ACC 300 · SESSION 14

Time value of money and borrowing

ACC 300 | October 15, 2026



Why payment dates matter

EXPLANATION

A borrower receives cash before repaying it. The lender gives up the use of that cash during the loan term and charges interest.

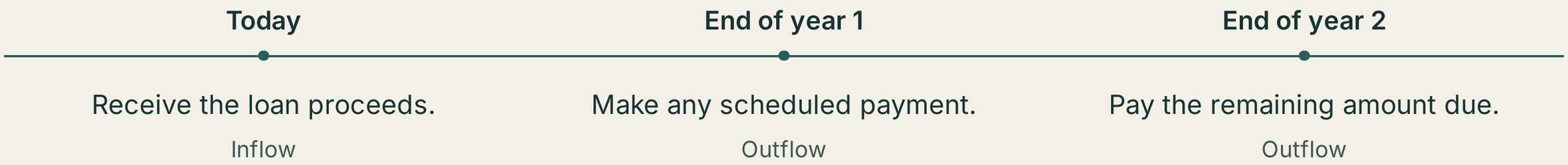
To compare payments at different dates, we calculate their values at the same date using an applicable interest rate.

Borrower's question	Calculation we need
How much will an unpaid balance become?	We compound it to a future date.
How much can we borrow against promised payments?	We discount those payments to today.
How much of a payment reduces the debt?	We separate interest expense from principal repayment.

A borrower's cash-flow timeline

WALKTHROUGH

Place every cash flow on its payment date. From the borrower's perspective, loan proceeds are cash received and repayments are cash paid.



Present value (PV) is the value at today's date. **Future value (FV)** is the value at a later date.

The number of periods counts intervals between dates. A payment today has no waiting period to discount.

Read the amounts, rate, and periods

EXPLANATION

Symbol	Meaning	Details
PV	Present value: the amount at the starting date.	Cash received today.
FV	Future value: the amount at a later date.	The balance or payment at that date.
i	Interest rate for one compounding period.	Use the rate for each year or month.
n	Number of compounding periods between the dates.	Count the intervals, not the date labels.

Convert the percentage number to a decimal: $\frac{10}{100} = 0.1$. Use i = 0.1 for annual compounding at 10%.

The rate and period count must use the same unit. For monthly compounding, use a monthly rate and count months.

Calculate one period of interest

WALKTHROUGH

A borrower owes $10,000.00 at the start of a year. The annual interest rate is 10% and no payment occurs during the year.

Interest **= beginning balance × period rate**

= $10,000.00 × 0.1 = $1,000.00

Ending balance = beginning balance + interest = $11,000.00

Multiplying by 1 + i combines the balance and its interest: 1 keeps the original balance, and i adds that period's interest.

Next year's interest = $11,000.00 × 0.1 = $1,100.00

Compounding means later interest also applies to earlier unpaid interest. The second year's interest is larger because the balance has grown.

Calculate a future amount

WALKTHROUGH

The borrower receives $10,000.00 today and makes no payment for 2 years. Interest compounds annually at 10%. Principal and all accumulated interest are due at the end of year 2. **How much must the borrower repay then?**

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

PV = $10,000.00; i = 0.1 per year; n = 2 years

$FV = \$10{,}000.00 \times (1 + 0.1)^2 = \$12{,}100.00$

Calculator step	Meaning
Add 1 + i.	Include the balance and one period's interest.
Raise the result to n using the power key, x^y or ^.	Apply that growth once per period. Here, $1.10^2 = 1.10 \times 1.10 = 1.21$.
Multiply by PV.	The borrower owes $12,100.00 after 2 years.

Keep the parentheses around 1 + i. Simple interest on only the original balance would give $12,000.00.

Compare amounts at different dates

iClicker | Question 1 of 5

At 8% annual compound interest, how does $5,000.00 today compare with $6,298.56 in 3 years?

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

Assume no fees or other cash flows.

A. The amount today has a higher equivalent value.

B. The future amount has a higher equivalent value.

C. The amounts have equal values at the same date.

D. We need a monthly interest rate to compare them.

Amounts at different dates: answer

iClicker | Answer 1 of 5 — **Correct answer: C.**

At 8% annual compound interest, how does $5,000.00 today compare with $6,298.56 in 3 years?

A **The amount today has a higher equivalent value.**
Incorrect. The stated rate makes the amounts equivalent.

B **The future amount has a higher equivalent value.**
Incorrect. The larger future amount includes compensation for waiting.

C **The amounts have equal values at the same date.**
Correct. $5,000.00 × $(1 + 8\%)^3$ = $6,298.56.

D **We need a monthly interest rate to compare them.**
Incorrect. Annual periods match the annual rate.

Calculate a present amount

EXPLANATION

To find how much a borrower can receive today, work backward from the promised future payment. **Discounting** removes the interest growth between those dates.

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

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

Step	What to identify or enter
Identify FV.	Use the amount promised at the future date.
Identify i and n.	Use a decimal rate and a period count with matching units.
Calculate $(1 + i)^n$.	Use parentheses and the power key to calculate the growth factor.
Divide FV by that factor.	Reverse the growth to find today's amount.

A factor is a multiplier or divisor calculated from the rate and period count. At a positive rate, present value is below the future payment.

Discount a payment due in 18 months

WALKTHROUGH

A borrower promises $11,961.47 in 18 months. Interest compounds monthly at 1% per month. Find today's cash advance.

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

FV = $11,961.47; i = 0.01 per month; n = 18 months

Growth factor = $(1 + 0.01)^{18} \approx 1.196147$

$$PV = \frac{\$11{,}961.47}{1.196147} \approx \$10{,}000.00$$

Today	Month 9	Month 18
$10,000.00	No payment.	$11,961.47
Cash the borrower receives	Half the term has passed.	Cash the borrower repays

Enter the power first, then divide the future payment by that result. Keep all calculator digits until rounding the final amount to cents.

Payment timing and interest rates

Match the rate and periods before choosing a calculation.



Match the rate to the period

EXPLANATION

An interest rate applies over a stated interval. The rate and the number of periods in a formula must use that same interval.

A hypothetical loan quotes a 12% nominal annual rate, compounded monthly, for 2 years.

