Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. The enrollment N in millions of students t years since 1965 in US public high schools is given by $N = -0.02t^2 + 0.44t + 11.65$. The model is applicable from 1965 to 1985.

   (a) Calculate $N(7)$ and explain in practical terms what it means.

   (b) In what year was the enrollment the largest? What was that largest enrollment?

   (c) Find the average yearly rate of change in enrollment from 1965 to 1985.

   (d) Graph N vs. t by appropriately adjusting your window. Explain in a **short sentence** your window choices.

2. The yearly profit P for a widget producer is a function of the number n of widgets sold. The formula is $P = -180 + 100n - 4n^2$, where P is measured in thousands of dollars, n is measured in thousands of widgets and the formula is valid up to a level of 20 thousand widgets sold.

(a) Make a graph of P vs. n.

(b) Calculate $P(0)$ and explain in practical terms what your answer means.

(c) What profit will the producer make if 15 thousand widgets are sold?

(d) Approximate the break-even point for this widget producer.

(e) What is the largest profit possible?

3. The relationship between the distance d in miles that you can travel without stopping for gas, the number of gallons g of gasoline in your tank and the gas mileage m in miles per gallon that your car gets is given by $d = gm$.

(a) How far can you drive if you have 12 gallons of gas in your tank and your car gets 24 miles per gallon?

(b) Solve the given equation for m. Explain in everyday terms what your new equation means.

(c) Use the new equation to determine the gas mileage of your car if you can drive 335 miles on a full 13-gallon tank of gas.

(d) A Detroit engineer wants to be sure that the car she is designing can go 425 miles on a full tank of gas, and she must design a gas tank to ensure that. She does not know yet what gas mileage this new model-car will get and so she decides to make a graph of the size of the gas tank as a function of the mileage. Make the graph that the engineer made.

4. Solve the following inequalities and make a graph of the solution sets.

(a) $-x^2 + 5x + 14 < 0$

(b) $\frac{x+2}{x^2+2x-15} \geq 0$

5. We want to form a rectangular pen of area 100 square feet. One side of the pen is to be formed by an existing building and the other three sides by a fence. Let W be the length in feet of the sides of the rectangle perpendicular to the building and L the length in feet of the other side.

(a) Find a formula for the total amount of fence needed as a function of both W and L.

(b) Express as an equation involving W and L the requirement that the total area formed be 100 square feet.

(c) Solve the equation you found in Part (b) for L.

(d) Use your answers in Parts (a) and (c) to find a formula for F, the total amount, in feet, of fence needed as a function of W alone.

(e) Make a graph F vs. W (and adjust your window).

(f) Determine the dimensions of the rectangle that requires the minimum amount of fence.