EXPERIMENT 9

COMPUTER GRAPICS AND MULTIMEDIA

Aim

Using Flash/Maya perform different operations (rotation, scaling, move etc.) on objects.

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EXPERIMENT 9

AIM:
Using Flash/Maya perform different operations (rotation, scaling move etc.) on objects.

THEORY:
Maya, is a 3D computer graphics application that runs on Windows, macOS and Linux,

originally developed by Alias Systems Corporation (formerly Alia Wavefront) and currently

owned and developed by Autodesk, Inc. It is used to create interactive 3D applications,

including video games, animated film, TV series, or visual effects.

Moving from 2D to 3D design can be challenging since most of us design using only two dimensions. However, you 've done this before but you just don 't remembers! Maybe you haven 't realized that building objects in Maya 3D is somehow similar to building objects using Legos. The key to design in Maya 3D is to think spatially. In Maya, we design not only acknowledging width and height we also incorporate depth!

1. X, Y and Z
In Maya the X axis is the width (red), the y axis is the height (green) and the Z axis is the depth (blue). The y axis is also referred to as Y – up. The center of the coordinate system is called the origin and the coordinates are 0, 0, 0 for x, y, z.

If you want to manipulate an object in Maya you can:

a) Enter x, y and z values for translate, rotate and scale in — Channel Box

• Translate: Value — 0 in x, y and z, position the object on the center or — origin ‖ of the workspace.

• Rotate: If you by mistake rotate an object, set all the values to — 0. This will take the object back to its

default position.

• Scale: — 1is the default value and it means the object 's size is100%. If you want to make the object twice its size enter 2 in all the scale values. If you want to make an object half its size enter 0.5 in all the scale values.

b) Use the manipulators handles of the move tool, scale tool and rotate tool.

When moving & rotating objects in Maya, it 's recommended that you move or rotate the object only along one axis, this can help you maintain your objects aligned.

You can do this by pulling the arrows of the move tool or by dragging the rings

Of the rotate tool. Moving the objects from the center handle will allow you to move the object freely across the view plane and it can be hard to control its translation and rotation.

When scaling object is Maya, if you want to maintain the object 's proportions drag the center box to

scale uniformly in all directions.

2. Views

When working in a 3D environment is very important to check that the object you are building looks good in all the views. Looking to just one view can be deceiving and you object might not be

Positioned correctly.

In order to ease the design process Maya provides up to 4 views, one perspective view and three orthographic views.

When you look at the object from the perspective view you can resolve the camera to freely tumble around the object. However, when you use orthographic views (top, side & front) they only focus in 2 axes at the time, so you can 't tumble around (unless you use the tumble tool).

3. Polygonal Modeling vs NURBS Modeling Polygons:

Polygons are the most basic genome try in Maya they are straight sided shapes of 3 sides or more. Polygons have faces, edges & vertices, some examples of polygons or primitives' hopes are spheres, cubes, cylinders, cones, and planes.

Because polygon 's surfaces can be directly extruded, scaled and positioned designers prefer them to create characters in Maya.

NURBS Curves and NURBS Surfaces:

NURBS curves stand for Non-Uniform Rational B-Splines. NURBS curves are very handy since you can

draw them in Maya or import them from a vector program like Adobe Illustrator.

NURBS primitives or surfaces, use UV coordinate space and you can modify them by trimming away portions of their forms, beveling their edges, or by sculpting the min to different shapes using the Maya artisan sculpting tools

NURBS are preferred for constructing organic 3D forms because of their smooth & natural characteristics.

Pivot

All transformations to an object are relative to the pivot point. The object 's pivot affects scale since the object will scale out from origin toward the pivot point. The pivot also affects the object 's rotation/animation because an object rotates around the pivot point.

4. Subdivisions Polygon Subdivisions:

If a polygon has less subdivisions, for example a value of—5 ‖, it will have less detail and a rougher surface.

If a polygon has more sub divisions, for example a value of — 20 ‖, it will have more detail & a smoother surface.

NURBS Subdivisions

If a NURB has less sections & spans, for example a value of — 2, it will have less detail and a rougher surface

If a NURB has more sections & spans, for example a value of — 20, it will have more detail and a smoother

5. UV Coordinate Space:

Surfaces in Maya have their own coordinate space. UV Coordinate Space is useful when working

with curve-on-surfaces and positioning textures.

6. Nodes

Every element in Maya is built with a single or a series of nodes. Nodes define all attributes like lighting, shading and geometry.

For example a primitive polygon, such as a sphere, is built from several nodes: a creation node that records the options that created the sphere, a transform node that records how the object is moved, rotated, and scaled, and a shape node that stores the positions of the spheres control points.

Shape nodes:

Holdsanobject'sgeometryattributesorattributesotherthantheobject'stransformnodeattributes.

Renderingnodes:

Materialsandtextureseachhavenodescontainingattributesthatcontroltheirlook.Textureplaceme

ntnodes haveattributes that control how atextureis fitted onto a surface.

Attributes

An attribute is a position associated with a node that can hold a value or a connection to another node. Attributes control how a node works. For example, a transform node has attributes for the amount of rotation in X, Y, and Z. You can set attributes to control practically every aspect of your animation.

There are many ways to set attributes in Maya: with the Attribute Editor, the Channel Box, the Attribute Spread Sheet, menu selections, and MEL.

Channel Box   Attribute Editor
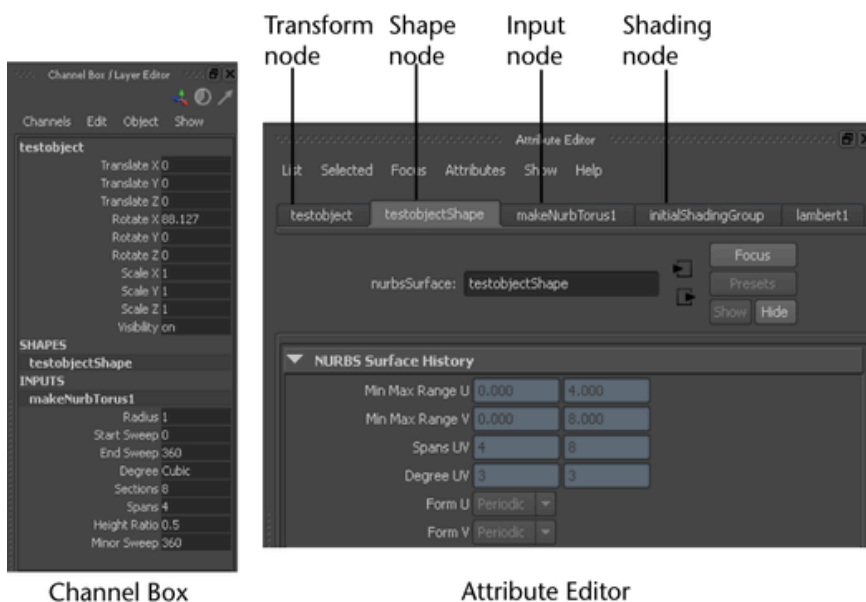
Every node is created with certain default attributes. Some attributes (such as Opacity and Color of particle objects) are added dynamically when you need them.

You can also add your own attributes to any node to store information. This is often useful for animation expressions and scripts, and can be used to control several normal attributes using one custom attribute.

Attention: Node and attribute names in Maya cannot begin with a number.

