

T/F: \$1,791 Ten Years From Now Is Equivalent To \$900 Now If The Interest Rate Equal 8% Compounded Annually

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Understanding the time value of money is fundamental in finance and investment decisions. The statement above raises an important question: does an amount of \$1,791 received ten years from now truly equate to having \$900 today, assuming an 8% annual interest rate compounded annually? To answer this, we need to explore the concepts of present value, future value, and the mathematics that link them.

What Is the Time Value of Money?

The time value of money (TVM) is a financial principle stating that a sum of money has a different value today than it will in the future, due to its potential earning capacity. This core idea underpins many financial calculations, including investments, loans, and savings.

Key Concepts:

- Present Value (PV): The current worth of a future sum of money, discounted at a specific interest rate.
- Future Value (FV): The value of a current sum of money at a future date, after accruing interest.

Why It Matters:

Knowing the relationship between PV and FV helps investors and borrowers make informed decisions about investments, loans, and savings plans.

Calculating Future and Present Values

To evaluate the statement in question, we need to understand how to calculate both the future value given a present value, and the present value given a future amount. The fundamental formulas are:

Future Value (FV):

$$FV = PV \times (1 + r)^n$$

Present Value (PV):

$$PV = \frac{FV}{(1 + r)^n}$$

where:

- PV = Present Value
- FV = Future Value
- r = annual interest rate (decimal)

- n = number of periods (years)

Applying the Formula to Our Scenario

Given:

- Future value, $FV = \$1,791$
- Interest rate, $r = 8\% = 0.08$
- Time period, $n = 10$ years

We want to determine whether \$900 now is equivalent to \$1,791 in ten years at an 8% interest rate.

Step 1: Calculate the present value of \$1,791 received in ten years

Using the present value formula:

$$PV = \frac{FV}{(1 + r)^n}$$

Plugging in the values:

$$PV = \frac{\$1,791}{(1 + 0.08)^{10}}$$

$$PV = \frac{\$1,791}{(1.08)^{10}}$$

Calculate $(1.08)^{10}$:

$$(1.08)^{10} \approx 2.15892$$

Thus:

$$PV = \frac{\$1,791}{2.15892} \approx \$830.02$$

Result: The present value of \$1,791 received ten years from now is approximately \$830.02, assuming an 8% annual interest rate compounded annually.

Is \$900 Today Equivalent to \$1,791 in Ten Years?

Since we calculated that the present value of \$1,791 in ten years is approximately \$830.02, this means:

- \$830.02 today, invested at 8% interest compounded annually, would grow to about \$1,791 in ten years.
- \$900 today, invested at the same rate, would grow to a future value of:

$$FV = PV \times (1 + r)^n$$

$$FV = \$900 \times (1.08)^{10}$$

$$FV = \$900 \times 2.15892$$

$$FV \approx \$1,943.03$$

Interpretation:

- Investing \$900 today at 8% compounded annually would result in approximately \$1,943.03 after ten years.
- The future value of \$1,791 in ten years is equivalent to a present value of about \$830.02 today.

Conclusion:

- \$900 today is worth more than \$1,791 in ten years when considering the 8% interest rate.
- Conversely, \$1,791 in ten years is only worth about \$830 today.

Therefore, the statement:

> T/F: \$1,791 Ten Years From Now Is Equivalent To \$900 Now If The Interest Rate Equal 8% Compounded Annually

is False.

Because \$900 today invested at 8% would grow to approximately \$1,943 in ten years, which exceeds \$1,791.

Why Does This Matter? Implications in Finance

This calculation illustrates the importance of understanding present and future values in financial planning. Whether you're evaluating investment opportunities, loan repayments, or savings goals, knowing how to compute these values ensures informed decision-making.

Practical Applications:

- Investment Planning:

Investors can determine how much to invest now to reach a future goal.

- Loan Amortization:

Borrowers and lenders can assess fair loan terms based on present value calculations.

- Valuation of Cash Flows:

Businesses evaluate the worth of future cash flows in today's dollars.

Additional Considerations

While the calculations above assume a constant interest rate and annual compounding, real-world scenarios can be more complex.

Factors that Might Affect Calculations:

- **Different interest compounding frequencies:** semi-annual, quarterly, monthly, or continuous compounding can alter the calculations.
- **Variable interest rates:** rates that change over time require more advanced models.
- **Inflation:** reduces the real value of future money, affecting the real equivalence.
- **Taxes and fees:** can diminish actual returns.

Adjusting for Different Conditions:

Always consider these factors when applying the time value of money in practical situations.

