Engineering Economics & Financial Management

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Source: Chan S Park; compiled by Lt Cdr Geethalakshmi PM

In this course

- Introduction to Engineering economics
- Time Value of Money
- Economic equivalence
- Economic analysis of alternatives
- Replacement analysis
- Depreciation accounting
- Financial Statement Analysis

Text books

1. Engineering economy

   By Thuesen and Fabrycky

2. Contemporary engineering economics

   By Chan S Park

3. Engineering Economics

   By James L Riggs

4. Fundamentals of Financial Management

   By Prasanna Chandra

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At the end of this session, the learner should be able to

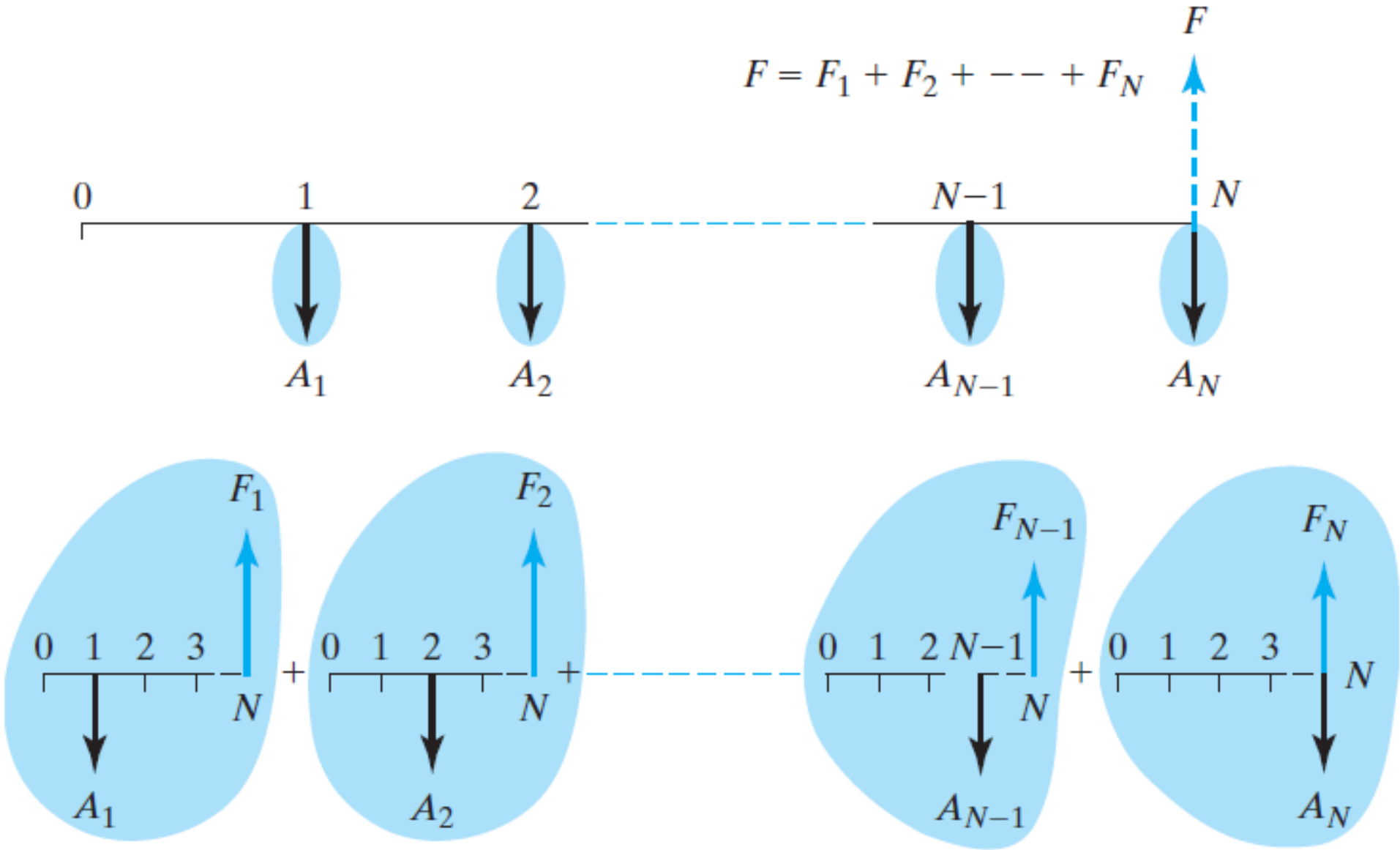
L4: Find the future worth (Compound amount) of equal (Uniform) payment series

