For this written assignment, answer the following questions showing all of your work.

1. Determine whether the lines given by the equations below are parallel, perpendicular, or neither. Also, find a rigorous algebraic solution for each problem.

**a. [ {3y+4x=12 \brace -6y=8x+1} ](https://my.uopeople.edu/filter/tex/displaytex.php?texexp=%20%7B3y%2B4x%3D12%20%5Cbrace%20-6y%3D8x%2B1%7D%20)     b. [  {3y+x=12 \brace -y=8x+1}  ](https://my.uopeople.edu/filter/tex/displaytex.php?texexp=%20%20%7B3y%2Bx%3D12%20%5Cbrace%20-y%3D8x%2B1%7D%20%20)    c. [  {4x-7y=10 \brace 7x+4y=1}  ](https://my.uopeople.edu/filter/tex/displaytex.php?texexp=%20%20%7B4x-7y%3D10%20%5Cbrace%207x%2B4y%3D1%7D%20%20)**

 [Suggestion: go to [www.desmos.com/calculator](http://www.desmos.com/calculator), write the two equations and try to conclude the answer.]

2. A ball is thrown in the air from the top of a building. Its height, in meters above ground, as a function of time, in seconds, is given by [ h(t)=-4.9t^2+24t+8 ](https://my.uopeople.edu/filter/tex/displaytex.php?texexp=%20h%28t%29%3D-4.9t%5E2%2B24t%2B8%20). What is the height of the building? What is the maximum height reached by the ball? How long does it take to reach maximum height? Also, find a rigorous algebraic solution for the problem.

[Suggestion: go to [www.desmos.com/calculator](http://www.desmos.com/calculator) and write

[ y=-4.9x^2+24x+8 ](https://my.uopeople.edu/filter/tex/displaytex.php?texexp=%20y%3D-4.9x%5E2%2B24x%2B8%20)

and observe the answers.]

3. In a market, there are 100 shops, and a shop’s average per day income is $200. If one more shop is added to the market, the average income per shop reduces by $5 due to price competition. Conversely, the decrease of one shop can increase the average income per shop by $5 due to cartelization among the shopkeepers. Please suggest the optimal number of shops to the city’s revenue department from a total income (revenue) point of view of the market?

4 Lines can be used to approximate a wide variety of functions; often a function can be described using many lines.

If a stock price goes from $10 to $12 from January 1st to January 31; from $12 to $9 from February 1st to February 28th; and from $9 to $15 from March 1st to March 31th. Is the price change of the stock $10 to $15 from January 1st to March 31st a straight line?

It is clear that in each of the three time intervals mentioned there was a complex daily variation of prices as in an electrocardiogram. But what would be a simplified solution for a first naive view of the situation? Would a simple function hold up? What is the simplest function to represent this situation? Does your naïve initial and simplified model allow you to predict the behavior of the stock in the next month?

How can I use three “pieces” of lines to describe the price movements from the beginning of January to the end of March? Show the graph for the price movement.

Go to [www.desmos.com/calculator](http://www.desmos.com/calculator), and write your equations following the example

y = x + 2    {0 < x < 2}

y = –x + 6  {2 < x < 5}

y = 2x – 9  {5 < x < 8}

