the Time unit type without affecting your animation’s key-based behavior, but it's a good idea to specify the Time unit before you begin animating.

Current time field

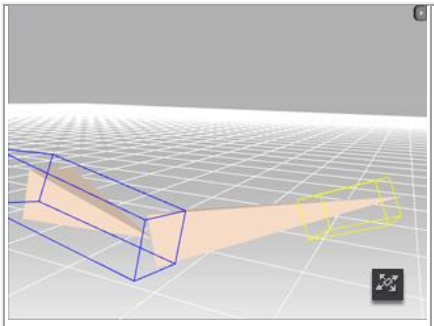
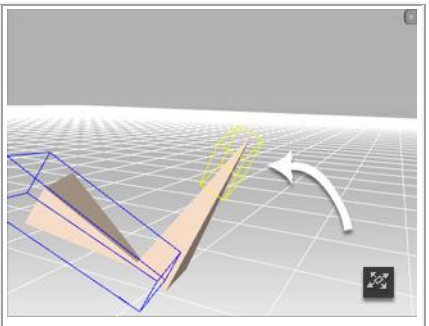
The entry field to the right of the Time Slider indicates the current time expressed in the current Time unit. You can change the current time by entering a new value. Your scene moves to that location in time, and the Current Time Indicator updates accordingly.

What is IK/FK

What is IK

IK, **Inverse Kinematics**, refers to a process utilized in 3D computer graphic animation. In this process, the parameters of each articulation, in a jointed flexible object (a kinematic chain), will be automatically calculated to achieve a desired pose, especially when the end point moves.

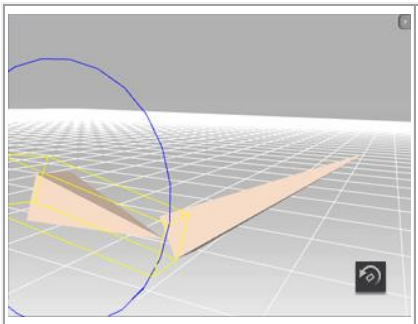
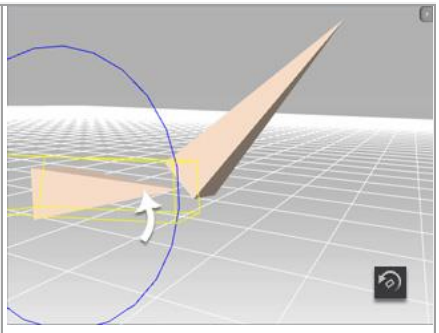
Basically speaking, IK is how the child node, as it moves, effects all the parents' position and orientation values.

	
Child node selected	Offsets of all nodes in the chain gets affected

What is FK

FK, **Forward Kinematics**, is how the positions of particular parts of a model at a specified time are calculated from the position and orientation, together with any information on them of an articulated model.

To sum up, FK refers to the effect on the child nodes as the parent moves or rotates.

	
Parent node selected	Only parent's offset gets affected

Playblast Animation

A Playblast is a quick preview that lets you make a "sketch" of your animation, providing a realistic idea of your final render result without requiring the time needed for a formal render. Playblasting gives you a fast way to evaluate your work on the fly, taking a screen grab of the animation in the viewport at each frame during playback, and then “blasting” those images to an image viewer.

By default, Playblast generates a movie or images using the active view and the current time range in the Time Slider to determine the animation range. The default scale is 0.5, which makes the Playblast image resolution one quarter the size of the active view.

- Create or open an animation.
- Select Window > Playblast > ❐to open the Playblast Options.
- Select the Format for the playblast output.

The Encoding drop-down updates automatically with associated codecs.

Tip: To create an image sequence instead of a movie, set Format to image, then select an image format in the Encoding drop-down list.

- (Optional) Select the codec or image format you want to use from the Encoding drop-down list.

Tip: Set Encoding to global to use the same format you have specified in the Render Settings: Common tab.

- Set the compression Quality value you want.
- Set Display Size to From Window.
- Click in a view to make it active.
- Click Playblast.