L5: Find the equivalent equal payment (Sinking Fund) given the future amount

L6: Find the Present Worth of a given equal payment series

L7: Find the Annuity (Capital Recovery) given the present amount

Compound Amount Factor – Equal Payment series



Compound Amount Factor – Equal Payment series

If $A_1=A_2=A_3=\ldots\ldots A_N = A$, then

$$F = A(1 + i)^{N-1} + A(1 + i)^{N-2} + \cdots + A(1 + i) + A,$$

or, expressed alternatively,

$$F = A + A(1 + i) + A(1 + i)^2 + \cdots + A(1 + i)^{N-1}.$$

Multiplying Eq. (3.8) by $(1 + i)$ results in

$$(1 + i)F = A(1 + i) + A(1 + i)^2 + \cdots + A(1 + i)^N.$$

Subtracting Eq. (3.8) from Eq. (3.9) to eliminate common terms gives us

$$F(1 + i) - F = -A + A(1 + i)^N.$$

Solving for F yields

$$F = A\left[\frac{(1 + i)^N - 1}{i}\right] = A(F/A, i, N).$$

Equal Payment series

Capital Recovery Factor

$$A = P(1 + i)^N \left[\frac{i}{(1 + i)^N - 1} \right],$$

or

$$A = P\left[\frac{i(1 + i)^N}{(1 + i)^N - 1} \right] = P(A/P, i, N).$$

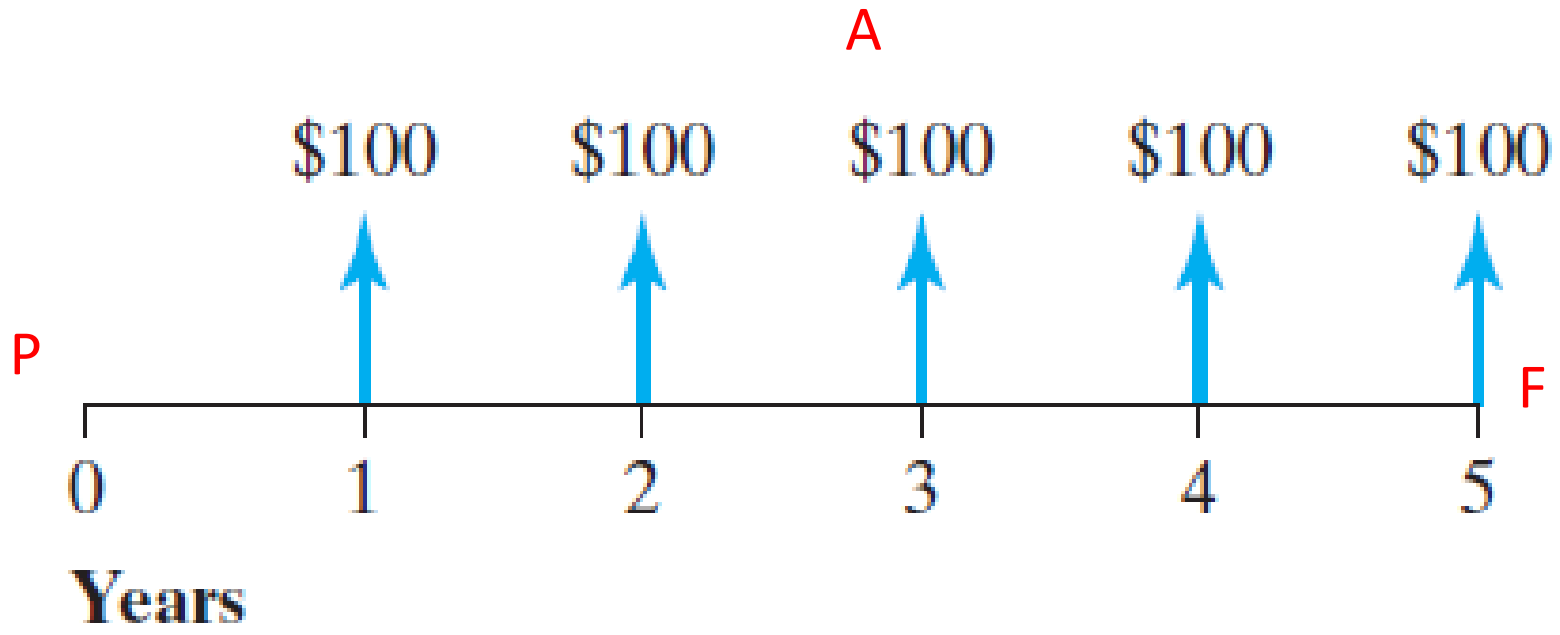
Equal Payment series

Present Worth Factor

$$P = A\left[\frac{(1+i)^N - 1}{i(1+i)^N}\right] = A(P/A, i, N).$$

E.g. What is the present worth of paying $ 2500 per year for five years at an interest rate of 10%?

