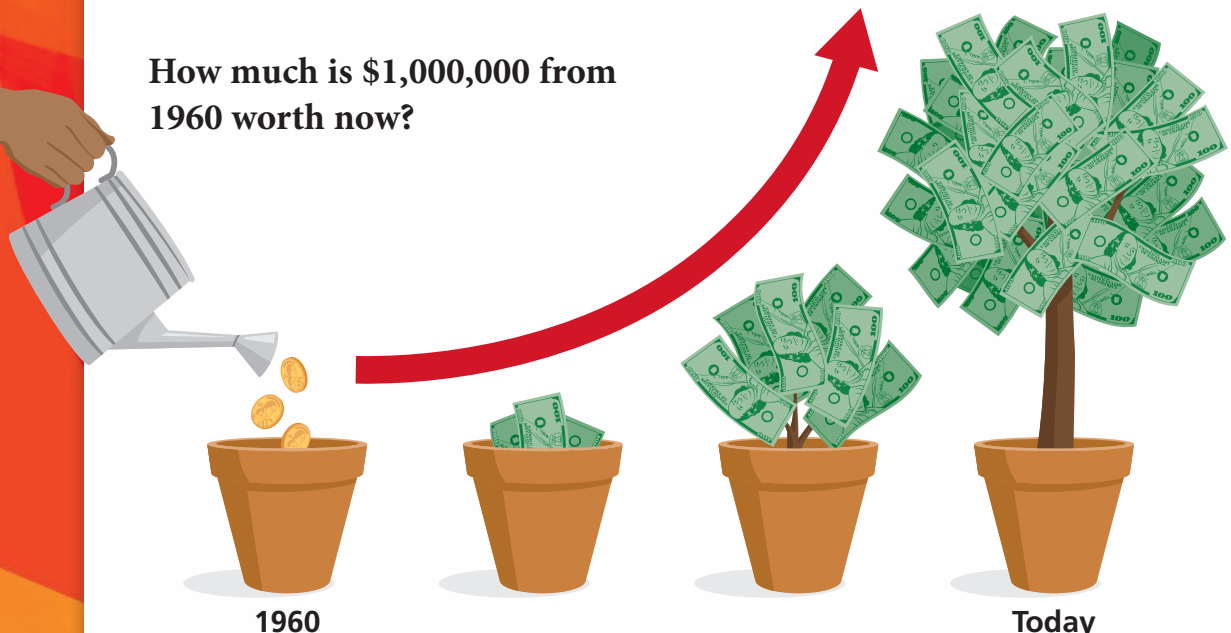
Module

8 Exponential Functions

Module Performance Task: *Spies and Analysts*™

Interest of Time

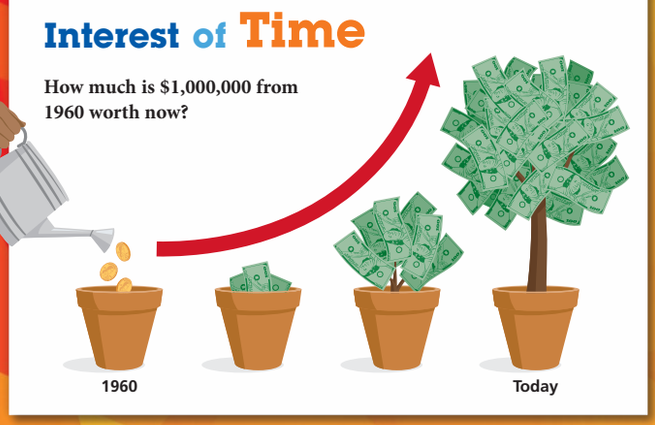
How much is $1,000,000 from 1960 worth now?



Module 8

Exponential Functions

Module Performance Task: *Spies and Analysts*™



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Connections to This Module

One sample solution might involve comparing the graph of the function that models the growth of the investment to the graph of the function that models the effect of inflation. Students can find relationships between these graphs to help determine the value of $1,000,000 from 1960 in today's economy.

- Invested at 5.0% compounded annually over 60 years, the $1,000,000 would grow to approximately $18,679,000. This ignores any taxes or fees associated with the account. **(8.3)**
- Use ordered pairs in the form (years since 1960, average annual inflation rate) to write a model for how the rate of inflation has changed over time. Note that actual inflation varies from year to year. **(8.1)**
- The average annual inflation rate in the U.S. is about 4%. Inflation compounds from year to year like interest. So for $1,000,000 to be worth the same amount today as it was in 1960, it would have to have grown to about $10,520,000. The investment grew to $18,679,000, so it managed to outpace inflation by about $8,159,000.

Interest of Time

Overview

This problem requires students to make assumptions to determine how much $1,000,000 from 1960 is worth now. Examples of assumptions:

- The money has been invested in an account that earns compound interest.
- The value of the money has decreased due to inflation.

Be a *Spy*

First, students must determine what information is necessary to know. This should include:

- the most common type of investment accounts offered by banks over the time period (whether banks were more likely to offer interest compounded annually, quarterly, monthly, or continuously, etc.) and the average rate of interest over the time period.
- how the annual rate of inflation has changed over the time period.

Students should recognize that the effect of inflation may be stronger than the effect of compounding interest.

Be an *Analyst*

Help students understand that a person could buy a lot more with $1 in 1960 than he or she could buy today. Even if that dollar was invested with compound interest and grew to be $20 between 1960 and today, that $20 might not actually buy much more than the original $1 in 1960.

Alternative Approaches

In their analysis, students might:

- write a function to model the change in the annual rate of inflation.
- use exponential equations to compare the value of the investment compounded at different rates and for different compounding periods.
- graph the function that models the value of the investment with compound interest on the same grid as the function that models the change in the annual inflation rate, as explained on the left.