The scene plays in the active view for the playback range in the Time Slider. After each time frame is drawn, Maya takes a screen grab of the active view.

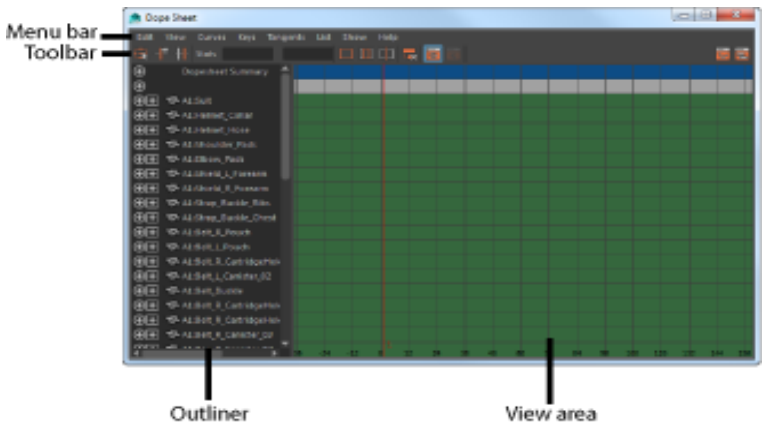
Dope Sheet editor

- From the main menu, choose Windows > Animation Editors > Dope Sheet.
- From the scene view, choose Panels > Panel > Dope Sheet.
- Click the Open the Dope Sheet icon in the Graph Editor window.

The Dope Sheet lets you edit event and sound synchronization and timing.

Use the Dope Sheet to manipulate key times, represented as colored rectangles in the view area. The blocks represent integer time units along the horizontal axis. The vertical axis represents the items currently loaded into the Dope Sheet outliner.

The Dope Sheet editor contains menu bar, icons, outliner, and the view area.



Draw Walk-Cycle

Getting Setup

- create a new project called “WalkTakeOne”
- copy the rig file (generi_rig.mb) to the scenes folder in the new project (do NOT open this file. You do not want to edit it directly)

Create a reference to your character before animating it

By creating a reference, you can animate your character without affecting the rig. This allows you to go back later and change your original model and the changes will then be applied automatically to the animation you have generated.

- File->new scene
- File->create reference [options]
    - Under Namespace Options, you can either leave “Use namespaces checked” (Maya’s new reference management system) or set Resolve All
    - Click “Reference”
    - Select “generi_rig.mb” in the dialog and select “reference” (You could use a different model here instead, such as Hogan.)
- We will not use arm IK, so be sure to turn that off. See the character warm up tutorial for details.

Animate Feet Sliding

- reduce the timeline to 20 units (enough for one walk cycle)
- move to a side view of your character
- The character will take two steps in the 20 frames.
- bring up the outliner. (Window->outliner, or Panels->savedLayouts->Persp/Outliner) It is useful for selecting body parts.
    - Select gerry:foot_ctrl_R under anim_Leg_R. This will be used to move the right foot forward
- The character will start in a stride position. We will key the IK handles on the feet and pelvis
    - Set the translate z of the R foot ctrl to 4
    - Set the translate z of the L foot ctrl to 0
    - Set the translate z of the cog_ctrl to 2.1
    - Key the translate parameters for each of these controls
-

- Now key the next step
    - Advance the timeline to frame 10
    - Set the translate Z of the L Foot ctrl to be 8
    - Set the translate Z of the Cog_ctrl to be 6.1
    - Leave the right foot where it is
    - Key each of these attributes
- Now key the next step
    - Advance the timeline to frame 20
    - Set the translate Z of the R Foot ctrl to be12
    - Set the translate Z of the Cog_ctrl to be 10.1
    - Do not move the left foot
    - Key the values of all three

- If you play your animation, your character should do a basic shuffle

Adjusting Animation Curves

Ultimately, we want to cycle the frames we've recorded to create a continuous walk sequence. To do this, we need to adjust the curves.