Keyable attributes

Animation in Maya is not limited to making things move. You can animate practically any attribute of any node in Maya. Attributes that control how a surface is constructed, or the look of a texture, or the influence of a deformer or physical force, can all change over time.

Construction history

As you work in Maya, most of your actions create nodes in the Construction history of the objects you work on. At each point in your work, the current scene is the result of all the nodes you've created so far.

Manipulating nodes and attributes

Much of working in Maya involves directly manipulating nodes and attributes using manipulators.

Manipulators are visual objects that let you accomplish complex tasks easily, concretely, and visually by dragging handles and seeing the results immediately.

Using the revolve example above, you can select the revolve node and edit its attributes (how it creates the surface) visually by showing its manipulator with the Show Manipulator Tool.
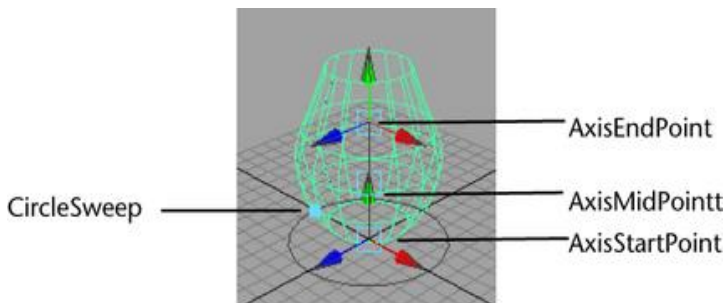
This lets you control attributes (such as how far around the centerpoint the surface goes) simply by dragging a handle.

You can also show manipulators for individual attributes to edit their values visually.

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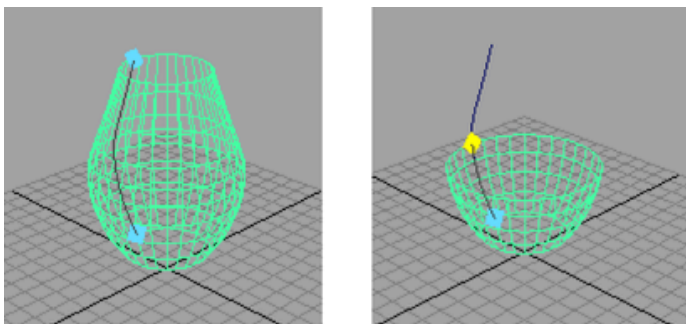
- 9. As a Scene hierarchy: A hierarchical list of nodes.

This shows which nodes are parents and children of other nodes. You can use the Outliner to view and edit the scene in this type of view.

The Outliner shows a hierarchical list of all objects in the scene.

- As a Dependency graph: A graph of connections between nodes.

This shows which nodes provide input or output to other nodes. You can use the Hypergraph or Node Editor to view and edit the scene in this type of view.

The Hypergraph shows a network of boxes representing nodes, and the lines that connect them to represent their relationships.

10. Parenting

Thechildobjectshaveindependentnodes,forexampleachildcanrotatebyitselfwithoutrota

tingthe parent. However, ifthe parent is rotated or moved the child follows.

Object Manipulation Tools

Obviously, these are all operations that sound relatively self-explanatory, but let's take a look at some of the technical considerations.

There are two different ways to bring up the translate, scale, and rotate tools:

- First, they can be accessed from the toolbox panel (pictured above) on the left side of your viewport.

- The second (preferred method) is to use keyboard hotkeys. During the modeling process, you'll be switching between tools constantly, so it's a good idea to learn the commands as quickly as possible.

With an object selected, use the following hotkeys to access Maya's translate, rotate, and scale tools:

Translate - w
Rotate - e
Scale - r

To exit any tool, hit q to return to selection mode.

Translate (Move)

Select the object you created and strike the w key to bring up the translation tool.

When you access the tool, a control handle will appear at your object's central pivot point, with three arrows aimed along the X, Y, and Z axes.

To move your object away from the origin, click any one of the arrows and drag the object along that axis. Clicking anywhere on the arrow or shaft will constrain movement to the axis it represents, so if you only want to move your object vertically, simply click anywhere on the vertical arrow and your object will be constrained to vertical movement.

If you'd like to translate the object without constraining motion to a single axis, clicking in the yellow square at the center of the tool to allow free translation. When moving an object on multiple axes, it's

often beneficial to switch into one of your orthographic cameras (by clicking spacebar, in case you'd forgotten) for more control.

Scale

The scale tool functions almost exactly like the translate tool.

To scale along any axis, simply click and drag the (red, blue, or green) box that corresponds to the axis you'd like to manipulate.

To scale the object globally (simultaneously on all axes), click and drag the box located at the center of the tool. Simple as that!

Rotate

As you can see, the rotation tool appears and operates slightly different from the translate and scale tools.

Like translate and scale, you can constrain rotation to a single axis by clicking and dragging any of the three inner rings (red, green, blue) visible on the tool.

You can freely rotate the object along multiple axes, by simply clicking and dragging in the gaps between rings, however, you're afforded a lot more control by rotating an object one axis at a time.

Finally, by clicking and dragging on the outer ring (yellow), you can rotate an object perpendicular to the camera.

With rotation, there are times when a bit more control is necessary — on the next page we'll look at how we can use the channel box for precise object manipulation.

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of 05

Using the Channel Box for Precision

In addition to the manipulator tools we've just introduced, you can also translate, scale, and rotate your models using precise numeric values in the channel box.

The channel box is located in the upper right section of the interface and functions exactly like the Inputs tab that we introduced in lesson 1.3.

There are quite a few instances where numeric values can be useful:

- Scale in Maya is based on real-world units (centimeters by default), and many of Maya's lights behave more realistically when objects are modeled using approximate real-world scale. This means if you're modeling a table that's supposed to be four feet tall, it should be scaled to approximately 162 cm.

- The channel box can also be useful if you need to space objects evenly, set fractional scales (double, half, etc.), align objects along an axis, or set exact angles for rotation (45 degrees, 90, 180, 360, etc.).

Like in the inputs tab, values can be keyed manually or by using the click + middle mouse drag gesture we introduced previously.

Finally, the channel box can be used to rename any object in your scene, including models, cameras, lights, or curves. It's a very good idea to get in the practice of naming your objects for better organization.

ANIMATION

- *Keyframe animation* lets you transform objects or skeletons over time by setting keyframes. For example, you can keyframe the joints and IK handles of a character's arm to create an animation of its arm waving. For more information, see Keyframe Animation.

- *Driven key animation* lets you link and drive the attributes of one object with those of another object by setting driven keys. For example, you can key a character's X and Z translations as Driver attributes and a door model's Y rotation as the Driven attribute to create an animation of a character and a swinging door. For more information, see Driven keys.

- *Nonlinear animation* lets you split, duplicate, and blend animation clips to achieve the motion effects that you want. For example, you can use nonlinear animation to create a looping walk cycle for one of your characters. For more information, see Nonlinear Animation.

- *Path animation* lets you set a curve as an animation path for an object. When you attach an object to a motion path, it follows the curve during its animation. For example, when you assign a car model to a motion path that follows a road in your scene, the car follows the road when you play the animation. For more information, see Path Animation.

- *Motion capture animation* lets you use imported motion capture data to apply realistic motion to the characters in your scene. For example, you can use the captured motion of a horse to animate the skeleton of a quadruped model. For more information, see Motion Capture Animation.

