Bachelor of Economics
THAMMASAT UNIVERSITY

FN 211 Financial Markets

Class 2: Time Value of Money

Time Value of Money and Interest Rates

Present Value of a Single Cash Flow

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

where:

PV = present value

FV = future value (lump sum) received in t years

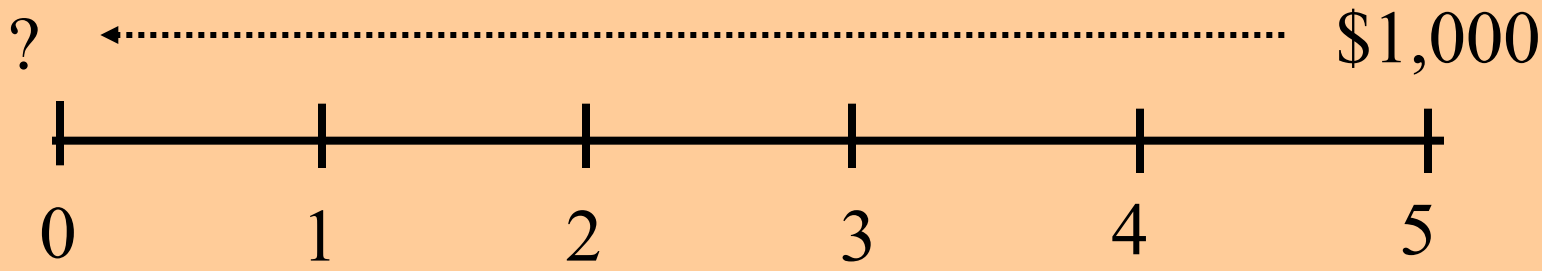
r = simple interest rate earned per period

t = total number of compounding periods

Time Value of Money and Interest Rates

Present Value of a Single Cash Flow

Find PV of a $1,000 cash flow to be received in five years, given a discount rate of 9%.



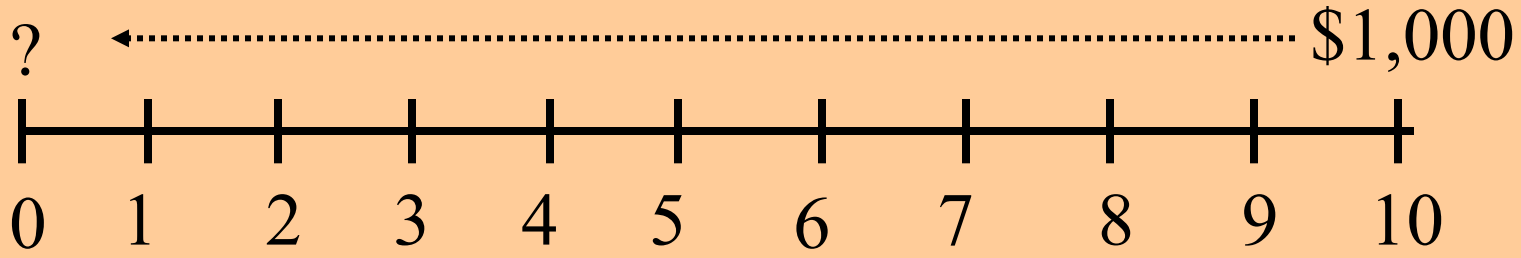
$$PV = \frac{1{,}000}{(1+0.09)^5} = 649.93$$

INPUT	5	9		0	1,000
	N	I/Y	PV	PMT	FV
OUTPUT			-649.93		

Time Value of Money and Interest Rates

PV of a Single Cash Flow: Semiannual Compounding

Find PV of a $1,000 cash flow to be received in five years, given a discount rate of 9%, semiannual compounding.