- select your character
- Window->animation editors->graph editor
- In the graph editor, select the z translate channels for the two feet. (Deselect everything, find the channels on the left. Click on one and then hold down the apple key and click on the other)
- View->Frame selected will give you a better view of the curves.

- Notice the tangents at the end. Select Tangents->flat This will set up the curves for sequencing.

Adding Pelvic Twist

The process now is to add more and more detail to your animation. We begin by adding twist to the pelvis.

- go to frame 1
- select the cog_ctrl
- adjust the pelvic y rotation to be about 10
- key this
- move to frame 10
- adjust the pelvic y rotation to be about -10
- to set the final rotation we will copy the first (this is just to give you practice with copying)
    - go to frame 1
    - MMB drag to frame 20
    - The cog_ctrl should still be selected. Highlight the rotate Y attribute in the channel box and RMB->key selected

    - Clicking anywhere on the timeline will reset it

- Save your animation! Get in the practice of saving frequently and renaming your files every so often to create a version history. Also view your animation from different angles throughout the animation process.

Add pelvic sway

- go to frame 5
- rotate the pelvis slightly up on the character's right side so the hip lifts with the leg
- translate the cog_ctrl to the left so that the weight is more on the support foot
- go to frame 15 and do the same thing (well, the opposite, actually)
- What animation principle is being invoked here?

Add bounce to the walk

For this, we will work in the graph editor to see a different way to manipulate your keys

- Open the graph editor
- Select the cog_ctrl translate y channel (make sure it is selected)
- Activate the insert keyframe tool (upper left corner of graph editor, one in from the left)
- With the curve selected, MMB click at frame 5 and 15 on the translate curve to add keys
- Select both these keys (select one and shift select the other)
- Hit w to select the move tool
- With the MMB, drag the keys up to about .5. Play the animation to have a look at your edit.

Add foot lifts

- go to frame 5
- lift the left foot off the ground about .7. Set a key.
- go to frame 15 and do the same thing for the right foot.
- View your animation.

Add arm motion

- Work on your own to add satisfactory arm swing and head rotation
- Go to frame 1 and bring the one arm back and slightly behind the character, bring the other arm in front with more of a bend
- Copy these frames to frame 20
    - MMB drag from frame 1 to 20

    - With the two shoulder controls selected, select the channels that you changed in the channel editor and RMB->key selected

    - Play your animation
- Go back and add a key at frame 10
    - Here you want the opposite arrangements of the arms as the opposite legs are forward

- Play your animation and make adjustments as needed.
- Note, this is very limited animation on the character's upper body. You will need to add more detail than this on your assignment.

Refining your animation

This is a very basic walk cycle. At this point we have not included any of the following:

- a succession of movement through the spine and into the arms
- a foot roll along the ground (e.g. add in toe bend)
- head movement
- personality!
- Experiment with refining this basic animation

Cycling the animation

At this point, you can cycle the animation in the graph editor to create a continuous walk.