Monthly rate $= \frac{12\%}{12} = 1\%$

Periods = 2 × 12 = 24 months

Using the annual rate for every month would charge a full year's rate each month. Divide a nominal annual rate by its stated compounding frequency; an effective annual rate needs a different conversion.

The effective annual rate

WALKTHROUGH

The **effective annual rate** measures a full year's growth, including interest earned on earlier interest.

A 12% nominal annual rate compounded monthly charges 1% per month. What is the equivalent annual rate?

Effective annual rate = (1 + monthly rate)^{12} − 1

= (1 + 1%)^{12} − 1 ≈ 12.68%

Starting balance: $1,000.00	Compounded annually	Compounded monthly
Quoted annual rate	12%	12%
Interest after one year	$120.00	$126.83
Ending balance	$1,120.00	$1,126.83

The result exceeds the quoted rate because interest added each month also earns interest. Use effective annual rates to compare loans with different compounding intervals.

Equal payments at different dates

EXPLANATION

An **annuity** is a series of equal payments at equal intervals. Payment timing changes how long each amount earns interest or is discounted.

An **ordinary annuity** pays at each period's end. An **annuity due** pays at each period's beginning. A is each equal payment; FV is a single future payment.

Payment arrangement	Today	End of year 1	End of year 2	End of year 3
Single amount	No payment.	No payment.	No payment.	Pay FV.
Ordinary annuity	No payment.	Pay A.	Pay A.	Pay A.
Annuity due	Pay A.	Pay A.	Pay A.	No payment.

For the same positive rate and payment count, an annuity due has a higher present value because every payment occurs earlier.

Calculate the value of equal payments

EXPLANATION

For an ordinary annuity, calculate each payment's present value, then add the results. The annuity formula combines those separate discounts.

$$PV = A \times \frac{1 - (1 + i)^{-n}}{i}$$

Symbol or expression	Meaning
A	The amount of each equal payment.
i	The decimal interest rate for one payment period.
n	The number of payments, with the first one period from today.
$(1 + i)^{-n}$	We use the reciprocal, $\frac{1}{(1 + i)^{n}}$, to reverse compounding.
$\frac{1 - (1 + i)^{-n}}{i}$	The ordinary-annuity present-value factor, which adds the separate discount factors.

For beginning-of-period payments, multiply the ordinary-annuity PV by $(1 + i)$. Every payment occurs one period earlier, so we remove one period of discounting.

Work through the annuity calculation

WALKTHROUGH

A borrower promises $1,000.00 at each year-end for 4 years. The effective annual rate is 6%. How much can the borrower receive today?

A = $1,000.00; i = 0.06; n = 4

$$PV = \$1{,}000.00 \times \frac{1 - \frac{1}{(1 + 0.06)^4}}{0.06}$$

Calculator step	Result
Calculate $(1 + i)^n$.	1.262477
Divide 1 by that result.	0.792094
Subtract that result from 1, then divide by i.	3.465106
Multiply the factor by A.	$3,465.11

Keep the calculator's unrounded results between steps. The borrower receives less than the total payments because repayment occurs later.

Select the model from the dates

STUDENT WORK

Spend a few minutes on your own or with those around you to work through this problem.

A borrower promises 5 payments of $4,000.00, due 1, 2, 3, 4, and 5 years from today. The annual effective rate is 10%. No other payment is due.

Draw the timeline. Select the present-value model, then explain whether its value is above or below the total payments.

Single amount: $PV = \frac{FV}{(1+i)^n}$

Ordinary annuity: $PV = A \times \frac{1-(1+i)^{-n}}{i}$

Annuity due: PV = ordinary-annuity PV × (1 + i)

FV is a single future payment; A is each equal payment; i is the period rate; n is the payment count.

Model selection and present value: solution

WORKED SOLUTION

Use an **ordinary annuity**: equal payments occur at each year-end. For 5 end-of-year payments of $4,000.00 at 10%, discount each payment for its own waiting period.

Today	End of year 1	End of year 2	End of year 3	End of year 4	End of year 5
$15,163.15	$4,000.00	$4,000.00	$4,000.00	$4,000.00	$4,000.00
Cash received	Cash paid	Cash paid	Cash paid	Cash paid	Cash paid

$$PV = A \times \frac{1 - (1 + i)^{-n}}{i}$$

$$= \$4{,}000.00 \times \frac{1 - (1 + 0.10)^{-5}}{0.10}$$

$$\approx \$4{,}000.00 \times 3.790787 \approx \$15{,}163.15$$

The present value is below the $20,000.00 total payments because the lender waits to receive them.

How does earlier repayment affect the advance?

iClicker | Question 2 of 5

A borrower promises 6 equal annual payments of $2,500.00. The lender requires 7% annually. Which option permits a larger initial advance, before any repayment?

- **Option 1:** Annual payments at the end of years 1–6.
- **Option 2:** One payment today; remaining payments at the end of years 1–5.

A. Option 2: the lender receives each payment sooner.

B. Option 1: the borrower makes each payment later.

C. Both allow the same advance because payment amounts match.

D. Both advances equal the total promised payments.

Earlier repayment: answer

iClicker | Answer 2 of 5 — **Correct answer: A.**

A borrower promises 6 equal annual payments of $2,500.00. The lender requires 7% annually. Which option permits a larger initial advance, before any repayment?

- **Option 1:** Annual payments at the end of years 1–6.
- **Option 2:** One payment today; remaining payments at the end of years 1–5.

A **Option 2: the lender receives each payment sooner.**
Correct. Option 2 discounts each payment for one fewer year, producing a larger advance.

B **Option 1: the borrower makes each payment later.**
Incorrect. Option 1 delays each payment, reducing its present value.

C **Both allow the same advance because payment amounts match.**
Incorrect. Payment dates affect present value even when amounts stay the same.

D **Both advances equal the total promised payments.**
Incorrect. Only the first payment occurs today; the remaining payments still require discounting.

Calculate the future value of deposits

EXPLANATION

To find a savings balance at the last deposit date, grow each deposit forward to that date. Add the future amounts.

$$FV = A \times \frac{(1 + i)^n - 1}{i}$$

A is each equal deposit, i is the decimal rate per deposit period, and n is the deposit count. This formula assumes deposits at each period's end.

