Time Value of Money Problems

2.5 How much will be in a bank account at the end of five years if $2000 is invested today at 12 percent per annum, compounded yearly?

2.7 Greg wants to have $50 000 in five years. The bank is offering five-year investment certificates that pay 8 percent nominal interest, compounded quarterly. How much money should he invest in the certificates to reach his goal?

2.9 Onkel Hans, the Official Mascot of Kitchener-Waterloo Oktoberfest, has $6000 now. In three months, he will receive a cheque for $2000. He must pay $900 at the end of each month (starting exactly one month from now). Draw a single cash flow diagram illustrating all of these payments for a total of six monthly periods. Include his cash on hand as a payment at time 0.

2.11 Heddy is considering working on a project that will cost her $20 000 today. It will pay her $10 000 at the end of each of the next 12 months and cost her another $15 000 at the end of each quarter. An extra $10 000 will be received at the end of the project, one year from now. Illustrate these cash flows in two cash flow diagrams. The first should show each cash flow element separately, and the second should show only the net cash flow in each period.

2.17 You have a bank deposit now worth $5000. How long will it take for your deposit to be worth more than $8000 if:

a) The account pays 5 percent actual interest every half-year and is compounded every half-year?

b) The account pays 5 percent nominal interest, compounded semi-annually?

2.20 How long will it take any sum to double itself with an 11 percent interest rate, compounded annually?

2.21 Compute the effective annual interest rate on each of these investments: (a) 25 percent nominal interest, compounded semi-annually. (b) 25 percent nominal interest, compounded quarterly.

2.39 You are comparing two investments. The first pays 1 percent interest per month, compounded monthly, and the second pays 6 percent interest per six months, compounded every six months.
(a) what is the effective semi-annual interest rate for each investment?
(b) what is the effective annual interest rate for each investment?
(c) on the basis of interest rates which investment do you prefer? Does your decision depend on whether you make the comparison based on an effective six-month rate or an effective one-year one?

Depreciation Problems

6.2 For each of the following, state whether the value is a market value, book value, scrap value, or salvage value:

(a) Inta can buy a new stove for $800 at Joe's Appliances.

(b) Jacques can sell his used stove to Inta for $200.

(c) Kitty can sell her used stove to the recyclers for $20.

(d) Liam can buy Jacques's used stove for $200.

(e) Noriko is adding up the value of the things she owns. She estimates her stove is worth $200 using a depreciation model.

6.7 An asset costs $14 000 and has a scrap value of $3000 after seven years. Calculate its book value using straight-line depreciation: a) After one year; b) After four years; c) After seven years

6.9 (a) An asset costs $14 000. What declining-balance depreciation rate would result in the salvage value of $3000 after seven years?

(b) Using the depreciation rate from part (a), what is the book value of the asset after four years?

6.18 (a) Using straight-line depreciation, what is the book value after four years for an asset costing $150 000 that has a salvage value of $25 000 after 10 years? What is the depreciation charge in the fifth year?

(b) Using declining-balance depreciation with d = 20 percent, what is the book value after four years for an asset costing $150 000? What is the depreciation charge in the fifth year?

(c) What is the depreciation rate using declining-balance for an asset costing $150 000 that has a salvage value of $25 000 after 10 years?

Cash Flow Analysis Problems

3.13 An investment pays $10 000 every five years, starting in seven years, for a total of four payments. If interest is 9 percent, how much is this investment worth today?

3.15 What is the present worth of the total of 20 payments, occurring at the end of every four months (the first payment is in four months), which are $400, $500, $600, increasingly arithmetically? Interest is 12 percent nominal per year, compounded monthly.

3.25 Yoko has just bought a new computer ($2000), a printer ($350), and a scanner ($210). She wants to take the monthly payment option. There is a monthly interest rate of 3 percent on her purchase.

(a) If Yoko pays $100 per month, how long does it take to complete her payments?

(b) If Yoko wants to finish paying in 24 months, how much will her monthly payment be?

3.34 Gail has won a lottery that pays her $100 000 at the end of this year, $110 000 at the end of next year, $120 000 the following year, and so on, for 30 years. Leon has offered Gail $2 500 000 today in exchange for all of the money she will receive. If Gail can get 8 percent interest on her savings, is this a good deal?