- *Layered animation* lets you create and blend animation on separate layers. You can modify an animation sequence on layers without permanently altering the original, or simply organize your keyframe animation onto layers. See Animation Layers

- *Dynamic animation* lets you create realistic motion using the rules of physics to simulate natural forces. For example, you can use Maya® Dynamics™ to create effects such as sparks spraying from a welding torch or hail falling from the sky.

- *Expressions* are instructions that you can type to animate attributes. For example, you can write an expression formula that animates the flapping of a bird's wings. For more information, see Animation expressions.

Animation controls

Between the Range slider and the Animation Preferences button are the

Current character control features and the Auto Key button.

The Time Slider controls the playback range, keys, and breakdowns within the playback range.
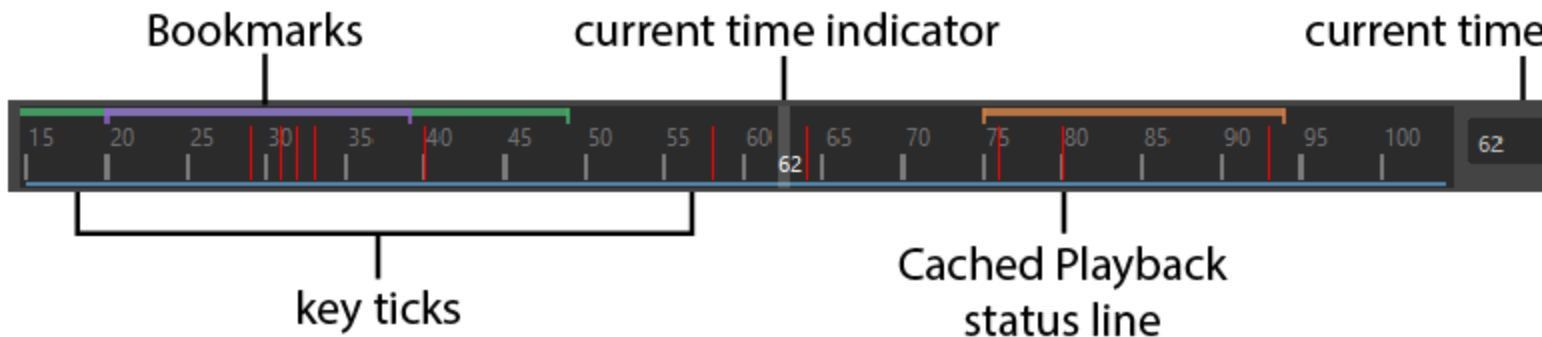
Tip: Resize the Time Slider to make it taller or more compact by hovering over the top edge of the Time Slider until the splitter cursor ⬍ appears and dragging it up or down. There is an Option Variable to configure the Time Slider splitter bar sensitivity if it is distracting while working in the Viewport: `optionVar -iv "splitterHandleMargin" 3`.

Current Time Indicator

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.

Right-click the Time Slider to access the Animation controls menu, which provides easy access to common operations.

Time Slider Bookmarks

Time Slider Bookmarks are colored tags along the top of the Time Slider that flag events in your scene. Bookmarks are a way you can draw attention to specific moments in time which is useful when you want to focus or highlight specific areas or moments in your scene.

Add a Bookmark to a selected time range by clicking the Bookmark icon 🔖 in the Range Slider or pressing Alt (Option) + T.

See Create a Bookmark for more.

Cached Playback status line

The Cached Playback status line is a blue stripe that displays the condition of the Cached Playback data for the current scene. Cached Playback is a method Maya uses to increase animation playback speed by storing the animation in memory and recomputing only the part of the animation that was changed, rather than updating the whole scene for the entire time range.

Whenever you edit a scene that has been cached, the modified area of the status line temporarily turns dark blue to show the segment of the animation that is out of date before becoming blue again to show that the values have been updated.

When Cached Playback encounters an unsupported node it will enter Safe Mode. While Cached Playback is in Safe Mode, the Cached Playback status line turns yellow and a warning symbol appears on the Cached Playback icon. See the Script Editor for an explanation of what is currently causing Cached Playback to enter Safe Mode. (You can find a list of currently unsupported nodes in Cached Playback unsupported nodes.)

Right-click the Cached Playback status line to turn Cached Playback off and on, flush the cache, or select a new Caching Mode. You can change the color of the Cached Playback status line in the Color Settings and set its width and placement in the Cached Playback Preferences.

See Use Cached Playback to increase playback speed for more information about Cached Playback.

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.

> Selecting keys on the Time Slider
>> To select a key on the Time Slider, Shift-select it. If you need to select a *range* of keys on the Time Slider, such as when you work with Time Slider Bookmarks, Shift + drag across the Time Slider.
>> Turn on Auto Snap Keys in the Time Slider Preferences to ensure that your key selection snaps to the nearest whole frame.
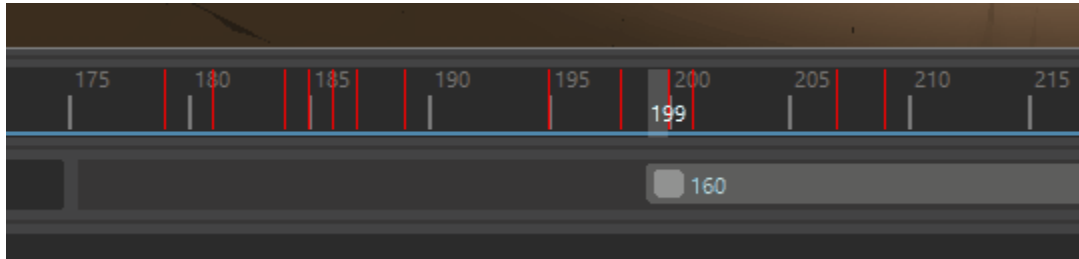
Time units

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 24 frames per second, the standard frame rate for film.

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. However, expressions that use the frame variable might not work correctly if you change the Time setting.

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.

Audio

Right-click the Time Slider to open the Animation controls menu, where you can select the Audio rollout that gives you access to the Audio menu, where you can manage your Maya's audio settings.

When you import an audio file, its waveform shows on the Time Slider. See Display audio on the Time Slider.

The Range Slider, located below the Time Slider, controls the playback range reflected in the Time Slider.
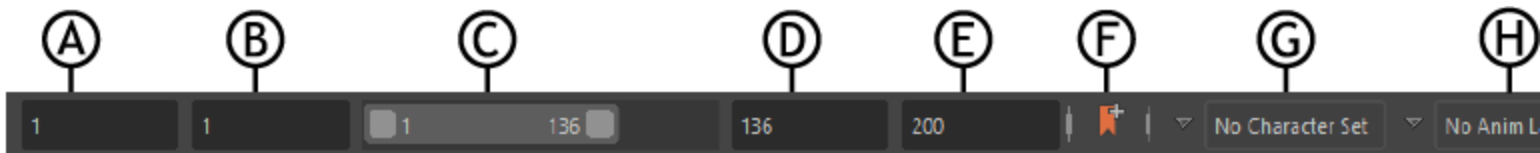
A. Animation Start Time B. Playback Start Time C. Range Slider Bar D. Playback End Time E. Animation End Time F. Time Slider Bookmark icon G. Character Set menu H. Animation Layer menu

See Playback options for information about the Framerate, Loop, Auto Key, and Animation icons that appear beside the Range Slider.
Note: Time Slider Bookmarks (F.) and Character Set menu (G.) are not available in Maya LT.
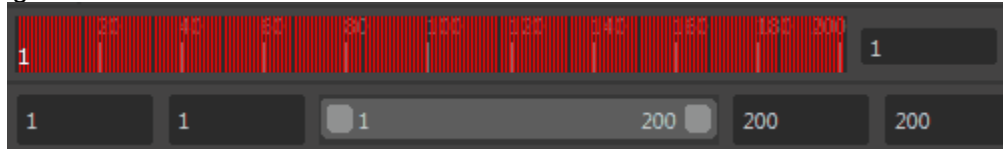
Animation Start Time
(A. in the illustration above.)
This field sets the start time of the animation.

