Chapter 4:

Interest Rates & Fixed Rate Mortgage Loans

Interest Rates

- There is a Cost to borrow money
- There is an Required Return to invest

- Investors must be compensated for lending their funds – even if there are no risks

- Real Rate of Interest
  - Excludes any adjustment for inflation

Interest Rates - Inflation

- Inflation Adjustment

- If investors expect inflation, it must be added to rate they require.

Components of the Mortgage Interest Rate

$$i_t = r_1 + f_1 + p_1$$

r_1 = **R**eal Rate (risk free)

f_1 = In**f**lation Rate (expected)

p_1 = Risk **P**remiums

Interest Rate & Risk Premiums

- Default Risk
- Interest Rate Risk
  - Prepayment Risk
- Liquidity Risk
- Legislative Risk
  - Taxes & other

Taxability of receipts could also affect the rate / premium required.

Note on Terminology

- Real Rate
  - Basic required return for lending money
  - No inflation; no risk
- Nominal Rate (Multiple definitions)
  - Nominal versus Real (difference being inflation factor)
  - Nominal versus Effective (difference is compounding)
  - Industry terminology: bond coupon rate (nominal) can differ from current yield, yield to maturity
  - Normally, Nominal rate = “quoted rate”.
- Effective Rate (Multiple definitions)
  - *Conceptually*; adjusted to be more accurate

Mortgage Loan Terms

- Loan amount
- Loan maturity date
- Interest rate
  - Nominal annual rate quoted (vs effective)
- Accrual rate (vs. pay rate) (accrual is actual interest accrued & owed)
- Fixed versus Variable rate
- Periodic payments
- Amortization
- Constant Payment Mortgage (CPM)

Fixed vs. Adjustable & i only vs amortization

- Fixed rate – lender has interest rate risk
- Adjustable rate* – borrower has i rate risk

- Amortization (pay-down concepts)
  - Fully amortizing
  - Partial am
  - No amortization (i only)
  - Negative am
  - Reverse am (special case)

** Adjustable rate = Variable rate*

Loan Amortization

- Accrued Interest and Loan Payments
  - Accrual rate (*i)* vs. pay rate (*ratio of payment/loan)*

Type of CPM Loan	**Pay Rate** (*ratio of payment/loan)*	**Loan Balance at Maturity**
Fully Amortizing Regular “fixed rate”	> Accrual rate	Fully repaid; zero bal.
Partially Amortizing	> Accrual rate	Not fully repaid
Interest Only	= Accrual rate	= Amount Borrowed
Negative Amortizing	< Accrual rate	> Amount Borrowed

Typical Mortgage Payment
Example 4-1

- Calculate the payment for a fixed rate, fully amortizing mortgage

  - **$100,000** Mortgage
  - 7% Interest (annual quoted rate)
  - 30 Years
  - Monthly Payments
    - (implies monthly compounding)

