

Panel 1

Organization

No class Wed (Imm. Convention) ↗ Open Sosh/notes  
 Send you Exam 3 as Take-Home on Wed, due on Monday  
 Maple 2 due today

Final Exam Wed, Dec 15 @ 7:45  
 Room = TBD (not our classroom)

Review on Monday in class for final

Review on Tuesday, TBD

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Panel 2

Last Time

Compound interest:  $S = P(1+r)^n$

Effective rate:  $r_e = (1 + \frac{r}{n})^n - 1$

Present Value: value of \$X in the future now

Excel: = PV (rate, nper, pmt, fv)

rate = rate per period

nper = # of periods

pmt = payments per period ↗ negative

fv = future value

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Panel 3

Use effective rate to find sum of investment of \$200 at 5% compounded monthly for 3 years.

$$\textcircled{1} \quad S = P(1+r)^n = 200 \left(1 + \frac{0.05}{12}\right)^{36} = \underline{232.29}$$

$$\textcircled{2} \quad \left\{ \begin{array}{l} r_e = \left(1 + \frac{r}{n}\right)^n - 1 = \left(1 + \frac{0.05}{12}\right)^{12} - 1 = \underline{0.05117} \approx \underline{5.12\%} \\ S = P(1+r_e)^n = 200(1+0.05117)^3 = \underline{232.67} \end{array} \right.$$

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Panel 4

Other useful Excel formulas for financial math

Future Value: future value of an investment

$$= FV(\text{rate}, \text{nper}, \text{pmt}, \text{pv})$$

rate = rate per period

nper = # of periods

pmt = payment per period  $\rightarrow$  negative

pv = present value

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Panel 5

Ex: Invest \$1000 at 8% compounded quarterly for 5 years.

$$S = 1000 \left(1 + \frac{0.08}{4}\right)^{4 \cdot 5} = \underline{\underline{\$1495.95}}$$

$$= FV(0.08/4, 20, 0, -1000) = \underline{\underline{\$1495.95}}$$

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Panel 6

Ex: Value of \$1000 at 8% compounded quarterly in 5 years if \$100 payments are made every quarter.

① Estimate	8% of 1000 = 80 × 5 years = 400	
	20 payments of \$100 =	\$2000
	initial amount	<u>\$1000</u>
		<u>\$3400,-</u>

$$② = FV(0.08/4, 20, -100, -1000) = \underline{\underline{\$3915.65}}$$

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Panel 7

Ex: What is the present value of \$3917.68 in 5 years at 8% compounded quarterly, if \$100 payments are made?

$$= PV(0.08/4, 20, -100, 3917.68) =$$

i.e. PV and FV are inverse of each other

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Panel 8

Annuities: a finite sequence of payments made at fixed periods of time over a given interval

Ex: - sequence of payments monthly after you retire, for 20 years.

- sequence of car payments

- mortgage payments

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Panel 9

Ex: Suppose you can afford payments of \$100 per month for a loan at 6% compounded monthly over 3½ years. How much money is this worth now?

① Estimate:  $100 \times 3.5 \times 12 = \underline{4200}$

②  $= PV(0.06/12, 3.5 \cdot 12, -100, 0) = \underline{3779.93}$

Bank B has 10% on the loan:

$= PV(0.1/12, 3.5 \cdot 12, -100, 0) = \underline{3531.62}$  (less)

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Panel 10

The "Payment" Function: calculates the payments per period for a loan under given conditions.

$= PMT(\text{rate}, \text{nper}, \text{pv}, \text{fv})$

rate = rate per period

nper = # of periods

pv = present value or loan amount ↙ negative

fv = zero (future value)

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Panel 11

Ex: The bank loans you \$ 3779.93 over 3½ years at 6% compounded monthly. What are the monthly payments?

$$= \text{PMT} (0.06/12, 3.5 \cdot 12, -3779.93, 0)$$

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Panel 12

Ex: You get a short-term loan of \$1500 over 3 months at a nominal rate of 12% compounded monthly. What are your monthly rates?

① Estimate: 1500 over 3 months  $\Rightarrow$  per month 500 }  
 total interest  $3 \cdot 0.011500 = 45$   
 monthly payments are  $\sim 515,-$

$$\textcircled{2} = \text{PMT} (0.12/12, 3, -1500, 0) = \underline{\underline{\$510.03}}$$

Why the difference?

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Panel 13

Loan \$1500 at 12% compounded monthly for 3 months.

	you owe	interest	pmt	pay off
month 1	1500	$0.1 \cdot 1500 =$ <u>\$15</u>	510.03	$510.03 - 15 =$ <u>\$495.03</u>
month 2	$1500 - 495.03$ $=$ <u>\$1004.97</u>	$0.1 \cdot 1004.97$ <u>\$100.497</u>	510.03	$510.03 - 100.5$ <u>\$409.53</u>
month 3	$1004.97 - 409.53$ <u>= \$595.44</u>	$595.44 \cdot 0.1 =$ <u>\$59.544</u>	510.03	$510.03 - 59.544 =$ <u>450.486</u>
		<u>\$169.94</u>	<u>1530.09</u>	<u>1699.99</u>
		<u>\$30.10</u>		

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Panel 14

Summary

Compound interest:  $S = P(1+r)^n$

Effective rate:  $r_e = (1 + \frac{r}{n})^n - 1$

Present Value:  $= PV(\text{rate}, n, \text{pmt}, \text{fv})$  negative

Future Value:  $= FV(\text{rate}, n, \text{pmt}, \text{pv})$

Payments:  $= PMT(\text{rate}, n, \text{pv}, \text{fv})$

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Panel 15

- ① You sign for a loan with payments of \$200 per month at 10% over 10 years compounded monthly  
*PV*
- ② You want to setup a trust fund of \$50,000 in 15 years at 3% interest compounded monthly with monthly payments of \$150,-. How much to plunk down now?  
*PV*
- ③ You invest \$150 per month at 7% compounded monthly for 4 years. How much will you have?  
*=FV*
- ④ You take out a loan for \$20,000 over 5 years at 4% interest compounded monthly. Payments per month?  
*=PMT*

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Panel 16

Last question: Suppose you want to purchase a house. You need a loan of \$200,000 over 30 years. Bank A offers 5%, Bank B offers 4.7%. What is the savings over the life of the loan if you make monthly payments and monthly compounding.

$$=PMT(0.05/12, 30 \cdot 12, -200000, 0) = \underline{\$1073.64} \text{ per month}$$

$$\text{Bank A gets } \$1073.64 \cdot 12 \cdot 30 = \underline{\$386517}$$

$$\text{Bank B gets } \$1037.29 \cdot 12 \cdot 30 = \underline{\$373419}$$

~ \$13k difference

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