3.35 Gail has won the lottery again! This time, the lottery pays her $100 000 and increases by 10 percent per year thereafter for 30 years. Leon is back, and this time offers Gail $2 500 000 today in exchange for all of the money she will receive. If Gail can still get 8 percent interest on her savings, is this a good deal?

3.43 You have been paying off a mortgage in quarterly payments at a 24 percent nominal annual rate, compounded quarterly. Your bank is now offering an alternative payment plan, so you have a choice of two methods – continuing to pay as before or switching to the new plan. Under the new plan, you would make monthly payments 30 percent of the size of your current payments. The interest rate would be 24 percent nominal, compounded monthly. The time until the end of the mortgage would not change, regardless of the method chosen.

(a) Which plan would you choose, given that you naturally wish to minimize the level of your payment costs?

(b) Under which plan would you be paying a higher effective yearly interest rate?

3.49 Coastal Shipping is setting aside capital to fund an expansion project. Funds earmarked for the project will accumulate at the rate of $50 000 per month until the project is completed in two years. Once the project starts, costs will be incurred at the rate of $150 000 per month over 24 months. Coastal currently has $250 000 saved. What is the minimum number of months it will have to wait before it can start if money is worth 18 percent nominal, compounded monthly? Assume that: 1) Cash flows are all at the end of months; 2) The first $50 000 savings occurs one month from today; 3) The first $150 000 payment occurs one month after the start of the project; 4) The project must start at the beginning of a month.

3.51 Xiaohang is conducting a biochemical experiment for the next 12 months. In the first month, the expenses are estimated to be $15 000. As the experiment progresses, the expenses are expected to increase by 5 percent each month. Xiaohang plans to pay for the experiment with a government grant, which is received in six monthly instalments, starting a month after the experiment completion date. Determine the amount of the monthly instalments so that the total of the six instalments pays for all expenses incurred during the experiment. Annual nominal interest is 12 percent, compounded monthly.

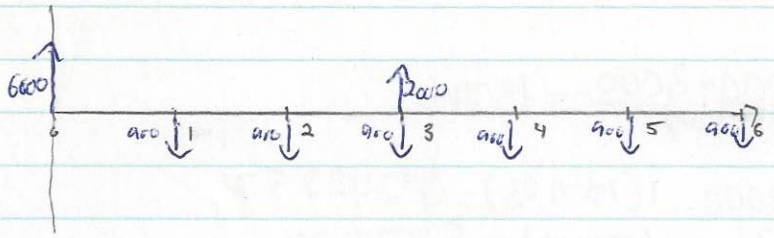
June 16 2020
Benjamin K

Review Questions - Econ Quiz 1

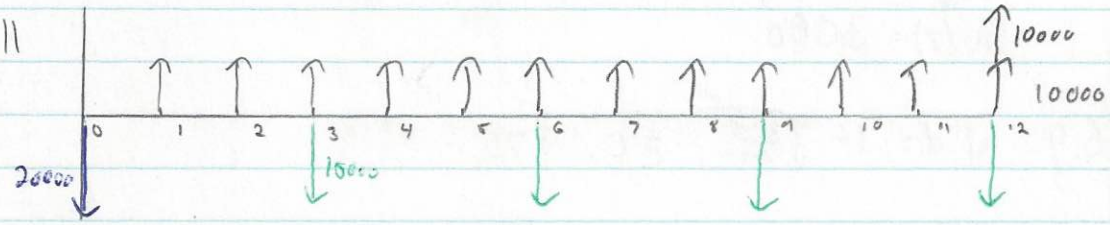
2.5 $2000(1.12)^5 = 3524.68$

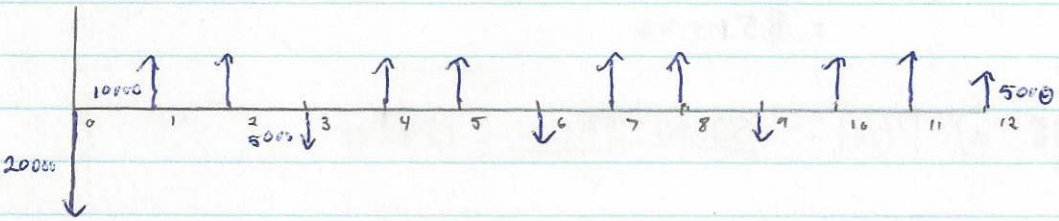
2.7 $50000 = P_0(1.02)^{4.5}$, $P_0 = 33648.57$