For 4 end-of-year deposits, each amount grows to the end of year 4:

End of year 1	End of year 2	End of year 3	End of year 4
$A \times (1 + i)^3$	$A \times (1 + i)^2$	$A \times (1 + i)$	A
Grows for 3 periods	Grows for 2 periods	Grows for 1 period	No time to earn interest

The first deposit earns interest for n − 1 periods. The final deposit earns none before this measurement date.

Savings deposits earn different amounts

WALKTHROUGH

Suppose you deposit $2,000.00 at each year-end for 4 years and earn 10% annually. Find the balance immediately after the last deposit.

Deposit date	Years earning interest	Value at the end of year 4
End of year 1	3	$2,662.00
End of year 2	2	$2,420.00
End of year 3	1	$2,200.00
End of year 4	0	$2,000.00

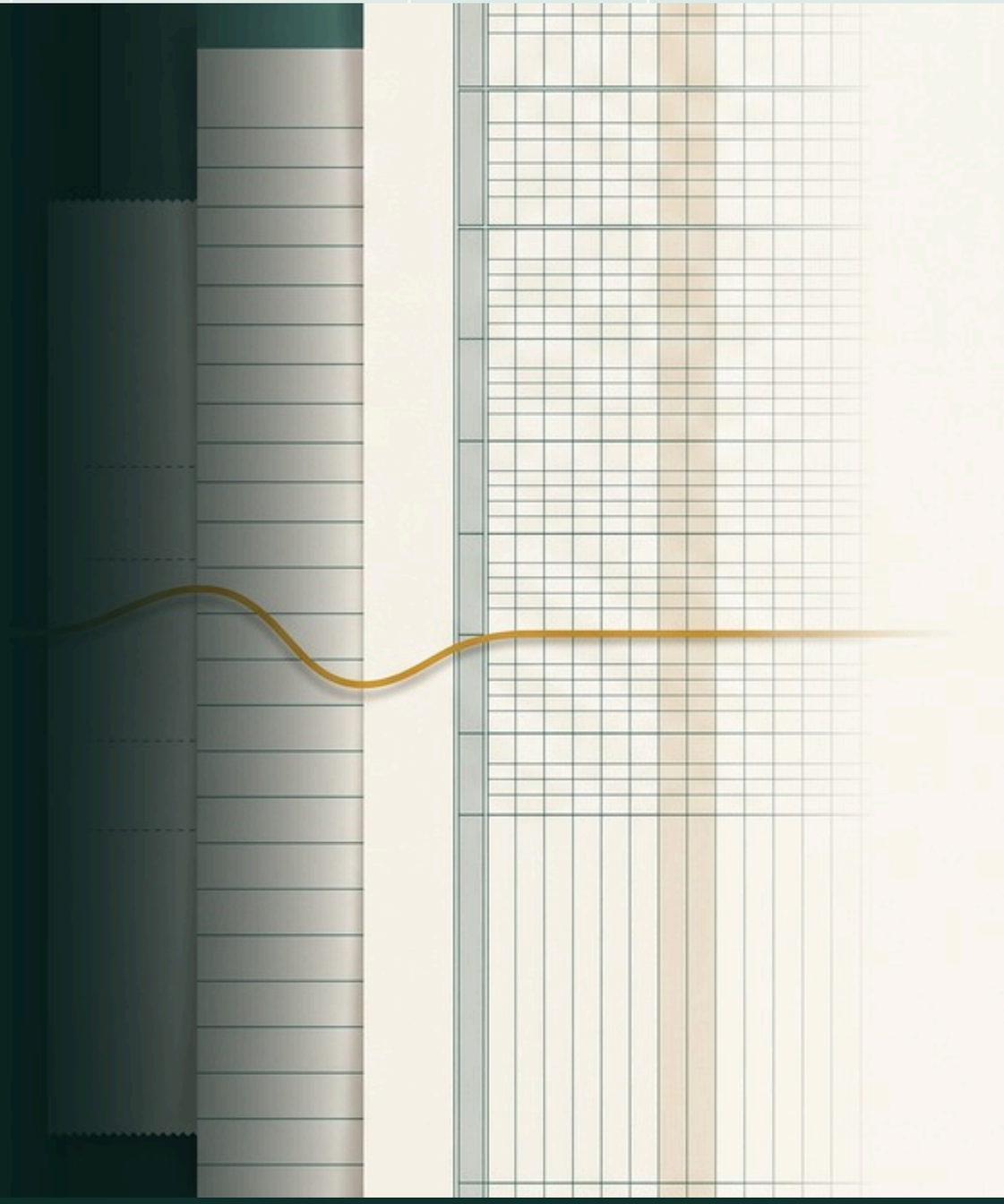
A = $2,000.00; i = 0.1; n = 4

$$\text{FV} = \$2{,}000.00 \times \frac{(1 + 0.1)^4 - 1}{0.1} = \$9{,}282.00$$

You deposit $8,000.00 and earn $1,282.00. The final deposit earns no interest before the measurement date.

Measure the note payable

Separate the cash received today from the amounts promised later.



Cash received and debt recorded

EXPLANATION

A **note payable** is a written promise to repay borrowed funds. Its **face amount** is the principal stated in the note.

Initial carrying amount = cash the borrower receives when the loan begins (T_o)

The **carrying amount** is the liability reported on the balance sheet. For a loan issued solely for cash, with no fees or other benefits:

Cash received at T_o	Adjustment account and normal balance	Reported liability
Less than face amount	Discount: **contra liability**, debit	Face amount – unamortized discount
Equal to face amount	None	Face amount
More than face amount	Premium: **adjunct liability**, credit	Face amount + unamortized premium

A **contra** account reduces the related account; an **adjunct** account adds to it. **Unamortized** means the adjustment still remaining.

A face-value cash loan has no discount merely because another market rate differs.

Stated interest and effective interest

EXPLANATION

What am I calculating?	Which rate do I use?
Contractual cash interest	**Stated rate** × principal still outstanding
Cash received today from promised future payments	**Effective rate** to calculate present value
Interest expense for the period	**Effective rate** × opening carrying amount

The **stated rate** sets the promised interest payments. The **effective rate** makes the present value of all repayments equal the cash initially borrowed.

Finding an unknown effective rate is a separate calculation. The earlier compounding example converted a known monthly rate into an annual rate; it did not solve for a loan's rate from its cash flows.

