

Problem 7-21

(a) First, find the distance travelled by the cheetah while accelerating:

$$\begin{aligned}x - x_0 &= \left(\frac{v_0 + v}{2} \right) t \\ &= \left(\frac{(0 + 25.0) \text{ m/s}}{2} \right) (5.50 \text{ s}) \\ &= 68.75 \text{ m}\end{aligned}$$

Let T = time for cheetah to catch up to gazelle.

In this time, the gazelle travels $(20.0 \text{ m/s})T$.

The cheetah travels $68.75 \text{ m} + (25.0 \text{ m/s})(T - 5.50)$.

These two distances are equal.

$$\therefore 20.0T = 68.75 + 25.0(T - 5.50)$$

$$\therefore 20.0T = 68.75 + 25.0T - 137.5$$

$$\text{Solving for } T \rightarrow T = 13.8 \text{ s} \quad (13.75 \text{ s})$$

(b) Easiest way to find distance travelled is

to use the gazelle distance = $20.0T$

$$= 275 \text{ m}$$

(276 m if rounded
ans. for T is used)