Animating a bouncing ball

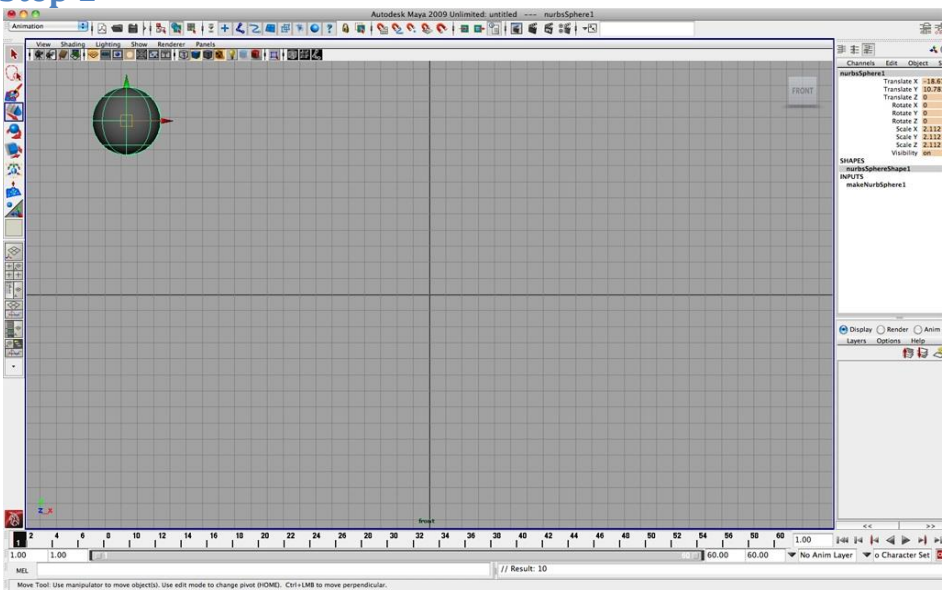
First things first. Before we can animate a believable bouncing ball, we need to know how an actual bouncing ball reacts when it bounces. Go find a nice rubbery ball – and drop it on the floor. Watch how it reacts to gravity. You could also videotape the ball in action and play the video back frame by frame. I always encourage students to investigate real world objects they're trying to animate – in this case, experiment with different types of balls, a tennis ball, a golf ball, etc. You might not see it now, but this will come in very handy for the second part of this tutorial when we'll be making a ball move like it's actually made of something besides pixels.

A real bouncing ball can be a great resource for an animator.

Now you're ready to get started animating in Maya (I'm assuming you already know some of Maya's interface – if not, then review the Autodesk Maya documentation and introductory tutorials). First, make sure you have the viewport and timeline showing. Now give yourself enough time for a decent animation, say, 60 frames. Don't worry, if you need more, you can add it later. Also, it will be easier if you have *auto-key mode* set to "on." The only other element you need is a ball. That's pretty simple, just create either a polygonal or NURBS sphere. The size and placement won't matter for this lesson.