Interest payments and principal at maturity

WALKTHROUGH

A borrower issues a $20,000.00 note on January 1, 2027. It pays 6% annual cash interest each December 31 and repays principal on December 31, 2030.

Jan. 1, 2027	Dec. 31, 2027	Dec. 31, 2028	Dec. 31, 2029	Dec. 31, 2030
Receive the agreed proceeds. Amount to calculate	Pay $1,200.00. Interest only	Pay $1,200.00. Interest only	Pay $1,200.00. Interest only	Pay $21,200.00. Interest plus principal

Cash interest = $20,000.00 × 6% = $1,200.00

Proceeds = PV of interest payments + PV of principal

Principal remains due at maturity because the earlier cash payments cover only contractual interest.

Value the two promised cash flows

EXPLANATION

A **present-value factor** is a multiplier that converts future payments into their value today. Calculate each factor using i, the effective rate per period, and n, the number of periods.

Payment to value	Factor and meaning	Present-value calculation
Equal interest payments at each period's end	**Annuity factor** = $\frac{1 - (1 + i)^{-n}}{i}$. Today's value of one dollar paid each period.	Annual cash interest × annuity factor
Principal paid once at maturity	**Single-sum factor** = $\frac{1}{(1 + i)^{n}}$. Today's value of one dollar paid at maturity.	Maturity principal × single-sum factor

Cash proceeds = PV of interest payments + PV of maturity principal

The stated rate determines annual cash interest. The effective rate determines the factors used to value both payment streams.

Calculate the loan proceeds

STUDENT WORK

Spend a few minutes on your own or with those around you to work through this problem.

A borrower issues a 5-year note with annual payments at each year-end. Principal is due with the final interest payment. The effective annual rate is 9%. Use i = 0.09 per year and n = 5 years. No fees or other benefits exist.

Cash flow	Amount	Factor formula = supplied factor
Annual cash interest	$2,520.00	Annuity: $\frac{1 - (1 + i)^{-n}}{i} = 3.88965126$
Principal due at maturity	$36,000.00	Single sum: $\frac{1}{(1 + i)^{n}} = 0.64993139$

Proceeds = (annual interest × annuity factor) + (principal × single-sum factor)

Discount = principal due at maturity − proceeds

Calculate the proceeds and discount, rounded to cents. Explain why the borrower receives less than face amount. What initial carrying amount would the lender report?

Calculate both parts of the proceeds

WORKED SOLUTION

The note promises $2,520.00 at each year-end for 5 years, plus $36,000.00 principal at maturity. Discount both parts at 9% annually.

Cash flow	Present-value calculation	Present value
Annual interest payments	$\$2{,}520.00 \times \frac{1 - (1.09)^{-5}}{0.09} = \$2{,}520.00 \times 3.88965126$	$9,801.92
Principal at maturity	$\frac{\$36{,}000.00}{(1.09)^{5}} = \$36{,}000.00 \times 0.64993139$	$23,397.53

Cash proceeds = $9,801.92 + $23,397.53 = $33,199.45

Discount = $36,000.00 − $33,199.45 = $2,800.55

The borrower and lender both initially report $33,199.45. The borrower receives less than the principal due at maturity. That difference becomes additional interest over the note's term.

Face amount and initial liability

iClicker | Question 3 of 5

For a $45,000.00 note, the agreed cash advance equals the payments' present value of $42,594.29. Total promised payments are $50,400.00. No fees or other benefits exist. What is the initial carrying amount?

Carrying amount = face amount − unamortized discount

A Record $45,000.00, the face amount.

B Record $50,400.00, the total future cash payments.

C Record $2,405.71, the difference from face amount.

D Record $42,594.29, the cash received.

E Record no liability until the first payment.

Initial liability: answer

iClicker | Answer 3 of 5 — **Correct answer: D.**

For a $45,000.00 note, the agreed cash advance equals the payments' present value of $42,594.29. Total promised payments are $50,400.00. No fees or other benefits exist. What is the initial carrying amount?

A **Record $45,000.00, the face amount.**
Incorrect. Face amount excludes the discount adjustment.

B **Record $50,400.00, the total future cash payments.**
Incorrect. Total payments include future borrowing costs.

C **Record $2,405.71, the difference from face amount.**
Incorrect. The discount is a deduction from face amount.

D **Record $42,594.29, the cash received.**
Correct. The borrower initially records the agreed cash advance of $42,594.29.

E **Record no liability until the first payment.**
Incorrect. The borrower owes the debt when the loan begins.

Face amount, discount, and premium

COMPARISON

Compare three possible notes. For each note, the borrower repays the same principal after 5 years and pays interest at each year-end. The **effective annual rate stays at 9%**.

Stated annual rate	Annual cash interest	Cash received today	Principal repaid in 5 years	Discount or premium
7%	$2,520.00	$33,199.45	$36,000.00	Discount: $2,800.55
9%	$3,240.00	$36,000.00	$36,000.00	Neither
11%	$3,960.00	$38,800.55	$36,000.00	Premium: $2,800.55

The **face amount** is the principal repaid at maturity. Only in the middle row does the borrower receive that same amount in cash today.

Stated rate ↑ → **Annual cash interest ↑** → **Cash received today ↑**

Face amount and effective rate stay fixed. Larger promised interest payments let the borrower receive more cash today.

The same note for both parties

WALKTHROUGH

Continuing the practice note, on January 1, 2027 the borrower receives $33,199.45 for the $36,000.00 note. The discount is $2,800.55. No fees or other benefits exist.

Borrower: note payable

The discount is a **contra liability** with a debit balance. A premium is an **adjunct liability** with a credit balance.