Summary

To summarize, the core takeaway from this analysis is:

- The present value of \$1,791 received ten years from now at 8% interest compounded annually is approximately \$830.02.
- Therefore, \$900 today is worth more than \$1,791 in ten years at the same interest rate.
- The statement claiming they are equivalent is incorrect.

Final Thought:

Mastering these calculations enhances your ability to make strategic financial decisions, whether saving for the future, evaluating investments, or managing debt.

FAQs

Q1: How does changing the interest rate affect the present value calculation?

A:

An increase in the interest rate decreases the present value of a future sum, meaning future money is worth less today. Conversely, a lower interest rate increases the present value.

Q2: What if the interest is compounded more frequently than annually?

A:

More frequent compounding (like semi-annual or monthly) increases the effective interest rate and thus affects the calculation. The formula adjusts by dividing the annual rate by the number of compounding periods and multiplying the number of periods accordingly.

Q3: Can I use these calculations for irregular cash flows?

A:

For irregular cash flows, more advanced methods like discounted cash flow (DCF) analysis are used, which sum the present values of each cash flow individually.

Conclusion

In financial decision-making, understanding the relationship between present and future values is crucial. The question posed about the equivalence of \$1,791 in ten years and \$900 today at an 8% interest rate reveals that, given the calculations, they are not equivalent. Instead, \$900 today would grow to a larger amount than \$1,791 in ten years at the same rate, making the statement false. Applying these principles helps investors, businesses, and individuals make smarter financial choices aligned with their goals and circumstances.

Frequently Asked Questions

Is the statement '1,791 dollars ten years from now is equivalent to 900 dollars now at 8% interest compounded annually' true or false?

False

How can we verify whether \$1,791 ten years from now is equivalent to \$900 today at 8% interest compounded annually?

By calculating the present value of \$1,791 received ten years from now at 8% interest and comparing it to \$900.

What is the formula to calculate present value with annual compounding interest?

$PV = FV / (1 + r)^n$, where PV is present value, FV is future value, r is annual interest rate, and n is number of years.

Using the formula $PV = 1791 / (1 + 0.08)^{10}$, what is the present value of \$1,791 received in 10 years at 8% interest?

The present value is approximately \$823.78.

Based on the calculation, is \$900 today equivalent to \$1,791 ten years from now at 8% interest?

No, because the present value of \$1,791 in 10 years is about \$823.78, which is less than \$900.

Why is the statement considered false?

Because the present value of \$1,791 in ten years at 8% is less than \$900, so \$1,791 in the future is not equivalent to \$900 today.

What would be the future value of \$900 invested today at 8% compounded annually for 10 years?

$FV = 900 (1 + 0.08)^{10}$, which equals approximately \$1,942.52.

If you want \$1,791 in 10 years at 8% interest, how much should you invest today?

You should invest approximately \$823.78 today.

Is understanding present and future value calculations important for financial decision-making?

Yes, it helps in comparing monetary values across different time periods considering interest rates.

Additional Resources

Understanding the Future Value and Present Value Relationship at 8% Interest Rate

When it comes to financial mathematics, one of the fundamental concepts is understanding how present value (PV) and future value (FV) relate under a certain interest rate. The statement, "T/F: \$1,791 Ten Years From Now Is Equivalent To \$900 Now If The Interest Rate Equal 8% Compounded Annually," prompts us to analyze whether such a claim holds true based on the principles of compound interest and time value of money.

In this comprehensive review, we will delve into the core concepts, perform detailed calculations, and examine the validity of this statement thoroughly.

Fundamentals of Time Value of Money (TVM)

Before evaluating the specific claim, it's essential to understand the core principles:

Present Value (PV)

- The current worth of a future sum of money, discounted at a specific interest rate.
- Reflects how much a future amount is worth today.

Future Value (FV)

- The amount an invested sum will grow to after a certain period, given a specified interest rate.
- Shows the potential growth of current investments over time.

Key Formula: Compound Interest

- The general formula for future value with annual compounding:

$$FV = PV \times (1 + r)^n$$

Where:

- FV = future value
- PV = present value
- r = annual interest rate (decimal)
- n = number of periods (years)

Conversely, to find the present value from a future value:

$$PV = \frac{FV}{(1 + r)^n}$$

Applying the Concepts to the Given Scenario

Given Values:

- Future Value (FV) = \$1,791 (after 10 years)
- Present Value (PV) = \$900 (now)
- Interest Rate (r) = 8% or 0.08
- Time (n) = 10 years

The question: Is \$1,791 in ten years equivalent to \$900 now at 8% compounded annually?