INPUT

N | I/Y | PV | PMT | FV

OUTPUT

Time Value of Money and Interest Rates

Future Value of a Single Cash Flow

$$FV = PV * (1 + r)^t$$

where:

PV = present value

FV = future value (lump sum) received in t years

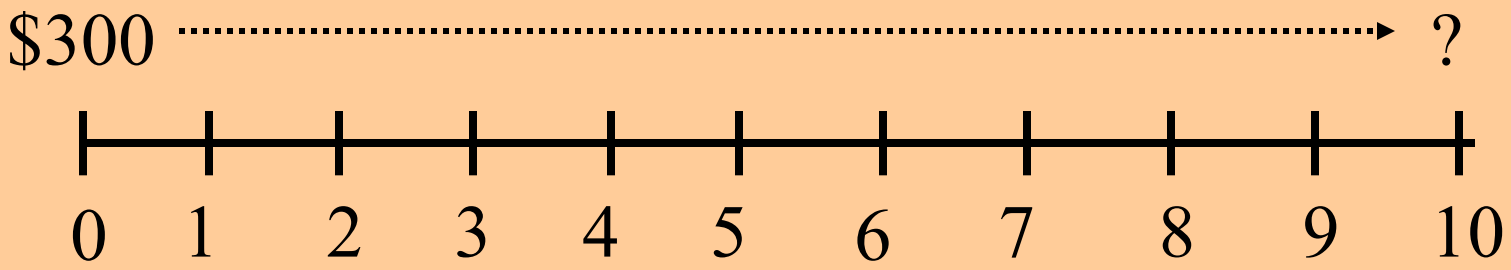
r = periodic rate earned on investments

t = total number of compounding periods

Time Value of Money and Interest Rates

Future Value of a Single Cash Flow

Find FV of a $300 investment, given you can earn a compound rate of return of 8% over a 10 year period of time.



INPUT

N	I/Y	PV	PMT	FV

OUTPUT

Time Value of Money and Interest Rates

Annuity is a stream of equal cash flows that occur at equal intervals over a period of time.

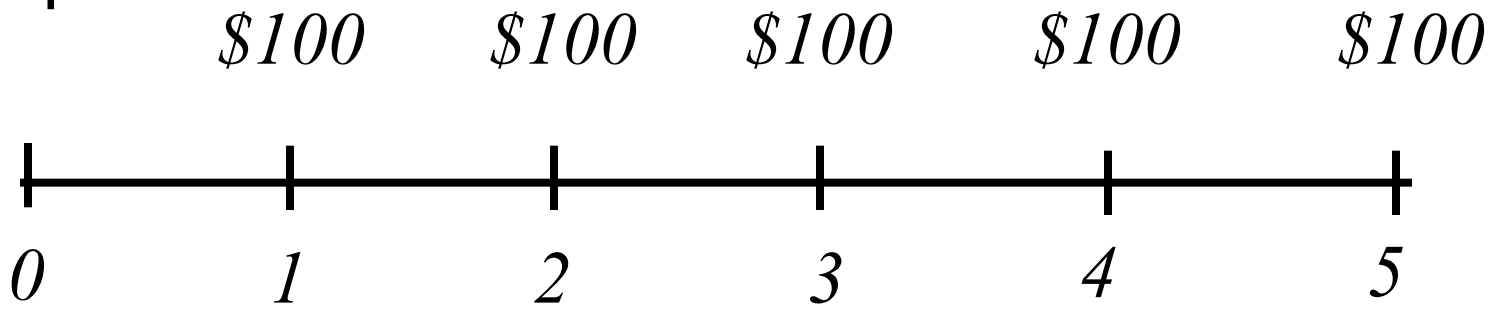
- Receiving $100 per year at the end of each year of the next eight years is an example of an annuity.

There are 2 types of annuities.

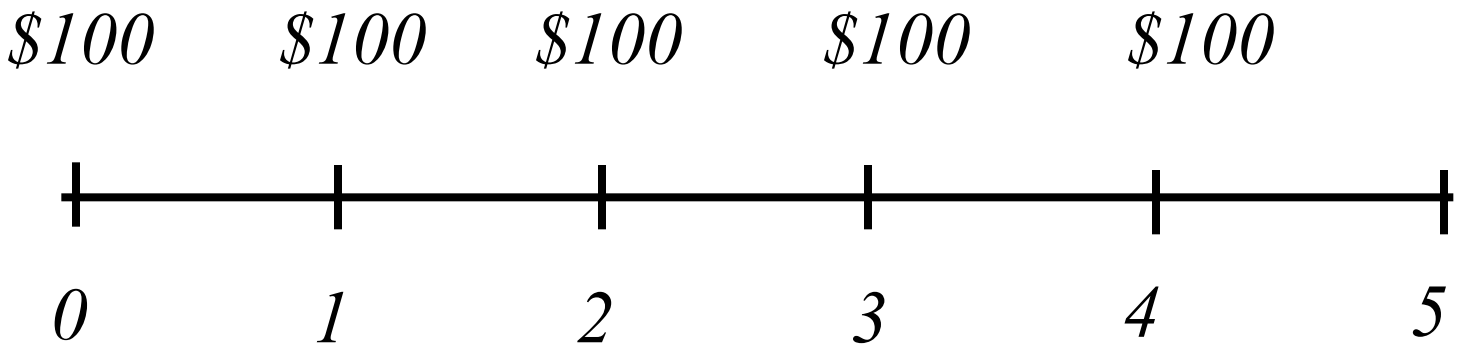
1. Ordinary Annuity – cash flows occur at the end of each period.
2. Annuity Due – cash flows occur at the beginning of each period.

Time Value of Money and Interest Rates

1. Ordinary Annuity – cash flows occur at the end of each period.



2. Annuity Due – cash flows occur at the beginning of each period.



Time Value of Money and Interest Rates

PV an Ordinary Annuity

$$PV = PMT * \left(1 - \frac{1}{(1+r)^t} \right) * \frac{1}{r}$$

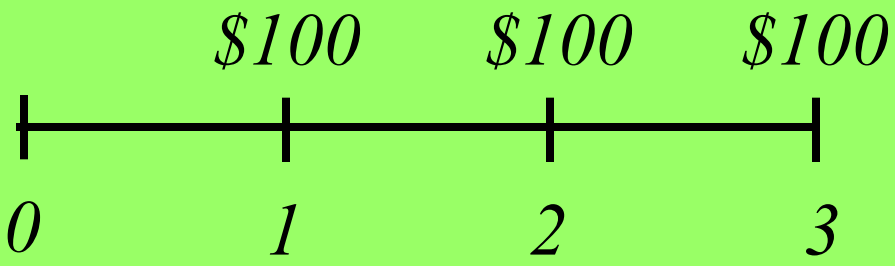
PV an Annuity Due

$$PV = PMT + PMT * \left(1 - \frac{1}{(1+r)^{t-1}} \right) * \frac{1}{r}$$

Time Value of Money and Interest Rates

Present Value of an Ordinary Annuity

What is the PV of an annuity that will pay $100 per year at the end of each of the next 3 years given a 10% rate of return?



Time Value of Money and Interest Rates

Present Value of an Ordinary Annuity

What is the PV of an annuity that will pay $100 per year at the end of each of the next 3 years given a 10% rate of return?

INPUT

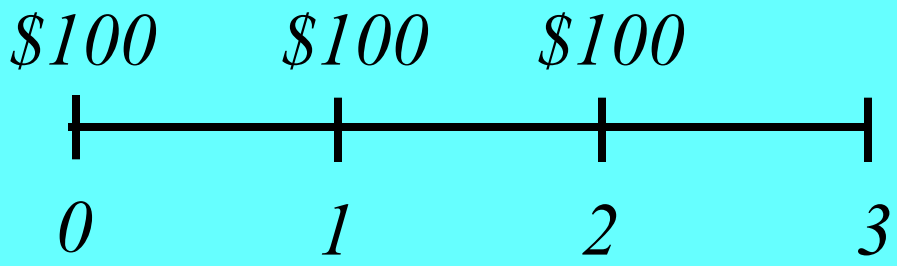
N	I/Y	PV	PMT	FV

OUTPUT

Time Value of Money and Interest Rates

Present Value of an Annuity Due

What is the PV of an annuity that will pay $100 per year at the beginning of each of the next 3 years given a 10% rate of return?



Time Value of Money and Interest Rates

Present Value of an Annuity Due

What is the PV of an annuity that will pay $100 per year at the beginning of each of the next 3 years given a 10% rate of return?

