Analyzing Numerical Data: Using Ratios

I.B Student Activity Sheet 5: Changing Tires

1. Fill in the missing information for each tire size. Find the circumference of each tire.

Tire	P245/70R16	P285/75R16
Width (mm)	245	285
Aspect ratio (%)	70	75
Height (in.)	6.7520	8.4154
Diameter (in.)	29.504	32.8308
Circumference (in.)	92.6895	103.1410

$$\frac{h}{245\ mm} = 0.70$$

height/width = aspect ratio Therefore, $h = 0.70 \cdot 245\ mm \cdot \frac{1\ in.}{25.4\ mm}$

$h = 6.7520\ in.$

diameter of the P245/70R16 tire in inches = 2 · height of tire + diameter of tire's rim

$$2 \cdot 6.7520 + 16 = 29.504\ in.$$

circumference of the P245/70R16 tire is $\pi(29.504) = 92.6895\ in.$

$$\frac{h}{285\ mm} = 0.75$$

Therefore, $h = 0.75 \cdot 285\ mm \cdot \frac{1\ in.}{25.4\ mm}$

$h = 8.4154\ in.$

diameter of the P285/75R16 tire in inches = 2 · height of tire + diameter of tire's rim

$$2 \cdot 8.4154 + 16 = 32.8308\ in.$$

circumference of the P245/70R16 tire is $\pi(32.8308) = 103.1410\ in.$

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2. After one rotation of the wheel, how many inches further has the truck with the larger tires traveled than the truck with the factory-installed tires?

103.1410 − 92.6895 = 10.4515 in.

The larger tire travels 10.4515 inches further with each rotation.

3. After one rotation of the wheel, the truck with the larger tires has traveled ____ times further than the truck with the factory-installed tires.

103.1410/92.6895 = 1.1128

The truck equipped with the larger tires travels 1.1128 times further with each rotation.

4. Use the results from the table in Question 1 to assist in completing the following statements about the truck after the larger tires have been installed on it.

If the odometer reading is 2 0 0 0 0, *you have actually traveled* ____ *miles.*

If the speedometer reading is 60, your actual speed is ____ *miles per hour.*

The following principles apply when determining actual distance and speed traveled according to tire size:

Actual mileage = k • odometer reading (mileage)

Actual speed = k • speedometer reading (miles per hour)

$$\text{where } k = \frac{\text{circumference of bigger tire}}{\text{circumference of factory-installed tire}}$$

Since the value of $k = 1.1128$ for the two tires in comparison, 1.1128(20,000) = 22,256 miles (actual) and 1.1128(60) = 66.768 miles per hour (actual).

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5. What is the percent error in the odometer readings? In the speedometer readings?

(22,256 – 20,000)/20,000 = 0.1128 or 11.28% (odometer)

(66.768 –60)/60 = 0.1128 or 11.28% (speedometer)

The percent error is 11.28% for both readings.

6. Using the odometer readings in the truck equipped with the larger tires, you determine that the gas mileage is 18 miles per gallon. What is your actual gas mileage in miles per gallon?

1.1128(18) = 20.03 miles per gallon

7. If you were driving in the truck with the larger tires and the speedometer showed a speed of 65 miles per hour, could you be ticketed for exceeding the 65-mph speed limit by more than 5 mph? More than 10 mph? Justify your answers.

Since 1.1128 • 65 = 72.332, I could be ticketed for exceeding the 65-mph speed limit by more than 5 mph but not by more than 10 mph.

8. REFLECTION: What is the relationship between the ratio of an actual distance to an odometer distance of 1 mile and the ratio of the circumference of a current tire to the circumference of a factory-installed tire?

Both of these ratios are equivalent to k.