

SHOOT FOR THE WIN

A Breakdown of the 2021-22 NBA Season in Wins and Shot Attempts

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Another action-packed season has run its course and we've seen the Golden State Warriors win yet another title. Perhaps, it's now time to admit that the game has completely changed.

As we have seen throughout the years, the game has trended more towards a certain shot profile, that is, close-range shots and threes. We see more and more teams prefer shooting the long shot than dribbling in for what traditionalists would call "the more sensible shot".

Naturally, looking at how certain shot profiles affect a team's ability to win would be interesting. This will inform us how a team's overall decision-making impacts their ability to win. Now, we are sure that you are not interested in these highfalutin statistics like "PER" or "win-shares".

To help you, the casual fan, appreciate this phenomenon without these advanced statistics, this newsletter will just focus on two main categories: Wins and Shot Attempts.

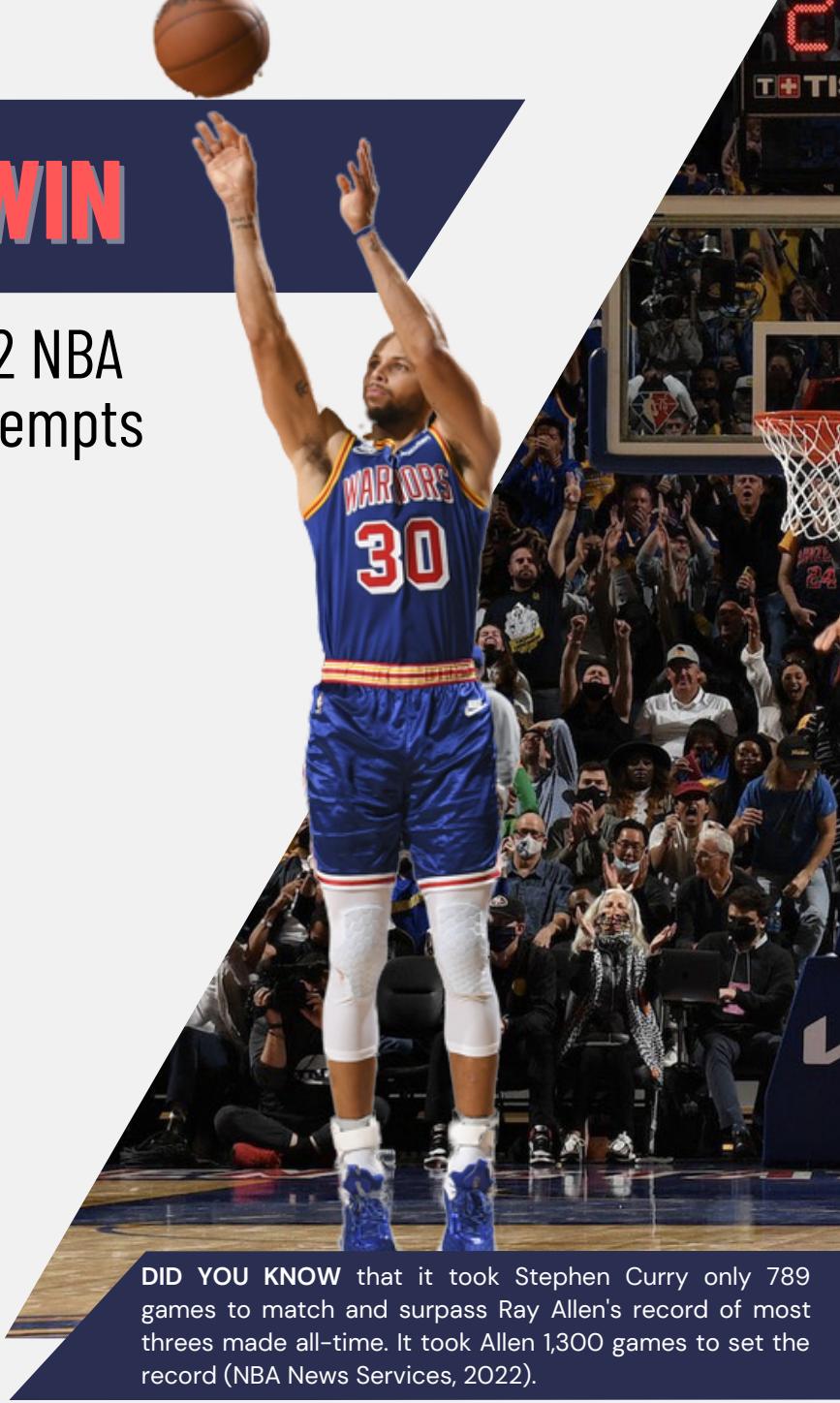
Let's now dunk into these numbers, and see what's up, and what's down.

Legend:

Total FGA (Total Field Goal Attempts per Game)

Total 2PA (Total 2 Point Shot Attempts per Game)

Total 3PA (Total Three Point Shot Attempts per Game)



DID YOU KNOW that it took Stephen Curry only 789 games to match and surpass Ray Allen's record of most threes made all-time. It took Allen 1,300 games to set the record (NBA News Services, 2022).



DID YOU ALSO KNOW that Kareem Abdul-Jabbar has the most career attempted shots, with a whopping 28,307 total field-goal attempts (Burke, 2020).



How it Ended...

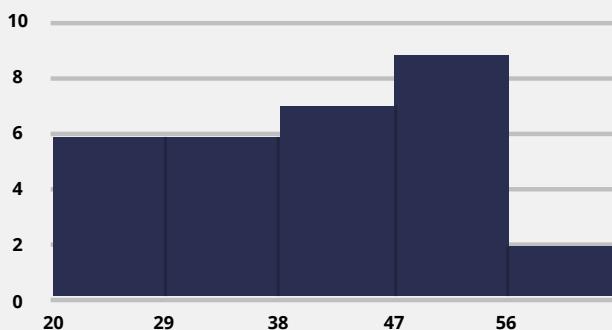
In this section, we take a broad look at the teams' Total Wins and Total Field Goal Attempts (FGA) for this year's Regular Season. From here, we look for trends and patterns to establish a relationship between these two. To aid in visualizing the stats, Frequency Distribution Tables and Histograms have been formed. See the diagrams below:

TOTAL WINS

Frequency Distribution Table for Total Wins

CLASS	LCB	UCB	FREQUENCY
20 to 28	19.5	28.5	6
29 to 37	28.5	37.5	6
38 to 46	37.5	46.5	7
47 to 55	46.5	55.5	9
56 to 64	55.5	64.5	2

Histogram for Total Wins



These results show that most teams' won between 47 to 55 games. With the 38 to 46 win bracket being the second-most populated bracket. Overall, it can be said that the competition was rather stiff with only two teams breaking 55 wins.

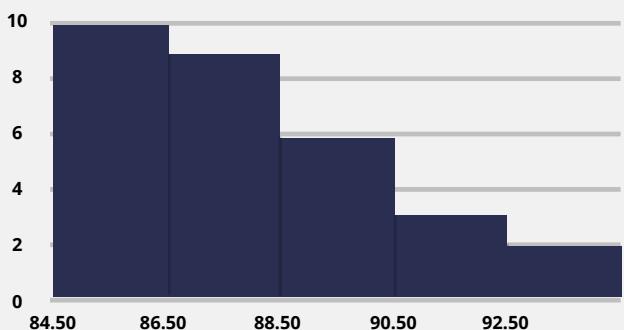
In terms of trends, the only evident trend is seen in the Total FGA frequency distribution. The data shows a descending trend which proves the difficulty for teams to finish the Regular Season with an FGA over 90.

TOTAL FGA

Frequency Distribution Table for Total FGA

CLASS	LCB	UCB	FREQUENCY
84.5 to 86.4	84.45	86.45	10
86.5 to 88.4	86.45	88.45	9
88.5 to 90.4	88.45	90.45	6
90.5 to 92.4	90.45	92.45	3
92.5 to 94.4	92.45	94.45	2

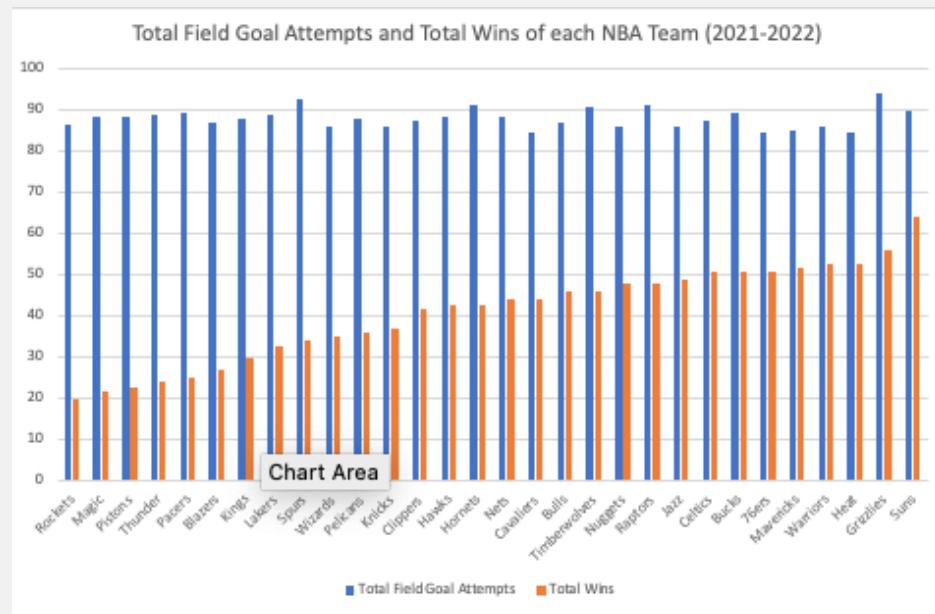
Histogram for Total FGA



These results suggest that most teams shot between 84.5 to 86.4 attempts. The Histogram also shows a descending order of data; telling us that as the Total FGA in question increases, the number of teams it describes decreases.

Breaking it Down

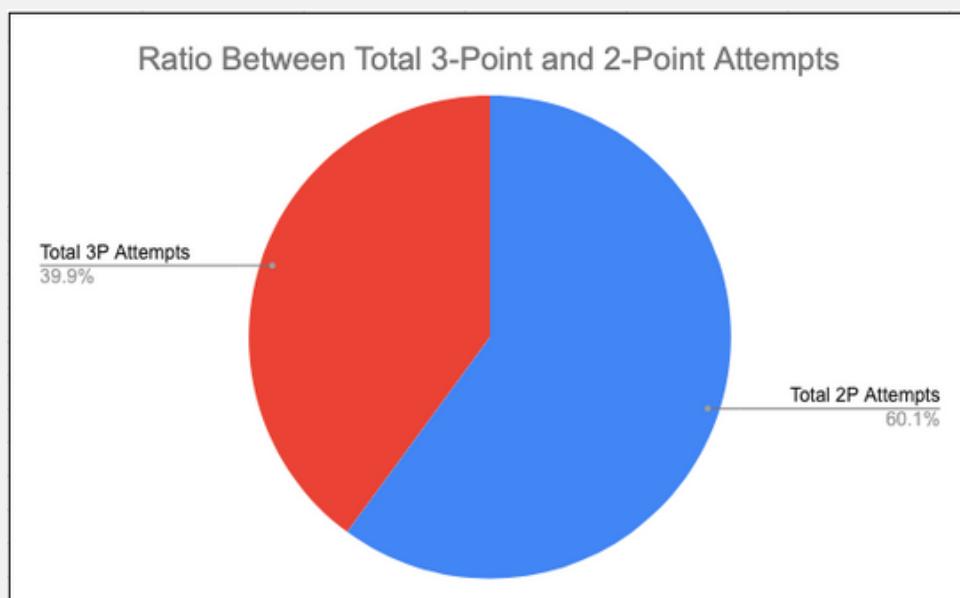
Now, we go a little bit deeper and take a look at a comparison of the teams' performance regarding the two categories, wins and shot attempts.



This bar graph shows the aforementioned comparison. Most noticeable is the lack of a clear relationship between the two categories. For instance, the team that attempted the most shots was the San Antonio Spurs, a team that barely made the play-in tournament (NBA, n.d.).

IN OTHER NEWS... DID YOU KNOW that Michael Jordan has the most clutch shots in NBA history with 9 buzzer-beaters (Fujita, 2022).

Looking particularly at the shot attempts, we see the following breakdown.



The pie graph shows a breakdown of the Total Shot Attempts into 2-point attempts (2PA) and 3-point attempts (3PA). It can be observed that NBA teams still take more 2-point shot attempts compared to 3-point shot attempts. This is expected as 3-point shots are considerably more difficult than 2-point shots. However, the 3-Point attempts this season is significantly higher compared to earlier seasons. For instance, it was only 20% in the year 2005. This is because the NBA has seen a trend of more players getting better at shooting threes (Schuhmann, 2021).



Centers of Attention

To get into a deeper analysis, we need landmark values. All you need to remember is that the measures of central tendency profile the average team and the measures of dispersion tell us how far better or worse a team is from this average profile.

Measures of Central Tendency	Wins	Total FGA	Total 2PA	Total 3PA
Mean	41	88.06	52.9	35.15
Median	43.5	88	52.9	34.95

By these two metrics, the average NBA team would be at .500 or a little bit over .500 (50-50 win-loss record in an 82-game season). If we were going to insert that team into this season's standings, they would miss the Eastern Conference Playoffs and barely make the play-in in the Western Conference.

Mode	51	87.4	50.4	36.8
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By this metric, the average team is the 4th best team in the East or the 5th best team in the West, by colloquial standards not a bad team, perhaps even sleeper bets to win the title.

Measures of Dispersion	Wins	Total FGA	Total 2PA	Total 3PA
Range	44	9.8	15.7	12.5
Standard Deviation (SD)	11.567	2.406	3.945	3.058
Variance	133.795	5.789	15.563	9.351

There is a 44-win difference between the best win record (Suns) and the worst win record (Rockets). This shows that win-now teams and rebuilding teams are at extreme ends of the win-loss spectrum. The SD metric corroborates this. An 11.567 suggests a large separation between teams.

The differences in shot attempts are not as drastic albeit still quite noticeable. A 9.8 unit difference exemplifies this. The SD metric of 2.406 seconds this. Again, this is not unremarkable yet also not as drastic.

Separating the Weeds

At this point, we look at deviations from the landmarks we set in the section preceding this.



As you may very well know, the Golden State Warriors just won the title of NBA Champions. As such, they may be the best candidates for examination. How did the champions of the world perform in the regular season?

The team had 53 wins in the Regular Season, naturally performing well above the average wins. To use some technical terms, they were "1.03 standard deviations to the right of the mean".

Meanwhile, Joel Embiid averaged a whopping 30.6 points on an amazing 20 shots per game. Zooming out, how does his squad, the Philadelphia 76ers stand compared to the rest of the league in terms of FGA?

Surprisingly, the 76ers shot well below the average attempts per game. They shot "1.53 standard deviations to the left of the mean".

Now looking at the league as a whole, how many teams performed above average? Below average? This helps us gauge the state of the league, whether or not the competition is at the top or at the bottom.

Perhaps to our collective relief, we see a very top-heavy league. According to calculations, only 12 teams performed below average, while the rest of the teams performed better than average.



We will now look into the percentage of teams that fall under a specific total wins, FGA, 2PA, or 3PA value

First Observation

Teams who have less than 43 total wins are below the 50th percentile line (Most of them missed the playoffs)

Second Observation

Teams that have an FGA that are greater than 88 are above the 50th percentile line

Third Observation

Teams that have an average 2PA and 3PA greater than 53.1 and 34.5 respectively are above the 50th percentile line

The Bulls, who were able to advance to the playoffs, had a total 2PA of 58.1, which is higher than the total 2PA of 27 of the 30 teams. What is the Bulls' total 2PA percentile?

Since 27 of the 30 NBA teams have total 2PA that are lower than the Bulls' average, this would mean that the Bulls are in the 90th percentile.

What percentage of the league has more wins than the Mavericks if they are ranked 5th in terms of total wins?

It may be deduced that the Mavericks have more total wins than 25 of the 30 NBA teams. Applying these numbers to the formula for percentile, one would get 83. This means that the Mavericks have more total wins than 83 percent of the league. Thus, to get the percentage of the league that have more wins than the Mavericks, one would need to subtract 83 from 100, resulting in 17 percent.



The Nets are in the 7th percentile of average 3 point attempts. Considering that there are 30 NBA teams, how many teams have more average 3 point attempts than the Nets?

Bearing in mind the formula for the percentile, one would approximately get 28. However, since the Nets should not be included in the count, the final answer will be 27 teams, which means that the Nets rank third lowest in the league in terms of total 3PA.



At what percentile would the Timberwolves be if they have a total FGA of 91, which is the 5th highest in the league?

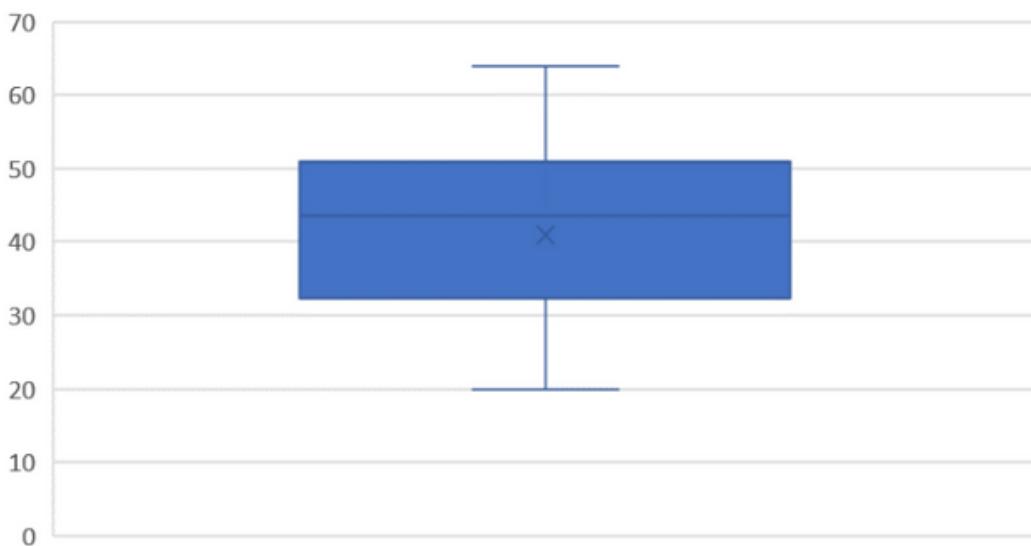
Since the Timberwolves are the 5th highest in terms of total FGA, it may be deduced that they have a field goal attempt average that is higher than the other 25 teams in the league. Applying these numbers to the formula for percentile, one would get 83, meaning that this team has a higher total FGA than 83% of the league.



Boxing Out

Now, we look at how the various teams are distributed in terms of their wins and shot attempts.

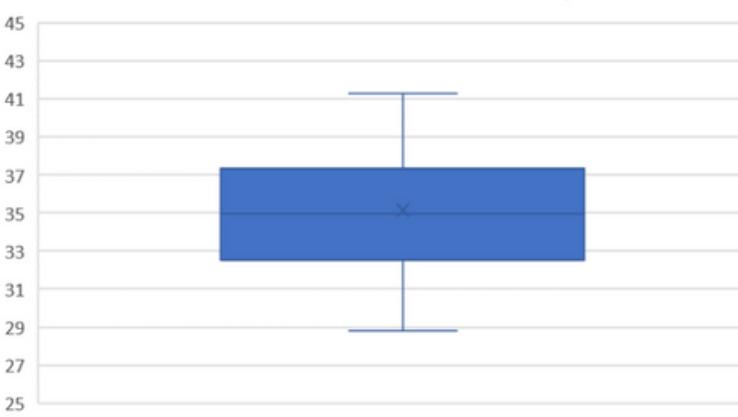
Box Plot of Total Wins



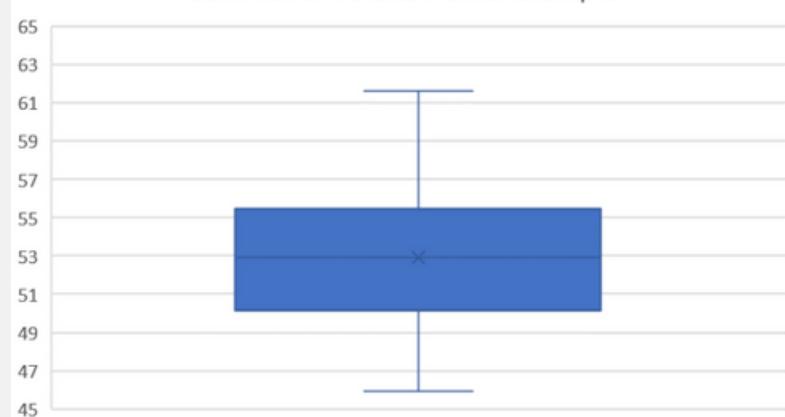
In the plot on the left, we can see that the median is closer to the upper half of the plot. In technical terms, it is closer to the 3rd Quartile which makes it a left-skewed box plot. This means that the majority of the NBA teams have many total wins on average, with a few teams having lesser wins. The lesser wins may be attributed to rebuilding teams, who are racking up losses or *tanking* with hopes of landing a high draft slot (Spencer, 2013).

DID YOU KNOW that Kobe Bryant has the most missed shots in NBA history with 14,481 missed field goal attempts (Adame, 2020).

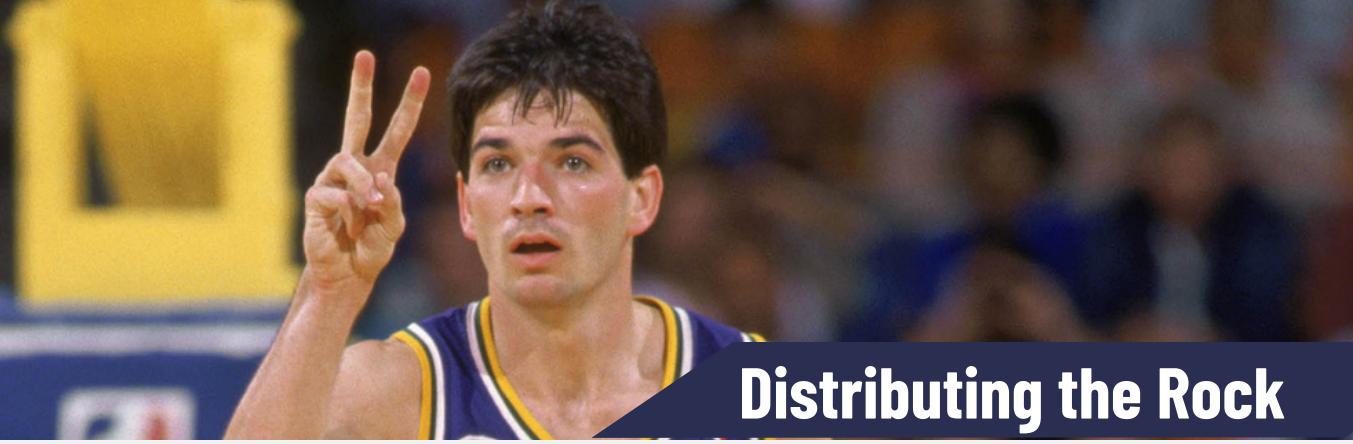
Box Plot of Total 3-Point Attempts



Box Plot of Total 2-Point Attempts

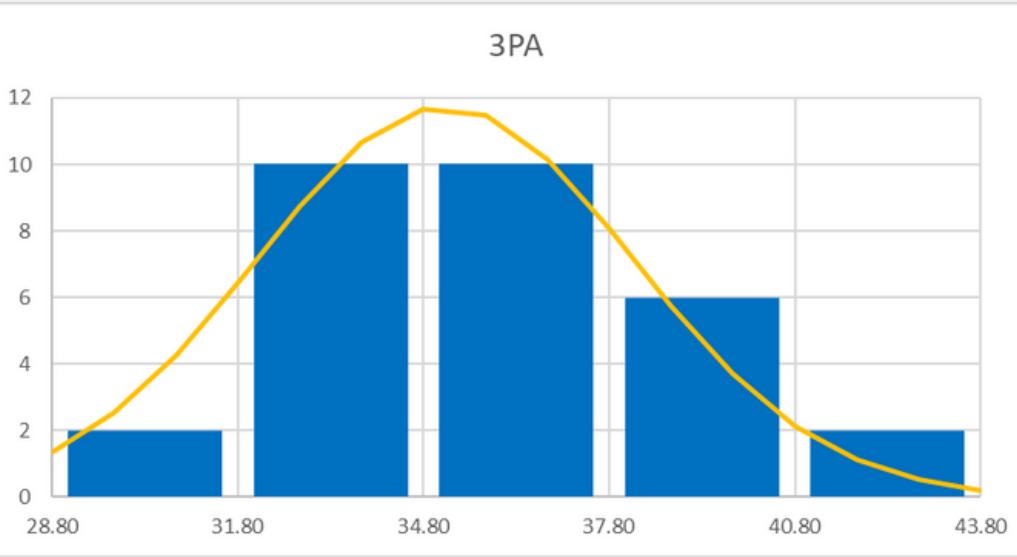


In terms of shot attempts, to get a more representative result, two plots are made representing 2PA and 3PA. From the two plots, we can observe that the 2PA had a greater range than the 3PA. In complex words, the 2PA plot had a greater variety than the 3PA plot. This is likely because 2-point shots are easier and more varied by nature (e.g. lay-ups and pull-up jumpers as compared to 3-point shots which are almost exclusively set shots and jump shots) making it harder to perform many times in the flow of a game - reducing its variety.



Distributing the Rock

To show the variety of 3-point shot attempts, we use a different type of plot. Looking at the original set of statistics, we see that the teams are spread fairly evenly when concerning their attempts from 3. Therefore, we use what's called a *normal distribution curve*.



From here, we want to point out a certain phenomena that can be derived from this graph, similar to what we did earlier.

Focusing once again on the NBA champion Warriors, for obvious reasons, it is interesting to see them ranking around the 92nd percentile in 3-point attempts.

For context, the Suns, who were the number one team in the league win-wise, ranked only in the 14th percentile.

Here we see the importance of having a good amount of 3-point attempts. The Suns, being a 2-point heavy team lacked the offensive firepower 3-pointers provide when it mattered most in the playoffs, even in games during the regular season where they struggled (ESPN, 2022, 1:37).

Looking at the other finalist now, the Boston Celtics, they ranked around the 73rd percentile in this category. Meaning, there is a 27.26% chance that a random team shoots more threes than the C's. So what? Well, this means that although we see with the Warriors that a good amount of 3-pointers is good, it is not the be-all and end-all of a championship-caliber team.



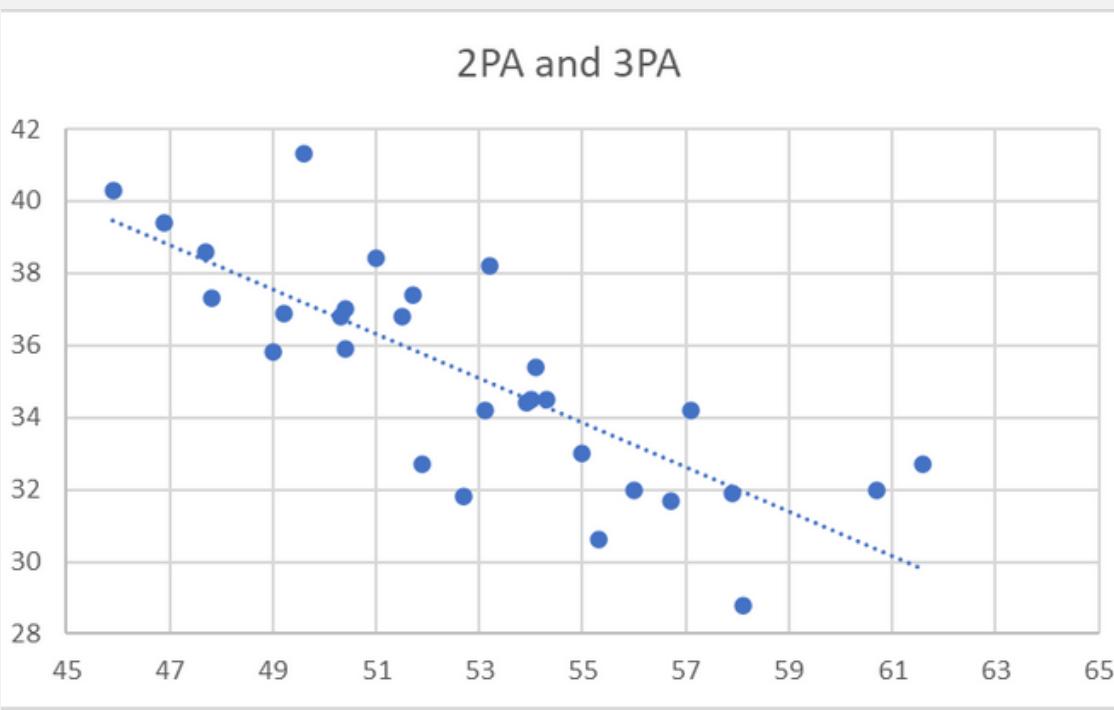
So from these metrics, many well-respected pundits like the guys from "Inside the NBA" would suggest that you would have to at least be "above-average" in terms of attempts from three to give yourself the chance to be at least close to average in terms of 3-point percentage. In that vein, which teams do we consider "above-average" in terms of 3-point attempts?

For our purposes, we would define above-average as around the 75th percentile. In which case, the closest teams are the Mavericks and the Thunder.



The Right Chemistry

In that respect, how then is the relationship between the 2PA and 3PA?

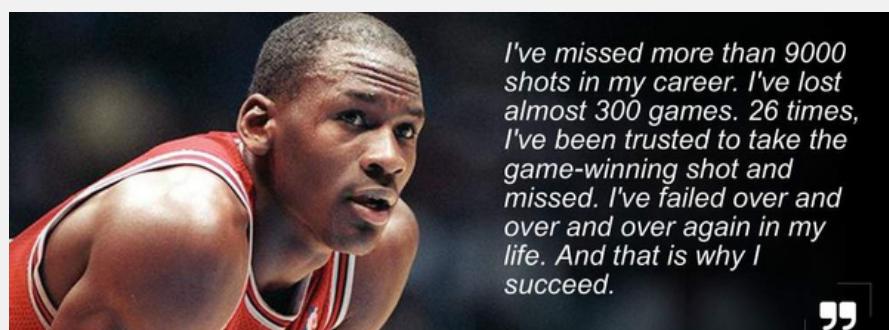


Pay attention to the straight descending line. This tells us that the 2PA and 3PA have an inverse relationship. In other words, the more 2-pointers attempted, the less 3-pointers attempted and vice versa.

This means that the argument about having a perfectly balanced amount of 3-pointers and 2-pointers is highly improbable, if not, impossible.

We know this, of course, is because of the finite amount of shots a team can shoot as a result of the 48-minute limit of a game.

Focusing now on the dots, we see a few teams shooting close to the ideal regression (straight line). However, many teams also are quite far from the regression line. This just means that the described relationship isn't strict, and can be affected by many other factors.



Going back to the original thesis of this newsletter, how do certain shot profiles affect winning?

The answer based on this analysis is that generally speaking, shooting more 3-pointers is helpful as it yields a more rewarding offense, but it is not the only predictor of wins. It isn't exclusive that if a team doesn't shoot that many 3-pointers, they'll be a losing team.

Nonetheless, from a broader perspective, a modern NBA team should shoot more shots, particularly heavier on the 3-pointers (ESPN, 2022, 1:21). These findings may impact a team's philosophy in terms of roster making, scouting and basically anything concerning team-building.

Hopefully, this simplified statistical analysis helped you understand how a team's shot profile affected their wins, as well as appreciate the importance of data management.



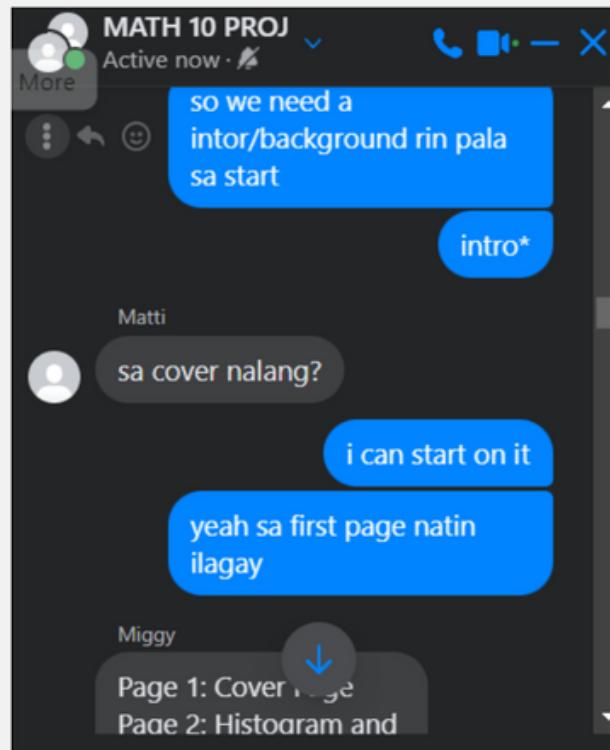
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"the grind never stops"

TEAMWORK

MEETING 1: Planning out our timeline



MEETING 2: Finalizing our computations



"the grind never stops"