INPUT

N	I/Y	PV	PMT	FV

******At BEGIN mode******

OUTPUT

Time Value of Money and Interest Rates

To set your calculator for BEGIN mode

2nd **PMT** **2nd** **ENTER** **2nd** **CPT**

To go back to END mode, simply repeat the same sequence

2nd **PMT** **2nd** **ENTER** **2nd** **CPT**

Time Value of Money and Interest Rates

FV of an Ordinary Annuity

$$FV = PMT * \left[(1+r)^{t} - 1 \right] * \frac{1}{r}$$

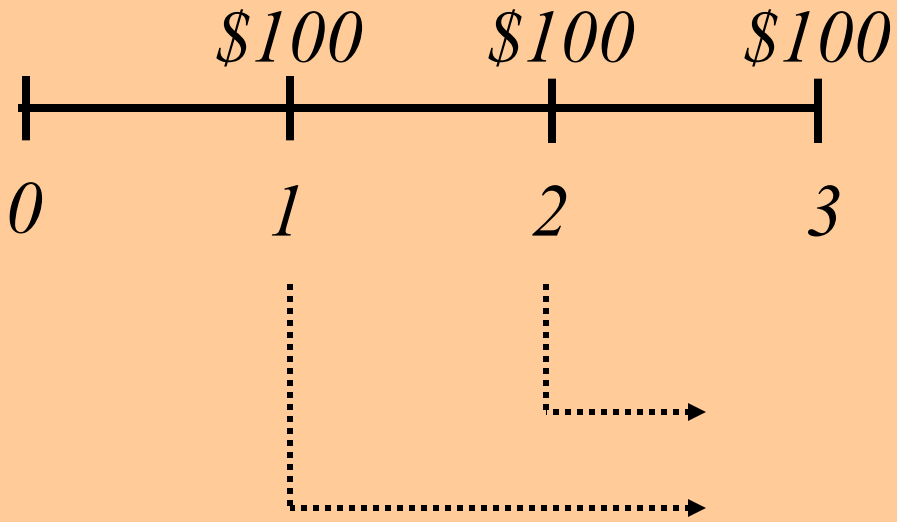
FV of an Annuity Due

$$FV = \left[PMT * \left[(1+r)^{t+1} - 1 \right] * \frac{1}{r} \right] - PMT$$

Time Value of Money and Interest Rates

Future Value of an Ordinary Annuity

What is the FV of an annuity that will pay $100 per year at the end of each of the next 3 years given a 10% rate of return?



Time Value of Money and Interest Rates

Future Value of an Ordinary Annuity

What is the FV of an annuity that will pay $100 per year at the end of each of the next 3 years given a 10% rate of return?

INPUT

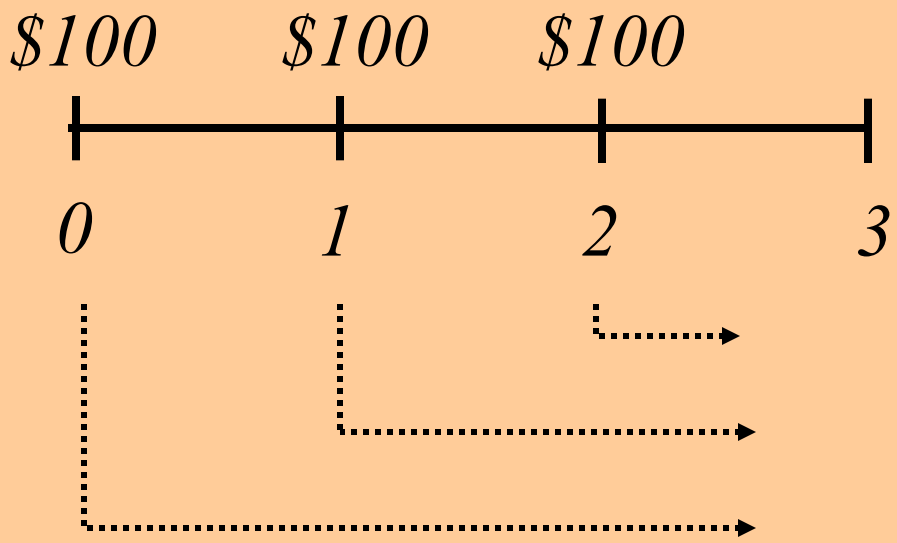
N	I/Y	PV	PMT	FV

OUTPUT

Time Value of Money and Interest Rates

Future Value of an Annuity Due

What is the FV of an annuity that will pay $100 per year at the beginning of each of the next 3 years given a 10% rate of return?



Time Value of Money and Interest Rates

Future Value of an Annuity Due

What is the FV of an annuity that will pay $100 per year at the beginning of each of the next 3 years given a 10% rate of return?

