1. Would you stick or switch? Take a few minutes to think about it on your own and then discuss with a partner.

2. We are going to run some simulations of the game. If you have access to a computer play ten rounds on this website http://math.ucsd.edu/~crypto/Monty/monty.html. Otherwise your teacher will give you 3 cards to play with a partner. One person places the cards facedown, knowing where the car is, and acts as the host. The other person acts as the contestant. Run through 10 rounds. Keep track of your results in the table below.

	Stuck	Switched
Won		
Lost		

1. Draw an ellipse centered at the origin with major axis length 2a and minor axis length 2b and to write the equation of the ellipse in standard form.

2. In pairs think about how the circle and ellipse are related. If you make an ellipse turn into a circle what happens to the a and b values?

3. Write the formula for the area of this circle and make a guess as to what the formula for area of an ellipse would be if a and b were different values.

Calculus Extension

1. Given the equation of an ellipse $\frac{x2}{a^2} + \frac{y2}{b^2} = 1$, solve for y.

2. You may have noticed that in the movie this is written as $|y| = \frac{b}{a}\sqrt{a^2 - x^2}$. Show this answer and the one you got are equivalent.

3. We are going to take just the top part of the graph to find the area and then multiply by 2 to get the full ellipse. Set up this integral.

4. What method can you use to evaluate this integral?

5. Solve to find the area.

1. Read the given article.

2. The cumulative home run ratio (CHR) is calculated as CHR = $\frac{cumulative\ home\ runs}{cumulative\ at{-}bats}$. Pick a player who has hit 500 home runs since 2005 and set up an Excel table with number of homeruns and number of at-bats for each year from the players start year until now. You can find player statistics at http://www.baseball-reference.com.

3. Calculate the CHR for each year.

4. Plot a graph in Excel of the CHR values.

5. Look at all of the graphs and find your own patterns in the CHR graphs or see if the article's pattern holds up.

Paying it Forward with Exponential Growth

1. Draw a tree diagram similar to the one in the movie. Then make a guess as to how many rows there need to be for everyone in the school to have received a good deed.

2. The top row is the original good doer but before he has done any good deeds he hasn't helped anyone so call that row 0, or $x = 0$ at that position. The next row, $x = 1$, has three people who have received a good deed so its value is 3. Use this idea to think of modeling this situation with a function. What is $f(3)$, $f(4)$, and $f(15)$? Do as many examples as you need to help you find a formula for $f(x)$.

3. Share your answers and explain how you got them.

4. Check the original guess about the number of rows needed to have everyone in the school receive a good deed. Is it what you expected?

5. Plot the points you got earlier and sketch a graph. This model won't include negative x values but you can include them to get full picture of the graph.

Fibonacci Numbers

1. The sequence that is produced is 1,1,2,3,5,8,13,…. Find a formula that defines these numbers.

2. Explore some properties of the Fibonacci numbers.

3. We will look at what happens when we divide a Fibonacci number by the previous one with increasingly larger Fibonacci numbers: $\lim_{n\to\infty} \frac{F_n}{F_{n-1}}$. Here are the first few ratios. Calculate a few more and guess the number it seems to be converging to. $\frac{1}{1} = 1, \frac{2}{1} = 2, \frac{3}{2} = 1.5$.

4. Let's prove this. Start with $\lim_{n\to\infty} \frac{F_n}{F_{n-1}}$ then use the definition and algebra to re-write this expression.

5. Create a sequence similar to the Fibonacci numbers but start with different initial values. Name your sequence and find any interesting properties it has.