

3/4 PENDULUM

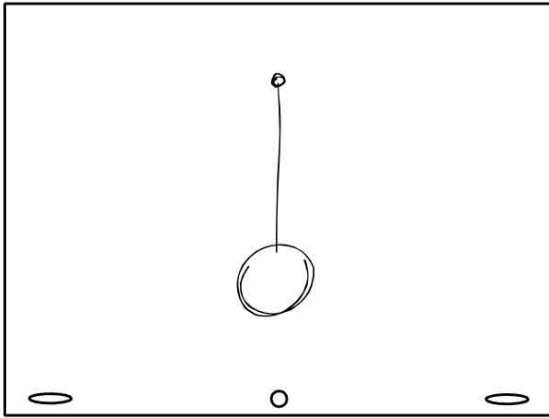
ASSIGNMENT:

- Create a 9-frame animation of a Pendulum swinging in 3/4 perspective.
- Pendulum's Pivot, Shaft and Weight should be constructed with three (3) different geometric shapes.
- Once animation is successful, add a Secondary Action object to the Pendulum for a total of 16 frames.

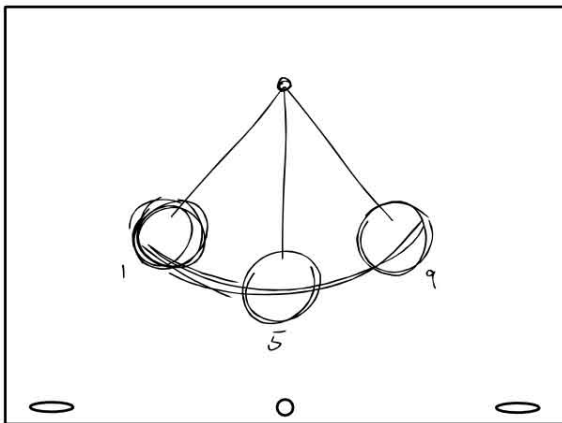
PRACTICE!

First, before we even attempt drawing our pendulum in perspective, let's establish the desired timing and movement.

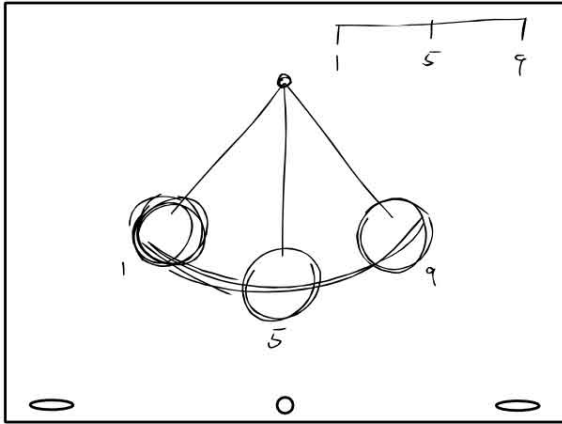
- 1) We'll start with a basic pendulum in its centered or starting position. Within the animation, this will act as Key Frame 5.



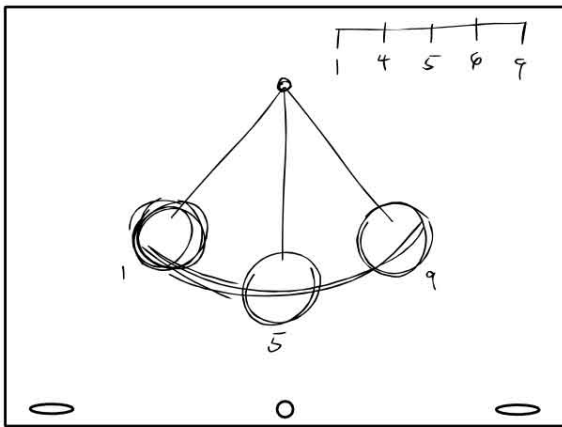
- 2) Now, let's add the two end Key Frames, 1 and 9- These drawings establish how high the pendulum will swing. A path of motion should be drawn as an arc. We have just drawn an Animation Layout- all the information we need to complete our swinging pendulum.