INPUT

N	I/Y	PV	PMT	FV

****At BEGIN mode****

OUTPUT

Net Present Value (NPV)

A NPV analysis includes the following steps:

1. Estimate the cash flows (inflows and outflows)
2. Determine the cost of capital(i.e. discount rate).
3. Discount the cash flows at the cost of capital
4. Sum up the discounted cash flows to determine the project's NPV.

$$NPV = CF_0 + \frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k)^2} + \cdots\cdots\cdots\cdots\cdots\cdots + \frac{CF_n}{(1+k)^n} = \sum_{t=0}^{n} \frac{CF_t}{(1+k)^t}$$

Internal Rate of Return (IRR)

- **Internal rate of return (IRR)** is the discount rate that sets the net present value equal to zero:

$$NPV = CF0 + \frac{CF_1}{(1+IRR)^1} + \frac{CF_2}{(1+IRR)^2} + \ldots + \frac{CF_n}{(1+IRR)^n} = 0$$

- Alternatively, the IRR is defined as the discount rate that equals the present value of cash inflows to the present value of investment costs.

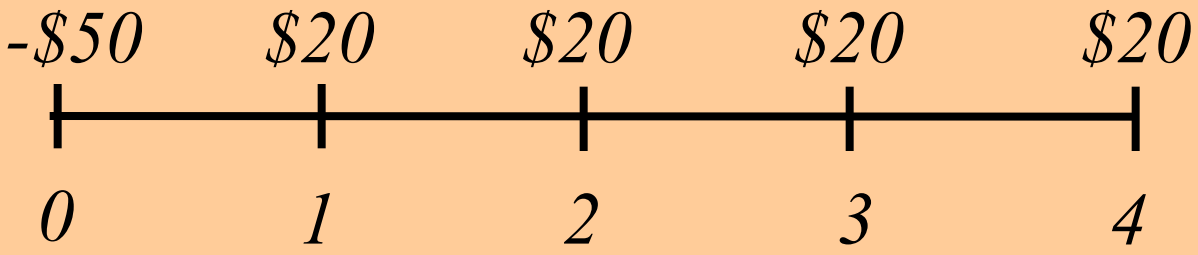
  PV (Investment costs) = PV (Cash Inflows)

- The IRR on a project is its **expected rate of return**.
  - If the IRR **exceeds** the cost of capital, a surplus remains after paying for the capital and thus increases shareholder value.
  - If the IRR is **less** than the cost of capital, taking on the project destructs shareholders value.

NPV vs. IRR

NPV and IRR of a Project

What is the NPV and IRR of a project that requires $50 initial investment and generates $20 cash flows for 4 years, given a 10% discount rate?



NPV vs. IRR

NPV and IRR of a Project

What is the NPV and IRR of a project that requires $50 initial investment and generates $20 cash flows for 4 years, given a 10% discount rate?

Mortgage Loan Schedule

Home Mortgage Interest Rate

- Each monthly payment of a *home mortgage* loan first covers in full the monthly interest on the outstanding principal. The remainder is then applied to the principal of the loan, such that the amount owed is reduced progressively.

Mortgage Loan Schedule

Home Mortgage Interest Rate

You agree to take out a 3,000,000 Baht loan for 10 years at an interest rate of 6% per year to buy your new home. Calculate the monthly payment and construct a mortgage table.

	N	I/Y	PV	PMT	FV
INPUT	10x12=120	6/12=0.5	3,000,000		0
OUTPUT				-33,306.15	

Mortgage Loan Schedule

Total monthly payment = interest + principal repayment

1st Month Payment:

Interest = beginning balance x interest rate per month
= 3,000,000 x 0.005
= 15,000

Principal = total monthly payment – interest
= 33,306.15 – 15,000
= 18,306.15

Monthly payment = 15,000 + 18,306.15
= 33,306.15

Mortgage Loan Schedule

Total monthly payment = interest + principal repayment

2nd Month Payment:

