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Assignment 1.

Q1. $d^{(4)} = 8\%$

a) $\delta = ?$

$$\left(1 - \frac{d^{(4)}}{4}\right)^4 = e^{-\delta}$$

$$0.92236816 = e^{-\delta}$$

$$\ln(0.92236816) = -\delta$$

$$\therefore \delta = 0.0808108292 7.$$

$$= 8.081082\%$$

b). $i = ?$

$$1 + i = \left(1 - \frac{d^{(4)}}{4}\right)^{-4}$$

$$\therefore i = 8.416578\%$$

c) $d^{(12)} = ?$

$$\left(1 - \frac{d^{(12)}}{12}\right)^{12} = \left(1 - \frac{d^{(4)}}{4}\right)^4$$

$$1 - \frac{d^{(12)}}{12} = 0.9932883884$$

$$d^{(12)} = 8.0539339 2\%$$

Q2. $\delta(t) = 0.004t + 0.0002t^2$

i) $1000 = PV \cdot e^{-\int_0^{10} 0.004t + 0.0002t^2 \, dt}$

$= PV \cdot e^{-\left[0.002t^2 + \frac{0.0002}{3}t^3\right]_0^{10}}$

$= PV\, e^{-\left[0.2 + \frac{0.2}{3}\right]}$

$PV = \cancel{1305\ 605172}.765.928\ 3384$

ii) $\cancel{1305\ 605172 = 1000 \times (1+i)^{10}}$

$(1+i)^{(-10)} = 0.7659283384$

$\therefore i = 0.02702540389$

Q3. i) $1 - d = \frac{1}{1+i}$

$1 - \frac{1}{1+i} = d$

$\frac{1+i-1}{1+i} = d$

$\frac{i}{1+i} = d$

$i \times \frac{1}{1+i} = d$

$iv = d$

ii) $d^{(2)} = ?$

a) $\frac{d^{(4)}}{4} = 2.25\%$.

$$\left(1 - \frac{d^{(4)}}{4}\right)^4 = \left(1 - \frac{d^{(2)}}{2}\right)^2$$

$$0.95550625 = 1 - \frac{d^{(2)}}{2}$$

$$\therefore d^{(2)} = 0.0889875.$$

$$= 8.89875\%.$$

b) $d^{(1/2)} = 5\%$.

$$\left(1 - \frac{d^{(1/2)}}{1/2}\right)^{1/2} = \left(1 - \frac{d^{(2)}}{2}\right)^2$$

$$\therefore d^{(2)} = 5.199250715\%.$$

iii) $100(1+i)^{\frac{91}{365}} = FV$

$FV = 101.2238407$.

$$\frac{101.2238407}{100} = \frac{1}{(1-dt)}$$

$$0.9879095608 = \left(1 - \frac{d91}{365}\right).$$

$$d \times \frac{91}{365} = 0.1209043925$$

$$\therefore d = 4.849461895\%.$$

Q4. i) Question repeated.

ii) $i = 0.08$

a) $d^{(12)} = ?$

$$\left(1 - \frac{d^{(12)}}{12}\right)^{-12} = (1+i)$$

$$1 - \frac{d^{(12)}}{12} = 0.993607102.$$

$$d^{(12)} = 7.671477614\ \%$$

b) $$\left(1 + \frac{i^{(365)}}{365}\right)^{365} = (1+i).$$

$$i^{(365)} = 7.696915541\%$$

c. $$(1+i) = e^{\delta}$$

$$\delta = 7.696104114\ \%.$$

d) $i^{(1/2)} = ?$

$$\left(1 + \frac{i^{(1/2)}}{1/2}\right)^{1/2} = (1+i).$$

$$i^{(1/2)} = 8.32\ \%.$$

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Q5. i) $d^{(4)} = 6\%$

a) $i^{(2)} = ?$

$$\left(1 - \frac{d^{(4)}}{4}\right)^{-4} = \left(1 + \frac{i^{(2)}}{2}\right)^{2}$$

$$i^{(2)} = 6.137751552\%$$

b) $d^{(12)} = ?$

$$\left(1 - \frac{d^{(4)}}{4}\right)^{4} = \left(1 - \frac{d^{(12)}}{12}\right)^{12}$$

$$d^{(12)} = 6.030252528\%$$

$$2,20,000 = 2,00,000\,(1+i)$$

$$i = 10\%$$

$$2,00,000\,(1+i)^{\frac{93}{365}} = FV$$

$$FV = 2,04,916.3564$$

$\therefore$ The sum paid by Amit on 17 July, 2005 to terminate the contract is 2,04,916.3564.

