**Short Answer (15 points each)**

1. List one disadvantage of a corporation compared to other forms of business.

**+15**  one of: profits taxed twice, potential conflicts between owners & managers, more expensive & complex to setup.

2. Based on the attached financial statements, did it take 3M more or less time to collect receivables in 2015 compared to 2014? (Calculations required).

*and assuming 3M's accounts receivable days in 2014 was 48 (not actual #)*

$$2015 = \frac{4154}{30,274/365} = 50.08 \; ; \; 2014 = \frac{4236}{31,821/365} = 48.61 \Rightarrow more$$

3. Based on the attached financial statements, did a larger or smaller percentage of 3M's capital come from debt in 2015 compared to 2014? (Calculations required).

*and assuming 3M's debt-to-capital ratio in 2014 was 0.3 (not the actual #)*

$$2015 = \frac{2044 + 8753}{2044 + 8753 + 11,747} = 0.479 \; ; \; 2014 = \frac{106 + 6705}{106 + 6705 + 13,142} = 0.341 \Rightarrow larger$$

4. Assume two annuities are identical except that one has higher growth after the initial cash flow, which will have a higher present value?

**+15** higher growth

5. Assume interest rates fall by 3%. The price of which of the following bonds should rise the least?
   a) bond matures in 5 years and pays no coupons, b) bond matures in 5 years and pays a 2% coupon, c) bond matures in 5 years and pays a 10% coupon, d) bond matures in 10 years and pays no coupons, e) bond matures in 10 years and pays a 2% coupon, f) bond matures in 10 years and pays a 10% coupon.

**+15** c)

**Problems (75 points each)**

*See 2:30 A*

Note: Unless I specifically state "calculations required", you can just set up all problems and tell me what you are solving for in each step. If you are using the result of an unsolved equation in a later step, just make that clear. One way to do this, set up the equation and call your result "A" or "B", etc. If you prefer, you can solve everything.

1. Audiomech trades for $550 and the Market ETF trades for $500. The one-year risk-free rate equals 5% and the two-year risk-free rate equals 6%.

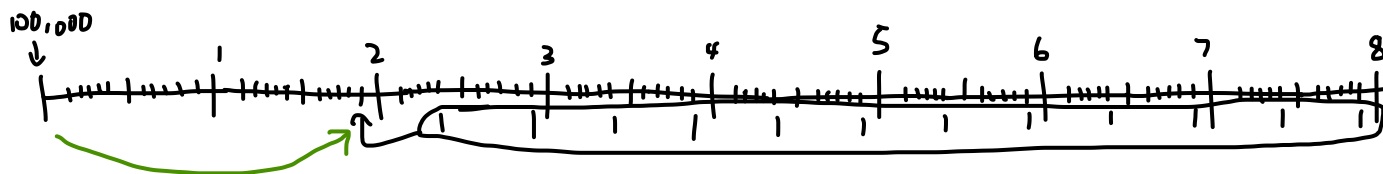| Year | | 1 | | | 2 | |
|---|---|---|---|---|---|---|
| State of Economy | Weak ~~Strong~~ | Strong ~~Weak~~ | | Weak ~~Strong~~ | Strong ~~Weak~~ | |
| Market ETF | 150 | 200 | | 400 | 700 | |
| AudioMech | 100 | 150 | | 500 | 800 | |

Identify the trades today (per share of Audiomech) that create an arbitrage profit today, show the cash flows created by all trades for ~~all states of~~ the economy ~~in all time periods~~ *two years from today*, and show your total cash flows for ~~all~~ *a weak* ~~states of the~~ economy ~~in all time periods~~. Use a "+" to indicate inflows and "–" to indicate outflows. Calculations required. *two years from today*

Equivalent portfolio = Market – $50 risk-free in 1yr + $400 risk-free in 2yrs

No arbitrage price = $500 - \frac{50}{1.05} + \frac{100}{(1.06)^2} = 500 - 47.619 + 89.000 = 541.381$ ⟹ Short Audiomech

| | | | CF₁ | | CF₂ | |
|---|---|---|---|---|---|---|
| | | | W | S | W | S |
| **Trans** | $CF_0$ | | –100 | –150 | –500 +5 | –800 |
| +6 Short-sell Audiomech | +550 +5 | | | | | |
| +6 Buy market | –500 +5 | +150 | +200 | +400 +5 | +700 |
| +6 Short 1yr rf | +47.619 +5 | –50 | –50 | 0̸ +5 | 0̸ |
| +6 Buy 2yr rf | –89.000 +5 | 0̸ | 0̸ | +100 +5 | +100 |
| Total | 8.619 +6 | 0̸ | 0̸ | 0̸ +5 | 0̸ |