CALCULATIONS

FREQUENCY DIST. TABLE AND HISTOGRAM

STEP 1: Determine number of classes						
$2^4 = 16$	k = 4					
$2^5 = 32$	k = 5					
2^k must be > 30						
Thus, $2^5 = 32$						
STEP 2: Determine class width						
WINS	$\text{UNDUP}((G72-G59)/5)$					
FGA	$=(H63-H71)/5$					
STEP 3: Frequency Distribution						
WINS						
CLASS	LCB	UCB	FREQUENCY			
20 to 28	19.5	28.5	6			
29 to 37	28.5	37.5	6			
38 to 46	37.5	46.5	7			
47 to 55	46.5	55.5	9			
56 to 64	55.5	64.5	2			
FGA						
CLASS	LCB	UCB	FREQUENCY			
84.5 to 86.4	84.45	86.45	10			
86.5 to 88.4	86.45	88.45	9			
88.5 to 90.4	88.45	90.45	6			
90.5 to 92.4	90.45	92.45	3			
92.5 to 94.4	92.45	94.45	2			
			LOWEST: 84.5			
			HIGHEST: 94.3			
			$(94.3-84.5)/5 = 1.96$			
			Class Width = 2			

"the grind never stops"

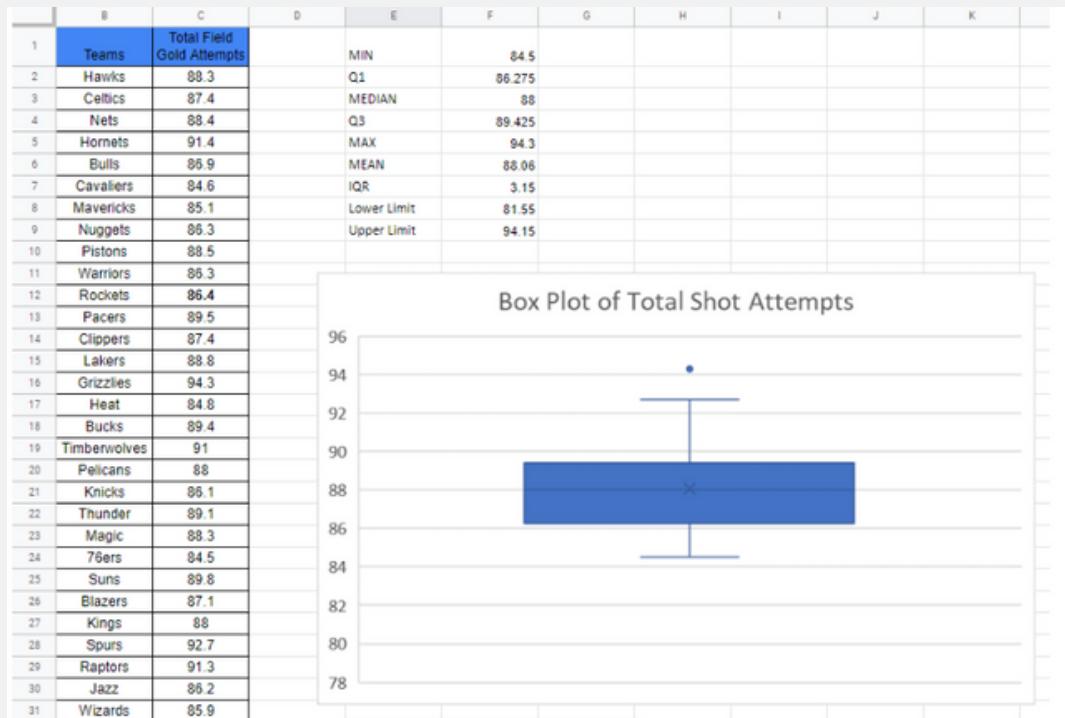
CALCULATIONS

BOX PLOT

Three total boxplots were made i.e. Total Wins, 2-Point Attempts, 3-Point Attempts. In constructing the boxplots, the following computations were obtained: minimum value, Q1, median, Q3, maximum value, mean, IQR, lower limit, upper limit. Note: The boxplots made were done in Excel 365 ProPlus.

$$\begin{aligned} \text{MIN} &= \text{MIN}(C:C) \\ \text{MAX} &= \text{MAX}(C:C) \\ \text{Q1} &= \text{QUARTILE.EXC}(C:C,1) \\ \text{Q3} &= \text{QUARTILE.EXC}(C:C,3) \\ \text{Mean} &= \text{AVERAGE}(C:C) \\ \text{Median} &= \text{MEDIAN}(C:C) \\ \text{IQR} &= \text{Q3} - \text{Q1} \\ \text{Lower limit} &= \text{Q1} - (\text{IQR} * 1.5) \\ \text{Upper limit} &= \text{Q3} + (\text{IQR} * 1.5) \end{aligned}$$

SAMPLE CALCULATION FOR BOX PLOT OF TOTAL SHOT ATTEMPTS



"the grind never stops"

CALCULATIONS

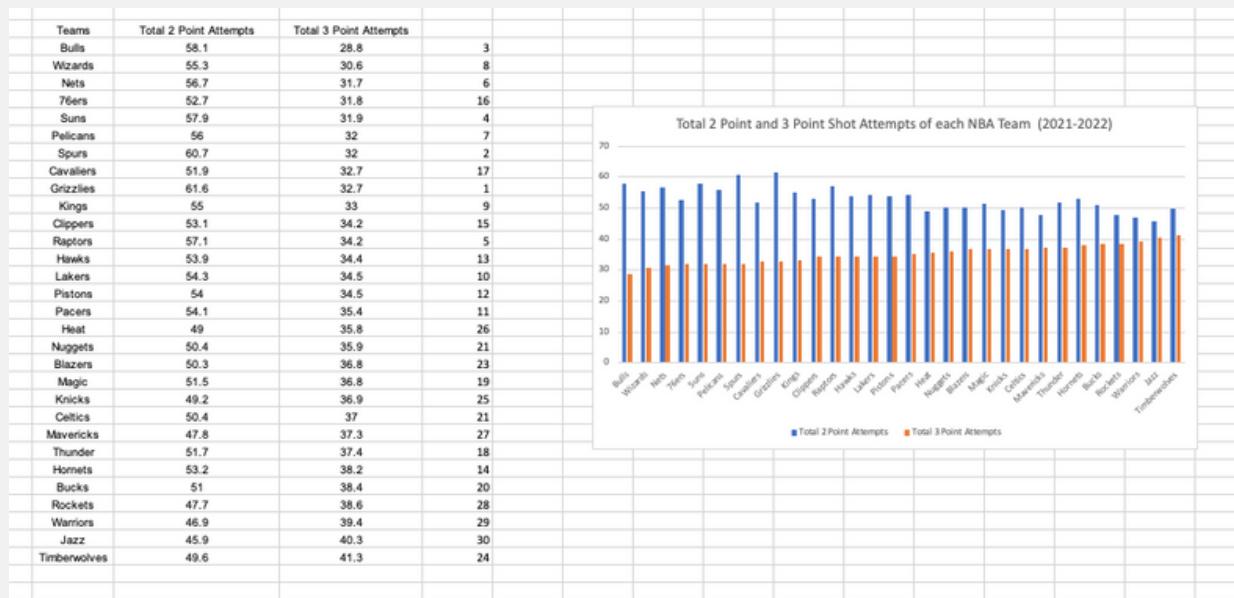
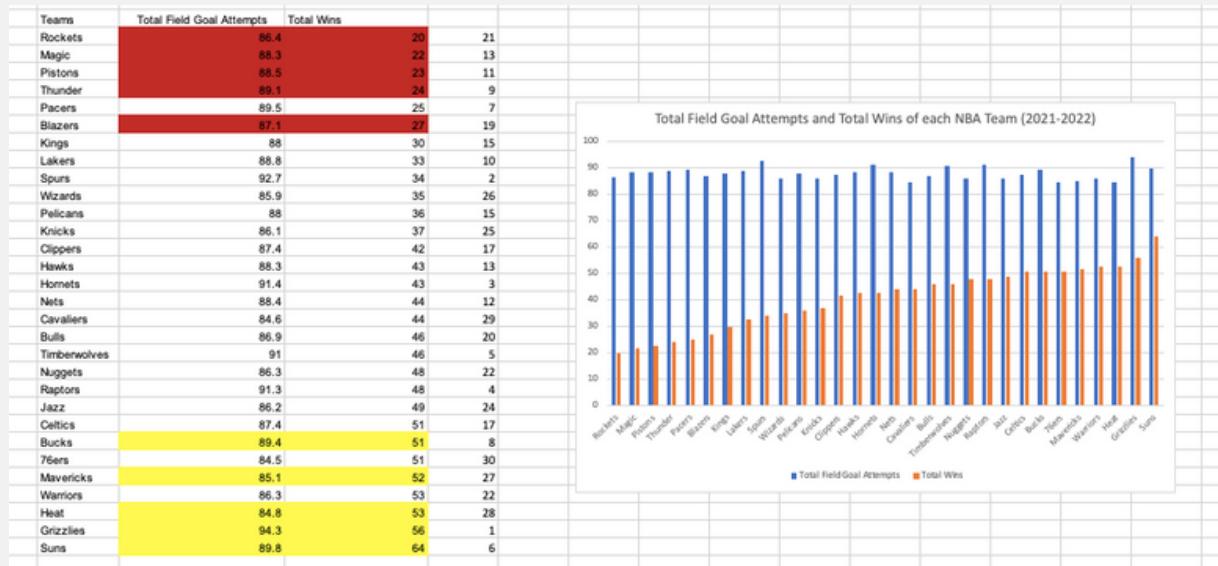
PIE CHART