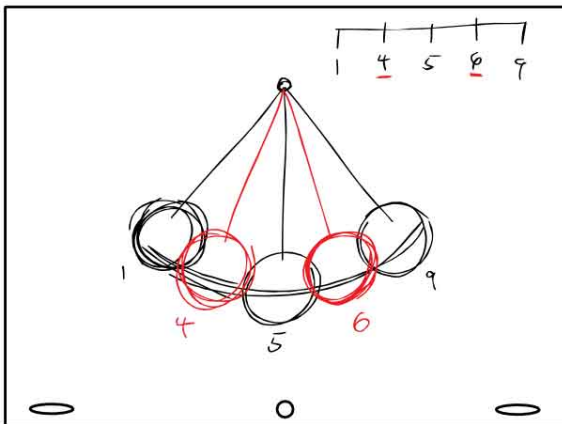
- 3) A helpful device is the Animator's Timing Chart. This is indicated by a line with marks that show where drawings or inbetweens should go. In this chart, we can see that drawing 5 should go right in between drawings 1 and 9.



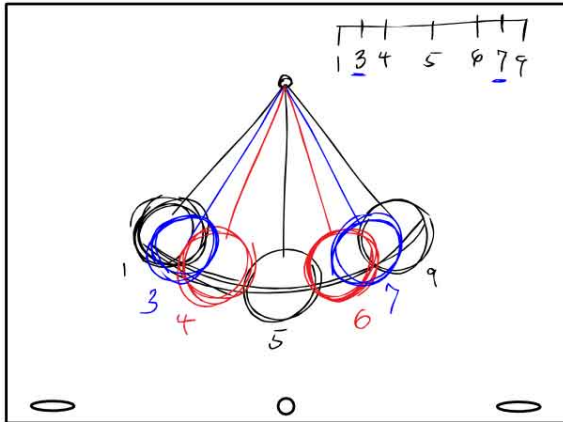
- 4) We now indicate even tweening on the chart by first marking drawing 4 right between 1 and 5, then drawing 6 between 5 and 9...



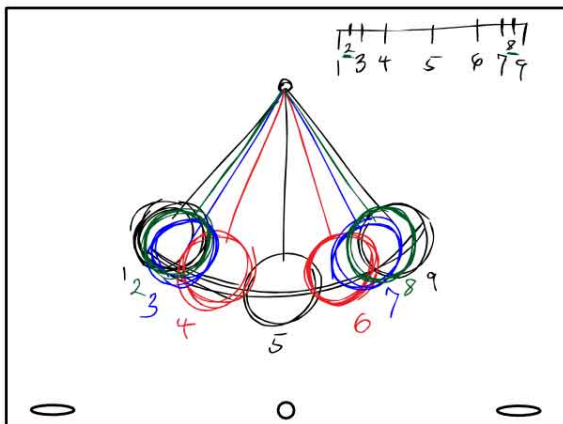
- 5) ...which is then drawn out in the animation.



- 6) In animation, one way to create the illusion of speed is to space out the drawings farther apart. To slow down a movement, drawings are bunched closer together. We want our pendulum to swing quickly as it passes its center position and slow down at both ends. To accomplish this, we will now add more tweens only at the ends.



- 7) With the last two tweens added, notice how overlapped the drawings are at both ends...almost on top of each other.



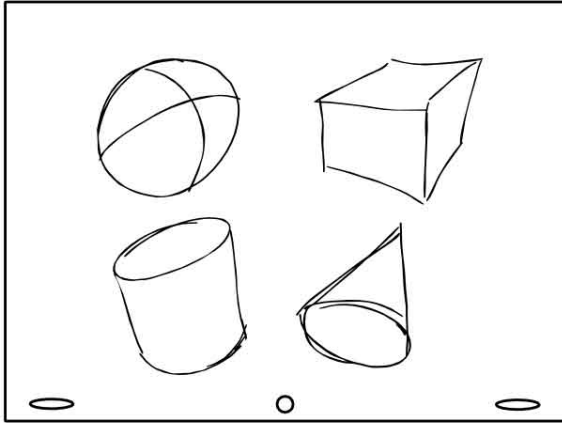
The frames are played from 1 to 9 then backward to 1 again creating a loop. Notice as it swings back and forth, how the pendulum appears to ease in and out of frames 1 and 9 and speed up at frame 5.

