Basketball Lab

Algebra 1

The purpose of this project is to explore how parabolas and quadratic functions can be used in a real-life situation, specifically the way that a basketball flies through the air. You will view videos of two basketball stars and analyze their shots using the tools you have learned recently in algebra class.

I. View the Video

A. Go to the class website and under the section for Algebra 1, click on the basketball shot for Mr. McKay.

B. Save the file on your local computer and open it in Geogebra.

C. You should see a picture on your screen, as well as a "slider" named *t*, which is set to 1. The *t* in this slider stand for time: this slider controls the time on the video.

D. In the lower left corner is a "play" icon. Press this icon and watch the video.

E. Notice that video ends before the ball gets to the basket. As you work through the steps of this project, you will predict an answer to this question:

Will the ball go in the basket?

II. Make a Graph and Table

A. Press the pause button at the lower left to stop the video.

B. Grab the point on the *t* slider and drag it back and forth. You will see that the video changes with this slider. We are going to use this control to plot the path of the ball as it moves.

C. Choose View | Axes, and also View | Grid to show the axes and the grid. Each grid line here represents approximately 1 foot.

D. Drag the *t* slider all the way to the left, and slowly drag it to the right until the ball *first leaves Mr. McKay's hands*.

E. Use the point tool (one of the buttons at the top) to plot a point at the center of the basketball. The new point will be automatically labeled "A."

F. We want to keep track of the points we plot. A good way to do this is in a table, which is done in Geogebra in the "Spreadsheet View" on the right side of the screen. There is already a table labeled with "*x*" and "*y*."

   i. Click in the first row in the "*x*" column.

   ii. Type the following formula (*without* the quotation marks): "**=x(A)**" [Hint: the x must be lower case and the A must be upper case.]

   iii. This will measure the *x*-coordinate of the point A that you just plotted.

   iv. In the *y*-column, type a similar formula: "**=y(A)**"

G. Now you have one point plotted, and its coordinates recorded in the table.

H. Go back to the arrow tool and drag the *t* slider to the right one unit. Repeat steps E–F to plot the new position of the ball. [Hint: the new point will be called B. Change all the *A*'s to *B*'s in step F.]

I. Keep doing this until you have plotted points for every position in the path of the ball.

III. Find a Parabola and its Equation

A. Now you are going to create a parabola that passes through all the points you plotted.

i. First, we need to tell Geogebra to put all your points together in a list. To do this, type the following command at the bottom of the screen in the "Input" box:

List1 = {A,B,C,D,...}

except you need to replace the ... with the names of all the points that you plotted.

ii. If you look in the "Algebra View" on the left side of the screen, you should see a new list called List1.

iii. Next, we will tell Geogebra to find a parabola that goes through all these points. To do this, type in the Input bar:

FitPoly[List1,2]

iv. You will see a parabola appear. Right-click the parabola, choose Properties..., and change the following things:

a) Change the color to your favorite color.

b) Change the thickness of the line to size 4 or 5 (this is under the "Style" tab).

IV. Now for Some Questions…

A. Look in the "Algebra View" on the left side. In the same color you used for the parabola, you will see its equation, using f(x) notation. Write down the equation here:

✎ _____

B. One of the points you plotted is the *y*-intercept of the parabola. Which point is it? ✎ _____
What are its coordinates? ✎ (_____ , _____) [Hint: Look at the table you made.]

C. Right-click the *y*-intercept, choose Properties..., and color it *green*.

D. What is the real-world meaning of the *y*-intercept in this situation? Answer this question by completing the following sentence:

✎ *The y-intercept is the point where the ball*_____

_____

E. Use the graph to estimate the coordinates of the two *x*-intercepts. Be precise: estimate to the nearest tenth. *x*-intercepts: ✎ (_____ , _____) and ✎ (_____ , _____).

F. Plot the two *x*-intercepts by typing their coordinates (including the parentheses) in the Input bar. Re-name them so they are labeled *Root1* and *Root2*, and color them *orange*.

G. What is the real-world meaning of the *x*-intercepts in this situation? Answer this question by completing the following sentence:

✎ *The x-intercepts are the two points where the ball*_____

_____

H. Use the *x*-intercepts to calculate the coordinates of the vertex. Show your work here:

✎ _____

_____

_____

Coordinates of vertex: ✎ (_____ , _____)

I. Plot the vertex by typing its coordinates in the Input bar. Name it *Vertex*, and color it *red*.

J. What is the real-world meaning of the vertex in this situation? Answer this question by completing the following sentence:

✎ *The vertex is the point where the ball*_____

_____

K. Take a look at your parabola, equation, and table, and make a prediction:

Will the ball go in the basket? ✎_____

Give a reason for your prediction. Your reason should include calculations.

✎ _____

_____

V. See the Rest of the Story

A. You can see the rest of the video, but it is hidden. Here is how to see it:

i. Choose View | Auxiliary Objects.

ii. In the Algebra View at left you will see the Auxiliary Objects folder and an object that says "z = false." Next to this object is a little circle that is empty, meaning the object is not visible. Click this little circle to see the object.

iii. You should see a check-box pop up on your screen, labeled "See the Rest of the Story." Check the box in this check-box, then play the video again.

iv. Was your prediction correct? ✎_____

VI. What About Everyone's Favorite Amish Basketball Star?

A. First, save the Geogebra file you have created.

B. Then, go back to the web page and download the Geogebra file for Mr. D.A.

C. Repeat parts II and III above to find a parabola for Mr. D.A.'s basketball shot.

D. Answer the questions below:

E. Write down your equation for Mr. D.A.'s shot: ✎_____

F. What are the coordinates of the *y*-intercept? ✎ (_____ , _____)

G. Right-click the *y*-intercept, choose Properties..., and color it *green*.

H. Use the graph to estimate the coordinates of the two *x*-intercepts. Be precise: estimate to the nearest tenth. *x*-intercepts: ✎ (_____ , _____) and ✎ (_____ , _____).

I. Plot the two *x*-intercepts and re-name them *Thing1* and *Thing2*, and color them *orange*.

J. Use the *x*-intercepts to calculate the coordinates of the vertex. Show your work here:

✎_____

_____

_____

Coordinates of vertex: ✎ (_____ , _____)

K. Plot the vertex and re-name it *Vertex*, and color it *red*.

L. Take a look at your parabola, equation, and table, and make a prediction:

Will the ball go in the basket? ✎_____

Give a reason for your prediction. Your reason should include calculations.

✎_____

_____

M. Just as you did in part V, view the end of this video. Was your prediction correct ✎_____

VII. What to Turn In

A. Send me a copy of one of your Geogebra graphs by doing this:

i. With the Geogebra window showing, press the "Print Screen" key.

ii. Go to Microsoft Word, and choose Edit | Paste. Save the file with *your name* in the filename.

iii. Attach this file to an email to your teacher.

B. Also turn in this packet with your name on the front and all questions completely answered.

VIII. The Moral of the Story

A. One final question: *Based on your observations and calculations today, if Mr. McKay and Mr. D.A. went head-to-head in a one-on-one basketball competition,*

Who would win?