Calculating the Present Value of \$1,791 in 10 Years at 8%

We will determine whether \$900 is the correct present value for \$1,791 in ten years.

Calculation:

$$PV = \frac{FV}{(1 + r)^n}$$

Plugging in the values:

$$PV = \frac{1791}{(1 + 0.08)^{10}}$$

Calculate denominator:

$$(1.08)^{10}$$

Using a calculator:

$$(1.08)^{10} \approx 2.1589$$

Now, compute PV:

$$PV = \frac{1791}{2.1589} \approx 829.55$$

Interpretation:

- The present value equivalent of \$1,791 received in 10 years at 8% interest is approximately \$829.55.
- Since the statement claims it is equivalent to \$900, which is higher than the calculated PV, it suggests the statement might be false.

Analyzing the Validity of the Statement

Based on the calculations:

- Calculated PV: ~\$829.55
- Given PV in the statement: \$900

Because:

$$\begin{aligned} & \backslash \\ & 900 > 829.55 \\ & \backslash \end{aligned}$$

The \$900 now is more than the present value implied by the future amount of \$1,791 at 8%. This indicates that \$900 now would grow to more than \$1,791 in 10 years at 8%, suggesting that \$900 is actually more than the amount needed today to reach \$1,791 in ten years at this rate.

Therefore, the statement:

> "\$1,791 ten years from now is equivalent to \$900 now if the interest rate equals 8% compounded annually"

is likely to be false because, based on calculations, \$900 today would grow to approximately:

$$\begin{aligned} & \backslash \\ & FV = PV \times (1 + r)^n = 900 \times 2.1589 \approx 1,943 \\ & \backslash \end{aligned}$$

which exceeds \$1,791.

Clarifying the Correct Relationship Between PV and FV at 8%

Let's verify the amount that \$900 would grow to in 10 years at 8%:

$$\begin{aligned} & \backslash \\ & FV = 900 \times (1.08)^{10} \approx 900 \times 2.1589 \approx 1,943 \\ & \backslash \end{aligned}$$

Thus, \$900 today is equivalent to roughly \$1,943 in 10 years, not \$1,791.

Similarly, find the PV of \$1,791 after 10 years:

$$\begin{aligned} & \backslash \\ & PV = \frac{1791}{2.1589} \approx 829.55 \end{aligned}$$

\]

which is less than \$900, confirming that \$900 is more than the PV of \$1,791 in 10 years.

Implications and Financial Intuition

This analysis reveals some key insights:

- Higher Present Value Means More Money Today: If you have \$900 today and invest it at 8%, after 10 years it will grow to approximately \$1,943, which is more than \$1,791. Therefore, \$900 now is more valuable than receiving \$1,791 in ten years at 8%.
- Lower Present Value Means Less Money Today: Conversely, the PV of \$1,791 in 10 years is about \$829.55, which is less than \$900.
- The Statement's Contradiction: The claim that \$1,791 in 10 years is equivalent to \$900 now at 8% interest is incorrect. Based on calculations, \$900 today is more than the amount needed today to reach \$1,791 in 10 years at 8%.

Summary of the Key Findings

- The correct present value of \$1,791 in 10 years at 8% compounded annually is approximately \$829.55.
- The future value of \$900 invested at 8% over 10 years is approximately \$1,943.
- The statement claiming equivalence between \$1,791 in the future and \$900 now at 8% interest is false.

Conclusion and Final Verdict

Final assessment:
The statement is false.

Based on the principles of compound interest and the calculations performed, \$900 today is worth more than \$1,791 in ten years at an 8% interest rate. The actual present value of \$1,791 in ten years is about \$829.55, not \$900. Therefore, the claim that these two amounts are equivalent is incorrect.

Additional Considerations: Variations and Contexts

While our calculations are straightforward and based on standard compound interest formulas, it's worth noting some additional points:

- Different compounding periods: If the interest were compounded semi-annually, quarterly, or monthly, the calculations would vary slightly, but the overall relationship remains similar.
- Inflation and real vs. nominal values: In real-world scenarios, inflation impacts the value of money over time, but this analysis assumes a nominal 8% interest rate.
- Risk factors: The calculations assume risk-free interest rates; real investments may carry risk, influencing actual returns.

Final Thoughts

Understanding present and future values is crucial for effective financial planning, investment analysis, and decision-making. The question posed is a classic example of testing one's grasp of compound interest calculations. As we've seen, precise calculations demonstrate that the statement is false, emphasizing the importance of mathematical rigor when evaluating financial claims.

In conclusion, always verify such statements with proper formulas and calculations to avoid misconceptions and ensure sound financial reasoning.

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