

## **Q4) Sum Of Money Q Will Be Received 6 Years From Now. At 5% Annual Interest. The Present Worth Now Of**

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In the realm of finance and investment analysis, understanding the concept of present worth (also known as present value) is essential. It enables investors, financial analysts, and business owners to determine how much a future sum of money is worth today, considering a specific rate of interest or discount rate. This knowledge helps in making informed decisions about investments, loans, and other financial transactions.

Imagine you are set to receive a certain amount of money,  $Q$ , exactly six years from now. The question then arises: what is the current worth of this future sum if the annual interest rate is 5%? This problem is a classic example of time value of money calculations, which emphasize that a specific amount of money today is worth more than the same amount in the future due to its potential earning capacity.

This article delves into the detailed process of calculating the present worth of a future sum, focusing on the scenario where the future amount is received after six years at an annual interest rate of 5%. We will explore the mathematical principles, practical applications, and step-by-step methods for solving such problems, ensuring clarity for both beginners and experienced financial professionals.

# Understanding Present Worth and Its Importance

Present worth is a foundational concept in finance that evaluates the current value of a future sum of money based on a specific discount rate. It accounts for the opportunity cost of tying up capital and the potential earnings that could have been accrued if the money was invested elsewhere.

## The Concept of Time Value of Money

The core idea behind present worth is that money has a time value. A dollar today is worth more than a dollar in the future because it can be invested to earn interest or returns over time. Conversely, a future sum of money can be discounted back to its present value to understand what it is worth now.

## Why Is Present Worth Calculation Critical?

- Investment Decisions: Helps determine whether future cash flows justify current investments.
- Loan and Mortgage Analysis: Assists in calculating the current value of future loan payments.
- Business Valuations: Used in valuing future earnings or cash flows.
- Budgeting and Planning: Facilitates comparing different financial options over time.

## Mathematical Foundations for Present Worth Calculation

The calculation of present worth relies on the concept of discounting future sums using a specified interest rate. The general formula for present worth (PW) when receiving a future sum (F) after a certain number of periods (n) at an interest rate (i) is:

## Present Worth Formula

$$[ PW = \frac{F}{(1 + i)^n} ]$$

Where:

- PW = Present Worth
- F = Future amount to be received
- i = Annual interest rate (decimal)
- n = Number of years until receipt

In our specific scenario:

- F = Q (the future sum)
- i = 5% = 0.05
- n = 6 years

## Calculating the Present Worth of Sum Q Received in 6 Years at 5% Interest

Applying the formula:

$$[ PW = \frac{Q}{(1 + 0.05)^6} ]$$

First, compute the denominator:

$$[ (1 + 0.05)^6 = 1.05^6 ]$$

Calculating  $(1.05^6)$ :

- $(1.05^1 = 1.05)$
- $(1.05^2 = 1.1025)$

- $(1.05^3 = 1.157625)$
- $(1.05^4 = 1.21550625)$
- $(1.05^5 = 1.27628156)$
- $(1.05^6 = 1.34009564)$

Thus:

$$PW = \frac{Q}{1.34009564}$$

This means the present worth of the future sum Q, received after 6 years at 5% interest, is approximately:

$$PW \approx \frac{Q}{1.3401}$$

Key Insight: To determine the current value of Q, divide Q by about 1.3401.

## Practical Example

Suppose you expect to receive  $Q = \$10,000$  six years from now. The present worth would be:

$$PW = \frac{10,000}{1.3401} \approx 7,462.89$$

So, the current worth of \$10,000 to be received after six years at 5% interest is approximately \$7,462.89.

## Factors Influencing Present Worth Calculations

While the basic formula is straightforward, several factors can influence the accuracy and application:

## 1. Changes in Interest Rates

Interest rates fluctuate over time, so selecting an appropriate discount rate is critical. A higher rate will decrease present worth, and vice versa.

## 2. Compounding Frequency

The above calculation assumes annual compounding. If interest compounds more frequently (quarterly, monthly), the formula adjusts accordingly:

$$[ PW = \frac{Q}{(1 + i/n)^{n \times t}} ]$$

Where:

- n = number of compounding periods per year
- t = number of years

## 3. Inflation Considerations

Inflation affects the real value of future sums. When planning long-term investments, adjusting for expected inflation ensures more accurate present worth calculations.

## Extensions and Variations of Present Worth Calculations

Beyond single sums, finance professionals often handle more complex scenarios:

### 1. Annuities

Regular payments over time, such as pensions or loan repayments, are valued using annuity formulas.

## 2. Perpetuities

A never-ending series of payments, valued differently due to their infinite duration.

