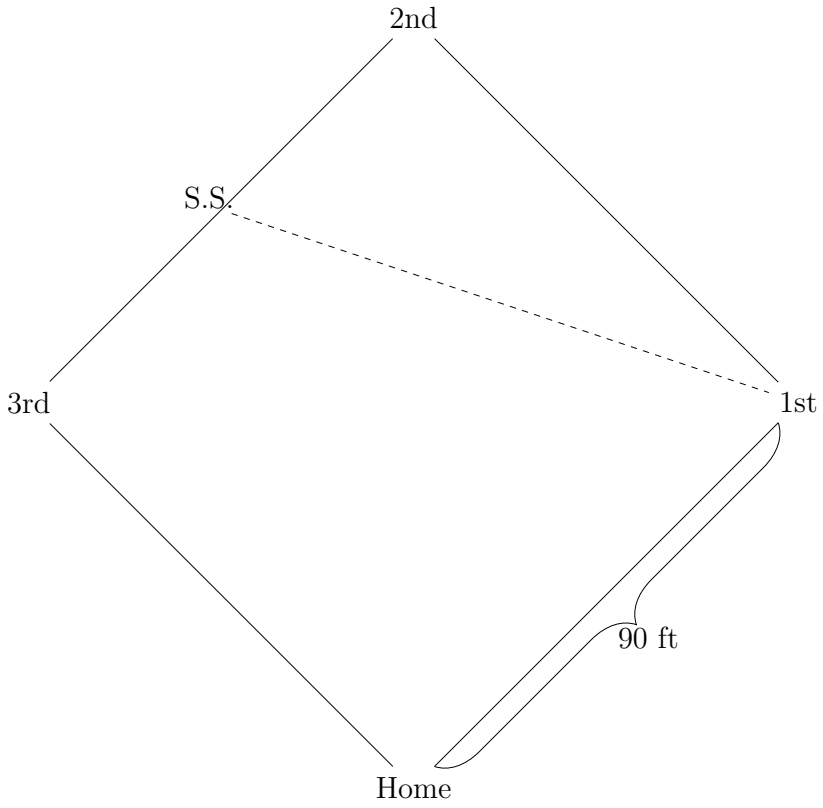
Problem 15 (Calc)

A baseball diamond is a square with sides of length 90 ft. The batter hits a ground ball to the shortstop who is on the baseline at the midpoint between the 2^{nd} and 3^{rd} bases, and then immediately runs to 1^{st} base at a constant rate of 21 ft/s. If the shortstop picks up the ball exactly 3.5 s after it is hit, and then immediately throws it to 1^{st}, what is the minimum speed *rounded up to the nearest ft/s* does he needs to throw it to get the out? (See diagram below)



Answer

$\boxed{129 \text{ ft/s}}$

Explanation

First, let us consider how long is takes for the batter to run to 1^{st} base:

$\frac{90 \text{ ft}}{21 \text{ ft/s}} \approx 4.2857 \text{ s}$

This implies that there is $4.2857 - 3.5 = .7857$ s for the shortstop to throw to 1^{st}.

The distance the shortstop has to throw is the hypotenuse of the right triangle made by the baseline from 1^{st} to 2^{nd}; from 2^{nd} to the shortstop; and then the straight line from the shortstop to 1^{st}. Using the Pythagorean Theorem, it is:

$\sqrt{45^2 + 90^2} \approx 100.6231$ ft.

Thus the speed is:

$\frac{100.6231}{.7857} \approx 128.0681$ which rounds up to 129 ft/s