[Gravity Animation by Jesse Toula](http://library.creativecow.net/articles/toula_jesse/Gravity-in-After-Effects/video-tutorial) **14 HW questions .** Due: Thursday, February 17th, 2012

The bounce of a ball is simulated in After Effects. A graph is used as reference. The graph is the path of a bouncing tennis ball. It’s a video of an actual bouncing ball. This represents the real system that we are trying to create a model of. The goal of the model is to be SIMILAR enough to the real system to be useful in understanding it or mimicking it.

The speed of the Adobe After Effects composition is 24 frames per second.

At 01:14 in the video tutorial, Jesse says:

“Now, if we think of this X–axis as TIME instead of the position, we can GRAPH the bounce of this ball ----. You can SEE the bounce of the ball. You can see the type of curve it is – … And that it hits a point and goes completely in the other direction – and you can see that the heights gets smaller as we go along and the time between the bounces gradually gets smaller as well. … so this is the graph we’re going to be using as a reference for the rest of this tutorial.”

Q01: “Every bounce gets slightly and slightly .” *Fill in the blanks question.*

Q02: “ … and you should know that there is some basic math and and that comes into play here”. *Fill in the blanks.*

At about 03:50 in the video tutorial, Jesse introduces the COSINE function. Math.cos() is the syntax for this After Effects Expressions language function. Math.cos(time) is shown at 04:08 in the video.

Q03: What two things do you need to do in After Effects in order to SEE the Graph of Math.cos(time)? You probably want to explain in words and draw a picture of the involved icons and context.

1. That 1st one is at 04:14
2. The 2nd thing is at 04:21 in the video.

Q04: From 04:35 to 05:55 in the video tutorial on Gravity in After Effects, Jesse shows and explains why it makes sense to use the COSINE function and not use the SINE function. “… and you might be wondering WHY we’re not using the SINE graph, now I can show you why … – “. Explain carefully in your own words and with a diagram/drawing/picture why the COSINE function is the best approach for simulating the bouncing ball and the SINE function is not as good a solution. You may quote Jesse, as needed. You may want to draw the SINE and the COSINE waves and relate them to your bouncing ball situation.

Q05: At 06:10 in the tutorial, Jesse says: “… and you can see that our graph repeats at around , a little less than seconds.” Fill in the two blanks.

Then explain WHY? Why does it repeat at this point on the After Effects timeline? Note: Relate your answer to RADIANS. Why radians? Look up RADIANS on the web or in a dictionary if you need to. I will also have a netlogo application that illustrates radians in connection with circles and PI.

Q06: At 06:50 in the video tutorial by Jesse, the Expression is changed from Math.cos(time) to a more complicated expression.

What is that expression?

Where does the graph curve repeat now?

Q07: What is the syntax for specifying the PI function or actually the PI constant in Java Script and the After Effects Expressions language? Area of a circle = PI \* radius squared or = PI r squared. PI = 3.14 = 3.1415926535 = …

Q08: At 07:22 Jesse states that it is a major problem that our peaks on the graph happen every second and it does NOT look like a bounce path. One major problem is that there are values that go below zero (speaking of Iowa winters!). We need our values to always stay above zero, and after each peak we need a HARD CORNER, and for the graph to go back up again and not fall BELOW ZERO.

How does Jessa solve this problem? What flips? Describe exactly what flips. Be sure to include in your answer the following concepts or terms. Flip all of the graph that “… and we’re gonna wrap this entire function … in our “.