## 3. Multiple Cash Flows

Discounting a series of varying future cash flows requires summing individual present worths.

# Practical Applications in Business and Finance

Understanding how to calculate present worth is vital for various practical purposes:

- **Investment Appraisal:** Determining whether future earnings justify current investments.
- **Loan Amortization:** Calculating current loan values based on future payments.
- **Business Valuation:** Estimating the current value of future cash flows or revenue streams.
- **Project Evaluation:** Comparing different projects by their net present values (NPV).

## Conclusion

Calculating the present worth of a future sum received after six years at a 5% annual interest rate is a fundamental skill in financial analysis. By understanding the underlying principles and formulas, one can accurately determine how much a future payment is worth today, facilitating sound decision-making in investments, loans, and business strategies.

Remember, the key formula:

$$PV = \frac{Q}{(1 + i)^n}$$

serves as the foundation for countless financial calculations. Whether you're evaluating a lump sum, an annuity, or complex cash flow series, mastering present worth calculations empowers you to make informed financial decisions with confidence.

In summary:

- Future sum Q discounted at 5% over 6 years equals approximately Q divided by 1.3401.
- Adjustments for compounding frequency and inflation can refine calculations.
- Present worth analysis remains a cornerstone of financial planning and analysis.

By applying these principles diligently, you enhance your ability to analyze and interpret financial data, ultimately leading to better investment and management outcomes.

## Frequently Asked Questions

**What is the present worth of a sum of money to be received 6 years from now at a 5% annual interest rate?**

The present worth can be calculated using the formula:  $\text{Present Worth} = \text{Future Value} / (1 + \text{interest rate})^{\text{number of years}}$ . For example, if the future sum is known, divide it by  $(1 + 0.05)^6$  to find its present worth.

**How do I calculate the present value of a future sum received after 6 years at 5% interest?**

Use the present value formula:  $PV = FV / (1 + r)^n$ , where FV is the future value, r is the annual interest rate (0.05), and n is the number of years (6).

**If I expect to receive \$10,000 in 6 years, what is its current worth at a 5% annual interest rate?**

Present Worth =  $10,000 / (1 + 0.05)^6$  =  $10,000 / 1.3401$  = \$7,463.48.

**Why is understanding the present worth important when planning for future money receipts?**

Understanding present worth allows you to determine how much a future sum is worth today, helping in investment decisions, budgeting, and comparing different financial options based on the time value of money.

**What factors influence the calculation of present worth in this context?**

The key factors are the future amount to be received, the annual interest rate (discount rate), and the number of years until receipt.

**Can the present worth be used to compare different investment options received at different times?**

Yes, by calculating their present worths, you can compare the value of money received at different times to make informed investment decisions.

**How does increasing the interest rate affect the present worth of a future sum received after 6 years?**

Increasing the interest rate decreases the present worth because the discount factor  $(1 + r)^n$  becomes larger, reducing the current value of the future sum.

## Additional Resources

Sum Of Money Q Will Be Received 6 Years From Now. At 5% Annual Interest. The Present Worth Now Of

Understanding the concept of present worth (PW) is fundamental in finance and investment decision-making. In particular, calculating the present worth of a future sum of money involves discounting that future sum back to its current value, accounting for the time value of money and the interest rate. This article delves deeply into the process of determining the present worth of a sum to be received six years from now, given an annual interest rate of 5%. Whether you're an investor, financial analyst, or student, grasping this concept is critical for making informed financial decisions.

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## Understanding the Concept of Present Worth

### What Is Present Worth?

Present worth, often called present value (PV), represents the current value of a future sum of money or stream of cash flows discounted at a specific interest rate. It answers the question: "How much is a future amount worth today?" This concept hinges on the principle that money available now is worth more than the same amount received in the future due to its potential earning capacity.

### Why Is Present Worth Important?

- Investment Evaluation: Helps compare different investment options with varying cash flow timings.
- Decision Making: Assists in determining the feasibility of future cash inflows or outflows.
- Cost-Benefit Analysis: Used extensively to evaluate projects, loans, or financial plans.

# Calculating Present Worth of a Future Sum

## The Formula

The general formula for calculating the present worth (PV) of a future sum (F) received after n years at an annual interest rate (i) is:

$$PV = \frac{F}{(1 + i)^n}$$

Where:

- ( PV ) = Present value
- ( F ) = Future sum of money
- ( i ) = annual interest rate (decimal form)
- ( n ) = number of years until receipt

## Applying the Formula to Our Scenario

In our case:

- ( F ) = Sum of Money Q (unknown)
- ( n ) = 6 years
- ( i ) = 5% = 0.05

Suppose the future sum of money Q is known; then the present worth now is:

$$PV = \frac{Q}{(1 + 0.05)^6} = \frac{Q}{(1.05)^6}$$

# Calculating the Discount Factor

## Understanding the Discount Factor

The denominator,  $\frac{1}{(1+i)^n}$ , is called the discount factor. It reflects how much the future sum is "discounted" back to its present value.