Mortgage Payment

PV = $100,000

n = 30 x 12 = 360

FV = $0

i = 7/12 = .58333

CPT **PMT** = -$665.30

Mortgage Payment Patterns

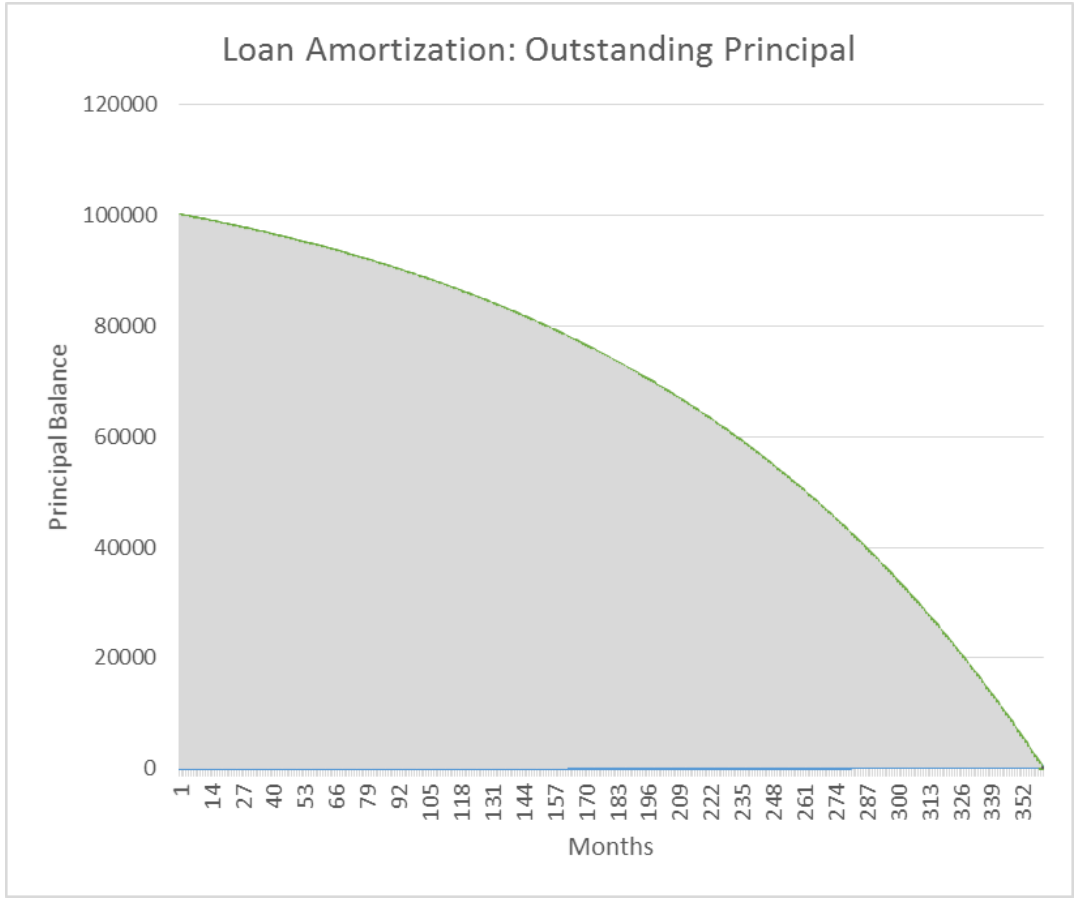
- Interest paid in the first month
  - (.07/12) x $100,000 = $583.33
- Principal paid in the first month
  - $665.30 - $583.33 = $81.96

- Every month, interest portion declines
- Every month, principal portion increases
- Amortization Schedule would show all.

Loan Amortization Table
Example 4-1

Month	Beg Bal	Payment	Interest	Principal	Ending Bal
1	100,000	665.30	583.33	81.97	99,918.03
2	99,918.03	665.30	582.86	82.45	99,835.58
3	99,835.58	665.30	582.37	82.93	99,752.66
4	99,752.66	665.30	581.89	83.41	99,669.24
.....	.....	.....	.....	.....	.....
359	1,319.05	665.30	7.69	657.61	661.44
360	661.44	665.30	3.86	661.44	0.00

