

## [RETIRED] MATH: Exponential Decay in Purchasing Power

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Inflation lowers the purchasing power of your money over time. This means that \$100 today, will be able to buy less in the future. Inflation rates change year to year, but we can estimate the long-term impacts of inflation using exponential decay. Understanding inflation and purchasing power helps you make decisions on where to save or invest your money.



Math Topics
<ul style="list-style-type: none"> <li>Exponential Decay</li> <li>Logs (optional)</li> </ul>

Personal Finance Topics
<ul style="list-style-type: none"> <li>Inflation <ul style="list-style-type: none"> <li><a href="#">Infographic</a></li> </ul> </li> <li>Purchasing power</li> </ul>

### Part I: Examples

Example 1: Olivia won a \$500 scholarship from a local organization as a 9th grader. She plans to use this money for college textbooks 4 years from now. What will be the purchasing power of the \$500 if the average inflation over the next 4 years is 1.5%?

#### Setting up the equation:

$$y = ab^x$$

$y$  = Value after 4 years (this is what we are solving for)  
 $a$  = \$500 (the initial value)  
 $b$  =  $100\% - 1.5\% = .985$  (100% maintains initial value - 1.5% decrease in value)  
 $x$  = 4 years (how many years)

#### Solving the equation:

$$\begin{aligned}
 y &= ab^x \\
 y &= 500(0.985)^4 \\
 y &= 500(0.94134) \\
 y &= \$470.67
 \end{aligned}$$

Solution: The scholarship will have a purchasing power of \$470.67 in 4 years.



# MATH: Exponential Decay in Purchasing Power

## Part II: Practice Problems

Complete the following practice problems and show your work in the space provided. Then, write your final solution in the answer boxes.

Question 1	Answer
Kendra's aunt sent her \$50 for her birthday 10 years ago. At the time, Kendra wasn't sure what she wanted to do with the money so she put it in a piggy bank and forgot about it. She just found this \$50 in the piggy bank when she was cleaning her room. Over the past ten years, yearly inflation has averaged 2.46%. How much is Kendra's birthday money worth now?	

Question 2	Answer
If Kendra hadn't found the money for another 10 years, and the average inflation rate continued, what would be the purchasing power of the \$50?	

Question 3	Answer
Sam is working his dream job as a graphic designer. Sam's starting salary was \$55,000. He is great at his job but has not received a raise since he started working 5 years ago. What is the purchasing power of Sam's \$55,000 salary now, compared to 5 years ago, if the average inflation rate over the past 5 years was about 3.5%?	

Question 4											
<p>In the time between 1917 and 1920, the US experienced historically high inflation rates. Below is a table with the average yearly inflation rates.</p> <table border="1"> <thead> <tr> <th>Year</th><th>Average inflation rate that year</th></tr> </thead> <tbody> <tr> <td>1917</td><td>17.80%</td></tr> <tr> <td>1918</td><td>17.26%</td></tr> <tr> <td>1919</td><td>15.31%</td></tr> <tr> <td>1920</td><td>15.90%</td></tr> </tbody> </table>	Year	Average inflation rate that year	1917	17.80%	1918	17.26%	1919	15.31%	1920	15.90%	
Year	Average inflation rate that year										
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<p>a. What was the total average (mean) inflation rate from 1917 to 1920?</p> <p>b. Using the average inflation rate, what would \$500 from the start of 1917 have been worth by the end of 1920?</p>											

### Part III: Reflection

5. Will Kendra's \$50 ever be worthless? Explain your reasoning.

6. Instead of putting the \$50 into a piggy bank, what could Kendra have done to try to preserve its purchasing power?

7. Question #4 gave four inflation rates that were much higher than normal year-to-year inflation rates. What was happening in the country at this time that contributed to extremely high inflation rates?

### BONUS

8. (Refer back to Questions 1 & 2) At the same average rate of inflation, after about how many years would Kendra's \$50 have lost **HALF** of its purchasing power?