3/4 PENDULUM

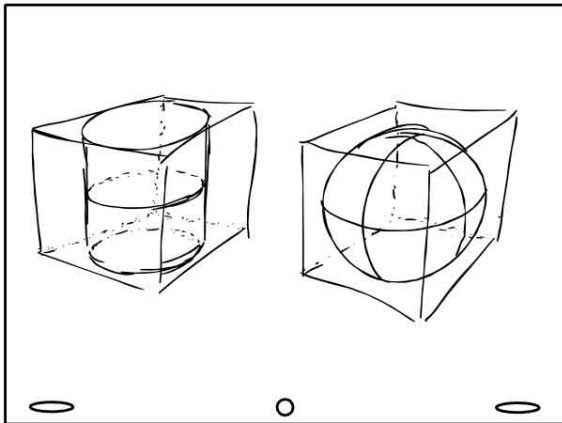
Now that we have a better understanding of how we want the timing, let's draw it in perspective!

- 1) Design your pendulum using three of the four basic geometric shapes- Sphere, Cube, Cylinder and Cone.

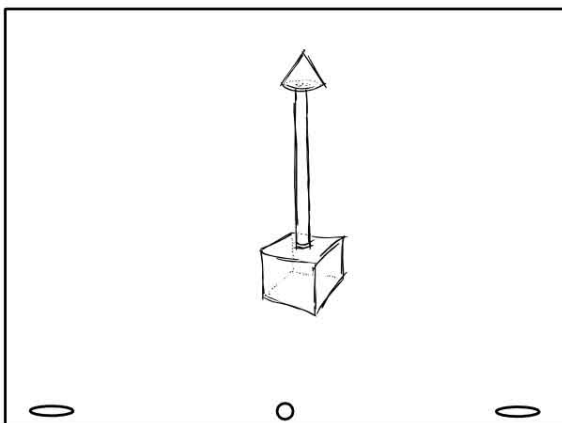
Be sure to use a different shape for the Pivot, Shaft and Weight.



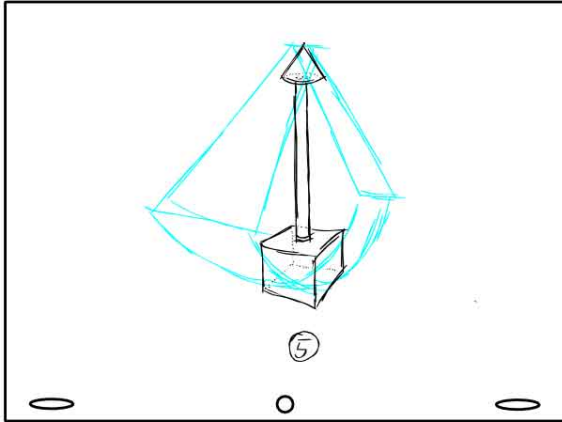
Since you'll be drawing these shapes from multiple angles, remember the rules from your Drawing and Perspective lessons. Whenever possible, use reference points or other geometric objects to help you draw something at a difficult angle.



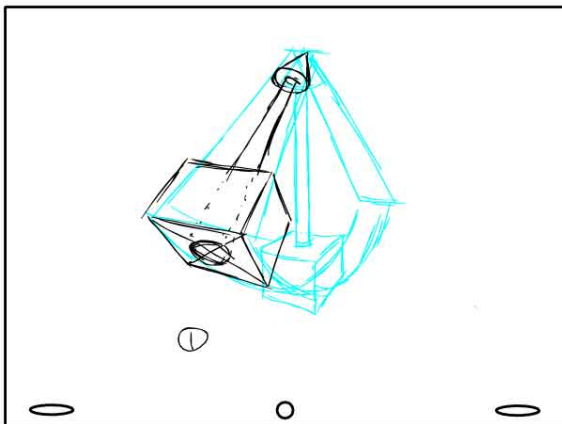
- 2) This pendulum uses a Cone for the Pivot, a Cylinder for the Shaft and a Cube for the Weight. Once you've got it designed, start the device in its centered position- Drawing 5.