Equal Payment Series



Factor notation

Equal payment series – Finding F, given A, I and N (compound amount factor)

$$F = A\left[\frac{(1+i)^N - 1}{i}\right] = A(F/A, i, N).$$

Eg. Suppose you invest 1,00,000 rupees at the end of each year at an interest rate of 10%, how much will you have at the end of 6 years?

E.g.Suppose you make annual contribution of ₹ 30,000/-, at an interest rate of 7%, wha will be in your account at the end of ten years?

Compound Amount Factor - Time shift

E.g. 2. Suppose you make annual contribution of ₹ 30,000/-, at an interest rate of 7%, and make ten deposits, starting from now (beginning of the year), what will be in your account at the end of ten years?

Factor notation

Equal payment series – **Sinking-Fund Factor: Find *A*, Given *F*, *i*, and *N***

$$A = F\left[\frac{i}{(1+i)^N - 1}\right] = F(A/F, i, N)$$

Eg. Suppose you wish to have in your account Rs.10,00,000 at an interest rate of 9% at the end of 5 years, what should be your yearly investment?

Factor notation

Equal payment series – **Capital Recovery Factor (Annuity Factor): Find *A*, Given *P*, *i*, and *N***

$$A = P(1 + i)^N \left[\frac{i}{(1 + i)^N - 1} \right]$$

Eg. Suppose you are to repay a loan amount of 10,00,000 at an interest rate of 9% in a period of 5 years, what should be your yearly payment?

Equal Payment series

Capital Recovery Factor

E.g. Biogen, a biotechnology firm borrowed $ 2,50,000/- to purchase a laboratory equipment for gene splicing. The loan carries an interest rate of 8% per annum and is to be repaid in equal installments over next six years. Compute the amount of annual installment

Equal Payment series

Capital Recovery Factor – deferred annuity

E.g. Biogen, a biotechnology firm borrowed $ 2,50,000/- to purchase a laboratory equipment for gene splicing. The loan carries an interest rate of 8% per annum and is to be repaid in equal installments over next six years. The company wants to negotiate with the bank and defer the loan repayment by two years (02 years from now) and retain six installments. Compute the annual installments, if the bank wants to retain its profit.

