# Introduction to Mathematical Modeling
## M331 Group Project I

<div align="right">Due Friday, September 14</div>

Problems one and two ask you to consider the model for a major league baseball team consisting of the marginal revenue curve

$$MR(q) = \beta \tag{1}$$

and the marginal cost curve

$$MC(q) = 2q^2 - 20q + 100 \tag{2}$$

**Problem 1.**

a) Describe the meaning of $\beta$ and why it is important.

b) If the management insists on hiring ten star players, what is the minimum value of $\beta$ such that the team is profitable.

**Problem 2.** Consider the new marginal revenue curve defined piecewise as

$$\beta = \begin{cases} 60 & \text{if } q \leq 10, \\ -60 & q > 10 \end{cases}$$

Now plot *and* interpret the total revenue model. You may assume $TR(0) = 0$.

**Problem 3.** Consider the definitions of the total cost

$$TC(q) = \int_0^q MC(\alpha)d\alpha + \text{fixed costs}$$

and total revenue

$$TR(q) = \int_0^q MR(\alpha)d\alpha + \text{fixed revenues}$$

where fixed costs and fixed revenues are independent of the number of star players. Can altering the fixed costs or revenues change the optimal number of players a team should employ assuming the model given in Equations (1) and (2)? Argue mathematically and please comment on your result. Assume that the number of players allowed comes from the set $\{0, 1, 2, \ldots, 20\}$.

**Problem 4.** Solve Problem 1.2 number 4. Start with the formula $MR(q + 1) = TR(q + 1) - TR(q)$.

**Problem 5.** Problem 1.3 number 1. To solve this problem emphasize the *relative* steepness of the supply and demand curves. You should plot four graphs selecting steep/flat combinations of the supply and demand curves. Now compare and draw conclusions.

**Problem 6.** Problem 1.3 number 5. Be succinct possible and consider using lists.