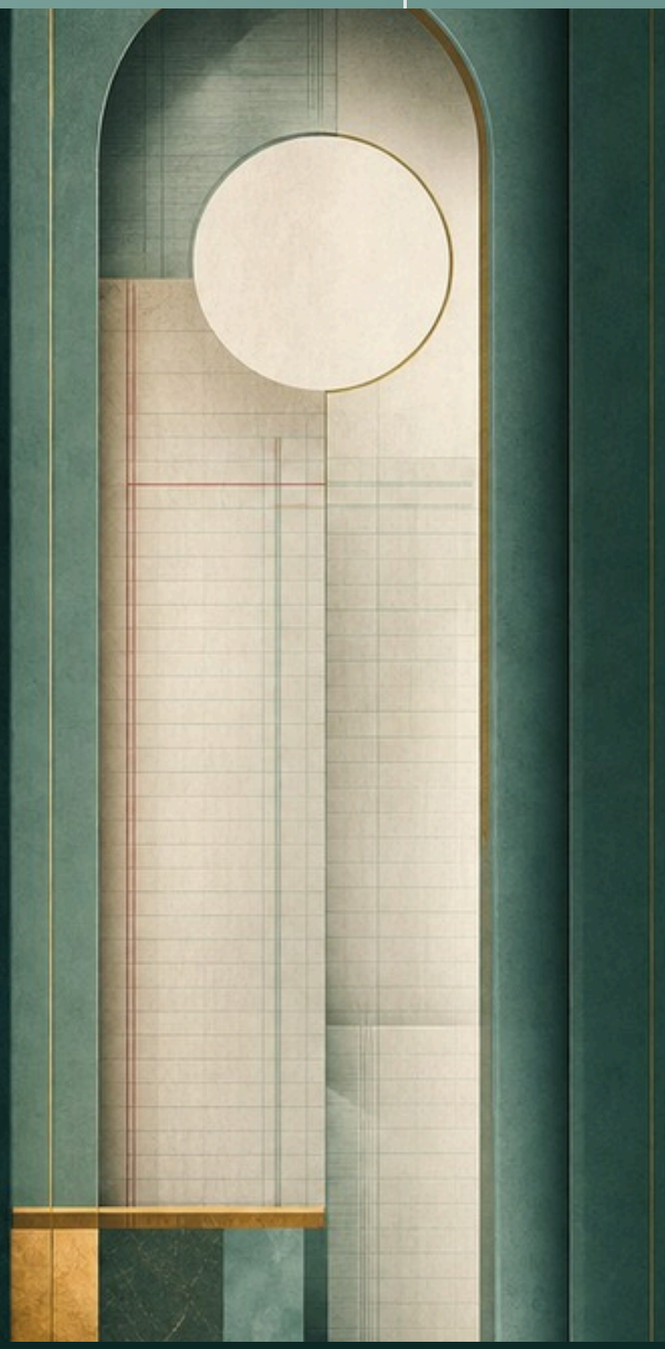
Account	Debit	Credit
Cash	$33,199.45	
Discount on notes payable	$2,800.55	
Notes payable		$36,000.00

Lender: note receivable

The discount is a **contra asset** with a credit balance. A premium is an **adjunct asset** with a debit balance.

Account	Debit	Credit
Notes receivable	$36,000.00	
Discount on notes receivable		$2,800.55
Cash		$33,199.45

The borrower has a liability; the lender has an asset. Both initially report a carrying amount of $33,199.45. Neither records the discount as an immediate expense or revenue.



Interest expense and the liability

Separate the cost of borrowing from the repayment of principal.

Why the carrying amount increases

WALKTHROUGH

Continuing the practice note: for the $36,000.00 note, opening carrying amount is $33,199.45. The effective rate is 9%, and annual cash interest is $2,520.00 ($36,000.00 × 7% stated rate).

Interest expense = $33,199.45 × 9% = $2,987.95

Discount amortization = $2,987.95 − $2,520.00 = $467.95

Ending carrying amount = $33,199.45 + $467.95 = $33,667.40

December 31, 2027: borrower	Debit	Credit
Interest expense	$2,987.95	
Discount on notes payable		$467.95
Cash		$2,520.00

Amortization gradually recognizes the discount as interest expense. As the discount shrinks, carrying amount rises. **At maturity, the fully amortized note has a carrying amount of $36,000.00.** Repaying that principal then reduces the liability to zero.

A note with no stated interest

WALKTHROUGH

A borrower receives $10,000.00 on January 1, 2027 and promises $12,100.00 on December 31, 2028. No earlier payment is due. The effective annual rate is 10%.

Year	Opening carrying amount	Interest expense	Cash paid	Ending carrying amount
2027	$10,000.00	$10,000.00 × 10%	None.	$11,000.00
2028, before payment	$11,000.00	$11,000.00 × 10%	None.	$12,100.00

Total interest expense = maturity payment − cash received = $2,100.00

The borrowing cost is included in the final payment. With no cash interest paid during the term, all interest expense increases the carrying amount until repayment.

Interest expense before the payment date

WALKTHROUGH

A borrower receives $18,000.00 at face amount on October 1, 2027. The 6-month note charges 8% simple annual interest, payable with principal on April 1, 2028. No interest has been recorded by December 31.

$$\text{Accrued interest} = \text{principal} \times \text{annual rate} \times \frac{\text{elapsed months}}{12}$$

$$= \$18{,}000.00 \times 8\% \times \frac{3}{12} = \$360.00$$

December 31, 2027: borrower	Debit	Credit
Interest expense	$360.00	
Interest payable		$360.00

The loan was outstanding for 3 months in 2027, so the borrower records 3 months of interest expense that year. Principal remains $18,000.00; accrued interest is a separate payable.

At maturity, cash paid is $18,720.00. Only the remaining $360.00 is 2028 interest expense; the borrower also clears the 2027 interest payable.

Separate interest from principal repayment

WALKTHROUGH

A borrower receives $5,000.00 at 6% annually. The 4-year loan requires year-end payments of $1,442.96, with a final cent adjustment. No fees exist.

Interest = beginning balance × annual rate

Principal repaid = payment − interest

Ending balance = beginning balance − principal repaid

Year	Beginning balance	Payment	Interest	Principal repaid	Ending balance
1	$5,000.00	$1,442.96	$300.00	$1,142.96	$3,857.04
2	$3,857.04	$1,442.96	$231.42	$1,211.54	$2,645.50
3	$2,645.50	$1,442.96	$158.73	$1,284.23	$1,361.27
4	$1,361.27	$1,442.95	$81.68	$1,361.27	$0.00

Each year starts with the prior ending balance. Interest falls as principal falls; the final payment includes a cent adjustment.

Divide the first loan payment

STUDENT WORK

An installment payment covers the period's interest and repays part of the principal. Interest in later periods falls as the remaining principal falls.