*Speaking of flips, 2012 summer Olympics are less than a year away. Speaking of WRAP up, RAP it up about CS 1025 turtles and waves and pens and predators and prey. (See the* [*Iowa State University Stat rap*](http://www.youtube.com/watch?v=1W6ppMIhA7k) *and/or the* [*Love to be a Panther video and rap*](http://youtu.be/GDJ_i9ax6mo)*)*

*FLIPS and LIPS that RAP out rhythms, WRAP it up, Gymnastics with words = RAP, tap that rhythm, cosine that rhyme, Math.sin() of the time(s), get After those Effects. Get adjacent to the hypotenuse, take the opposite attitude to math and see if it makes a difference. Your appreciation might multiply, or even grow exponentially, really. Sine up now! I will cosine for your loan of enthusiasm. It’s worth the investment.*

Q10: At 08:50 “and if you go into our graph editor now, you can see what we’ve created”. Jessa compares it to the video clip graph of the actual bouncing tennis ball. How has it improved? What is its limitation, i.e. what does it NOT model about the actual bouncing ball in the film of a bouncing ball from the real world? Explain both what it does capture (how it has improved) and what it does NOT model or capture?

Q11: At 09:25 Jesse says: “However, in our video, the graph gets so we are going to have to use an to mimic this look.” *(Note: MIMIC look of the tennis ball bouncing on the table and its motion path).*

Q12: At about 09:45 Jesse creates a new null object to play with and to learn about and demonstrate the next needed function from the Math library of Javascript and AE Expressions language. He wants you to learn it and to see it in a demo all by itself, alone first, BEFORE using it in our task of mimicking a bouncing ball and improving our model of a bouncing ball. Watch the video from 09:45 until about 11:00 and talk about whether or not in your opinion you think it is useful in math and science and computers to isolate and play with and try out a technique or concept BEFORE using it for some specific purpose. Note: See question #13 below. It’s **BEFORE** the COMBINE our technique with the earlier developed COSINE function, we have mastered and played with and understood the technique. Good problem solving strategy???? You decide and discuss and think about for Q12.

Q13: At 10:50, Jesse says: “So what we need to do now is to combine our with our cosine function that we created.”

Q14: At 10:05 to 10:25 , Jesse states: “… and inside the parentheses, we’ll put time, *(Jim Croce liked to put time in a BOTTLE)*, and back in our graph editor you can see that our exponential curve is **SLOWLY GOING UP**. It is creating the curve we want, but we want our values to **SLOWLY GO DOWN**.” What is the “easy way to fix this”, according to the tutorial?

See your email and www.uni.edu/elearning: Due anytime on Thursday, Feb 17th or before.

Send email to [jacobson@cs.uni.edu](mailto:jacobson@cs.uni.edu) with your answers as an attachment or as body of the note.

TO: jacobson@cs.uni.edu

**SUBJECT: It’s a COSINE of the TIMES 14 Questions.**

**INTERLUDE DANCE and TRIGONOMETRY:** WARMING HANDS UP AROUND THE FIRE is cyclic.

Note that CLAPPING YOUR HANDS if you feel it, is optional, but you always feel it, so always clap your hands would also be cyclic.

Note further that INTERLUDE and REVENGE OF THE INTERLUDE, the arms are cyclic. If you did the interlude and filmed it and slowed it way down, which you can do using AFTER EFFECTS, you could say that each arm during the INTERLUDE:

SLOWLY GOES UP

and then

SLOWLY GOES DOWN

Slowly going up like a rising COSINE wave,

Slowly going down like a falling COSINE wave.

Repeating over and over with a certain frequency, perhaps after getting warmed up and getting the contagious enthusiasm of the rest of the McLeod or UNI-Dome crowd, increasing the AMPLITUDE of the wave, as the arms rise to higher heights and descend down to lowest reach while still keeping tempo with the ATTACK ATTACK song.

<http://www.cs.uni.edu/~jacobson/interlude/dance.txt>

<http://youtu.be/ZVcHX2ItNYY> is an early Interlude at Men’s BB game.

<http://www.youtube.com/watch?v=lU2CJO_AzhY> KWWL news story on Interlude hitting Afghanistan – New York National Guard unit.

*See also* [*http://www.cs.uni.edu/~jacobson/1025/AE/SineCosine.html*](http://www.cs.uni.edu/~jacobson/1025/AE/SineCosine.html)

*Trigonometry and Turtles*

***Math, Trigonometry, Geometry applied to simulating gravity in After Effects.***