GALLOP ROUND 7

19. Quadrilateral $ABCD$ is constructed such that $\overline{BD}$ bisects $\angle ABC$. Let X denote the intersection of $\overline{AC}$ and $\overline{BD}$. We have that $\overline{AB} = 4, \overline{BC} = 8, \overline{AC} = 6\sqrt{2}$, and $\overline{BX} = \overline{XD} = 4$. Find $\overline{CD}^2$.

20. John throws a ball up in the air from a certain height. If it peaks at 2 seconds at an altitude of 37 feet, and lands after 6 seconds, what height was John at when he threw the ball, to the nearest foot? Note that the trajectory for the ball can be written as $y = at^2 + bt + c$, where *y* is height, *t* is time, and *a*, *b*, and *c* are constants.

21. Wallace and Gromit are trying to meet over Zoom between 6 and 7 PM. Wallace is willing to wait for some time for Gromit to join the call. Gromit, being more patient, is willing to wait twice as long for Wallace to arrive. If the probability that they end up meeting is $\frac{17}{90}$, how long is Gromit willing to wait, in minutes?