Playback Start Time
(B. in the illustration above.)
This field shows the current start time for the playback range. You can change it by entering a new start time, including a negative value. If you enter a value that is greater than the Playback End Time, the Playback End Time is adjusted to one time unit greater than the Playback Start Time.
Range Slider bar

(C. in the illustration above.)
Drag either end of the Range Slider to manually extend or shorten the Playback Range.
Playback End Time
(D. in the illustration above.)
This field shows the current end time for the playback range. You can change it by entering a new end time. If you enter a value less than the Playback Start Time's value, the Playback Start Time is shifted to one time unit less than the Playback End Time.
You can also edit the preceding settings from the Animation Preferences window.
Note: Changes to the Range slider are undoable. You can change this setting in the Undo preferences with the Consolidate Time Changes option.

Animation End Time
(E. in the illustration above.)
This field sets the end time of the animation.
Time Slider Bookmark icon   **New**
(F. in the illustration above.)

Click to set a Time Slider Bookmark for the selected time. See Time Slider Bookmarks for more.
Character Set menu
(G. in the illustration above.)
The Character menu is a quick way to switch the current Character Set.
Animation Layer menu
(H. in the illustration above.)
Note:

The Animation menu is a quick way to switch the current Animation Layer.
A graphical representation of interpolation between animation keys that you can modify.

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.

- You can switch to the Classic Graph Editor in the Preferences window. See Animation (Settings) Preferences > Graph Editor > Graph Editor and turn on the Classic option.

