8. David is living on the 37th floor of a fancy building. He wants to get rid of an ancient (very energy inefficient) refrigerator that was in the building before alterations were made to the apartment. The box will not fit through the new doors of the apartment, so the refrigerator must be pushed down a rather rickety ramp out the window. The ramp is 350 feet long. Below is a table showing the distance from the window along the ramp at given times:

time (seconds)	0	2	4	6	8	10	12	14	16
distance from window (feet)	0	3.9	18.6	43.1	79.4	122.5	174.6	240.1	313.6

Suppose $s(t) = d$ is the distance from the window, in feet, as a function of time, t, in seconds.

(a) (3 points) Compute the average velocity of the refrigerator over the time interval $4 \le t \le 12$.

The average velocity over the time interval $4 \le t \le 12 = \dfrac{174.6 - 18.6}{12 - 4} = 19.5$ ft / sec

(b) (4 points) Approximate the instantaneous velocity of the refrigerator when $t = 8$ seconds.

Av. vel. over $6 \le t \le 8 = \dfrac{79.4 - 43.1}{2} = 18.15$ ft / sec..

Av. vel. over $8 \le t \le 10 = \dfrac{122.5 - 79.4}{2} = 21.55$ ft / sec.

Or, we could average those velocities, giving the approximate instantaneous velocity at $t = 8$ as 19.85 ft / sec.

Note: any of the three approximations were accepted.

(c) (3 points) Approximately where will the refrigerator be after 18 seconds? Justify your answer.

The refrigerator will be on the sidewalk.

This is because the approximation of the velocity at 16 seconds is: $\dfrac{313.6 - 240.1}{2} = 36.75$ ft / sec.

which would mean that in 2 more seconds it would travel 73.5 ft,

but it is only 36.4 ft to the ground.

(d) (4 points) Based upon the information in the table, does s appear to be concave up or concave down at $t = 8$? Justify your answer.

The velocity appears to be increasing at $t = 8$, because the average velocity for $6 \le t \le 8$ is less than the average velocity for $8 \le t \le 10$. Thus, if s' is increasing, s'' is positive, and the graph would be concave up.