2.9



2.11





2.17 a) $8000 = 5000(1.05)^t$

$\ln(1.6) = t\ln(1.05)$

$t = 9.633$ half years, ~~5 years~~

b) $8000 = 5000(1.025)^t$

$t = 19.034$ (19.5 half years), $= 10$ years

2.20 $2 = 1.11^t$, $\ln(2) \div \ln(1.11) = t = 6.64$ years $= 7$ years

2.21 a) $i_e = (1+0.125)^2 - 1 = 26.56\%$

b) $i_e = (1+0.0625)^4 - 1 = 27.44\%$

2.39 a) $i_c = 6\%$, $i_e = (1.01)^6 - 1 = 6.15\%$

b) $i_c = (1.06)^2 - 1 = 12.36\%$; $i_c = (1.01)^{12} - 1 = 12.68\%$

c) monthly investment compounding is preferable. It does not depend on this distinction

6.2 a) Market Value
b) Salvage Value
c) Scrap Value
d) Market Value
e) Book Value

6.7 $D_{sl}(7) = \frac{14000-3000}{7} = 1571.43$

$BV_{sl}(1) = 14000 - 1(1571.43) = \$12428.57$
$BV_{sl}(4) = 14000 - 4(1571.43) = \$7714.29$
$BV(7) = 3000$

6.9 a) $d = 1 - \sqrt[7]{\frac{3000}{14000}} = 0.1975$

b) $BV(4) = 14000(1-0.1975)^4$
$= \$5805.48$

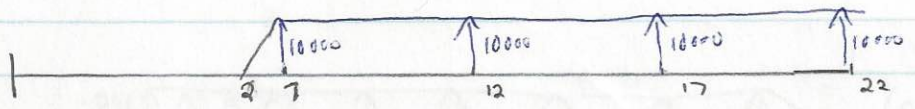
6.18 a) $D(10) = \frac{150000 - 25000}{10} = 12500$

$BV(4) = 150000 - 12500(4)$
$= 100000$
Depreciation Charge = 12500

b) $BV(4) = 150000(0.8)^4$
$= 61440$
$D(5) = 61440 \cdot 0.2$
$= 12288$

c) $d = 1 - \sqrt[9]{\frac{25}{100}}$
$= 0.164$

3.13



$i_e = (1.09)^5 - 1$
$= 0.5386$, new $N = 4$

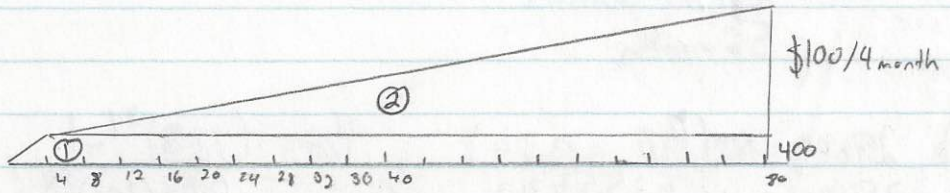
$P = 10000(P/A, 0.5386, 4)$
$= 10000(1.5253)$
$= 15253.11$

, $\frac{(1+0.5386239)^4 - 1}{0.5386239(1+0.5386239)^4}$
$= 1.5253$

$P = 15253.11(P/F, 0.09, 2)$
$= 15253.11 \cdot \frac{1}{(1.09)^2}$
$= 12838.24$

, $\frac{1}{(1.09)^2}$

3.15



$i_e = 0.01$

$P_1 = 400(A/F, 0.01, 4)(P/A, 0.01, 80)$
$= 400(0.24628)(54.88821)$
$= 5407.17$

$A/F = \frac{0.01}{1.01^4 - 1} = 0.24628$

$P/A = \frac{(1.01)^{80} - 1}{0.01(1.01)^{80}} = 54.88821$

$ie = (1.1)^4 - 1$
$= 0.04060401$

$P_2 = 100(A/G, 0.04060401, 20)(P/A, 0.04, 20)$
$= 100(8.190409)(13.51792744)$
$= 11071.74$

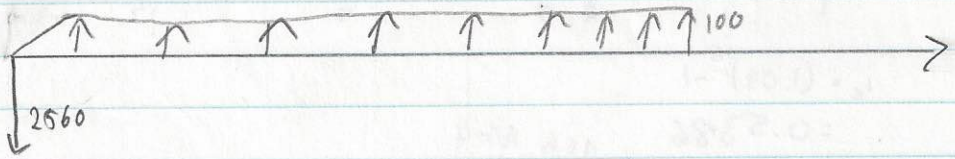
, $A/G = \frac{1}{0.04} - \frac{20}{1.04^{20} - 1} = 8.190409$

