Day 1 Finance **Student Notes:** Financial Examples

$i = \frac{r}{k}$

A= amount total in account (accumulated $)
P= principal amount (starting $ in acct)
r= interest rate (% → decimal)
t= time in years
k= # times compounded per year
R= # of $ paid periodically
i= interest rate per compound period (NOT $i = \sqrt{-1}$)
n= # of equal payments made periodically
$n = kt$

Interest Compounded k times per year	Interest Compounded continuously
$A = P\left(1+\frac{r}{k}\right)^{(kt)}$ *Add these ( ) here*	$A = Pe^{rt}$ (remember, e is a constant like pi π)
Future Value $FV = R\frac{(1+i)^n - 1}{i}$ ↳ use when saving	**Present Value** $PV = R\frac{1-(1+i)^{-n}}{i}$ ↳ use when buying

* watch exponent ... needs (kt)

$i = \frac{r}{k}$, $n = kt$

When to use which formula?

Spending money? OR Saving money?

Spending money → $PV = R\frac{1-(1+i)^{-n}}{i}$

Saving money → multiple deposits / single deposit

multiple deposits → $FV = R\frac{(1+i)^n - 1}{i}$

single deposit → compounded continuously / compounded (NOT continuously) k times per year

compounded continuously → $A = Pe^{rt}$

compounded (NOT continuously) k times per year → $A = P\left(1+\frac{r}{k}\right)^{kt}$

1) Suppose Lucy Cash invests $1000 at 6% interest compounded **annually**. What is the value of Lucy's investment after 8 years?

$P = 1000$, $t = 8$, $r = 0.06$, $k = 1$ time per yr (not "continuous" so NOT Pert)

↳ Find A ← GOAL

$A = P\left(1+\frac{r}{k}\right)^{kt}$ $A = 1000\left(1+\frac{0.06}{1}\right)^{(1\cdot 8)} = \$1593.85$

2) Richie Rich has $700 to invest at 2% annual interest compounded monthly. How long will it take for his investment to grow to $4000? How much interest did he earn?

$P = 700$, $r = 0.02$, $A = 4000$ = accumulated $, $k = 12$ times per yr (NOT continuous)

↳ Find t ← GOAL (a)

$A = P\left(1+\frac{r}{k}\right)^{kt}$ $4000 = 700\left(1+\frac{.02}{12}\right)^{(12t)}$ ← Be careful

Do $y_1 = 4000$ & $y_2 = 700\left(1+\frac{.02}{12}\right)^{(12t)}$ and intersect

3) Suppose Anita Lone invests $200 in her savings account at 0.9% annual interest compounded **continuously**. Find the value of her investment at the end of 6 years.

$A = Pe^{rt}$ ↳ find A

$P = 200$, $t = 6$ years, $r = 0.009$ * be careful

$A = 200e^{(0.009*6)}$

$211.10

(a) $t = 87.22$ years

(b) How much interest earned? 4000 − 700 = $3300 (end $ A − start $ P)

→ use $FV = R\dfrac{(1+i)^n - 1}{i}$

4) a. Buck is saving money for his spring break trip and the banks are offering great rates on their saving accounts. At the end of each quarter (report card time), Buck makes deposits of $200 into an account that pays 3% interest compounded quarterly. How much will Buck have in his account at the end of the year?

$R = 200$; $r = 0.03$; $K = 4$; $n = Kt = 4 \cdot 1_{yr} \Rightarrow n = 4$; $i = \frac{r}{K} = \frac{0.03}{4}$

$FV = 200\dfrac{\left(1+\frac{0.03}{4}\right)^4 - 1}{\left(\frac{0.03}{4}\right)} = \boxed{\$809.05}$

b. How much money did he contribute? How much interest did he earn?

$200 \cdot 4 = \boxed{\$800}$ (each report card (quarterly) · report cards a year (4 quarters a year) = contributed)

$\$809.05 - 800 = \boxed{\$9.05}$ interest earned

5) a. Mercedes purchases a car for $18,500. What are the monthly payments for a 4-year loan with a $2000 down payment if the annual interest (APR) is 2.9%?

$18500 - 2000 \Rightarrow PV = 16500$

GOAL: Find R

→ use $PV = R\dfrac{1-(1+i)^{-n}}{i}$

$r = 0.029$; $i = \frac{r}{K} = \frac{0.029}{12}$; $n = Kt$; $n = 12 \cdot 4 = 48$ payments

$16500 = R\dfrac{1-\left(1+\frac{0.029}{12}\right)^{-48}}{\left(\frac{0.029}{12}\right)}$ (16500 = y_1; right side = y_2; and intersect)

$R = \boxed{\$364.49}$ monthly payments

b. What if the interest rate was 5.9%? How much more are you paying in interest?

$PV = R\dfrac{1-(1+i)^{-n}}{i}$

$16500 = R\dfrac{1-\left(1+\frac{0.059}{12}\right)^{-48}}{\left(\frac{0.059}{12}\right)}$

$R = \boxed{\$386.75}$ new monthly payment with 5.9%

$\$386.75 - 364.49 = \boxed{\$22.26}$ monthly

6) a. Haley Homes wants to buy a townhouse. She has nothing to put towards her down payment and the townhouse she likes is $140,000. If Corporate Mortgage Financial is offering her a loan with a 4.6% interest rate compounded monthly for 30 years, what is her monthly payment?

→ use $PV = R\dfrac{1-(1+i)^{-n}}{i}$

$140000 = R\dfrac{1-\left(1+\frac{0.046}{12}\right)^{-12\cdot 30}}{\frac{0.046}{12}} \rightarrow R = 717.702\frac{1}{2}$

$\boxed{R = \$717.70}$ monthly payments

b. After 30 years, how much does she actually end up paying for the townhouse?

$717.70\frac{2}{1} \cdot 12 \cdot 30 = \boxed{\$258,372.76}$

717.70 monthly payments · 12 months per year · 30 years = total paid for town home

c. How much does she pay in interest?

Interest Paid = Total Paid − Cost of Home

$= \$258,372.76 - 140,000 = \boxed{\$118,372.76}$

interest paid to Corporate Mortgage Financial