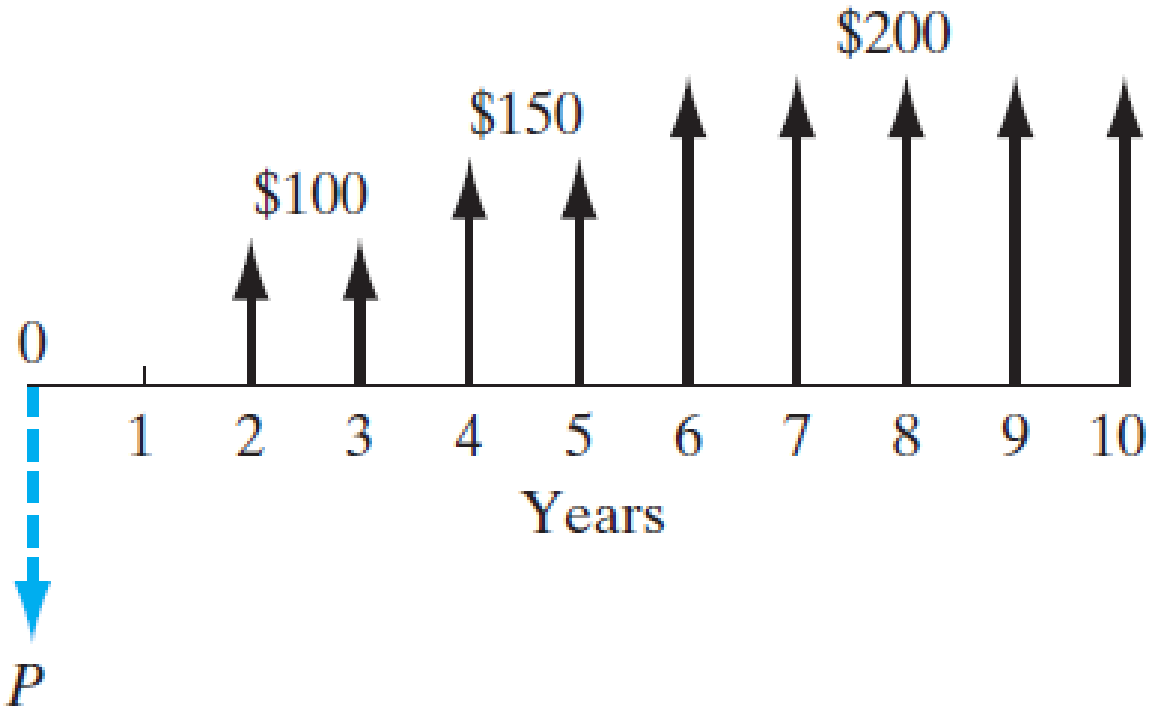
Factor notation

Equal payment series – **Present-Worth Factor: Find *P*, Given *A*, *i*, and *N***

$$P = A\left[\frac{(1+i)^N - 1}{i(1+i)^N}\right] = A(P/A, i, N)$$

Eg. How much should you invest now in order to withdraw an amount of 1,00,000 per year for four years at an interest rate of 10%?

Find the present worth of the cash receipts where $i = 12\%$ compounded annually with only four interest factors.

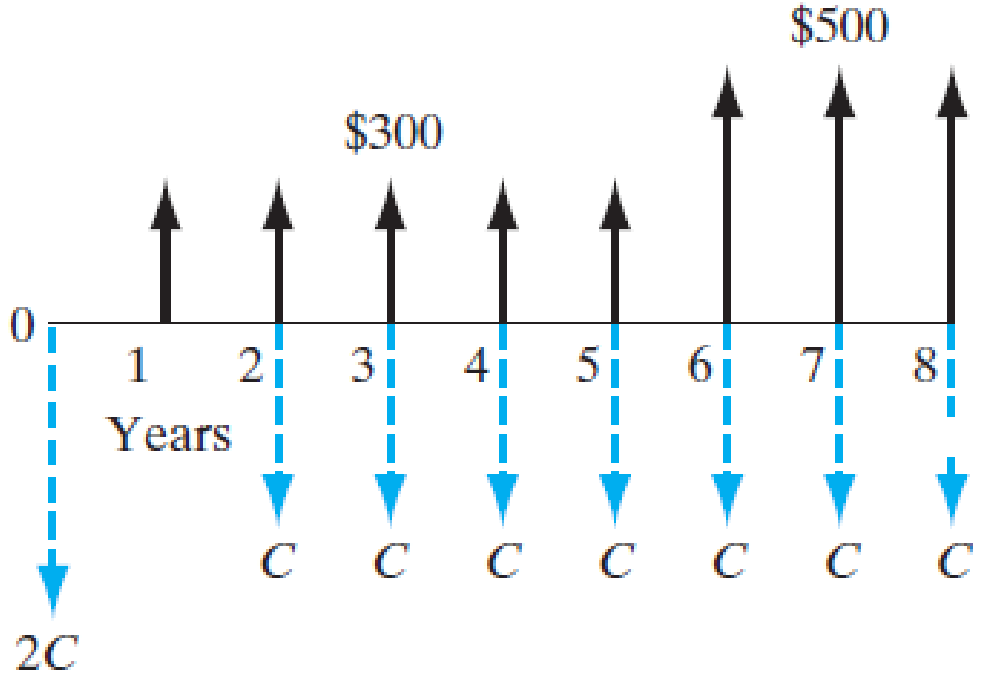


Ans: $740.49

A couple with a newborn daughter wants to save for their child's college expenses in advance. The couple can establish a college fund that pays 7% annual interest. Assuming that the child enters college at age 18, the parents estimate that an amount of $40,000 per year (actual dollars) will be required to support the child's college expenses for 4 years. Determine the equal annual amounts the couple must save until they send their child to college. (Assume that the first deposit will be made on the child's first birthday and the last deposit on the child's 18th birthday. The first withdrawal will be made at the beginning of the freshman year, which also is the child's 18th birthday.)