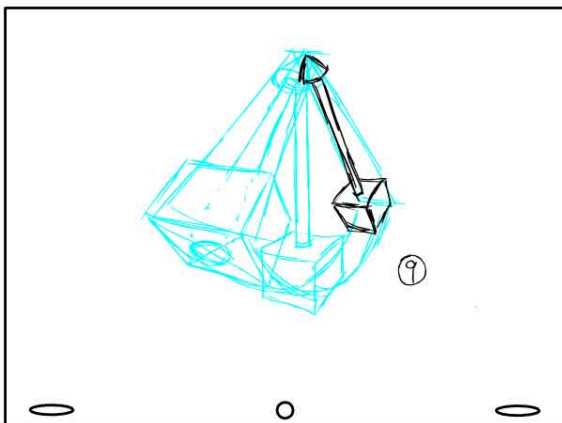
- 3) Now, sketch out the area that the pendulum will swing in. It may help to lightly draw positions 1 and 9 on top of 5 to help you figure out the correct perspective. This is important to make sure you have an appealing layout and that the pendulum won't be swinging off of the page.



- 4) Key Frame 1 will be the position swinging towards us. Notice how existing points of reference are used. For instance: by intersecting the corners on the bottom of the Cube, we can find its center, which helps us draw the Shaft at the correct angle.

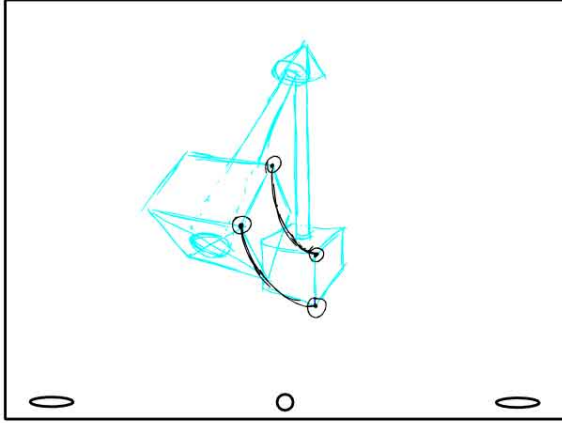


- 5) Key Frame 9 is farthest from us. Now, using the same timeline from our practice, we can add the inbetweens.

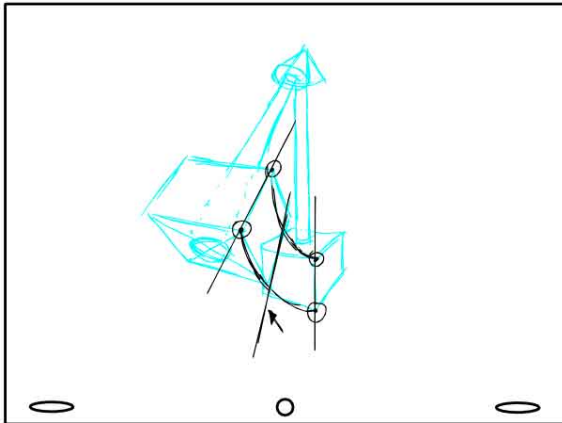


- 6) This time it will be much trickier to draw our tweens: Angles keep changing and, if you aren't careful, it will look like the objects making up the pendulum are changing shape. This is where it becomes imperative to use points of reference.