Spend a few minutes on your own or with those around you to work through this problem.

A borrower receives $9,000.00 on January 1, 2027 at 7% annually. It pays $2,195.02 each December 31 for 5 years, with a final cent adjustment. No fees exist.

Calculate the first payment's interest, principal repayment, and ending balance.

Interest = beginning balance × annual rate

Principal repaid = cash payment − interest

Ending balance = beginning balance − principal repaid

First payment: solution

WORKED SOLUTION

For the $9,000.00 loan at 7%, the first year-end payment is $2,195.02.

Part of the calculation	Calculation	Result
Interest	Beginning balance × annual rate	$630.00
Principal repaid	$2,195.02 − $630.00	$1,565.02
Ending balance	$9,000.00 − $1,565.02	$7,434.98

Only the principal portion reduces the debt. Next year's interest uses the smaller ending balance.

How much principal is repaid?

iClicker | Question 4 of 5

A borrower owes $16,000.00 at the start of the year, pays 9% annual interest, and makes a $4,113.48 year-end payment. How much principal is repaid?

Interest = beginning balance × rate

Principal repaid = payment − interest

A $4,113.48

B $2,673.48

C $1,440.00

D $13,326.52

E $16,000.00

Principal repayment: answer

iClicker | Answer 4 of 5 — **Correct answer: B.**

A borrower owes $16,000.00 at the start of the year, pays 9% annual interest, and makes a $4,113.48 year-end payment. How much principal is repaid?

A **$4,113.48**
Incorrect. The cash payment includes interest.

B **$2,673.48**
Correct. $4,113.48 − $1,440.00 = $2,673.48. Ending balance is $13,326.52.

C **$1,440.00**
Incorrect. The amount covers interest expense, not principal repayment.

D **$13,326.52**
Incorrect. The amount remains owed after the payment.

E **$16,000.00**
Incorrect. The borrower has not repaid the whole loan.

December 31, 2027: borrower	Debit	Credit
Interest expense	$1,440.00	
Notes payable	$2,673.48	
Cash		$4,113.48

Solve for the equal loan payment

WALKTHROUGH

A borrower receives $12,000.00 and repays it with 6 equal year-end payments at 10%. How do we find each payment?

A is the unknown payment. PV is the cash borrowed; i = 0.1 per year; n = 6 payments.

PV = A × ordinary-annuity present-value factor

$$A = \frac{PV}{\text{ordinary-annuity present-value factor}}$$

$$\text{Factor} = \frac{1 - (1 + 0.1)^{-6}}{0.1} \approx 4.355261$$

$$A = \frac{\$12{,}000.00}{4.355261} \approx \$2{,}755.29$$

Calculate the factor first, then divide the loan amount by it. We divide because the unknown is A; when A is given, we multiply to find PV.

Round payments to cents. Adjust the last payment for accumulated rounding so the ending balance is zero.

Why the note's carrying amount rises

Build the discount-amortization schedule, then compare a note issued at face amount.

The note we will model

PREDICTION AND DEMONSTRATION

	A	B	C
1	**Borrower Note Amortization Schedule & Analysis**		
2	*Effective-Interest Method • 5-Year Term • Annual Payments*		
3	**Assumption / Metric**	**Value**	**Notes & Formulas**
4	Face Amount (Par Value)	**$30,000.00**	Maturity principal payable
5	Stated Annual Interest Rate (Coupon)	**7.00%**	Annual cash coupon rate
6	Effective Annual Interest Rate (Yield)	**9.00%**	Borrower effective rate / yield
7	Term to Maturity (Years)	**5**	Annual payment periods
8	Payment Frequency	Annual (Year-End)	Paid at each year-end
9	Annual Cash Interest Payment	**$2,100.00**	Face Amount × Stated Rate
10	Initial Cash Proceeds (PV)	**$27,666.21**	PV of cash interest + maturity par at yield
11	Total Note Discount at Issuance	**$2,333.79**	Face Amount − Initial Proceeds
12			

Predict: As the discount disappears, will carrying amount rise or fall? What should it reach before principal repayment?

Assume no fees; retain full precision and display cents.

Build the schedule with Gemini

DEMONSTRATION

Open the full prompt and recorded demonstration.

Ask Gemini to create input cells and formulas for the note's cash proceeds and discount-amortization schedule.

Include in the schedule	What we will inspect
Opening carrying amount, interest expense, cash interest	The effective rate determines expense; the stated rate determines cash interest.
Discount amortization, ending carrying amount, remaining discount	Each year's amortization reduces the discount and increases carrying amount.
Principal repayment shown separately	Carrying amount reaches face amount before repayment, then falls to zero.

Ask for a carrying-amount chart with face amount as a reference line. Require formulas that reference inputs, plus checks on total amortization and the final balance.

Explain the first row

GUIDED VERIFICATION

The note starts at $27,666.21. **B6 contains the 9% effective annual rate** used in the selected cell's formula. Annual cash interest is $2,100.00.

C15 `=B15*$B$6`

	A	B	C	D	E	F	G
12							
13	**5-Year Note Amortization Schedule (Effective-Interest Method)**						
14	**Year**	**Opening Carrying Amount**	**Interest Expense**	**Cash Interest Paid**	**Discount Amortization**	**Ending Carrying Amount**	**Remaining Discount**
15	**1**	$27,666.21	$2,489.96	$2,100.00	$389.96	$28,056.17	$1,943.83
16	**2**	$28,056.17	$2,525.06	$2,100.00	$425.06	$28,481.22	$1,518.78
17	**3**	$28,481.22	$2,563.31	$2,100.00	$463.31	$28,944.53	$1,055.47
18	**4**	$28,944.53	$2,605.01	$2,100.00	$505.01	$29,449.54	$550.46
19	**5**	$29,449.54	$2,650.46	$2,100.00	$550.46	$30,000.00	$0.00
20	**Total**	-	**$12,833.79**	**$10,500.00**	**$2,333.79**	-	-

Interest expense = $27,666.21 × 9% ≈ $2,489.96

Discount amortization = $2,489.96 − $2,100.00 = $389.96

Ending carrying amount = $27,666.21 + $389.96 = $28,056.17

The borrower pays cash interest, but the discount also counts as borrowing cost. Recognizing that part of the cost reduces the discount and raises carrying amount.