- This version of Graph editor was introduced in Maya 2017, if you are running an earlier version of Maya, only the Classic Graph Editor is available.
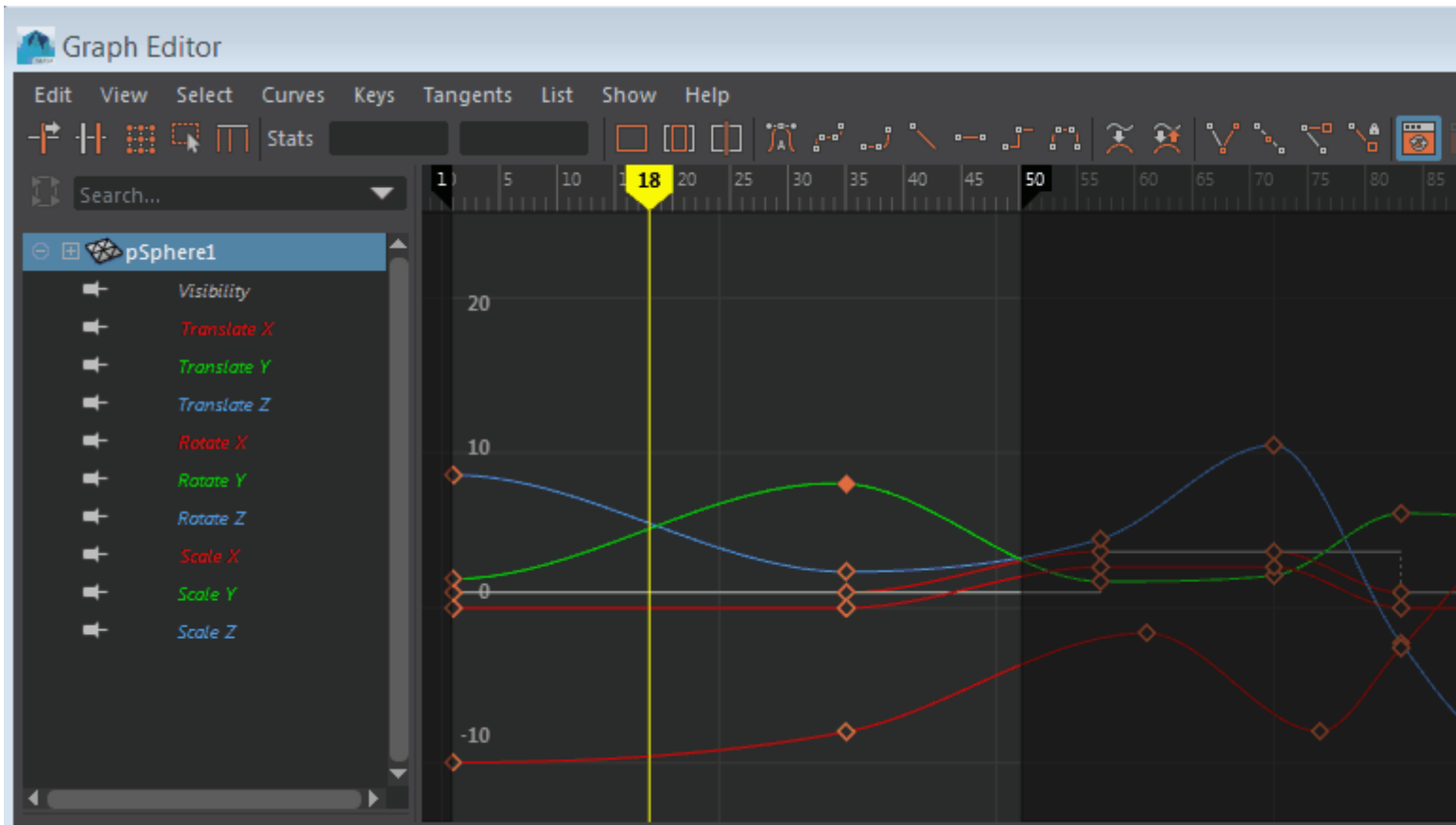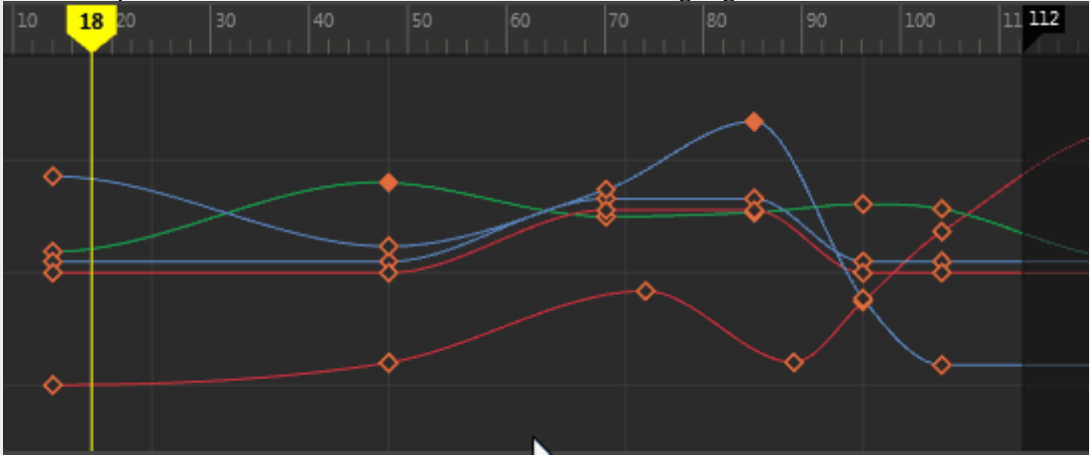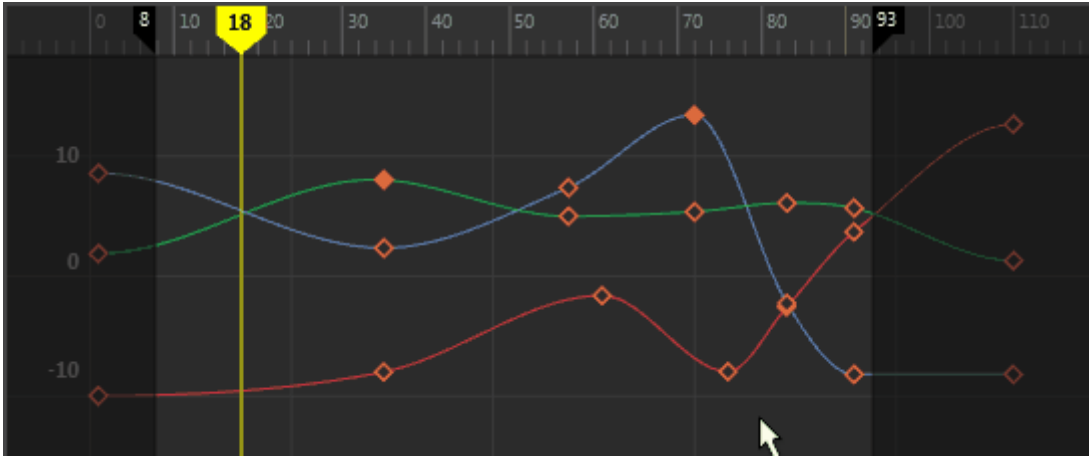
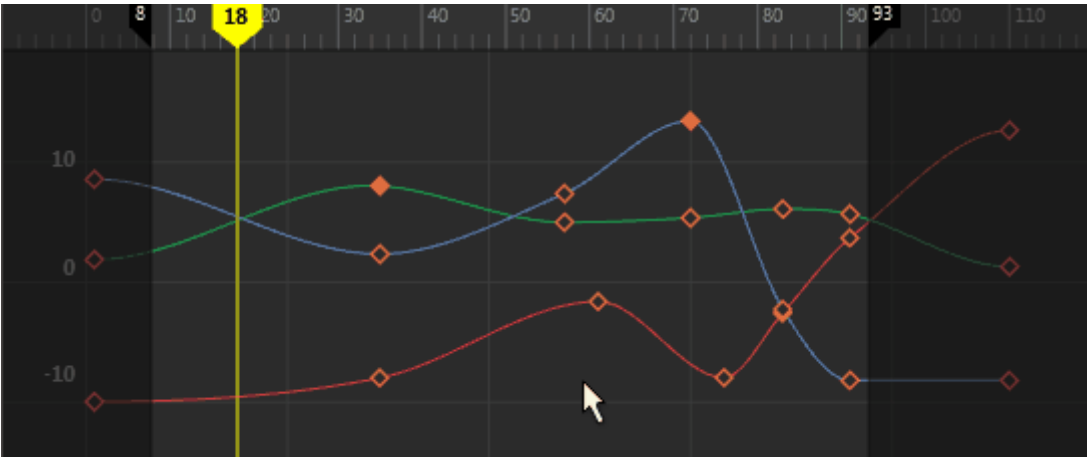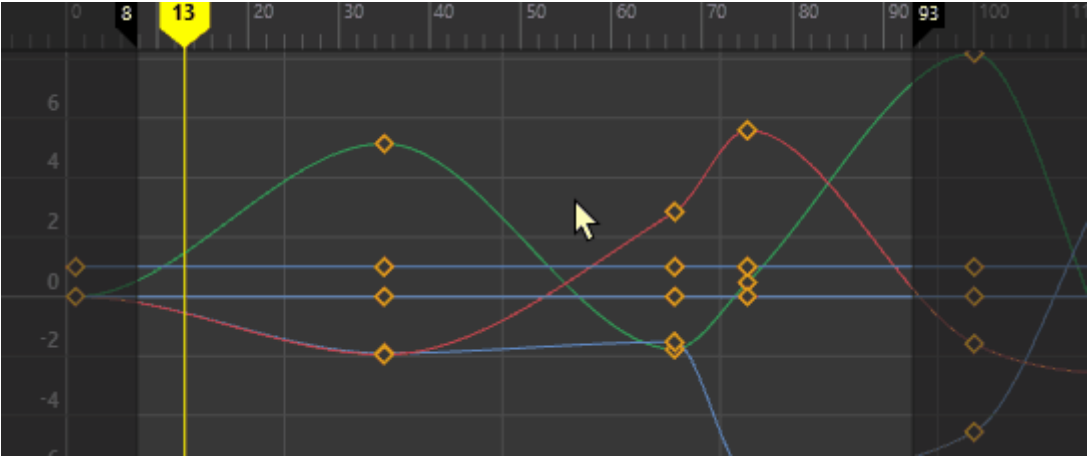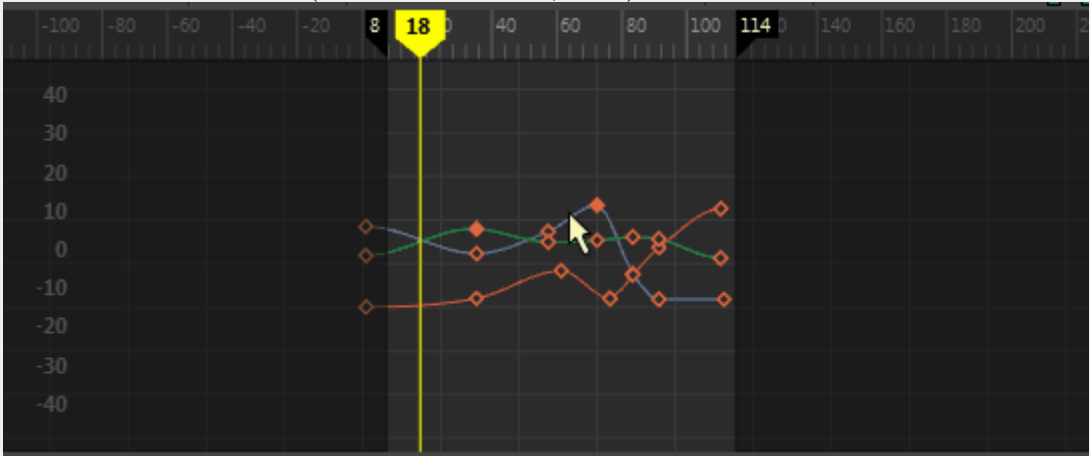Maya's Graph Editor is an updated version of the legacy Maya Graph Editor, giving you a more intuitive approach to manipulating animation curves and keys in your scene.