Loan Amortization Example 4-1



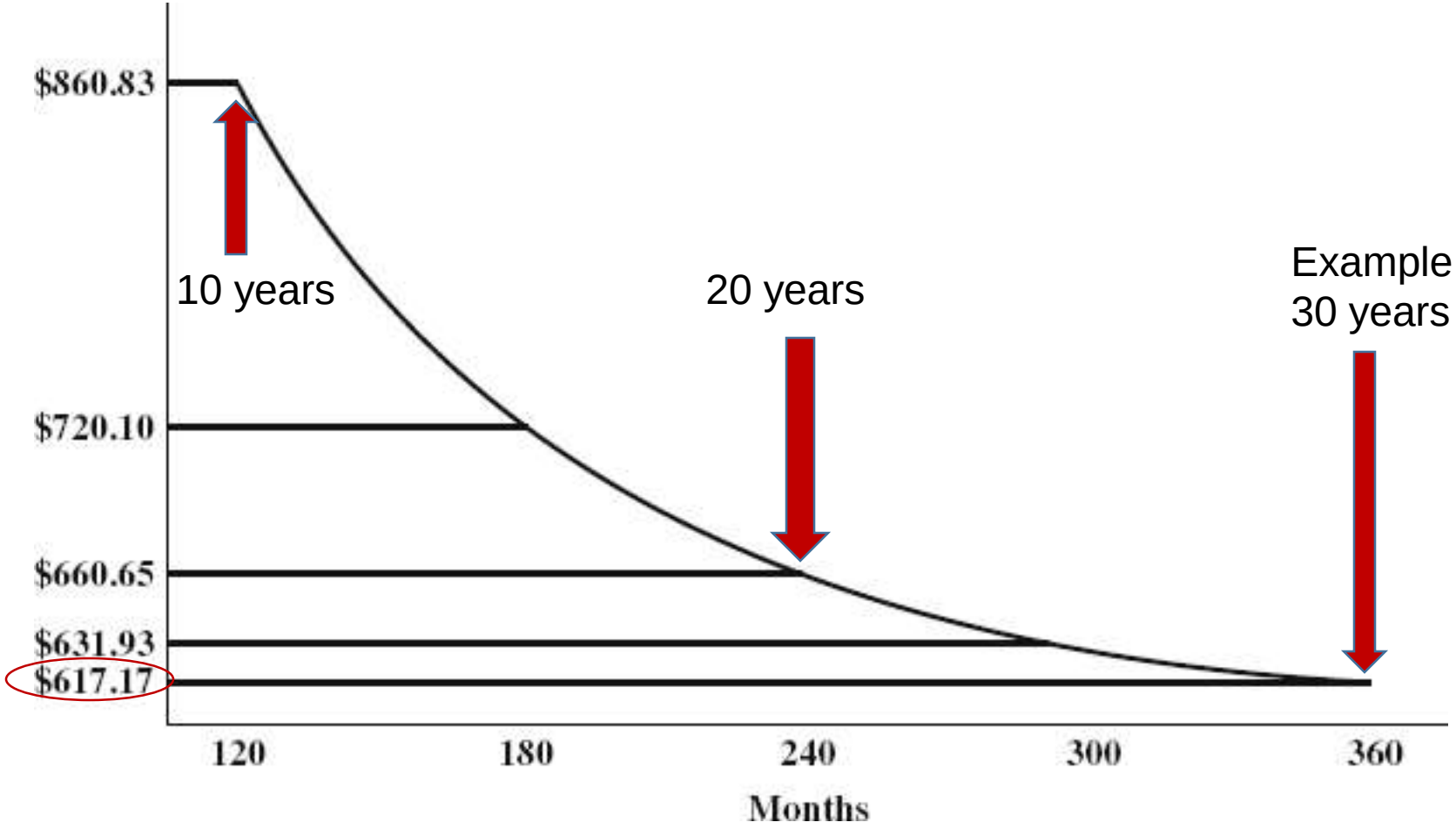
Text Example

- Calculate the payment
  - **$60,000** Mortgage
  - 12% Interest
  - 30 Year “Am”
  - Monthly Payments

$617.17

Exhibit 4-3

Increase in monthly payments can shorten maturity
OR Shorter maturities result in higher payments



Mortgage “Constant”
(Concept box 4.1)

- Industry term still used
  - Originated with tables used before calculators
- This “factor” can be used to determine monthly payments on a loan or max loan amount

= Monthly Payment / Loan Amount

= $617.17 / 60,000

= .010286

“Constant” considers:
- term (30 yrs; mthly)
- rate (12% or 1%mth)

- Often used to calculate loan amounts given a max monthly payment (Pymt / factor)

Mortgage “Constant”
(example)

- Suppose you can afford more than $617.17?

- If you can afford $800 /month; how much of a mortgage can you afford? (30 year amortization loan)

