

1. (15 points) Convex, Inc, has just paid a \$3 annual dividend on its common stock. The dividend is expected to grow at 6% per year indefinitely. If the required rate of return on Convex's stock is 16%, what is the current price?

Next period's dividend is $\$3(1.06) = \3.18 .

P.V. of dividend flows is a growing perpetuity:

$$P_0 = \frac{3.18}{.16 - .06} = \$31.80$$

$$\left(\frac{2.16}{.16 - .08} = \frac{\$2.16}{.08} = \$27.00 \right)$$

-2 for using \$3

-1 for denominator

2. (25 points) Two projects have the following cash flows (the payments are lump sums at the end of the year):

	Year 0	Year 1	Year 2	Year 3+
Project A	-100	30	120	0
Project B	-250	30	30	30

The interest rate is 8%. (Note: the \$30 in project B continues forever)

- 6 a. What is the NPV of both projects? (3pts each)
 4 b. What is the payback period of both projects? (2pts each)
 4 c. What is the Profitability Index of both projects? (2pts each)
 6 d. What is the IRR of both projects? (3pts each)
 4+1 e. For each criteria, which project would be selected? (1pt each)

a). $NPV(A) = -100 + \frac{30}{1.08} + \frac{120}{(1.08)^2} = \30.66 (double NPV for other version; all others will be the same)
 $NPV(B) = -250 + \frac{30}{0.08} = \125

b). $PBP(A) = 2 \text{ years}$

$PBP(B) = 9 \text{ years}$ (lump sum, so no "averaging" is necessary)

c). $PI(A) = \frac{NPV \text{ outflows}}{NPV \text{ inflows}} = \frac{130.66}{100} = 1.307$ ((total) -1 each for NPV on top)

$PI(B) = \frac{30/0.08}{250} = \frac{375}{250} = 1.5$

d). $IRR(A): 0 = -100 + \frac{30}{1+IRR} + \frac{120}{(1+IRR)^2}$ $a = \frac{1}{1+IRR}$
 $-100 + 30a + 120a^2 = 0 \Rightarrow a = \frac{-30 \pm \sqrt{(30)^2 - 4 \cdot (120)(-100)}}{(120) \cdot 2} = .7964$ (the one that makes sense)

$\frac{1}{1+r} = .7964 \Rightarrow r = 25.567\%$

$IRR(B) = -250 + \frac{30}{IRR} = 0 \Rightarrow IRR = 12\%$

e). NPV: B

PBP: A

PI: B

IRR: A

3. (20 points) Suppose you are negotiating to buy computers for your company. They will keep being replaced indefinitely when they break, and you will be going back to the same vendor at the same prices you negotiated. You have received Fenceway's best offer, and are currently negotiating with Bell. Fenceways' computers are slightly better and last one additional year, but the computers are the same in every other way. The appropriate interest rate is 14%, and the cash flows and maintenance costs per computer are below:

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Fenceway	-\$1200	-\$50	-\$75	-\$75	-\$125	-\$150
Bell	-\$X	-\$75	-\$100	-\$125	-\$200	

10 pts
10 pts

- a. What is the Equivalent Annual Cost of a Fenceway computer?
b. What would X have to be to make you indifferent between Bell computers and Fenceway?

$$a). \quad PV(F) = -1200 - \frac{50}{1.12} - \frac{75}{1.12^2} - \frac{75}{1.12^3} - \frac{125}{1.12^4} - \frac{150}{1.12^5} =$$

$$= -1200 - 44.64 - 59.79 - 53.38 - 79.44 - 85.11 = -1522.37 \quad (5 \text{ pts})$$

$$EAC: -1522.37 = C \cdot A_{.12}^5 \Rightarrow C = \frac{-1522.37}{3.605} = \boxed{\$422.32} \quad (1286.55) \quad (356.90)$$

b). We need Bell to have the same EAC. PV of 4 years of \$422.32 is

$$PV = C \cdot A_{.12}^4 = 422.32 \cdot [3.037] = \$1282.73. \quad (1084.036)$$

so the stream of payments for a Bell computer should equal this;

$$-1282.73 = -X - \frac{75}{1.12} - \frac{100}{1.12^2} - \frac{125}{1.12^3} - \frac{200}{1.12^4}$$

$$\Rightarrow X = -919.97 \quad (-9759)$$

4. (25 points) Deceptor Sports has decided to sell a new line of freestyle snowboards. The firm's president has come up with the projections of gross profit (revenues – variable costs) and other costs shown below. The new line will erode sales of the firm's existing line of high-priced snowboards, but will increase sales of the firm's line of boots. New production equipment will cost \$12.3 million and will be straight-line depreciated over three years. Net working capital will increase by \$750,000 which will be recovered after three years. The firm faces a tax rate of 40%.

(\$ in thousands)	Year 0	Year 1	Year 2	Year 3
Initial Investment	12,300			
NWC	750	750	750	0
New board gross profit		18,000	20,000	25,200
Old board lost gross profit		6,000	8,000	10,000
Old boot increase in gross profit		5,000	6,000	7,000
Fixed costs		8,000	8,000	8,000

What is the net cash flow for each year of this project?

Item	Year 0	Year 1	Year 2	Year 3
Gross Profit	0	\$18,000	20,000	\$25,200
Fixed Costs	0	\$8,000	\$8,000	\$8,000
Net Profit	0	10,000	12,000	17,200
Taxes (40%)	0	4,000	4,800	6,880
Dep.	0	4,100	4,100	4,100
Tax Shield	0	1,640	1,640	1,640
OCF ((Profit - costs)(1 - T _c) + shield)		7,640	8,840	11,960
ΔNWC	-750	0	0	+750
Investment	-12,300	0	0	0
After tax increment of other lines	0	(6,000 + 5,000)(1 - T _c) = 1,000 · 0.6 = 600	-1,200	-1,800
Cash flows (OCF + Inv + ΔNWC + increment)	-13,050	7,040	7,640	10,910

5. (15 points) The Chestnut Company has a bond outstanding with a face value of \$1,000 that has a coupon rate of 11% paid semi-annually and matures in 10 years. The yield for similar bonds is 8% SAIR compounded semi-annually.

- 6 a. What is the value of the bond if the first coupon payment is in six months?
 6 b. If the 11% coupon is paid yearly instead of semi-annually, but everything else remains the same (including the interest rate) what is the value of the bond? (The first payment of \$120 is in one year)
 3 c. Compare the answers to (a) and (b), and give a brief explanation of why the answers are the way they are.

a). $V = 55 A_{.04}^{20} + \frac{\$1000}{(1.04)^{20}}$ 8% SAIR \rightarrow 4% semi-annual

$$= 747.47 + 456.39 = \boxed{\$1,203.85}$$

b). Everything the same \Rightarrow interest is still 8% SAIR semi-annually
 use EAIR (correct rate for 1 year). $EAIR = (1+.04)^2 - 1 = 8.16\%$

$$V = 110 A_{.0816}^{10} + \frac{\$1000}{(1.04)^{20}} = 732.81 + 456.39 = \boxed{\$1,189.20}$$

also equals $\frac{\$1000}{(1.0816)^{10}}$

-1 wrong rate
 -1 wrong coupon

(infrequent annuity)

c). b is worth less money; this is because in (b) we are getting the money later; in (a) we get \$55 after 6 months and \$55 in one year, but in (b) all that money is received in one year.