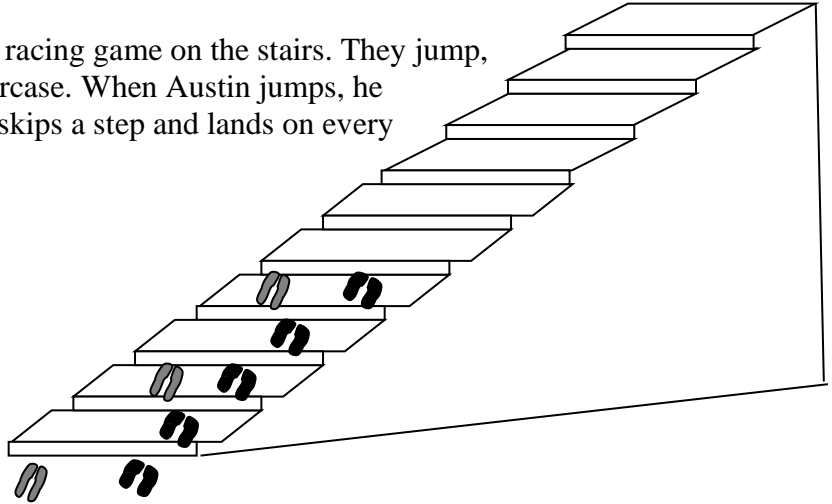


First Rate

Level A

Dylan and Austin are brothers. They play a racing game on the stairs. They jump, landing on two feet, as they race up the staircase. When Austin jumps, he lands on each step. When Dylan jumps, he skips a step and lands on every other step.



1. Who has to take more jumps to get to the top of the stairs? How do you know?
2. When Dylan jumps up the staircase, how many jumps does he make?
3. When Austin jumps up the staircase, how many jumps does he make?
4. If Austin and Dylan each took 5 jumps, who would be farthest up the stairs?
5. At the end of the race, who took fewer jumps?
6. Who do you think won the race? Explain your answer.

First Rate

Level B

Tom and Diane started to race. Tom took 4 seconds to run 6 yards. Diane ran 5 yards in 3 seconds.



If they continued to run at the same speeds, who would get to 30 yards first? Show how you figured out your answer.

Who runs faster? How can you compare their speeds?

First Rate

Level C

The Environmental Club at school attends an annual community clean-up event. They have recycling games. A team is assigned an area of land that is scattered with litter. The goal is for a pair of participants to clean up the area in the least amount of time possible.

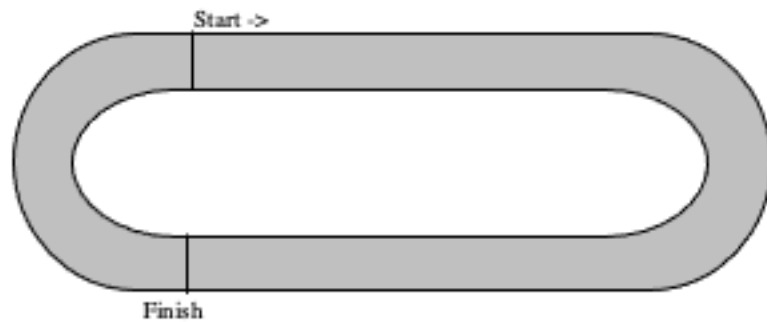


Tammy can clean one-half the area in one hour working alone. Her partner, Melissa, can clean one-third of the area in one hour working alone. During the contest, when they work together, how long will it take them to clean the area? Explain how you found your solution.

First Rate

Level D

You are an Olympic-hopeful runner. You have just qualified to be in the finals of a 1,500-meter race. The track is 400 meters in an oval shape. The race is three and three-fourths laps around the track.



The favorite to win the race is Jaali, who holds the current best time, which is 3 minutes 29.4 seconds. Jaali runs a very steady race. Each of Jaali's lap times (400 meters) is within a second of one another.

You run a completely different type of race. You have a very strong kick, which means you usually lag behind for the first three laps to save energy, and when the leader has 300 meters to go, you push yourself to win at the finish line. You like to save energy in the first three laps, but you don't want to be more than 50 meters behind when you start your kick to the finish line.

Determine your strategy to win this race.

What is the average speed you need to run in the first part of the race? What is the average speed you need to run during your kick to win the race? How might your race change if Jaali runs two seconds faster?

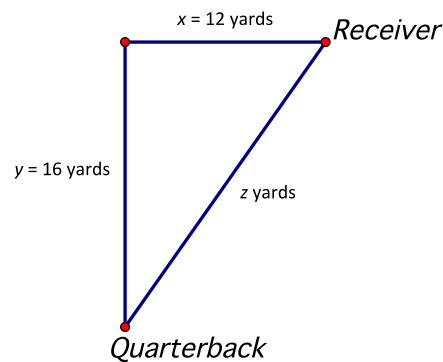
First Rate

Level E

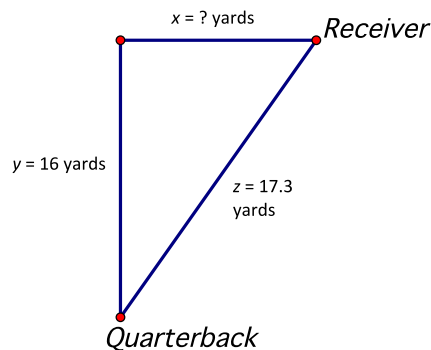
The quarterback calls his favorite play during a football game: the receiver runs straight ahead, turns right, and runs toward the sideline.

When the play starts, the receiver runs straight ahead for ten yards, makes a right turn, and runs toward the sideline. The quarterback moves to his right and stops 6 yards behind where the receiver began. The quarterback does not make the pass until after the receiver turns right toward the sideline. The receiver is running toward the sideline at a speed of 8 yards/sec.

The quarterback tracks the receiver, deciding when to throw the ball. If the receiver makes the catch 12 yards after turning right, what is the distance between the quarterback and the receiver when he catches the ball, and at what rate is the distance between the receiver and quarterback changing at that moment?



Suppose the quarterback threw the ball sooner, and the receiver is running toward the sideline at the same speed (8 yards/second). The distance between the quarterback and the receiver when he caught the ball was 17.3 yards. How many yards had the receiver run after turning right when he caught the ball, and at what rate was the distance between the receiver and quarterback changing at that time?



— Inside Problem Solving: First Rate —

Given the constant speed of the receiver, consider several locations where the receiver could catch the ball. Explain the relationship between the location of the receiver when he catches the ball, the distance between the quarterback and receiver when he catches the ball, and the rate that the distance between the receiver and quarterback was changing at that time.