$P/A = \frac{(1.04)^{20} - 1}{0.04(1.04)^{20}} = 13.51792744$

$P_1 + P_2 = \$16478.91$

3.25

a)



$2560 = 100(P/A, 0.03, N)$, $P/A = \frac{(1.03)^N - 1}{0.03(1.03)^N} = \frac{100}{3}\left[1 - 1.03^{-N}\right]$

$2560 = 100 \cdot \frac{100}{3}\left[1 - 1.03^{-N}\right]$

$0.232 = \frac{1}{1.03^N}$

$1.03^N = 4.31034$

$N \ln(1.03) = \ln(431034)$

$N = 49.4$ months

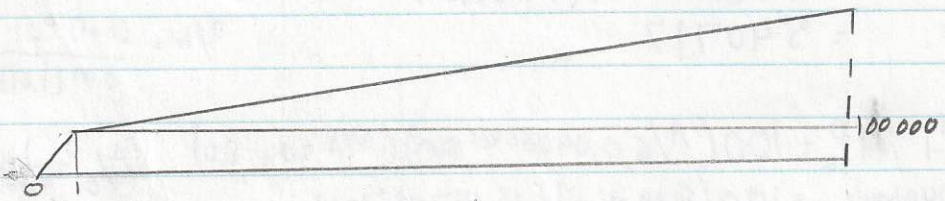
$= 50$ months

b) $2560 = x(P/A, 0.03, 24)$ $\quad P/A = \frac{(1.08)^{24} - 1}{0.03(1.03)^{24}} = 16.93554212$

$2560 = x \cdot 16.93554212$

$x = 151.16$/month

3.34



$(P/A, 0.08, 30) = \frac{(1.08)^{30} - 1}{0.08(1.08)^{30}} = 11.25778334$

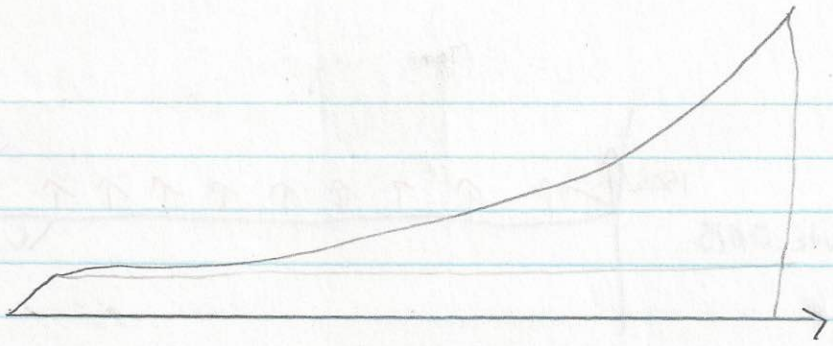
$(A/G, 0.08, 30) = \frac{1}{0.08} - \frac{30}{(1.08)^{30} - 1} = 9.18971248$

$P = 11.25778334\left(100000 + 10000(9.18971248)\right)$

$= 2160336.26 < 2500000$

$\therefore$ A is a good deal

3.35



$i = \frac{1.08}{1.1} - 1$

$= -0.0\overline{18}$

$(P/A, i, 30) = \frac{(1-0.0\overline{18})^{30} - 1}{-0.0\overline{18}(1-0.0\overline{18})^{30}} \cdot \frac{1}{1.1} = 36.7037526$

$P = 100000(36.7037526)$

$= 3670375.26$ ∴ bad deal

3.43

a) $(P/F, 0.06, 1) = \frac{1}{1.06}$ $(P/A, 0.02, 3) = \frac{(1.02)^3 - 1}{0.02(1.02)^3} = 2.8839$