  - Use “Mortgage Constant” factor
  - $800 / .010286

    Result: $77,776

Computing Loan Payoff

Amortized Loan Balance at a future date

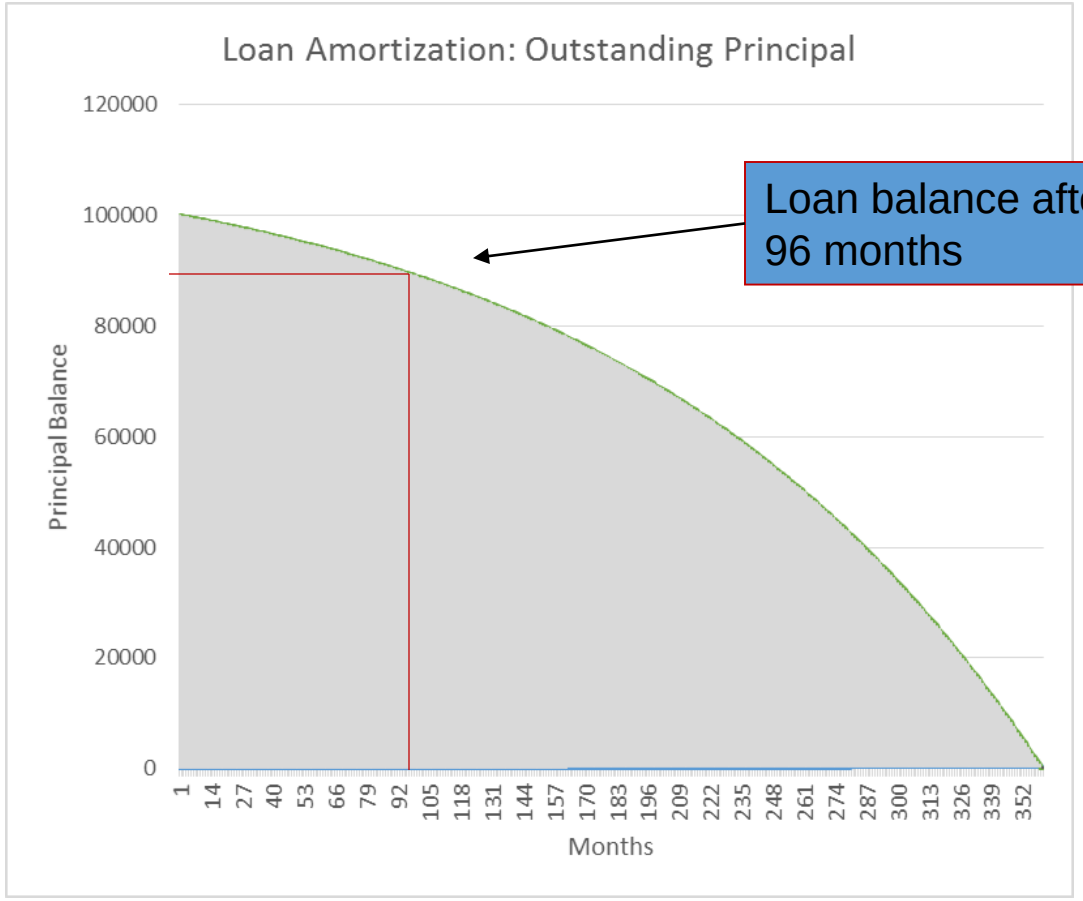
- Two mathematical methods (use either)
  - Compute the present value of the remaining payments.
  - Compute the future value of the amortizing loan amount.

Computing a Loan Balance
(return to original $100,000 loan example)

- From Example 4-1:
  - $100,000 30 year loan @ 7%
  - We calculated mthly payments of $665.30

- What is the outstanding (remaining) loan balance after 8 years (96 months)?
  - See chart on next slide.

Loan Amortization Example 4-1



Computing a Loan Balance

Present Value Method*

PMT = $-665.30

n = 22 x 12 = 264

Years remaining

FV = $0 (not used)

i = 7/12 = .58333

CPT **PV** = $89,491

*Present value (as if we were at end of year 8) of the remaining contracted payments

Computing a Loan Balance

Future Value Method – Another approach

PV = $100,000

n = 8 x 12 = 96

PMT = $-665.30

i = 7/12 = .58333

CPT **FV** = $-89,491

Summary – so far

- We've covered typical mortgage scenarios
- Focus on "fixed rate" (but alternatives)
- Amortization
  - Solving for payment
  - Solving for principal amount
  - Solving for interest rate (yield)
  - Solving for "balance due" at future time
- Now we take it up to the next level

Loan Closing Costs

- Loan Closing Costs
- Additional Finance Charges
  - Loan Origination Fees
    - Cover origination expenses
  - Loan Discount Fees – “Points”
    - Used to raise the yield on the loan
    - 1 Point = 1% of the loan amount
    - Lender may offer a lower rate
    - Borrower trade-off: points vs. contract rate
      - “Buying down your rate” with points
- Loan Fees increase the *effective* interest rate

Loan Closing Costs

- Why Points?
  - Lender can increase yield
  - Lender quotes rate based on 30 year amortization of points
  - Lender can increase true yield based on “expected” payoff date
  - Lender can quote “Lower rate” (to appear more competitive)
    - Thus, this will reduce amount of “payments”
    - Allow borrower to “qualify” for larger loan
  - Lender can provide alternatives (rate buy-downs)

Loan Fees & Borrowing Costs

- Calculating the *effective* interest cost on an 8% loan
- Multiple steps

- Example 4-2:
  - $250,000 home
  - 80% LTV (loan to value) Loan (*thus loan of $200,000*)
  - 8% Interest
  - **4** Points
  - 30 Years
  - What is the "*effective*" interest rate?