Formula: Average of 2P/3PT Attempts divided by Total Attempts (88.06)

% of Total 2PT Attempts = 52.9/88.06

% of Total 3PT Attempts = 35.15/88.06

BAR GRAPH



"the grind never stops"

CALCULATIONS

Z-SCORES

1	2	3
Z-SCORE	Z-SCORE	Z-SCORE
=STANDARDIZE(K14,C7,C13)	=STANDARDIZE(L27,D7,D13)	
QUESTION: How did the 2021-2022 NBA Champions, the Golden State Warriors, perform in terms of Total Wins the Regular Season compared to the rest of the teams?	QUESTION: Joel Embiid finished the 2021-2022 NBA Regular Season with the highest points scored garnering a per game average of 30.6 points and a total of 2,079 points all in all. The question now is, where does the Total FGA of his team, the Philadelphia 76ers, stand compared to the rest of the teams this Regular Season?	QUESTION: Given the 30 teams in the NBA Regular Season, how many teams have a Total Win count above the mean? How many teams have a Total Win count below the mean?
ANSWER: The Golden State Warriors, the 2021-2022 NBA Champions, had a total of 53 wins in the Regular Season. The Z-Score finds that their Total Win count is greater than the mean of all teams in the Regular Season; It is 1.03 standard deviations away from said mean. This means that the Golden State Warriors performed well in the Regular Season clearly boosting their motivation during the Play-offs.	ANSWER: Even with the help of top scorer Embiid, the Z-Score shows that the Total FGA of the Philadelphia 76ers is less than the mean. It is 1.53 standard deviations away from the mean of all the Total FGAs. Thus, the team as a whole underperformed in terms of their Total FGA as compared to the other teams.	ANSWER: After calculating the Z-Scores of all the team's Total Wins, it can be concluded that there are 12 teams that scored less than the mean. The rest of them scored above the mean of all Total Wins.

"the grind never stops"

CALCULATIONS

Percentile

MEASURE OF RELATIVE POSITION: Percentile

A value x is called the **p th percentile** of a data set provided $p\%$ of the data values are less than x .

$$\text{Percentile of score } x = \frac{\text{number of data values less than } x}{\text{total number of data values}} \cdot 100$$

1) $\frac{27}{30} \times 100 = 90$
 $\rightarrow 90\text{th percentile}$

2) Let $x = \text{number of teams that have more average 3-point attempts than nets}$
 $\frac{x}{30} \times 100 = 7$
 $\rightarrow \frac{100x}{30} = 7$ \rightarrow Subtract from 30
 $30 - 7 = 27$
 $x = 2.1$ ≈ 27 (not 28 since the last one is not included)

3) 5th Rank \rightarrow Better than 25 teams
 $\frac{25}{30} \times 100 = 83.33$
 $\rightarrow 83\text{rd percentile}$

4) 5th Rank \rightarrow Better than 25 teams
 $\frac{25}{30} \times 100 = 83.33$
 $\checkmark 83\text{rd percentile}$
Implies that Nets are better than 83 percent of the league in terms of total wins
 $100\% - 83\% = \underline{\underline{17\%}}$ \rightarrow We want more wins

CALCULATIONS

Measures of Central Tendency and Distribution

Central Tendency and Dispersion

Measures of Central Tendency	Wins	Total FGA	Total 2PA	Total 3PA
Mean	41	88.06	52.9	35.15
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Measures of Dispersion	Wins	Total FGA	Total 2PA	Total 3PA
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Standard Deviation	11.567	2.406	3.945	3.058
Variance	133.795	5.789	15.563	9.351

Sample Calculations for the 'Wins' column

Mean = average('Data Set'!D41:D70)
Median = median('Data Set'!D41:D70)
Mode = mode('Data Set'!D41:D70)
Range = max('Data Set'!D41:D70) - min('Data Set'!D41:D70)
Standard Deviation = round(stdev('Data Set'!D41:D70),3)
Variance = round(C11^2,3)