The Graph Editor is presented as graph view of scene animation so you can create, view, and modify animation curves various ways. For example, you can control interpolation between keyframes, extrapolation of curves, and change animation curves value and timing by altering the shape of animation curves using tangent handles.
Note: While the Graph Editor's color scheme is designed for high visibility, you can customize the colors in the Color Settings.
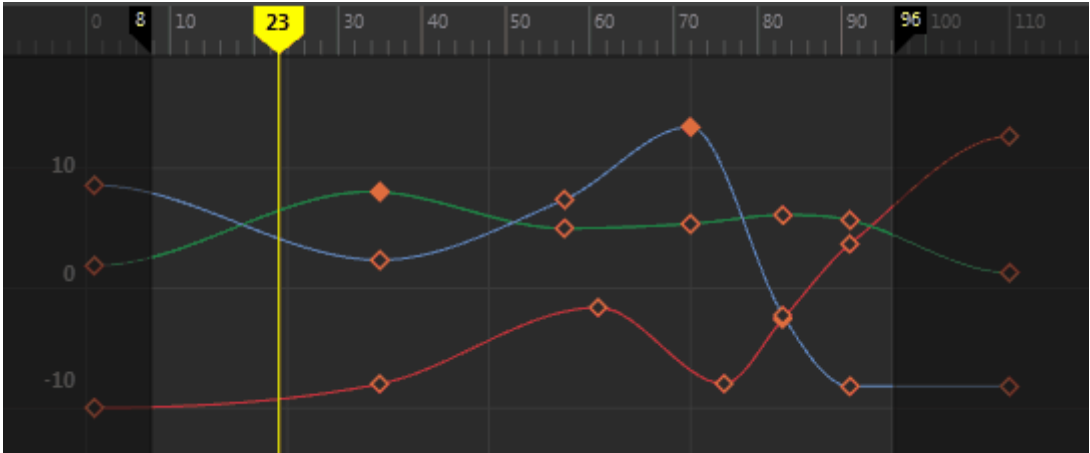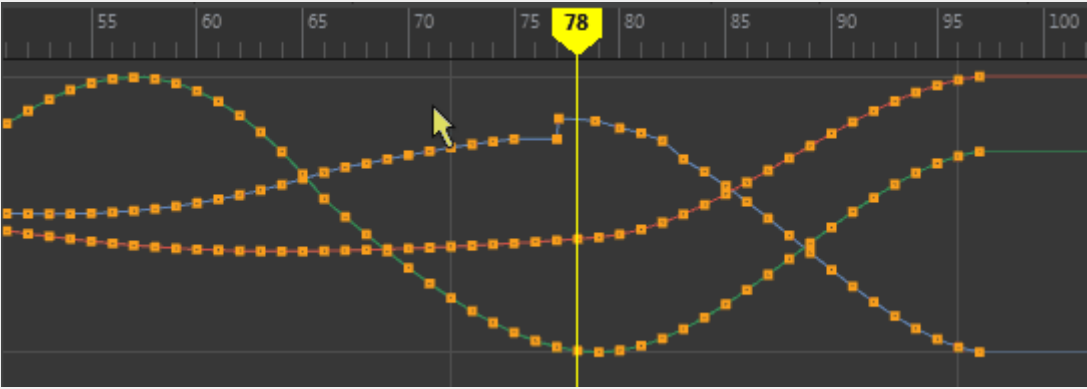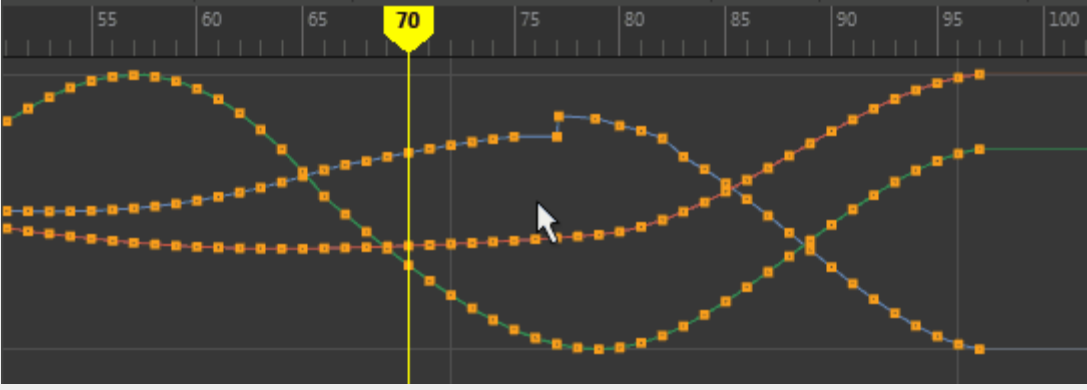
Other improvements include:
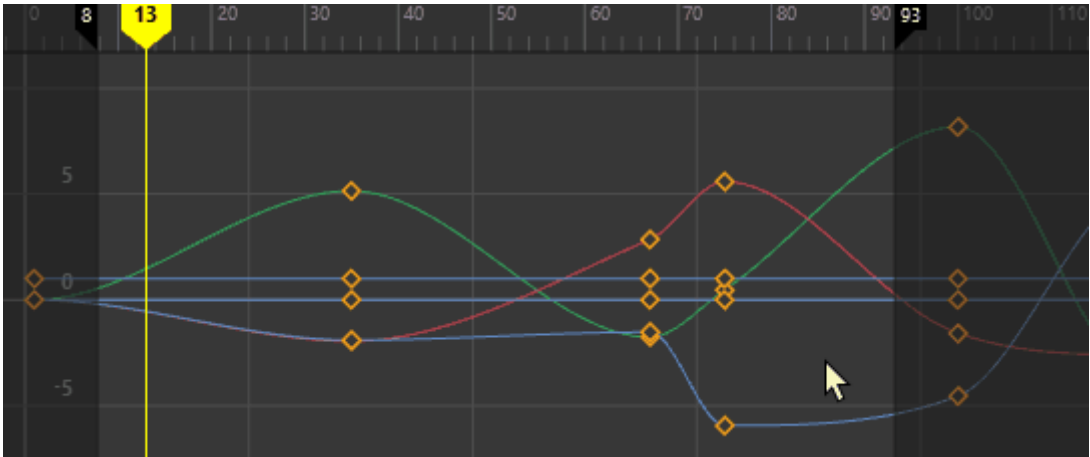
- The Move Tool is no longer needed to move keys

- Tangents are non-weighted by default

- Interactive keyframes and the ability to isolate curves

- Scrubbable Time Marker that moves anywhere you click on the Time ruler

- Resizeable play range

- Simplified view names. (Stacked Curves is now Stacked View , Display Normalized is now Normalized View and now there is an Absolute View.)

