Exercises: Determining distance traveled from velocity

Problems 1-4: The velocity of a green car is given by $g(t) = 8\sqrt{t}$ meters/second. The velocity of a red car is given by $r(t) = 8t$ meters/second. In a trial on a straight course, both cars drive for ten seconds ($0 \leq t \leq 10$).

1. Sketch the velocity graphs. Can you use the graph of $g(t)$ to determine the green car's exact distance traveled? Can you use the graph of $r(t)$ to determine the red car's exact distance traveled? Explain. If it is possible in either case, complete the calculation.

2. Can you use antidifferentiation to determine the distance traveled by the cars? If it is possible, complete the calculation.

3. Can you use antidifferentiation to determine the ending position of the cars? If it is possible, complete the calculation.

4. In a second trial on a straight course, the green car is given a starting position in front of the red car, and the cars drive for 4 seconds. We wish for the cars to end at the same position, after 4 seconds. How far ahead should the green car's starting position be?

5. Find an antiderivative:

a. $f(t) = t^3$
b. $g(t) = 2t^{1/3}$
c. $h(t) = \sqrt{t} + \frac{1}{\sqrt{t}}$
d. $k(t) = 3t^{-5/2}$

6. Imagine you drive a car on the highway for several hours. Every 10 minutes, you record your speed (in miles per hour). Would the recorded data represent your position function, or your velocity function, or neither?

7. The Active Calculus authors state (section 4.1.1), "when the velocity of a moving object's velocity is constant (and positive), the area under the velocity curve over an interval of time tells us the distance the object traveled." What if the velocity is not positive?

8. A student remembers "distance = rate x time" from a previous science class. Can we use that formula in our class, to calculate distance traveled?

9. Why is "distance = rate x time" visualized as a rectangle?

10. The velocity function graphed below is made of circle and line segments.
a. Find the object's displacement.
b. Describe the object's motion.