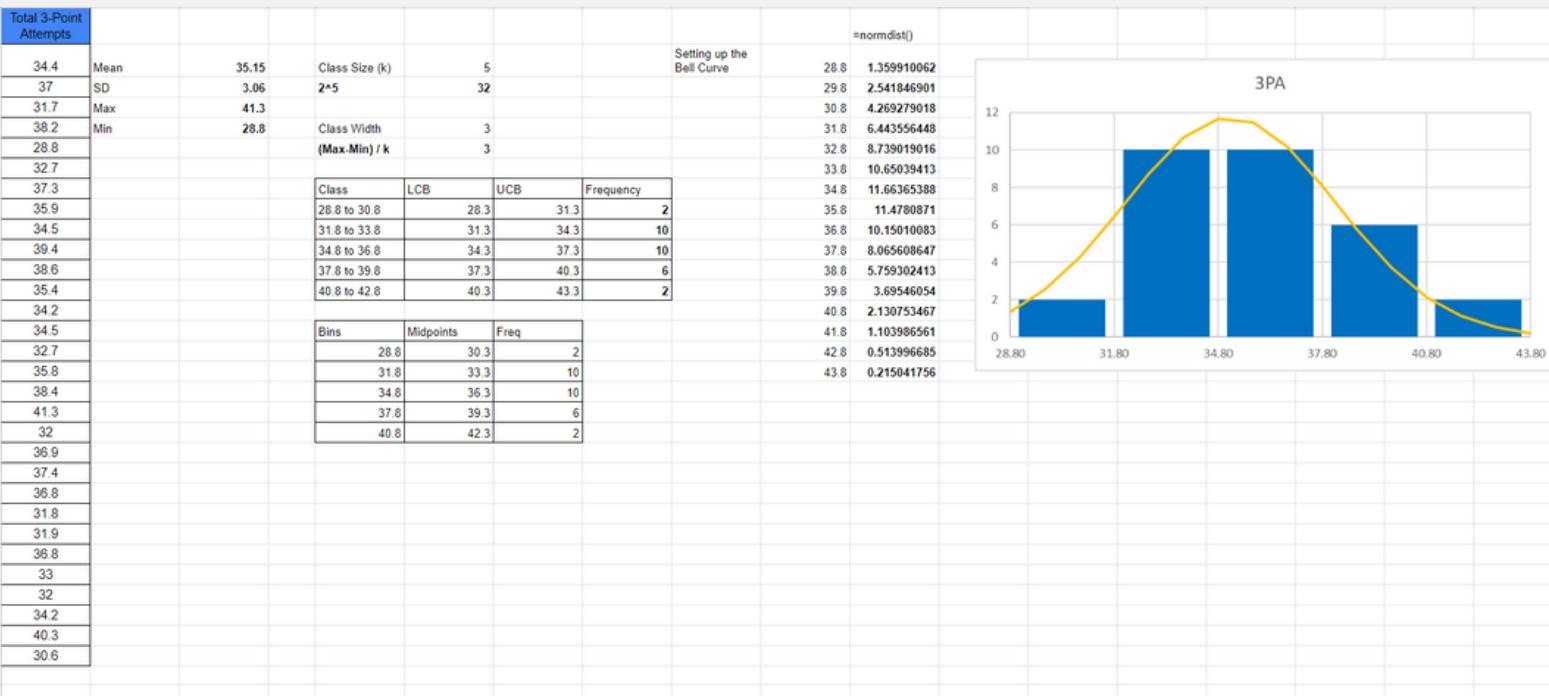
Sample Calculations for the 'Total FGA' column

Mean = average('Data Set'!E41:E70)
Median = median('Data Set'!E41:E70)
Mode = mode('Data Set'!E41:E70)
Range = max('Data Set'!E41:E70) - min('Data Set'!E41:E70)
Standard Deviation = round(stdev('Data Set'!E41:E70),3)
Variance = round(D11^2,3)

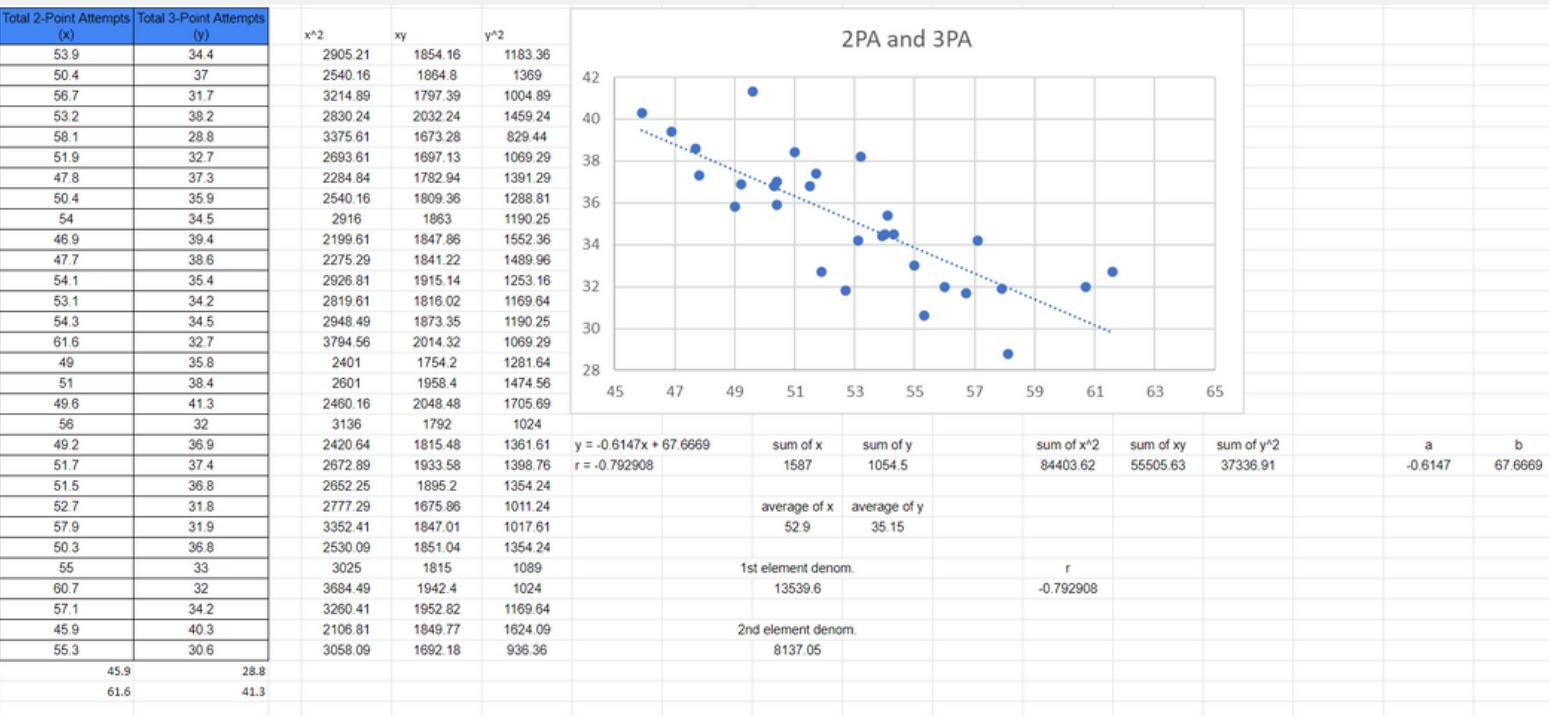
"the grind never stops"

CALCULATIONS

Standard Normal Distribution



Linear Regression



"the grind never stops"