Interest = beginning balance x interest rate per month

=

=

=

Principal = total monthly payment – interest

=

=

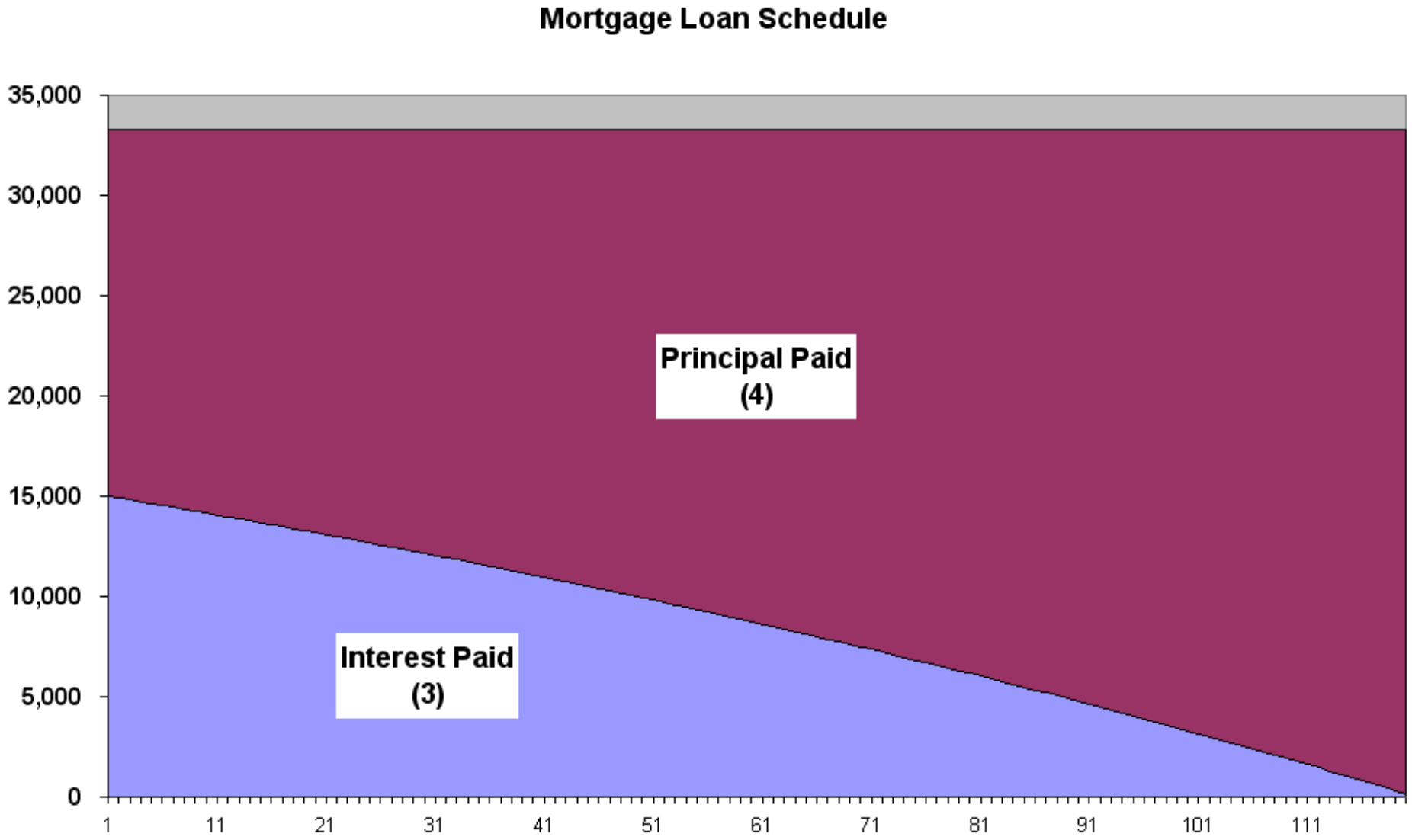
Monthly payment =

=

Mortgage Loan Schedule

Month	Beginning Balance (1)	Monthly Payment (2) = (3) + (4)	Interest Paid (3)	Principal Paid (4)	Ending Balance (5) = (1) - (4)	Effective Rate (6) = [(3)/(1)]*12
1	3,000,000	33,306.15				
2						
3						
4						
5						

Mortgage Loan Schedule



Group Presentation: Stock pitch

Please prepare 20 minutes presentation of your group company's stock. Your presentation should cover (but not limited to) these topics.

- Company background and recent development
- Industry and competitor analysis
- Company's financial analysis
- Recent stock price development
- Investment thesis
- Valuation
- Risks
- Recommendation on this stock (Buy/Hold/Sell)
- Any question, please email wacharaphanart@gmail.com

Group Presentation: Stock pitch

Suggested resources

- Company's annual report
- Company's website (investor relation page)
- Company's financial statement
- SET Opportunity day

(http://setlive.thailivestream.com/#/oppday)

- Analyst research