Name: _____ Date: _____

The Arithmetic of the Arc

Reading level 13 · 1646 words

One player, 79 games, 886 attempts. In 2015-16, Stephen Curry tried 11.2 threes a game, four times what the average NBA team tried in 1979-80, which was 2.8 a game, in the first season the league counted them. By 2025-26 the average team tried 37.0 a game, about thirteen times as many as in that first season. Those are Basketball-Reference's figures, and the comparisons are our arithmetic. Who is Stephen Curry in this story? He is a guard from Akron, Ohio, born in 1988, who has made 4,275 regular-season threes through early November 2026. His career is a useful ruler for how the shot went from a rarity to the center of the sport.

The attempts did not rise in a straight line, and the interruptions are informative. NBA teams averaged 9.9 attempts a game in 1993-94. The next season the league moved the line in to a uniform 22 feet, a change that rewarded threes, and attempts jumped to 15.3 before climbing to 16.8 by 1996-97; when the full distance returned in 1997-98, they fell to 12.7. Moving the top of the arc in by 1 foot 9 inches raised the count by more than half, and moving it back cut it by about a quarter, though not all the way to 9.9. That is as near to a controlled experiment as this sport offers, although rosters and styles were changing too. The later climb, from 18.4 in 2011-12 to 24.1 in 2015-16 and then to 34.1 in 2019-20, happened with the line exactly where it was.

Why would teams choose to shoot more of a harder shot? Because difficulty is not the same as value. Points per attempt is what a make is worth multiplied by how often it goes in, and Basketball-Reference's 2025-26 league table divides shots by distance. Within three feet of the rim, which accounted for 23.1 percent of all shots, .703 went in, worth about 1.41 points each. From 3 to 10 feet, .463 gave 0.93; from 10 to 16 feet, .446 gave 0.89; and from 16 feet to the line, .401 gave 0.80. Threes, at 41.5 percent of shots, went in .360 of the time for 1.08, and corner threes, only 22 feet away, went in .387 for 1.16. These products are ours. They ignore free throws, rebounds and the identity of the shooter.

The long two-point jumper is the shot that table condemns. In 2015-16, it made up 16.2 percent of attempts and went in .398, about 0.80 points a shot; by 2025-26, its share had fallen to 4.9 percent, while threes had risen from 28.5 to 41.5 percent. To match the league's average two, worth 1.10 points, a shooter must make .367 of his threes, a bar only a little above the league's .360. That is the analytics case in a paragraph: if shots at the rim and threes are worth about 1.4 and 1.1 points, and long twos only 0.8, a team that shoots like the league average should stop taking long twos. Curry carried the case to its limit. Of his 19,264 career shots through early November 2026, 10,136 were threes, and at .422 each of those

has produced 1.27 points, by our arithmetic.

How is a shooter's accuracy stated in the first place? Field goal percentage divides makes by attempts, so that a two and a three weigh the same, while three-point percentage divides 3P by 3PA. Effective field goal percentage corrects for the extra point: (FG + 0.5 × 3P) divided by FGA. Basketball-Reference's example imagines one player going 4 for 10 with two threes and another going 5 for 10 with none; each scored 10 points, so each is at 50 percent. In 2015-16, Curry made 805 of 1,598 shots, 402 of them threes, so (805 + 201) divided by 1,598 gives .630, compared with .502 for the whole league. His career figure through early November 2026, (9,073 + 2,137.5) divided by 19,264, is .582, and the league figure for 2025-26 was .546.

The shot has critics who accept the arithmetic. Daryl Morey, a leading analytics executive and then the president of the 76ers, said in March 2021 that the three was "just too big of a bonus," that it should count two and a half points, and that the game offered "only one path to victory." He also said the line had worked: "You wanted the 3-pointer so people would have to space the floor and get more dynamic play, which has worked, but they just gave it too much." In December 2024, commissioner Adam Silver said some offenses "start to look sort of cookie cutter," adding, "I would not reduce it to a so-called 3-point shooting issue." In January 2025 he agreed that "you start to see very similar offenses around the league" and said, "we will tweak it, we will correct those issues."

What does the count say about sameness? The spread between teams narrowed only slightly: the standard deviation of the 30 teams' three-point shares was .049 in 2015-16 and .042 in 2025-26, by our arithmetic from Basketball-Reference's team tables. What moved was the floor. The team with the lowest share in 2025-26, Sacramento at .339, attempted a larger share of threes than the average team had in 2015-16, .285, and the highest, Golden State at .497, took about half its shots from behind the line. Teams still differ from one another by almost as many percentage points as before, though from a higher base the gap is smaller in proportion. Every one of them now stands farther out. Whether that looks alike to a fan is a matter of taste, and no table can settle it.

