MATHCOUNTS® Problem of the Week Archive

On the Road Again – June 24, 2024

Problems & Solutions

Each summer Radolpho, Lucia and Mya, along with their families, spend two weeks on vacation at their shared lake house.

Mya travels the furthest distance to get to the lake house from her home. Mya's truck has a fuel tank that holds 12 gallons of gas, and she can drive an average of 22 miles per gallon of gas. If Mya leaves home with a full tank of gas, drives directly to the lake house, and arrives with exactly 1/8 tank of gas remaining, how far does Mya travel from her home to the lake house?

Since Mya can drive an average of 22 miles per gallon of gas, with 12 gallons of gas, she can travel a total of 12 × 22 = 264 miles. Since she uses only 1 – 1/8 = 7/8 of the full tank of gas, she must travel only 7/8 of this distance. Therefore, the distance Mya travels from her home to the lake house is (7/8) × 264 = ***231*** *miles.*

Typically, it takes Lucia 2 hours to drive 132 miles from her home to the lake house. But this year Lucia is towing a trailer with two jet skis, and the trip takes 20% longer than usual. What is the ratio of Lucia's typical average speed to Lucia's average speed when towing the jet skis? Express your answer as a common fraction.

Towing the jet skis takes 20% longer than the typical 2 hours, or 1.2 × 2 = 2.4 hours. Traveling 132 miles in 2.4 hours means Lucia is traveling at an average speed of 132/2.4 = 55 mi/h. Typically, Lucia can travel 132 miles in 2 hours; that is an average speed of 132/2 = 66 mi/h. The ratio of Lucia's typical average speed to her average speed when towing the jet skis then is 66/55 = ***6/5****.*

At 9:35 a.m. Radolpho passes a highway sign that indicates the next rest area is 36 miles from his current location. The speed limit on the highway is 55 mi/h, but after Radolpho has driven 3/4 of the distance to the rest area, the speed limit is reduced to 40 mi/h due to ongoing construction. If Radolpho does not exceed the speed limit at any time by more than 5 mi/h, what is the earliest time he will reach the rest area?

If the total distance traveled is 36 miles, we know that ¾ of that distance is ¾ × 36 = 27 miles. Since we are told that Radolpho at no time exceeds the speed limit by more than 5 mi/h, he will go a maximum of 55 + 5 = 60 mi/h for the first 27 miles. We also know that he will go a maximum of 40 + 5 = 45 mi/h for the remaining 36 – 27 = 9 miles. If Radolpho travels at a maximum speed of 60 mi/h, that means he is traveling at a maximum speed of 1 mile per minute. Therefore, at that rate, it will take him a minimum of 27 minutes to travel the first 27 miles. Using the formula d = rt, we can determine that the time it takes Radolpho to travel 9 miles at a maximum speed of 45 mi/h is 9 = 45t → t = 0.2 hours. That means it will take Radolpho a minimum of 0.2 × 60 = 12 minutes to travel the final 9 miles to the rest area. It follows that it will take Radolpho a minimum of 27 + 12 = 39 minutes to get from the location of the highway sign to the rest area. If he passes the sign at 9:35 a.m., the earliest he can get to the rest area is 39 minutes later at ***10:14 a.m.***

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