

Cut-Throat: A Game Using Junior High School Geometry

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Cut-Throat is a game based on the application of angles in billiards and provides students with an opportunity to use angles in a practical and enjoyable context. This activity addresses many instructional methods and objectives of the mathematics curriculum, including the estimation, measurement and construction of angles of a given measure.

Cut-Throat is played in groups of three or four players. Each group requires a game board, a die and a protractor. Each player requires a colored marker, a ruler and a pencil or crayon. The game board is a facsimile of a billiard table, with six pockets and straight rails (see Figure 1). The game board may be larger if desired for demonstration purposes or for use in a whole-class setting.

The game begins as each player places his/her marker at a random point on the billiard table. The objective of the game is to bank opponents' balls off one rail into a pocket. Once a player's ball is banked into a pocket, that player is out of the game. The winner is the player whose ball is the last to remain on the table. In Cut-Throat there are two important assumptions: (1) balls bounce off the rails at exactly the same angle with which they hit the rail, that is, *the angle of incidence always equals the angle of reflection*, and (2) balls cannot be bounced off a pocket.

Rules for Playing the Game

- Each player places his/her marker at a random point on the board.
 - A die is rolled to determine who will go first. Play continues in a clockwise direction from the first player.
 - The first player chooses any one of his/her opponents' balls and verbally specifies: (a) into which pocket he/she will attempt to sink the ball, and (b) which rail he/she will use. Remember: all balls must be banked once (and only once) off one rail.
 - To shoot the ball, the player selects the point along the rail which the ball will hit and places a pencil mark at that point.
 - A line is drawn connecting the centre of the opponent's ball to this point on the rail.
 - The angle formed by this line and the rail is found using the protractor, and a line showing the rebound path of the ball is constructed. Remember: the angle of incidence must always equal the angle of reflection.
 - The rebound line is extended until it either enters one of the six pockets or strikes a second rail.
 - If the rebound line enters one of the six pockets, the ball is removed from the table, and the owner of this ball is now out of the game (see Figure 2 for an example). Play proceeds to the left.
 - If the rebound line strikes a second rail rather than a pocket, the ball is placed at the halfway point along the rebound line (see Figure 2 for an example). Play proceeds to the left.
- Teachers may find using an overhead projector is a good idea to list the rules and provide some examples when the game is first introduced. This discussion will help eliminate confusion and enable the students to enter into the game quickly. The teacher may find it necessary to review the steps for construction of an angle, and may want to give several examples of how the rule the angle of incidence equals the angle of reflection applies in this context.
- This game has several variations and uses. For example, the board may simply be used as an individual

activity, giving students practice at measuring and constructing angles. As students become increasingly adept at playing Cut-Throat, the teacher may wish to change some of the rules to increase the challenge. For example, balls must bank off two (or more) rails, or balls may bank off pockets.

If the teacher wishes to extend the activity to include a further discussion or summary session, he or she can explore some interesting questions that arise from playing this game. Is it always possible to bank a ball into *any* pocket from *any* position on the table? Why or why not? Is there a method of calculating the correct and exact angle at which to bank a ball into a pocket? Describe how this might be done.

Whenever possible, it is beneficial to provide examples and applications when teaching mathematical concepts. Application games such as Cut-Throat help promote interest in the topic and (perhaps more importantly) provide a sense of relevance to student learning. Cut-Throat represents an attempt to increase students' motivation and heighten their sense of the usefulness of angles in the "real world."

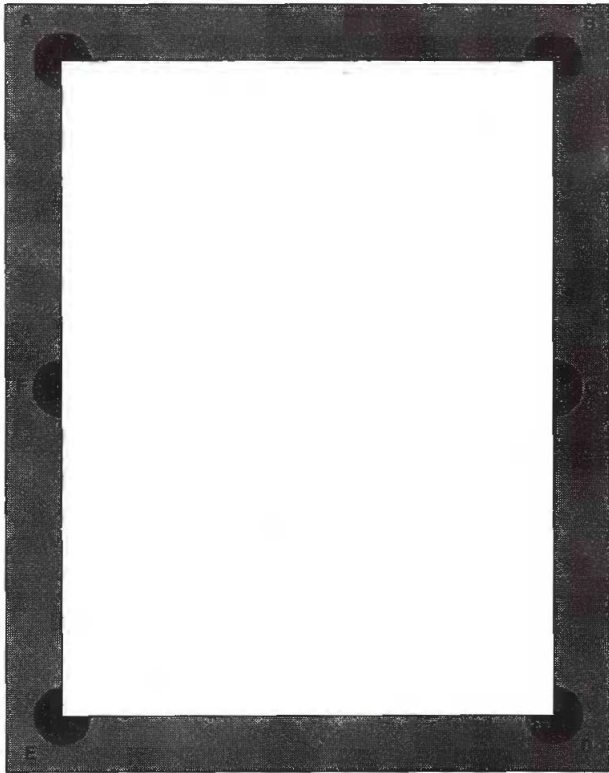


Figure 1. The Billiard Table (Game Board)

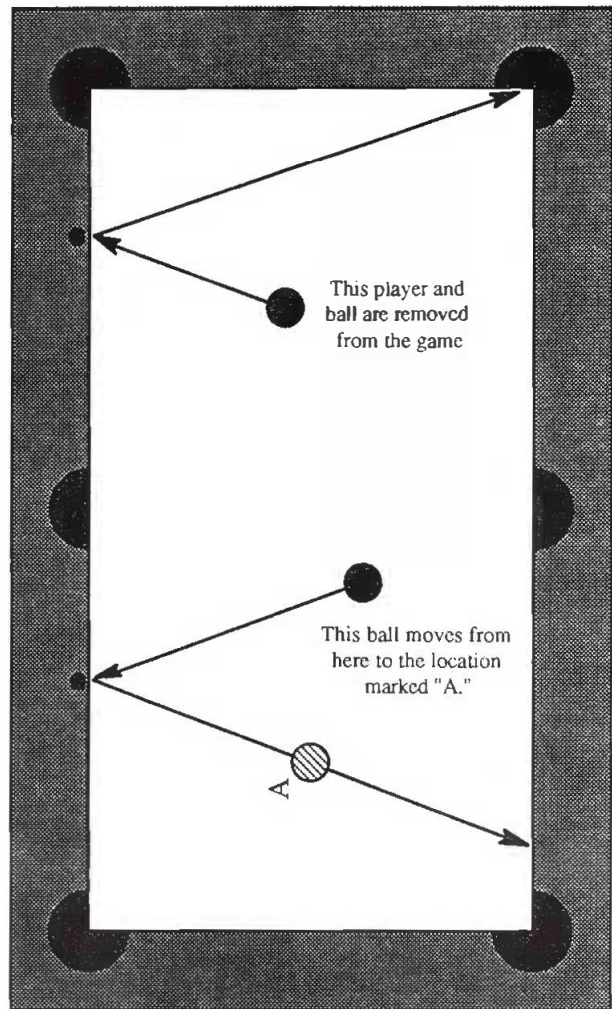


Figure 2. Examples