Did the threes buy better offense? League effective field goal percentage rose from .486 in 1979-80 to .502 in 2015-16 and then to .546 in 2025-26. Yet three-point accuracy barely moved, from .354 in 2015-16 to .360 in 2025-26, while two-point accuracy rose from .491 to .550 over the same decade. So the improvement came less from shooters hitting a higher share of their threes than from where the shots were taken and from easier twos, which fits Morey's remark that the line spaces the floor. That is an interpretation. The data cannot separate spacing from better shooters, different players on the floor, or other changes in the game, and it says nothing about whether the games have become more or less enjoyable to watch.

Now the physics. A shot from the NBA line is a projectile problem: the arc is 7.24 meters from the middle of the basket, the rim is 3.05 meters high, and we assume a release at 2.1 meters and no air resistance, which are assumptions and not measurements; a higher release, such as 2.4 meters, lowers every launch angle that works. By our arithmetic, a launch at 40, 45, 50 or 55 degrees needs almost the same speed, 9.2, 9.0, 9.0 and 9.1 meters per second, or about 20 miles an hour. But the flight lasts 1.02, 1.13, 1.25 and 1.38 seconds, and the ball enters the rim at about 30, 36, 43 and 49 degrees. The speed that a shooter needs hardly changes from one arc to the next; the shape of the path, and what it does at the rim, changes a great deal.

Why does the entry angle matter? A ball about 9.4 inches across, which is the 29.5-inch circumference listed for a men's ball divided by pi, must pass through an 18-inch ring. A ball falling at an angle ? sees the ring as an opening 18 × sin ? inches wide, and setting that equal to the ball's width gives ? near 31 degrees; below it, the ball cannot fit without touching the iron. A University of Virginia player, crediting his physics professor, gave 32 degrees but called it a launch angle, and the article does not say how it is measured. Ours is a falling angle. From the NBA line, our arithmetic needs a launch near 41 degrees to get one, or 39 if the ball leaves the hand at 2.4 meters. At a 45-degree entry the opening is 12.7 inches, which leaves about 3.3 inches of room across the ball's path.

Higher is not always better. Physics Today reported in 2010 that Peter Brancazio's analysis gives 45 degrees only when the ball leaves at the height of the basket. Shooters who release lower need steeper launches, typically 52 to 59 degrees, with more recent simulations suggesting about 52. In our table the lowest speed falls near 50 degrees, and a shot launched there is the least changed by a degree of error in the launch angle. Past that the needed speed climbs again, to 9.4 meters per second at 60 degrees, so a good arc balances a wider opening against a harder throw. A 2017 preprint written at a London school modeled this as a smile-shaped region of angles and speeds that score. It is a preprint, not a reviewed paper, and it concerns free throws, so it supports the idea without proving it for threes.

Curry's own training put the arc on a scoreboard. In the summer of 2021, his trainer Brandon Payne told NBA.com, "Making shots in workouts is no longer good enough." Technology tracked each ball's movement, its arc and how deep it went into the rim. A ball that missed the middle counted as a miss, which in the terms above keeps a shooter in the center of his room for error. The league's own camera tracking came from Second Spectrum from 2017-18 and has come from Hawk-Eye since 2023-24. Silver warned that moving the line might bring "more clogging under the basket," and the 2026-27 rulebook still says 23 feet 9 inches. What no source can say is how long a shooter can keep this up, or whether the league will move the line.

Questions

1. Why does the book call the 1994-97 line change close to an experiment?

A. The league measured every shooter's arc
B. Scoring fell in all three seasons
C. Attempts rose when the line moved in and fell when it moved back

2. By the book's arithmetic, about how many points did an average long two from 16 feet to the line produce in 2025-26?

A. About 1.08
B. About 0.80
C. About 1.41

3. In "a bar only a little above the league's .360," what does bar mean?

A. A level to reach
B. A rod of metal
C. A place that serves drinks

4. Why does the book say the data cannot show that threes alone made offense better?

A. Three-point accuracy fell sharply
B. Two-point accuracy and other factors changed too
C. The league stopped counting threes

5. About what entry angle does the book's arithmetic give as the least a ball needs to fit through the rim without touching it?

A. About 52 degrees
B. About 45 degrees
C. About 31 degrees

6. Which source does the book call a preprint rather than a reviewed paper?

A. The 2017 free-throw model written at a London school
B. The Basketball-Reference glossary
C. The Virginia newspaper story

Words to know

analytics: number crunching
projectile: thrown object
preprint: unreviewed paper
effective: adjusted
spaces: spreads out

Answer key: The Arithmetic of the Arc

1. C. Attempts rose when the line moved in and fell when it moved back
2. B. About 0.80
3. A. A level to reach
4. B. Two-point accuracy and other factors changed too
5. C. About 31 degrees
6. A. The 2017 free-throw model written at a London school