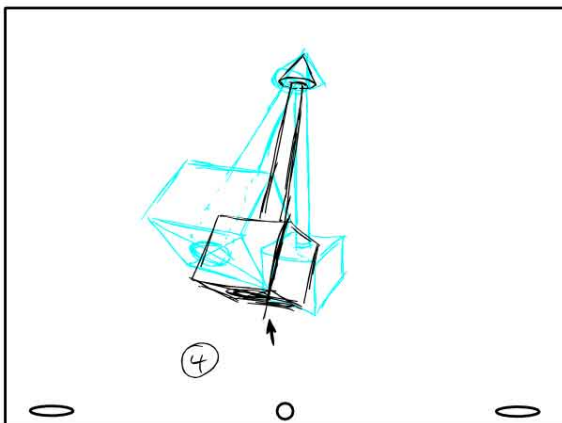
In tweening frames 1 and 5, see how the top and bottom corners of the right front of the cube are used as points of reference to help find where to draw that edge. Arcs are drawn from one corner to another to indicate the path of the swing. This will help us place additional points of reference.



- 7) Now we can see where to draw the front, right edge for frame 4- right in between the other two edges!



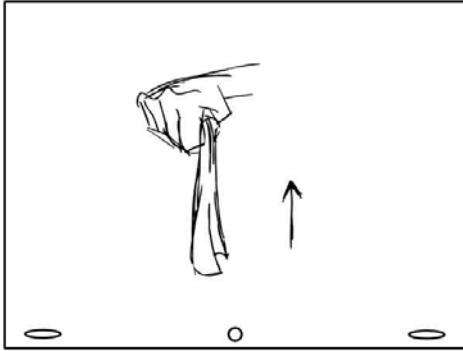
- 8) Clean up your reference sketching then continue this technique to find the placement of all the other edges and shapes. Frames 1-9 are played forward then in reverse to achieve the back and forth motion. Notice how dimensional the entire animation looks. It all has to do with the first three Key Frames.



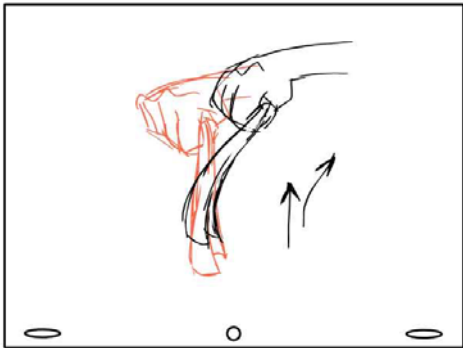
SECONDARY ACTION (DRAG)

Now you need to add a Secondary Action object to the animation. Secondary Action is movement that occurs as a result of the movement from something else. For instance: Long hair can't move on its own yet gets *dragged* when the head moves...and continues to *follow through* after the head has stopped until it finally settles. Other similar objects would be long ears, tails, clothes, capes, breasts and fat bellies.

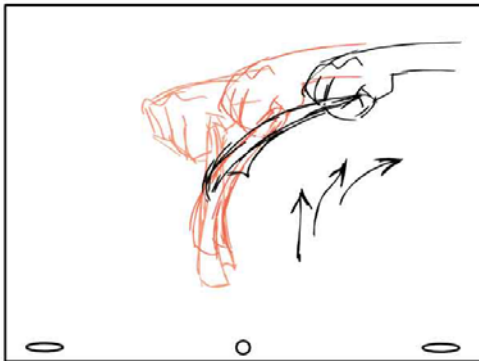
- a) In this example, the hand holding the hankie will be pulled back. The arrow indicates the direction of the hankie and where it's attached.



- b) As the hand moves, it takes the hankie with it...but only where it's attached. The part of the hankie that hangs loose gets left behind. Its length shortens since it is being pulled away but, because the object is light and not stiff, it gives way to the air in its path.



- c) Still being left behind, the hankie conforms to the path it's being pulled in. Having no more slack left, the end finally starts to head off with the hand.