- Customizable key and curve colors (See the Graph Editor section in the Color Settings)

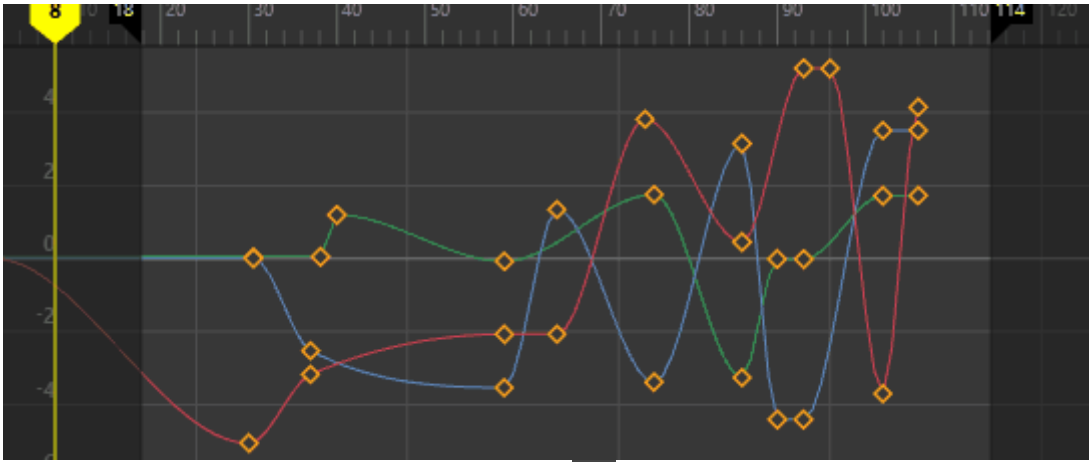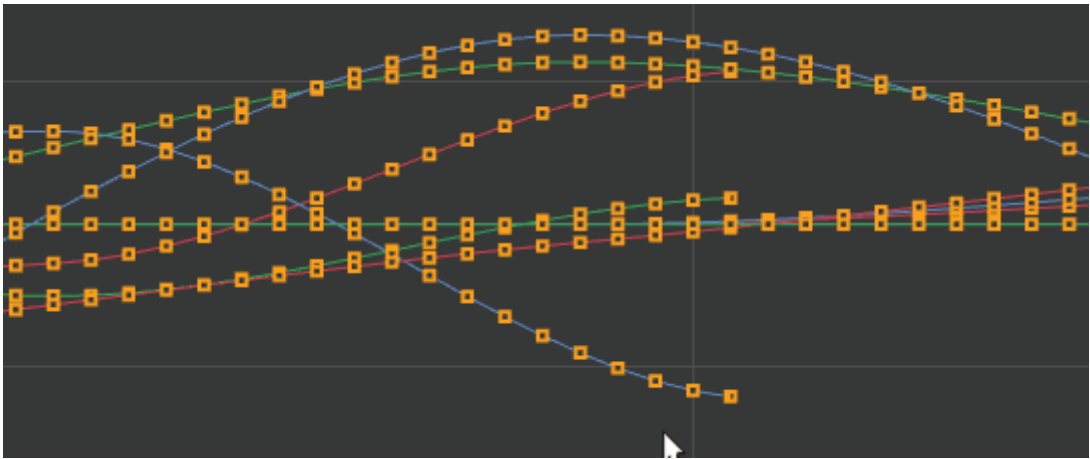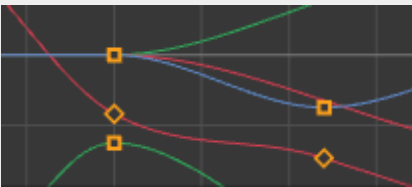The following table provides a brief overview of tasks using the Graph Editor:

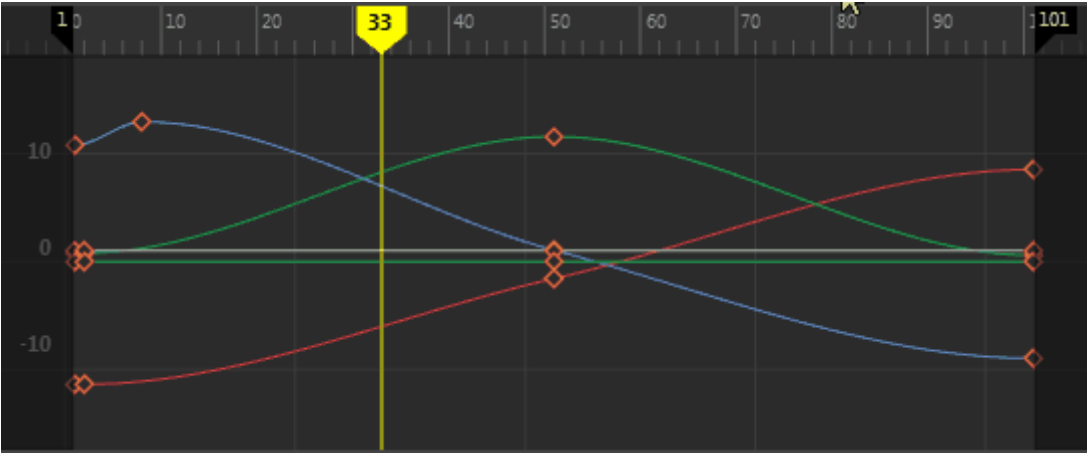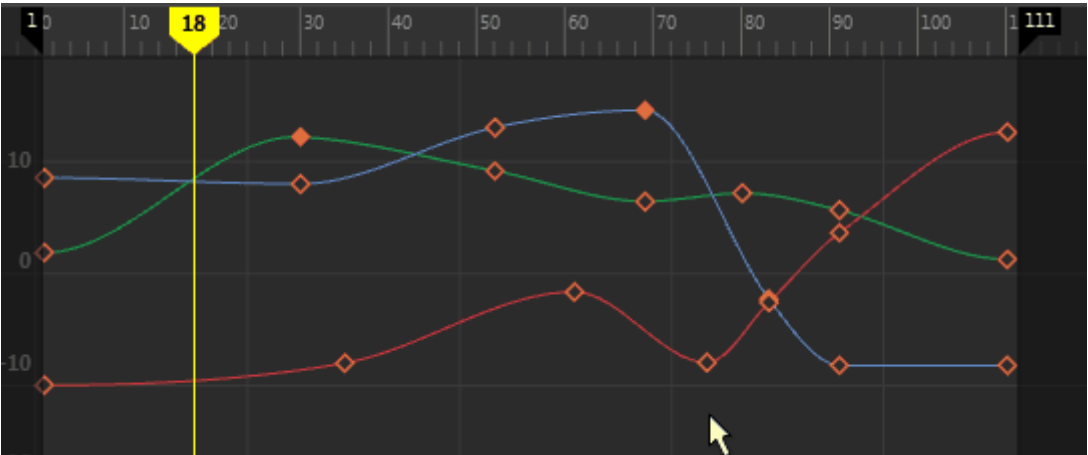| To…	Do this
Place the Graph Editor in a scene view	Select the scene view in which you want the Graph Editor to appear, then select Panels > Panel > Graph Editor.
Turn on Pre-selection highlighting in the Graph Editor	In the Graph Editor menu bar, turn on Select > Pre-select Highlight. Tip: Change the highlight color with the Colors window. Select Windows > Settings/Preferences > Color Settings, then change the Pre-selection highlight option in the Animation Editors section.

Pan and Zoom in the Graph Editor	Same as Viewport navigation:
	    • Pan: press Alt or Option (Mac OS X) key and middle-drag.)
	
	    • Zoom: press Alt or Option (Mac OS X) and drag or right-drag. Zooming is centered based on the location of the mouse cursor.