The discount disappears over five years

GUIDED VERIFICATION

Cash interest stays fixed at $2,100.00 (using the 7% stated rate). Interest expense uses the growing carrying amount and the 9% effective rate.

	A	B	C	D	E	F	G
12							
13	**5-Year Note Amortization Schedule (Effective-Interest Method)**						
14	**Year**	**Opening Carrying Amount**	**Interest Expense**	**Cash Interest Paid**	**Discount Amortization**	**Ending Carrying Amount**	**Remaining Discount**
15	**1**	$27,666.21	$2,489.96	$2,100.00	$389.96	$28,056.17	$1,943.83
16	**2**	$28,056.17	$2,525.06	$2,100.00	$425.06	$28,481.22	$1,518.78
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18	**4**	$28,944.53	$2,605.01	$2,100.00	$505.01	$29,449.54	$550.46
19	**5**	$29,449.54	$2,650.46	$2,100.00	$550.46	$30,000.00	$0.00
20	**Total**	-	**$12,833.79**	**$10,500.00**	**$2,333.79**	-	-
21	**Maturity Principal Settlement (End of Year 5)**	**Pre-Repayment Carrying Amount**	**Principal Repaid (Cash Outflow)**	**Post-Repayment Liability Balance**	**Note Status**		
22	**End of Year 5**	**$30,000.00**	**($30,000.00)**	**$0.00**	**RETIRED ($0.00 Balance)**		
23							
24	**Model Integrity & Reconciliation Audit Checks**						
25	**Audit Check Description**	**Target / Expected Value**	**Actual Model Value**	**Audit Status**			
26	1. Total Discount Amortization = Initial Discount	$2,333.79	$2,333.79	PASS			
27	2. Final Carrying Amount = Face Amount (Pre-Repa	$30,000.00	$30,000.00	PASS			
28	3. Remaining Note Discount = $0.00 at Maturity	$0.00	$0.00	PASS			

Total amortization is $2,333.79, equal to the initial discount. The final row shows $30,000.00 **before principal repayment.** Paying that principal then reduces the liability to $0.00.

Calculations retain full precision. Displayed amounts can differ by a cent when added after rounding.

When the two rates match

PREDICTION AND DEMONSTRATION

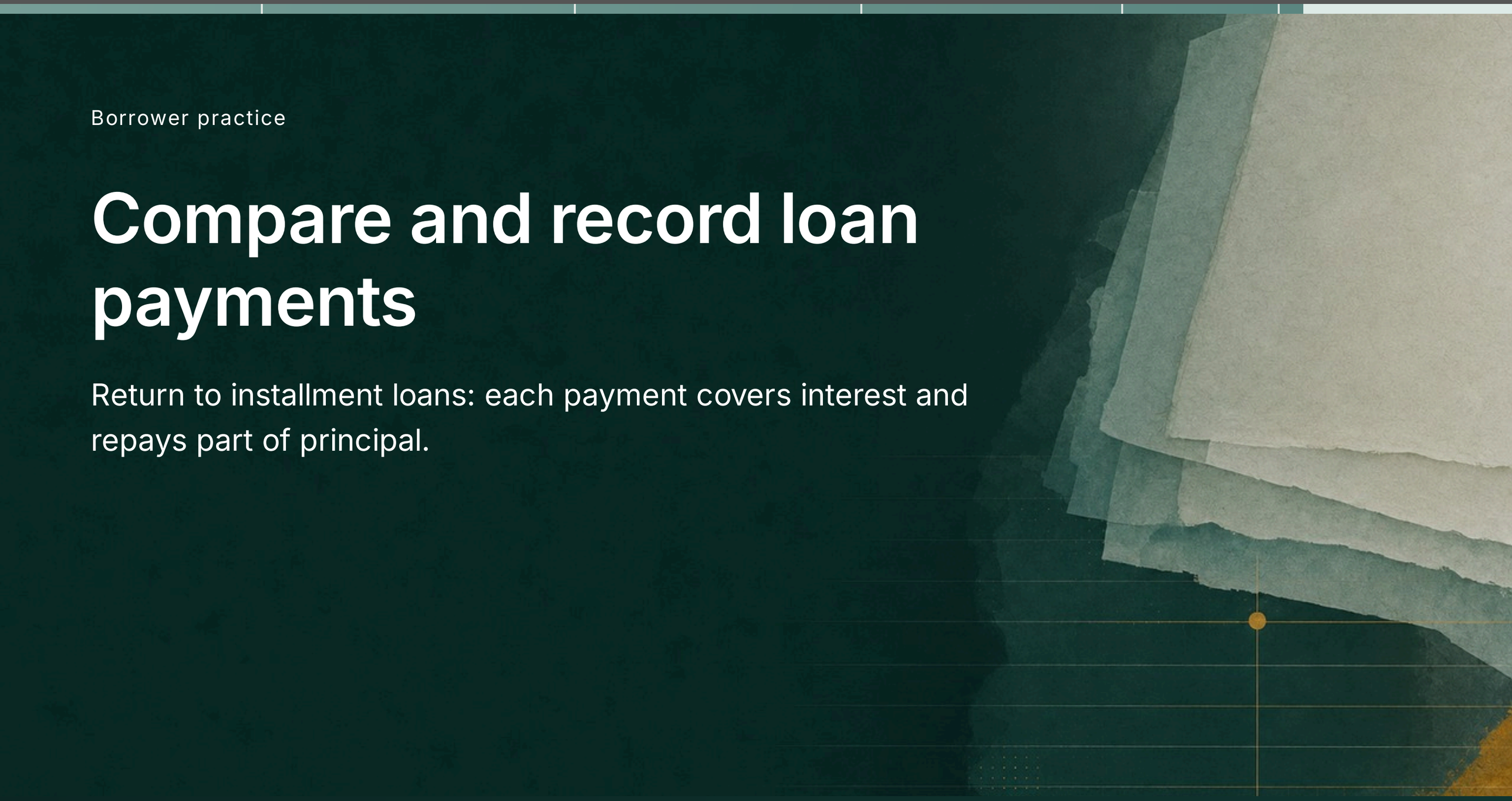
Compare a second possible loan **at issuance**. Keep the promised payments unchanged, but change the effective annual rate from 9% to 7%.