1 2. You have just deposited $100,000 into an account. Two years and five months from today you would like to make the first of a series of semiannual withdrawals from an account that will grow by 2.5% each. You plan to make your final withdrawal seven years and 11 months from today. The account earns an APR of 3.5% with monthly compounding. Set up the calculations needed to determine how large you can make your first withdrawal.
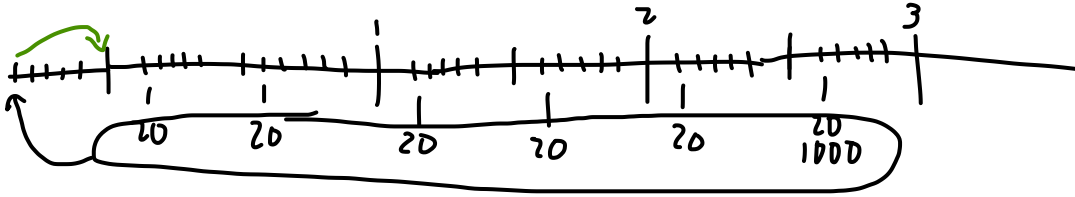
100,000 ↓



$$V_{1y11m} = \left(\frac{C}{r(\frac{1}{2}) - .025}\right)\left(1 - \left(\frac{1.025}{1 + r(\frac{1}{2})}\right)^{12}\right) = 100{,}000\left(1 + r(\frac{1}{12})\right)^{23} \Rightarrow \text{solve for } C$$

$$r(\frac{1}{12}) = \frac{.035}{12}$$

$$r(\frac{1}{2}) = \left(1 + r(\frac{1}{12})\right)^{6} - 1$$

2~~3~~. A bond matures for $1000 two years and seven months from today. The coupon rate on the bond (which pays semiannual coupons) is 4%. Set up the calculations needed to determine the clean price of the bond if the yield to maturity on the bond equals 6%.



$$V_{-5m} = \left(\left(\frac{20}{y}\right)\left(1 - \left(\frac{1}{1+y}\right)^6\right) + \frac{1000}{(1+y)^6}\right)$$

$$V_0 = V_{-5m}(1+y)^{5/6}$$

$$y = \frac{.06}{2}$$

$$Clean = V_0 - \frac{5}{6}(20)$$

3 4. Small Effect Corp is considering investing $100 million in a new factory that will generate net monthly cash flows beginning four months from today. The first cash flow will equal $2 million and subsequent cash flows will grow by 5% each through the final cash flow which will occur four years and five months from today. The project's cost of capital equals 8.5%. Set up the calculations needed to determine the internal rate of return on the factory.

per year

anual



$g = .05$
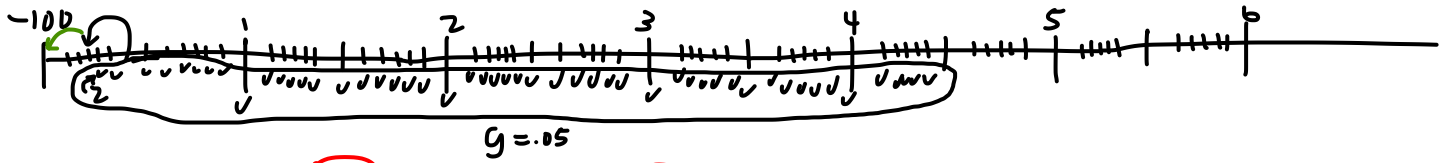
$$+4 \ NPV = -100 + \left(\frac{2}{r\left(\frac{1}{12}\right) - .05}\right)\left(1 - \left(\frac{1.05}{1+r\left(\frac{1}{12}\right)}\right)^{50}\right)\left(\frac{1}{1+r\left(\frac{1}{12}\right)}\right)^{3} + 10 = 0 \Rightarrow \text{solve for } r\left(\frac{1}{12}\right) \ +5$$

$$+7 \ r(1) = \left(1 + r\left(\frac{1}{12}\right)\right)^{12} - 1$$