

# A.APR Combined Fuel Efficiency

## Task

The US Department of Energy keeps track of fuel efficiency for all vehicles sold in the United States. Each car has two fuel economy numbers, one measuring efficiency for city driving and one for highway driving. For example, a 2012 Volkswagen Jetta gets 29.0 miles per gallon (mpg) in the city and 39.0 mpg on the highway.

Many banks have "green car loans" where the interest rate is lowered for loans on cars with high *combined* fuel economy. This number is not the average of the city and highway economy values. Rather, the combined fuel economy (as defined by the federal Corporate Average Fuel Economy standard) for  $x$  mpg in the city and  $y$  mpg on the highway, is computed as

$$\text{combined fuel economy} = \frac{1}{\frac{1}{2} \left( \frac{1}{x} + \frac{1}{y} \right)}.$$

- What is the combined fuel economy for the 2012 Volkswagen Jetta? Give your answer to one decimal place.
- For most conventional cars, the highway fuel economy is 10 mpg higher than the city fuel economy. If we set the city fuel economy to be  $x$  mpg for such a car, what is the combined fuel economy in terms of  $x$ ? Write your answer as a single rational function,  $a(x)/b(x)$ .
- Rewrite your answer from (b) in the form of  $q(x) + \frac{r(x)}{b(x)}$  where  $q(x)$ ,  $r(x)$  and  $b(x)$  are polynomials and the degree of  $r(x)$  is less than the degree of  $b(x)$ .
- Use your answer in (c) to conclude that if the city fuel economy,  $x$ , is large, then the combined fuel economy is approximately  $x + 5$ .



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