	A	B	C	D	E	F	G
1	**Borrower Note Amortization Schedule & Analysis**						
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3	**Assumption / Metric**	**Value**	**Notes & Formulas**				
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8	Payment Frequency	Annual (Year-End)	Paid at each year-end				
9	Annual Cash Interest Payment	**$2,100.00**	Face Amount × Stated Rate				
10	Initial Cash Proceeds (PV)	**$30,000.00**	PV of cash interest + maturity par at yield				
11	Total Note Discount at Issuance	**$0.00**	Face Amount − Initial Proceeds				
12							
13	**5-Year Note Amortization Schedule (Effective-Interest Method)**						
14	**Year**	**Opening Carrying Amount**	**Interest Expense**	**Cash Interest Paid**	**Discount Amortization**	**Ending Carrying Amount**	**Remaining Discount**
15	**1**	$30,000.00	$2,100.00	$2,100.00	$0.00	$30,000.00	$0.00
16	**2**	$30,000.00	$2,100.00	$2,100.00	$0.00	$30,000.00	$0.00
17	**3**	$30,000.00	$2,100.00	$2,100.00	$0.00	$30,000.00	$0.00
18	**4**	$30,000.00	$2,100.00	$2,100.00	$0.00	$30,000.00	$0.00
19	**5**	$30,000.00	$2,100.00	$2,100.00	$0.00	$30,000.00	$0.00
20	**Total**	**-**	**$10,500.00**	**$10,500.00**	**$0.00**	**-**	**-**

When both rates match, cash received equals the principal due at maturity. Interest expense equals cash interest; no discount remains. Follow-up prompt and recording.

Compare and record loan payments

Return to installment loans: each payment covers interest and repays part of principal.



Smaller payments and total interest

iClicker | Question 5 of 5

For an $18,000.00 loan at 6%, the 3-year option totals $20,201.93 in payments. The 5-year option totals $21,365.67 and has smaller annual payments. Which statement is correct?

Total interest = total payments − original principal

A The longer term reduces both annual payments and total interest.

B The interest totals are equal because the rates match.

C Each payment is entirely interest expense.

D The shorter term has smaller annual payments.

E The longer term reduces annual payments but increases total interest.

Repayment terms: answer

iClicker | Answer 5 of 5 — **Correct answer: E.**

For an $18,000.00 loan at 6%, the 3-year option totals $20,201.93 in payments. The 5-year option totals $21,365.67 and has smaller annual payments. Which statement is correct?

A **The longer term reduces both annual payments and total interest.**
Incorrect. Lower annual payments do not establish a lower total cost.

B **The interest totals are equal because the rates match.**
Incorrect. The borrower owes principal over different lengths of time.

C **Each payment is entirely interest expense.**
Incorrect. Each payment also repays principal.

D **The shorter term has smaller annual payments.**
Incorrect. The shorter term requires larger annual payments.

E **The longer term reduces annual payments but increases total interest.**
Correct. Total interest rises from $2,201.93 to $3,365.67.

Compare two repayment terms

STUDENT WORK

Spend a few minutes on your own or with those around you to work through this problem.

A borrower receives $24,000.00 at 7% annual interest. Both options have year-end payments, no fees, and no remaining balance after the final payment.

Term	Regular annual payment	Final payment	Total cash paid
4 years	$7,085.47	$7,085.50	$28,341.91
7 years	$4,453.28	$4,453.25	$31,172.93

Calculate total interest for each option. Which option requires less cash each year, and which has the lower total borrowing cost?

Repayment terms: worked solution

WORKED SOLUTION

Both options provide $24,000.00 at 7% annually.

Term	Total cash paid − original principal	Total interest
4 years	$28,341.91 − $24,000.00	$4,341.91
7 years	$31,172.93 − $24,000.00	$7,172.93

The 7-year term has smaller annual payments but greater total interest. The borrower keeps some principal outstanding longer.

Repayments equal the loan's present value

WALKTHROUGH

The 6-year loan has an initial advance of $12,000.00 and a 10% annual effective rate. Discount each year-end payment back to the issue date.

Payment date	Payment	Present value
End of year 1	$2,755.29	$2,504.81
End of year 2	$2,755.29	$2,277.10
End of year 3	$2,755.29	$2,070.09
End of year 4	$2,755.29	$1,881.90
End of year 5	$2,755.29	$1,710.82
End of year 6	$2,755.28	$1,555.28

$$PV = \frac{payment_1}{(1+i)} + \frac{payment_2}{(1+i)^2} + \dots + \frac{payment_6}{(1+i)^6}$$

$$\approx \$12{,}000.00$$

Discounting removes the time-value growth included in the payments. The result matches the original borrowing to the cent; intermediate values retain full precision.

Complete the next payment and entry

STUDENT WORK

Spend a few minutes on your own or with those around you to work through this problem.

A different borrower received $10,000.00 on January 1, 2027 at 8% annually. It makes 4 year-end payments of $3,019.21, with a final cent adjustment. No fees or unpaid interest exist.

Year	Beginning balance	Payment	Interest	Principal repaid	Ending balance
2027	$10,000.00	$3,019.21	$800.00	$2,219.21	$7,780.79
2028	$7,780.79	$3,019.21	?	?	?

Interest = beginning balance × rate

Principal repaid = payment – interest

Ending balance = beginning balance – principal repaid

Complete the 2028 row and prepare the borrower's December 31 payment entry. Round interest to cents before subtracting.

Record the second loan payment

WORKED SOLUTION

For the 8% loan, the 2028 beginning balance is $7,780.79 and the year-end payment is $3,019.21.

Interest = $7,780.79 × 8% = $622.46

Principal repaid = $3,019.21 − $622.46 = $2,396.75

Ending balance = $7,780.79 − $2,396.75 = $5,384.04

December 31, 2028: borrower	Debit	Credit
Interest expense	$622.46	
Notes payable	$2,396.75	
Cash		$3,019.21

Only $622.46 is the cost of borrowing for 2028. The remaining $2,396.75 reduces the liability; it is not an expense.

Account for cash and receivables

Tuesday, October 20, 2026

Upcoming dates

- **October 22:** Units 3 and 4 mini-exam.
- **October 25, 11:59 p.m.:** Unit 4 review assignment due.