Problem 2.34

A race car reaches a top speed of 100 m/s. It can slow at a maximum rate of 5 m/s/s.

   a.) How quickly can the car be brought to rest?

   b.) If the car is on an 800-meter track, will it stop without leaving the track?

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a.) How quickly can the car be brought to rest?

$$v_1 = 100 \ {m}/{s}$$

$$a = -5 \ {m}/{s^2}$$

$$v_2 = \quad v_1 \quad + \quad a \quad \Delta t$$

$$0 = \left(100 \ {m}/{s} \right) + \left(-5 \ {m}/{s^2} \right) \Delta t$$

$$\Rightarrow \quad \Delta t = 20 \text{ seconds}$$

b.) If the car is on an 800-meter track, will it stop without leaving the track?

$$x_2 = x_1 + v_1 (\Delta t) + \left({1}/{2} \right) a (\Delta t)^2$$

$$= 0 + \left(100 \ {m}/{s} \right) (20 \text{ s}) + \left({1}/{2} \right) \left(-5 \ {m}/{s^2} \right) (20 \text{ s})^2$$

$$= 1000 \text{ m}$$

800 meters is not enough room to stop the car, which will need 1000 meters to do so.