## Calculating $\frac{1}{(1.05)^6}$

Let's compute the discount factor:

$$\frac{1}{(1.05)^6} = \frac{1}{1.05 \times 1.05 \times 1.05 \times 1.05 \times 1.05 \times 1.05}$$

Calculating step-by-step:

- $\frac{1}{1.05^1} = 1.05$
- $\frac{1}{1.05^2} = 1.1025$
- $\frac{1}{1.05^3} = 1.1576$
- $\frac{1}{1.05^4} = 1.2155$
- $\frac{1}{1.05^5} = 1.2763$
- $\frac{1}{1.05^6} \approx 1.3401$

Hence, the present worth of Q is:

$$PV = \frac{Q}{1.3401}$$

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# Practical Examples and Applications

## Example 1: Calculating Present Worth of a Known Future Sum

Suppose you expect to receive \$10,000 six years from now. With an annual interest rate of 5%, the present worth is:

$$PV = \frac{10,000}{1.3401} \approx \$7,463.63$$

This means that \$7,463.63 invested today at 5% annual interest will grow to \$10,000 in 6 years.

## Example 2: Determining Future Sum for a Present Investment

Alternatively, if you want to determine what future sum  $Q$  would equal a present investment of \$7,500, you can rearrange the formula:

$$Q = PV \times (1.05)^6$$

$$Q = 7,500 \times 1.3401 \approx \$10,051$$

So, an investment of \$7,500 today at 5% interest would grow to approximately \$10,051 in 6 years.

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# Features and Considerations in Present Worth Calculations

## Features of the Present Worth Method

- Time value of money: Recognizes that money today is more valuable than the same amount in the future.
- Interest rate sensitivity: Changes in the interest rate significantly affect the present value.
- Ease of comparison: Provides a common basis to compare different cash flow streams.

## Limitations and Assumptions

- Assumes a constant interest rate over the entire period.
- Does not account for inflation or changes in market conditions unless explicitly incorporated.
- Presumes cash flows occur at the end of each period, which may not always be accurate.

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## Pros and Cons of Using Present Worth Calculations

- Pros:

- Enables consistent comparison of financial options with different timings.
- Helps in assessing the viability of long-term investments.
- Incorporates the time value of money, reflecting realistic valuation.

- **Cons:**

- Relies heavily on the accuracy of the assumed interest rate.
- May oversimplify complex cash flow scenarios involving multiple payments or irregular timings.
- Assumes a stable interest rate, which is often unrealistic in fluctuating markets.

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## Advanced Considerations

### Incorporating Multiple Cash Flows

While this article focuses on a single future sum, real-world scenarios often involve multiple cash flows at different times. In such cases, the present worth is calculated by summing the discounted values of each cash flow:

$$PV = \sum_{k=1}^n \frac{F_k}{(1 + i)^k}$$

Where  $F_k$  is the cash flow at year  $k$ .

## Using Present Worth in Financial Decision-Making

- Investment Appraisal: Comparing project costs and benefits over time.
- Loan Amortization: Determining the current value of loan payments.
- Valuation of Assets: Estimating current value based on expected future income streams.

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## Conclusion

Calculating the present worth of a future sum, such as the sum  $Q$  to be received six years from now at 5% annual interest, is a foundational concept in finance that enables informed decision-making. By understanding and applying the formula:

$$PV = \frac{Q}{(1.05)^6}$$

or equivalently, using the discount factor 1.3401, financial professionals can accurately assess the true value of future cash flows. While the basic method is straightforward, real-world applications often require considering multiple cash flows, changing interest rates, and inflation. Mastery of present worth calculations empowers investors and analysts to optimize their financial strategies, evaluate investments, and plan for future financial needs effectively.

Key takeaways:

- Present worth discounts future sums to their current value based on a given interest rate.
- The choice of interest rate significantly influences the present worth calculation.
- Accurate future cash flow estimation and rate assumptions are critical for meaningful analysis.
- The concept remains essential across various financial disciplines, from investment analysis to project management.

Whether you're planning long-term investments or assessing the value of future income, understanding the calculation of present worth at a 5% annual interest rate provides a powerful tool for sound financial planning.

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