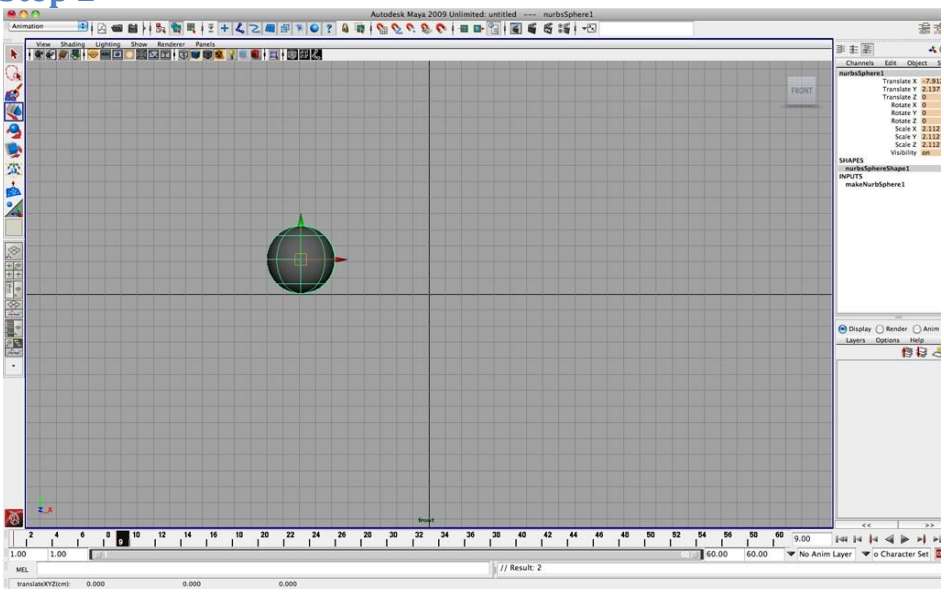
Initial Keyframes

Step 1



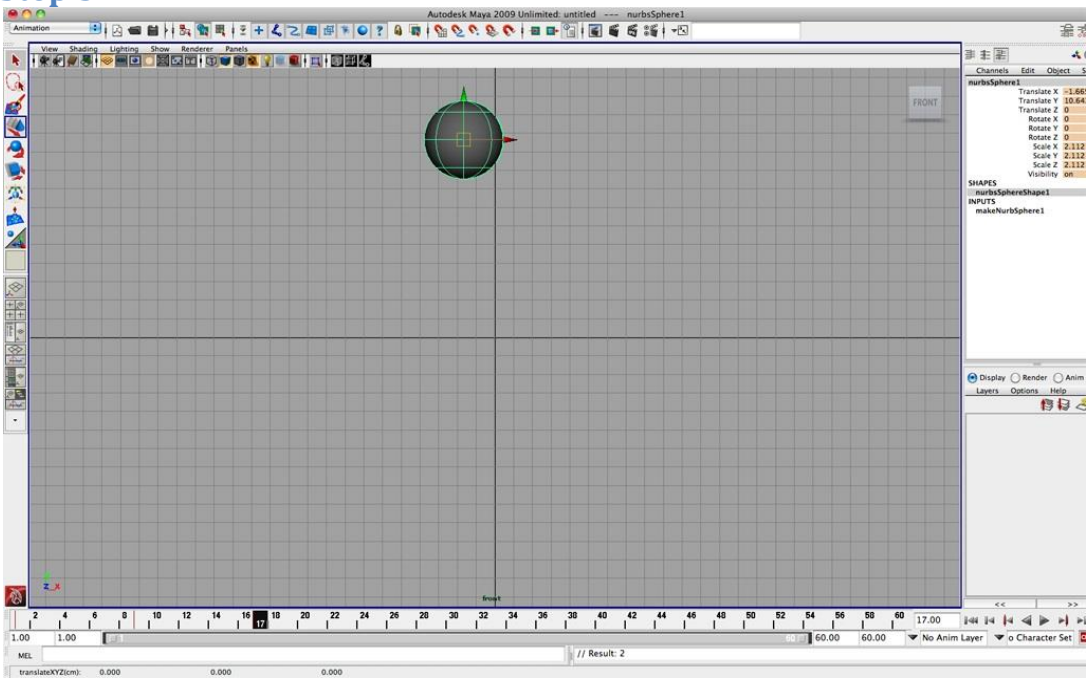
Start on frame 1. Set the viewport to the front view. Move your sphere somewhere up (+Y) and to the left (-X), place the object "up in the air," so to speak. Now press "S" to set a keyframe for all the attributes.

Step 2



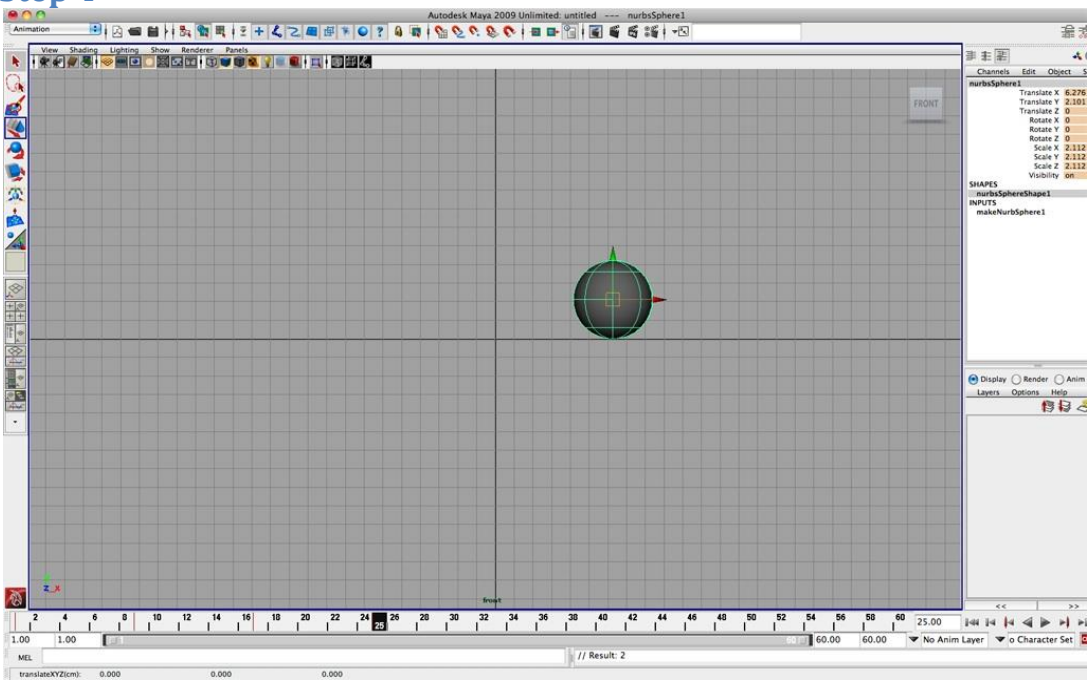
Now, move ahead in the timeline to frame 9 (just an arbitrary choice – we'll adjust timing later). Move the ball down (-Y) and to the right (+X) so that it looks like it's hitting the "ground." The auto-key setting should automatically set a keyframe on the changed values.