Loan Fees & Borrowing Costs

- Step 1: Compute payment using the face value (contract value) of the loan (ignoring points for now[1]).

PV	= $200,000
n	= 360
i	= 8 / 12
PMT	= $-1,467.53

But, with points paid up front, the borrower actually receives less than the face value.

[1] The loan contract itself calculates payment on gross loan amount.

Loan Fees & Borrowing Costs

- Step 2: Actual loan “proceeds”

Loan Amount:	$200,000
- Points Paid (.04 x $200,000)	(8,000)
Amount Received (net)	$192,000

Loan Fees & Borrowing Costs

- Step 3: Compute *effective* interest cost:

PV = $192,000 **PMT** = $-1467.53

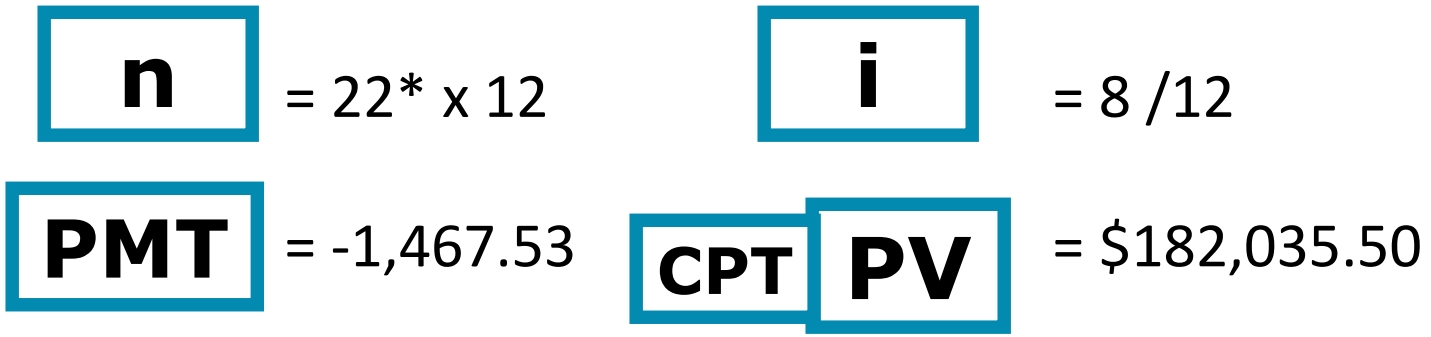
n = 360 **CPT** **i** = .70295

Multiply Monthly i rate result X 12 = 8.435%

Legal: This is APR and requires disclosure for home loans.

Loan Fees & Borrowing Costs

- Above example assumes full 30 year payout
- But, what is the *effective* rate if we think this loan might be repaid after 8 years (as most are- on average)?
  - Step 1: Compute PMT = $1,467.53 (already done)
  - Step 2: Compute Future Loan Balance (payoff)



* 22 years remaining in loan structure

Loan Fees & Borrowing Costs

- Step 3: Compute effective interest cost.

PV = $192,000

FV = $-182,035.50

PMT = $-1,467.53

n = 96 (this is 8 years)

CPT **i** = .726773 x12 = 8.72%

Summary

- Nominal quoted rate on which payments are based
  - 8.00%.
- Disclosure rate including points
  - 8.435% *(assumes full 30 year amortization – and loan outstanding)*
- More likely rate (yield) given typical prepayment
  - 8.72%

Truth-in-Lending

- Truth-in-Lending Act
  - Law requiring disclosure of:
  - Annual Percentage Rate (“APR”)