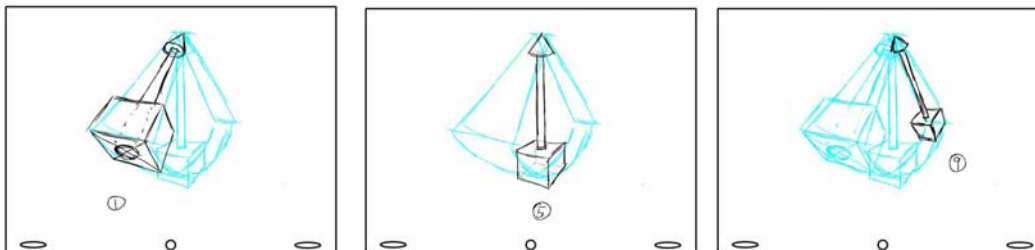


Now, let's attach a Fox Tail to our pendulum so we can apply this principle to the existing animation.

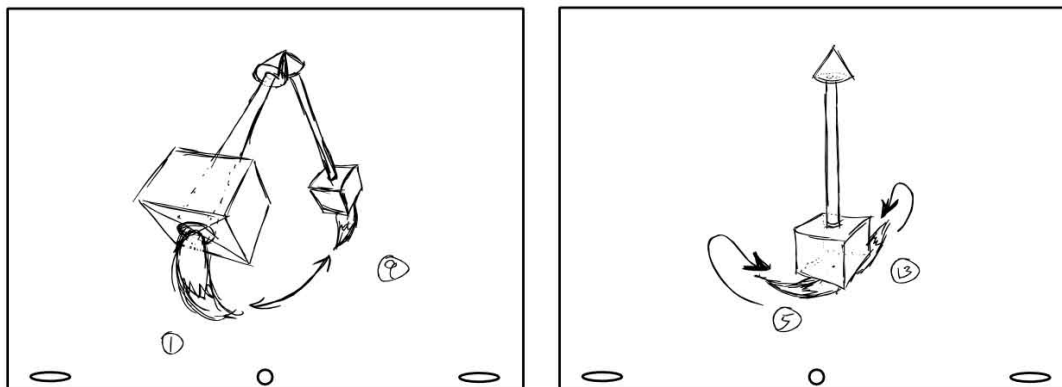
- 1) First thing you need to realize is that we can't just play frames 1-9 back and forth like before. Drawings 2-8 need to be traced or copied in reverse, giving us 16 drawings in total- a complete animation that loops.

It works like this: You already have 9 drawings of animation. Trace drawing 8 and number it 10. Now, trace 7 and number it 11. Then trace 6 and number it 12. Keep going in this fashion until you have a total of 16 drawings.

Remember, you don't need to trace drawings 1 or 9 because they will only be shown once. You just need all the tweens to get from drawing 9 back to 1.



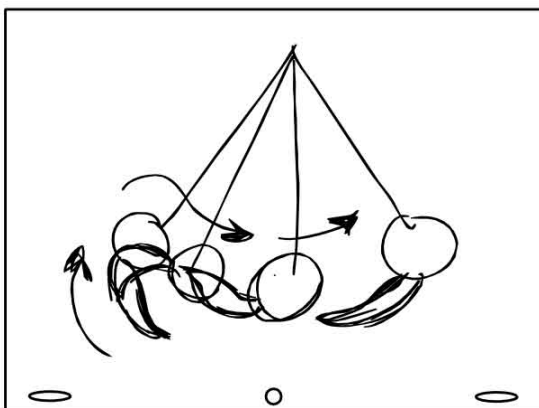
- 2) Once there are 16 frames, we can add our Fox Tail to the pendulum. I find it is easiest to start with either the ends: Drawings 1 or 9, or the middles: Drawings 5 or 13.



When starting from the ends, it's important to remember that the pendulum is always swinging from the center. Since the Fox Tail is being dragged along, the tip will always be pointing inward towards the middle.

When starting from the middle, remember that the tail points in the direction the pendulum just swung from. Drawing 5 will point towards 1 and drawing 13 will point towards 9.

- 3) When tweening the Secondary Action object, be sure that it turns around gradually as the pendulum changes direction and does not snap from one side to another.



Notice here how the Fox Tail flows with the path as the pendulum swings from drawing 1 to 9. The same smooth transition occurs from drawing 9 back to 1.