$P = x/1.06$

$= 0.9434x$

$P = 0.3x(2.8839)$

$= 0.865x$

∴ B is favorable

b) $i_e = (1.06)^4 - 1$

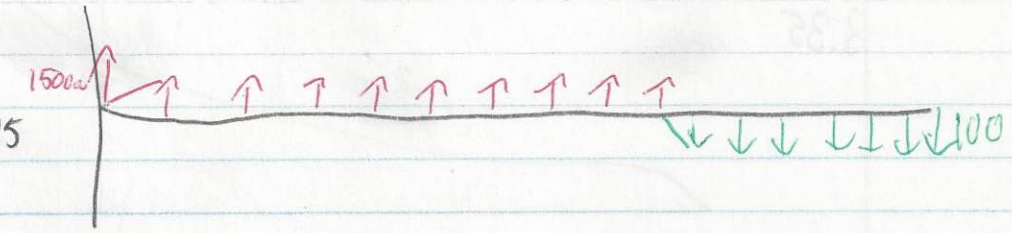
$= 26.247$ ← A charge

$i_e = (1.02)^{12} - 1$

$= 0.26824$

3.49

monthly rate = 0.015



$$\text{Costs} = 100 \cdot (P/A, 0.015, 24)(P/F, 0.015, N)$$

$$= 100 \cdot \left[\frac{1.016^{24} - 1}{0.015(1.015)^{24}}\right]\left[\frac{1}{1.015^N}\right]$$

$$= \frac{2003.040537}{1.015^N}$$

$$\text{Savings} = 250 + 50(P/A, 0.015, N)$$

$$= 250 + 50\left[\frac{1.015^N - 1}{0.015(1.015)^N}\right]$$

$$= 250 + 50\left[\frac{200}{3} - \frac{200}{3(1.015)^N}\right]$$

$$= 3483.333 - \frac{3333.333333}{1.015^N}$$

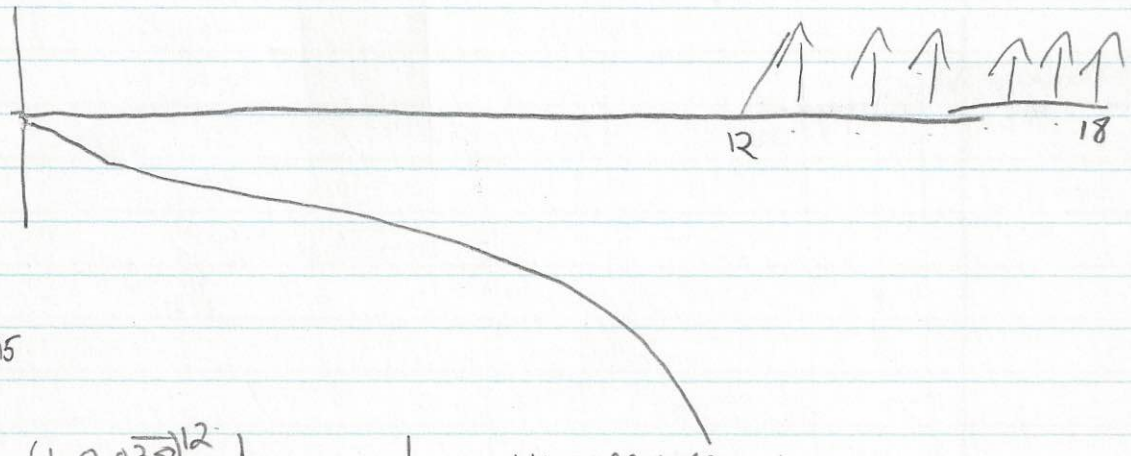
$$3583.33 = \frac{5336.3739}{1.015^N}$$

$$1.015^N = 1.489220623$$

$$N \ln 1.015 = \ln 1.489220623$$

$$N = 27$$

3.51



$i = 0.01$

$i' = \frac{1.01}{1.05} - 1$

$= -0.038095$

$(P/A, i', 12) = \frac{(1-0.038)^{12} - 1}{-0.038(1-0.038)^{12}} \cdot \frac{1}{1.005} = 14.84328263$

$\therefore 15000(14.84328263)$

Costs $= \$222649.24$

$\text{Savings} = x(P/A, 0.01, 6)(P/F, 0.01, 12)$

$= x\left[\frac{(1.01)^6 - 1}{0.01(0.01)^6}\right]\left[\frac{1}{(1.01)^{12}}\right]$

$= 5.143191107x$

$222649.24 = 5.143191107x$

$x = 43290.10$