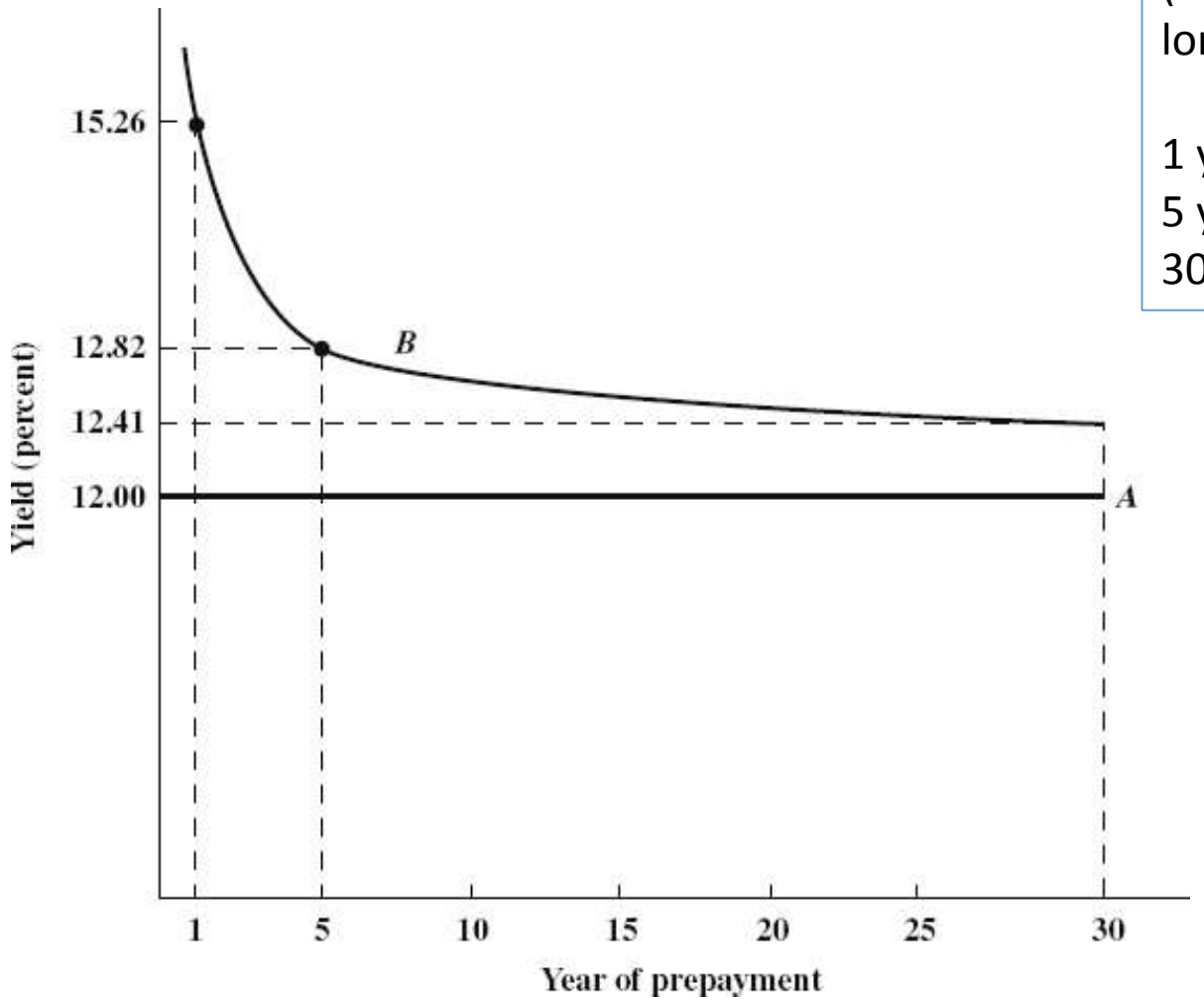
  - APR on prior example is 8.435%

Example – Try these

- $100,000 30 year loan @ 12%; 3points
- Compute monthly payment
  - $1,028.61
- Compute “net proceeds” from loan
  - $97,000
- Re-compute interest rate (assume 30 year life)
  - 12.41% (This is APR disclosure rate)
- Re-compute interest rate (assume 5 year life. Must calculate “payoff”)
  - 12.82%

Exhibit 4-8

Orig. fees, Mortgage Yields and Maturity
Text Example 12% & 3 points



This chart simply illustrates that the effective interest rate on a loan structure (with points) varies depending on how long the loan is outstanding.

1 year payoff	15.26%
5 year payoff	12.82%
30 years	12.41%

Pricing Fixed Rate Mortgages

- Lender's can adjust yields by altering the combinations of:
  - Quoted rates
  - Points
  - Other fees charged
  - Their assumption (or experience) with expected payoff timeframe
  - Prepayment fees
  - Compounding frequency (ie. Credit card loans)