

# Problem Set #4

## Physics 131

14 September 2022

Ignore air resistance in the all of the following problems.

1. Check out one of my favorite Michael Jordan shots:

<http://www.youtube.com/watch?v=-qCCm0V4hvw>

- (a) Estimate Jordan's hang time from the first part of the video that shows the play in normal speed.
- (b) How long was Jordan in the top half of his motion?

2. The best fastball in baseball in recent years belongs to Aroldis Chapman of the New York Yankees. Check out this short *Sports Science* video concerning Chapman (then of the Cincinnati Reds):

<https://www.youtube.com/watch?v=yEpdoAZiHWQ>

- (a) As the video suggests, Chapman releases the ball 8.5 ft in front of the pitcher's rubber. If he releases the ball horizontally with a speed of 105 mph, how long does it take to reach the back point of home plate (the pitcher's rubber is 60.5 ft from the back point of home plate)?
- (b) How much does the ball fall vertically in the time you found in part (a)? Backspin actually keeps the ball from falling as much as your vacuum answer.

3. On 11 June 1988, more than three decades ago, Galina Chistyakova of the Soviet Union set the women's long jump record with a leap of 7.52 m. Her record stands to this day. Watch the jump here:

<http://www.youtube.com/watch?v=RIQrnP1DN7Q>

Assume Chistyakova's center of mass fell by 0.5 m, which means her landing height was 0.5 m below her launch height. Estimate her time of flight from the video. That time of flight and her horizontal range will be needed for what follows.

- (a) Determine the vertical component of her initial launch velocity.
- (b) Determine the horizontal component of her initial launch velocity.
- (c) From your two previous answers, determine her initial launch speed.
- (d) Determine her launch angle.

Due date: **21 September 2022** (*beginning of class*)