

School Nova
Challenge Problem
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Submarine Battleship

You and a friend play a special version of battleship: your friend has one submarine to hide in an infinite ocean, but you will get infinitely many chances to bomb it. The setup is as follows: define a center of the ocean. At the start of the game, your opponent will place their submarine some integer distance (in meters) from the center and tell you which direction it is in. They will then assign the submarine an integer velocity (in meters per minute), moving either directly towards or directly away from the center.

Now its your turn: you have an unlimited supply of depth charges, a special type of bomb that detonates in a vertical column from the ocean surface to the ocean floor. The detonation happens in an instant, destroying everything in its column of fire but nothing else. Each minute you may drop a depth charge anywhere in the ocean.

Devise a strategy that guarantees destroying your friend's submarine eventually, no matter its starting point and velocity. Note: your friend may not tamper with the submarine once it's set on its course.

(Offered prize: cookies/fruits. Submit any solutions or partial solutions to me during next week's meeting (23 October) in writing or verbally (either is fine) (and partial credit is given for solution progress).)