



Dogstown  
Population  
same as  
Catsville

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Dogstown

## Problem of the Week

### Problem D and Solution

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#### Problem

The populations of Dogstown and Catsville were equal at the end of 2015. The population of Dogstown decreased by 3.2% during 2016, then increased by 8.1% during 2017. The population of Catsville increased by 2% during 2016, then increased by  $r\%$  during 2017. If the populations of the towns were equal again at the end of 2017, determine the value of  $r$  correct to one decimal place.

#### Solution

Let  $p$  be the population of Dogstown at the end of 2015. Since Dogstown and Catsville have the same population size, then  $p$  is also the population of Catsville at the end of 2015.

The population of Dogstown decreased by 3.2% in 2016, so the population at the end of 2016 is  $p - \frac{3.2}{100}p = \left(1 - \frac{3.2}{100}\right)p = 0.968p$ .

The population of Dogstown then increased by 8.1% during 2017, so the population at the end of 2017 is  $0.968p + \left(\frac{8.1}{100}\right)(0.968p) = \left(1 + \frac{8.1}{100}\right)(0.968p) = 1.081(0.968p) = 1.046408p$ .

The population of Catsville increased by 2.0% in 2016, so the population at the end of 2016 is  $p + \frac{2.0}{100}p = \left(1 + \frac{2.0}{100}\right)p = 1.02p$ .

The population of Catsville then increased by  $r\%$  during 2017, so the population at the end of 2017 is  $1.02p + \frac{r}{100}(1.02p) = 1.02p + \frac{1.02rp}{100}$ .

Since the populations of Dogstown and Catsville are equal at the end of 2017, we have

$$\begin{aligned} 1.046408p &= 1.02p + \frac{1.02rp}{100} \\ 1.046408p - 1.02p &= \frac{1.02rp}{100} \\ 0.026408p &= \frac{1.02rp}{100} \\ 0.026408 &= \frac{1.02r}{100} \quad \text{dividing both sides by } p, \text{ since } p > 0 \\ 2.6408 &= 1.02r \\ r &\approx 2.6 \end{aligned}$$

Therefore, correct to one decimal place,  $r = 2.6$ .

