

Fall 2016 471/571 - Midterm 1

Name: _____

In each question below, circle your final answer. If you used a calculator, numbers entered must be listed.

1. A bank customer takes out a loan of 1000 with a 16% nominal interest rate convertible quarterly. The customer makes payments of 100 at the end of each month for 11 month, and pays all of remaining balance X at the end of 12th month. Calculate X .

$$4\% \text{ 3mo.}$$

$$(1.04)^{\frac{1}{3}} = 1.0132 \quad \text{3mo.}$$

$\frac{N}{8}$	$\frac{I/Y}{1.32}$	$\frac{PV}{-1000}$	$\frac{PMT}{100}$	$\frac{FV}{DB_8}$
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$$272.42$$

$$DB_9 = DB_8 (1.0132) = \boxed{276.02}$$

2. Bank A lend 15,000 at annual effective rate of 6%, with 15 level annual payments. Immediately after the 10th payment, the rights to remaining loan payments were sold to Bank B at the price X that will yield 5% effective annual rate for Bank B. Calculate X .

$\frac{N}{15}$	$\frac{I/Y}{6}$	$\frac{PV}{-15000}$	$\frac{PMT}{(K)}$	$\frac{FV}{0}$
			↓	
			→	1544.4

Bank B has 5 payments of K .

$\frac{N}{5}$	$\frac{I/Y}{5}$	$\frac{PV}{(X)}$	$\frac{PMT}{K}$	$\frac{FV}{0}$
			1544.4	
		↓		
		→		-6686.6

$X = 6686.6$

3. Tomi purchased a 20-year bond with par value X and semi-annual coupon 45 at a nominal annual yield rate of 8% convertible semiannually at a price of 1700. After the purchase, Tomi found out that the bond can be called at par value on any coupon date starting at the end of year 15. What is the minimum yield that Tomi could receive, expressed as a nominal annual rate of interest convertible semiannually?

Find X

$\frac{N}{40}$	$\frac{I/Y}{4}$	$\frac{PV}{-1700}$	$\frac{PMT}{45}$	$\frac{FV}{(X)}$
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3885.6 ~~3885.6~~ ← Bought at discount

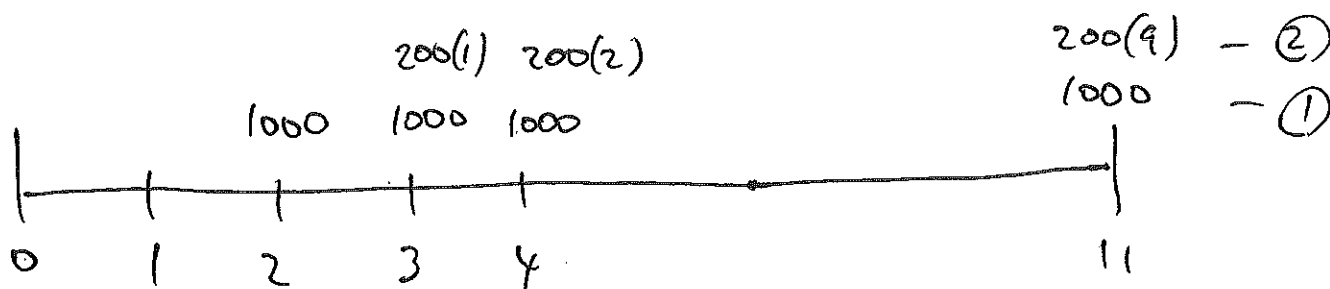
worst case is

when Not called ←

↳ 4% is worst case.
bmo,

$i^{(2)} = 8\%$ is guaranteed

4. John makes deposits to an account earning effective annual rate of 4%. First deposit of 1000 will be made in 2 years, then continues at the end of each year for 10 years. Every subsequent deposit will increase by the amount of 200. Calculate the account balance immediately after the last deposit.



(1) 10 deposit of 1000

$$FV = 1000 S_{\overline{10}|.04} = (12,006.1)$$

(2) 9 deposit of increasing annuity

$$FV = 200 (IS)_{\overline{9}|.04} = 200 (IA)_{\overline{9}|.04} (1.04)^9$$

$$= 200 \left(\frac{\ddot{a}_{\overline{9}|.04} - 9v^9}{i} \right) (1.04)^9$$

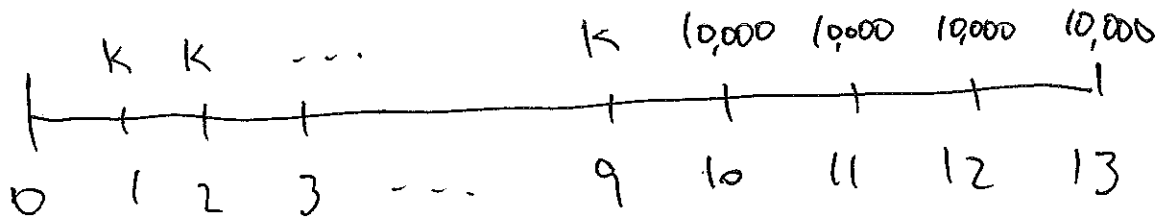
$$= 200 (50.1526) = (10,030.5)$$

$$\text{Soln} = \boxed{22,036.6}$$

mo.

5

5. Four 10,000 annual withdrawals at the end of 10th, 11th, 12th, 13th ~~year~~ needs to be funded by nine equal monthly deposit of K , at nominal rate of 6% convertible monthly. First deposit will be made one month from today. Find K .

Find PV ~~10,000~~

$$j = \frac{.06}{12}$$

$$K a_{\overline{97.005}|j} = 10,000 a_{\overline{4}|j} v^9$$

$$K = 10,000 \frac{1 - v^4}{1 - v^9} \cdot v^9$$

$$= \boxed{4302.38}$$

5. Four 10,000 annual withdrawals at the end of 10th, 11th, 12th, 13th (year) needs to be funded by nine equal monthly deposit of K , at nominal rate of 6% convertible monthly. First deposit will be made one month from today. Find K .

monthly rate $\frac{6}{12} = .5\%$

annual rate $(1.005)^{12} = 1.0617 \quad 6.17\%$

$$K a_{\overline{9}|.005} = 10000 a_{\overline{4}|.0617} \left(\frac{1}{1.0617} \right)^9$$

$$K = 10000 (2.1380) / 8.823$$

$$= \boxed{2,423.2}$$