Step 3



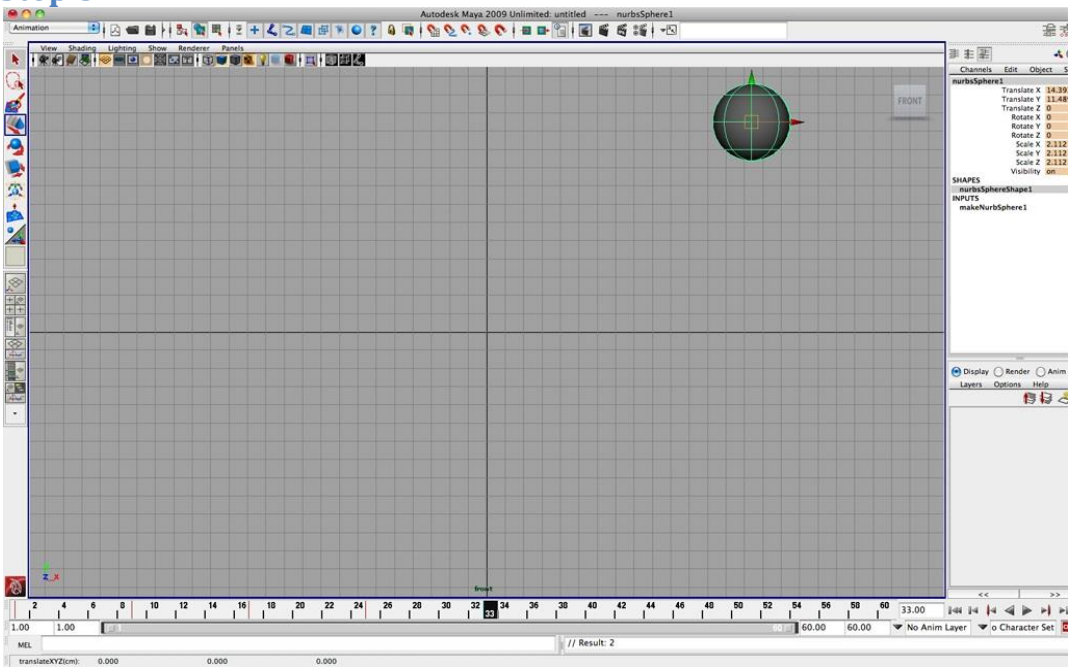
Move ahead to frame 17 and once again move the ball upward (+Y) and to the right (+X) so that it looks like it's in the air again.

Step 4



Move forward to frame 25 and move the ball down (-Y) and to the right (+X) so that it is on the ground again.

Step 5



Repeat the last couple steps, putting the ball in the air at frame 33 and on the ground again at frame 41.