Math 103 Section 3.1, 3.2: Math of Finance

- simple interest
- compound interest

Simple Interest:

$$A = P(1 + rt)$$

- A: amount, or future value
- P: principal, or present value
- r: annual simple interest rate (decimal form)
- t time in years.

Example:

$$A = P(1 + rt)$$

Find the total amount due on a loan of \$1200 at 8% simple interest at the end of 6 months.

$$\begin{aligned} A &= \text{unknown} \\ P &= 1200 \\ r &= .08 \\ t &= .5 \text{ (Note: 6 months is half a year.)} \end{aligned}$$

Then

$$A = 1200(1 + (.08)(.5)) = 1200(1 + .04) = 1200(1.04) = 1248$$

Summary: The total amount due (future value) on a loan of \$1200 at 8% simple interest at the end of 6 months is \$1248.

Example:

$$A = P(1 + rt)$$

Find the total amount due on a loan of \$6,000 at 12% simple interest at the end of 9 months.

$$\begin{aligned} A &= \text{unknown} \\ P &= \\ r &= \\ t &= \text{ (Note: 9 months is 3/4 (0.75) of a year.)} \end{aligned}$$

Summary:

Warmup for Compound Interest:

Problem: That new atomic cell phone you've always wanted is marked at a price of \$100. But today only, the phone store is giving a 30% discount. The sales tax is 8.25%.

You jump on it and ask the cashier to ring up the sale. The cashier does something strange. He adds in the sales tax on the full price of \$100 and then subtracts the discount of 30%. You expected him to take the discount off first and then add in the sales tax? Does it matter which way he computes the final price?

Warmup for Compound Interest:

Sales tax rate: 8.25%, discount: 30% off.

Method I: add sales tax first, then subtract discount.

Method II: subtract discount first, then add sales tax.

Warmup for Compound Interest:

Sales tax rate: 8.25%, discount: 30% off.

Another way to look at the problem: multiply, don't add.

Method I: add sales tax first, then subtract discount.

Method II: subtract discount first, then add sales tax.

Compound Interest: An example

Deposit $100.00 into an account earning 5% compounded annually (each year). How much will you have after 10 years?

Year	$Interest	$Balance
	$	$100.00
1	$5.00	$105.00
2	$5.25	$110.25
3	$5.51	$115.76
4	$5,79	$121.55
5	$6.08	$127.63
6	$6.38	$134.01
7	$6.70	$140.71
8	$7.04	$147.75
9	$7.39	$155.13
10	$7.76	$162.89

Compound Interest: An example

Deposit \$100.00 into an account earning 5% compounded annually (each year). How much will you have after 10 years?

$$A = 100(1.05)^{10} = 162.89$$

Summary: You will have \$162.89 after 10 years.

Compound Interest:

$$A = P(1 + i)^n$$

- A: amount, or future value
- P: principal, or present value
- r: annual nominal rate
- m: number of compounding periods per year
- $i = r/m$: rate per compounding period
- n number of compounding periods.

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Compound Interest:

Example: Invest \$1200 (principal, present value) at an annual rate of 6% compounded semi-annually. How much will you have (future value) at the end of 10 years?

A	amount, or future value
$P = 1200$	principal, or present value
$r = .06$	annual nominal rate
$m = 2$	number of compounding periods per year
$i = .03 = .06/2$	rate per compounding period
$20 = 10(2)$	number of compounding periods.

$$A = 1200(1 + .03)^{20} = 1200(1.03)^{20} = 2167.33$$

Summary: You will have \$2167.33 after ten years.

Compound Interest:

Example: Invest $45,000 (principal, present value) at an annual rate of 8% compounded quarterly. How much will you have (future value) at the end of 5 years?

A	amount, or future value
$P =$	principal, or present value
$r =$	annual nominal rate
$m =$	number of compounding periods per year
$i =$	rate per compounding period
	number of compounding periods.

$A =$

Summary: