ENME 444 Paper Helicopter Design Project

You are to form groups of three students to design and construct 'helicopters' out of common office supplies:

20# paper
#1 paper clips
tape

The functional specifications for these helicopters is as follows:

The helicopter will be released from the second floor of the atrium.
Neither spin nor velocity may be imparted during the release.
The helicopter must rotate at least 6 times before hitting the 1st floor.
The helicopter must land within a 6' x 6' square below the drop point.

The objectives are twofold:

Helicopter time aloft must be maximized.
Helicopter price must be minimized.

There are several factors groups will use in order to determine helicopter price:

Capital costs:	
Development labor	$20.00 / person-hr
Equipment costs:	
Scissors	$1.50
Ruler	$1.00
Manila Folder Stock	$0.89 each
Full-scale testing:	
private	$3.00 / test
public	$0.50 / test
Incremental costs:	
Manufacturing labor	$10.00 / person-hour
Paper	$0.0125 / sheet
Paper Clips	$0.00067 each
Tape	$0.008 / inch
Incremental recycling income:	
5% of cost for paper clips.	
10% of cost for white paper scrap (no markings)	
5% of cost for marked paper	

Capital costs must be spread over the production run, unfortunately you don't know how many helicopters you'll sell until you know how you stack up to the competition. Therefore, we must try to estimate how many you will sell. The primary indication of how good your design is a score that combines the two objectives of time aloft and price:

$$\text{Score} = \frac{\text{Time Aloft (seconds)}}{\text{Price (dollars)}}$$

Your market share will depend on the size of the total market and the performance of your helicopter. The total size of the market depends on the best score:

Market Size = 10^(max(score)/10)

Your share of the market will be based on how well your helicopter scores in relation to all others:

$$\text{Market Share} = \frac{\text{your score } \hat{}2}{\text{sum(scores}\hat{}2)}$$

If your design does not capture 1% of the market, your market share will go to zero.

The main goal of the project is to make the best **profit** from your endeavor. Your profit can be calculated as:

Profit = (Market Share)x(Price – Incremental Cost) – Capital Cost

The project has two phases:

Phase I (9/7-9/9) **Helicopter Design and Prototyping**

An open test (all teams will be allowed to attend) will be run the last 15 minutes of class period on 9/7. On Thursday, the process continues with redesign for the first 45 minutes of class, followed by 15 minutes during which each team must manufacture six of their helicopters. Three of these will be chosen for a market test during the last 15 minutes of class. **Save all prototypes & design notes!!!!**

Phase II (outside of class + 9/14) **Helicopter Redesign**

Groups will redesign their helicopters, register a final score (in class on 9/16), and turn in a report discussing:

1) design alternatives explored
2) design selection
3) manufacturing plan
4) costing – break down capital vs. incremental costs.
5) profit projections

Each group member must also turn in a short essay (1-2 pages) reflecting on the design process as exemplified in this project.

Final grading will be determined by profitability in the final market (20%) as well as report completeness, clarity, and brevity (80%).