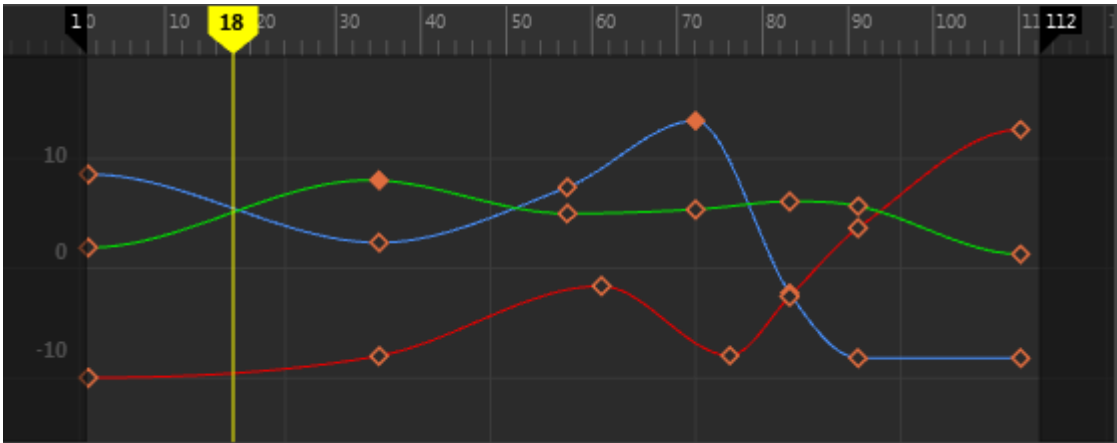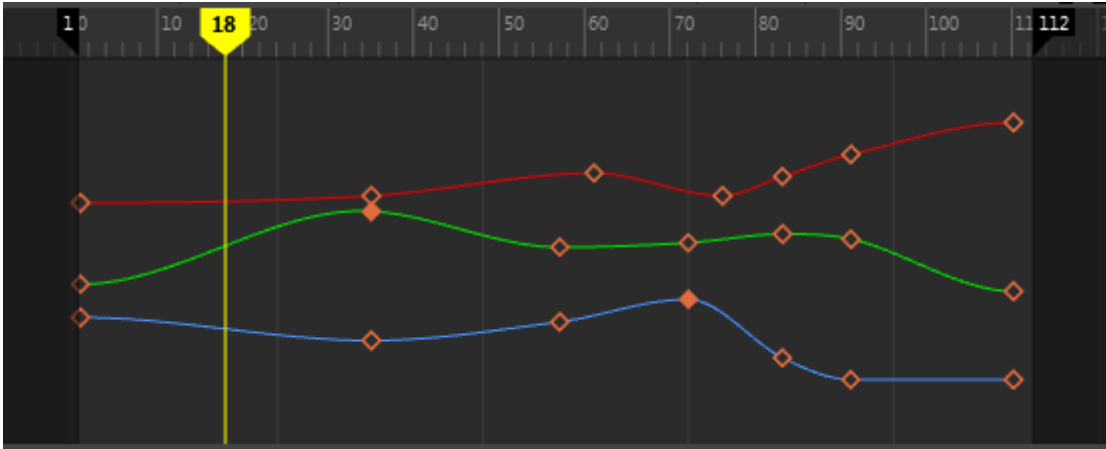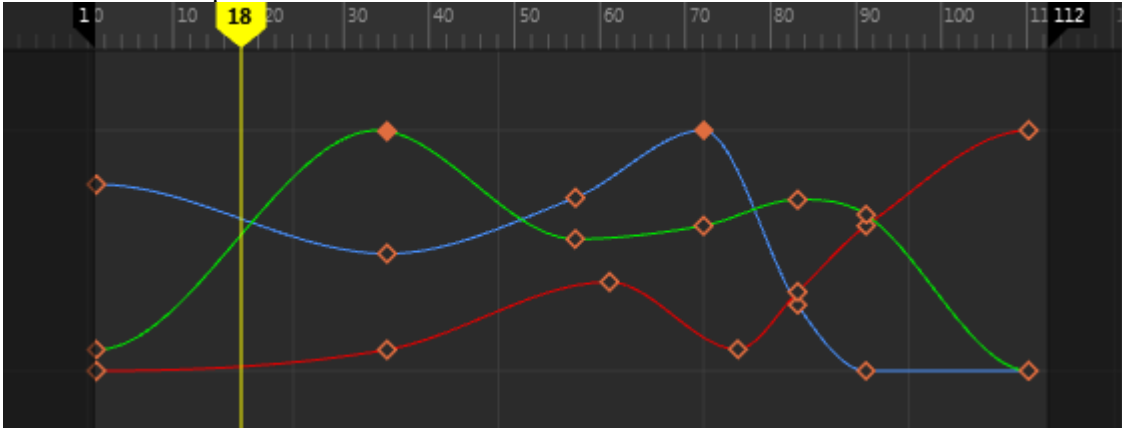| To...	Do this
	• Zoom horizontal: Press Alt or Option (Mac OS X) + Shift and right-drag.
Zoom on a curve	Select the animation curve (see To select a curve, below) and click F to frame the selection.
Resize the Playback range	On the Time Ruler, click the edge of the dark region and drag to change the playback range. Stretch the playback range in the time view by dragging the flags on the Time ruler.

To...	Do this
Scrub animation	Drag the Current Time Marker. • To scrub along the Time ruler at the top of the Graph view, drag the Current Time Marker left or right. • To scrub in the Graph view (below the Time ruler), press K to release the cursor lock. (The cursor is locked from scrubbing in the Time view to prevent moving keys/curves unintentionally.)
Lock a curve	Press H to lock and J to unlock a curve.

To...	Do this
Move to the previous or next view	Use the square bracket hotkeys ([and]). These are the same hotkeys that let you move between camera views in the viewport.
	To navigate through views using these hotkeys, click in the Graph Editor then press left bracket ([) to move to the previous view, or right bracket (]) to move to the next view.
Filter mangled Euler angles	Select the mangled animation curves (for example, Rotate X, Y, and Z), then select Curves > Euler Filter. See Graph Editor Curves menu.
Change the rotation interpolation type of existing curves	Use the Change Rotation Interp option in the Graph Editor and Dope Sheet Curves. See Graph Editor Curves menu.
Select a key	1. Click the Move Nearest Picked Key Tool on the Graph Editor Toolbar. 2. Click a key. The key becomes white to indicate it is selected. 3. Middle-click the key so the cursor becomes a crosshair ( ). 4. Position the key.

To...	Do this
	Tip: Double-click Move Nearest Picked Key Tool to open the options window, where you can set the Direct Key Settings. See the entry for Move Nearest Picked Key Tool in the Graph Editor Toolbar topic.
Set an FK/IK key curve	Use the Set IK/FK Key option in the IK/FK Keys menu (Key > FK/IK Keys > Set IK/FK Keyin the Animation menu set.)
Select a curve	Curve selection is on by default. 1. Click (or drag-select) the curve *between* two keys to select it. 2. Click (or middle-mouse-click) the curve again to move it.
Key types	• Diamond key: non-weighted tangents • Square key: weighted tangents • Circle key: a key on a quaternion curve (no tangents) • Hollow key: A new key with 'automatic' tangents. The key is filled when you adjust the tangents to show that it has been edited.
Move a key	Select a key and drag it.

To...	Do this
	To open the Move Key tool, select Edit > Transformation Tools > Move Keys Tool > ☐ Settings. You can also middle-click an empty area of the Graph Editor and drag to reposition selected keys.
Move multiple keyframes in time without changing the attribute value	Drag-select the keyframes to move. Shift-middle-drag the frames left or right.
Change views	Absolute view: Press 1 This view is the default.

To...	Do this
Stacked view: Press 2

Normalized view: press 3

Select View > Renormalize to revert back.

Note:
Curves are automatically renormalized when you turn on Display Normalized or the active curve list changes. |