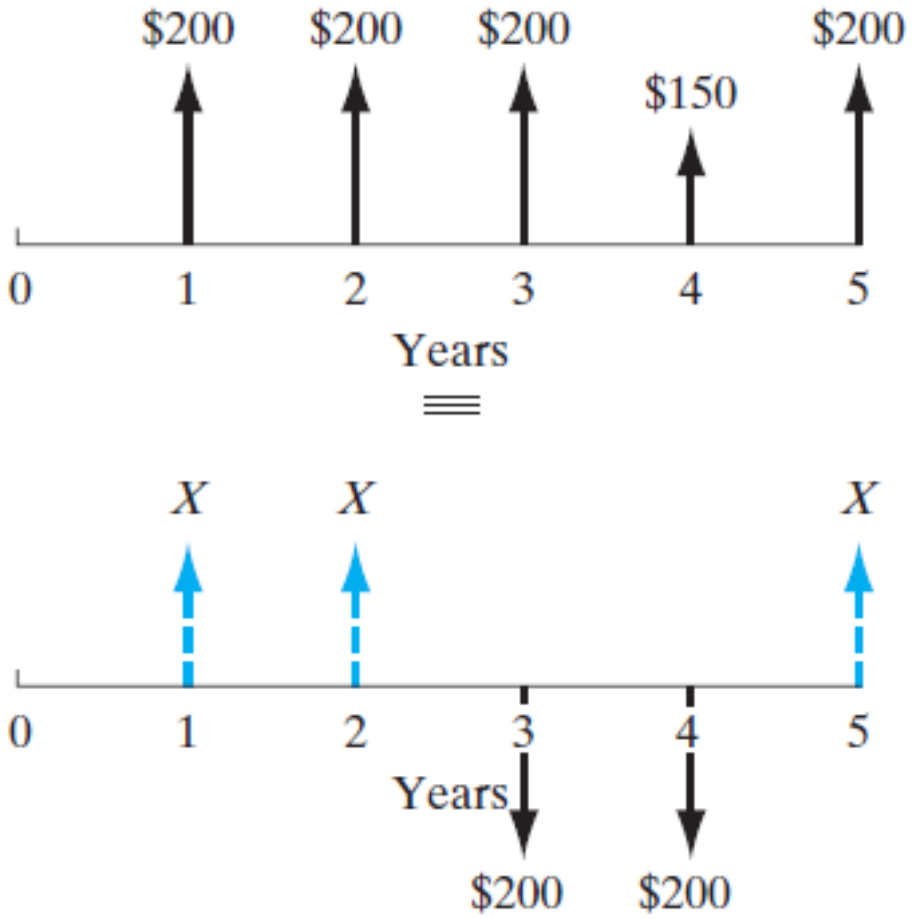
Ans: $ 4264

Consider the cash flow shown in the accompanying diagram. What value of C makes the inflow series equivalent to the outflow series at an interest rate of 10%?



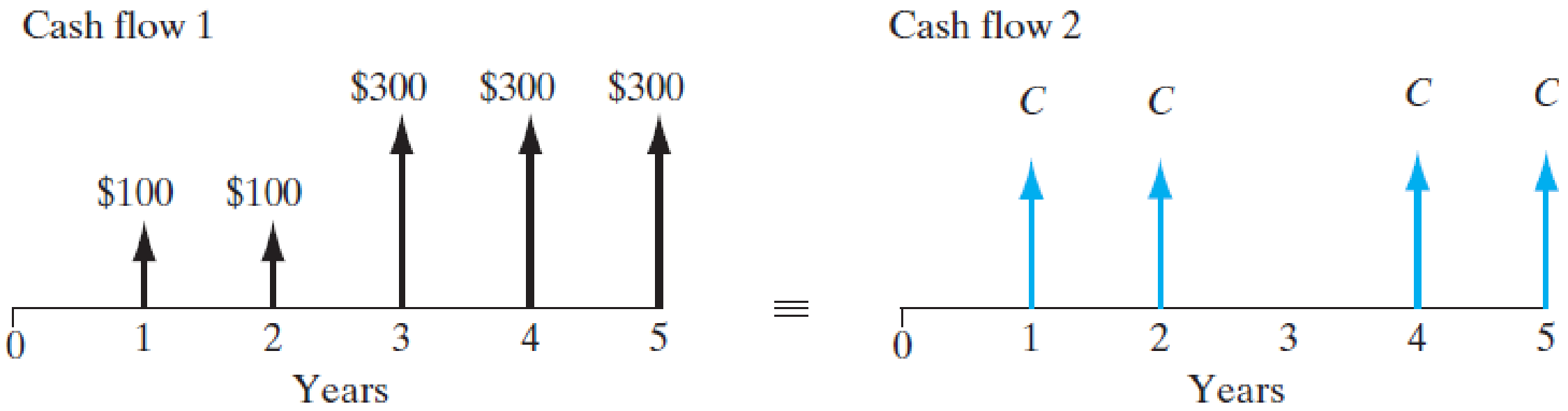
C= $ 297.13

Find the value of X so that the two cash flows shown in the diagram are equivalent for an interest rate of 8%.



Ans: X= 431

Q. Two cash flows are equivalent at 12% interest, determine the value of ‘C’



Ans:$256.97