6Q i) Let the product be of ₹100.

Cash payment at t_0 = 70.

Credit payment at $t_{0.5}$ = 75.

$$70 = 75(1-d)^{1/2}.$$

$$1 - \left(\frac{70}{75}\right)^2 = d.$$

$\therefore$ $d = 12.888889\%$.

ii) a) $$(1-d) = \left(1 - \frac{d^{(12)}}{12}\right)^{12}.$$

$\therefore$ $d^{(12)} = 13.7195439\%$.

b) $i^{(2)} = ?$

$$\left(1 + \frac{i^{(2)}}{2}\right)^2 = (1-d)^{-1}$$

$$i^{(2)} = 14.2857142\%.$$

c) $\delta = ?$

$$(1-d) = e^{-\delta}$$

$$\ln(1-d) = -\delta$$

$$-\ln(1-d) = \delta$$

$$\delta = 13.7955743\%.$$

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7\. Q. $20{,}000 \rightarrow 26{,}000$ in 17 months.

10\. $$\frac{26{,}000}{20{,}000} = (1+i)^{\frac{17}{12}}$$

$$i = 20.34570672\%$$

i) $i^{(4)} = ?$

$$\left(1 + \frac{i^{(4)}}{4}\right)^{4} = (1+i)$$

$$i^{(4)} = 18.95525456\%$$

ii) $d^{(2)} = ?$

$$\left(1 - \frac{d^{(2)}}{2}\right)^{-2} = (1+i)$$

$$d^{(2)} = 17.68823531\%$$

iii) ~~$(1+i)^{\frac{17}{12}}$~~ = Simple interest.

$$\frac{26{,}000}{20{,}000} = (1+ni)$$

$$1.3 = 1 + \frac{17}{12} i$$

$$i = 21.17647059\%$$

iv). The interest rate decreases as ~~p~~ increases in nominal rates of interest convertible p^{th} ly. Also simple interest is more than compound if the time period is more than 1 year.

8. $i = 8\%$.

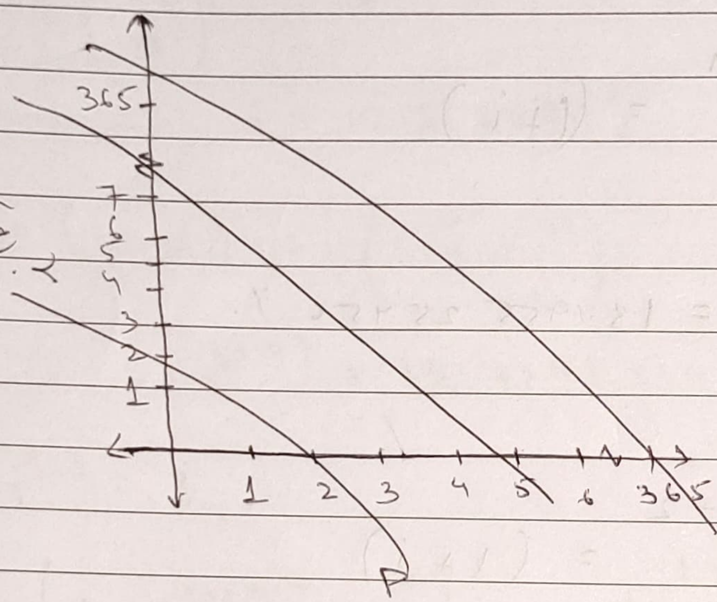
$i^{(2)} = 7.846096908$

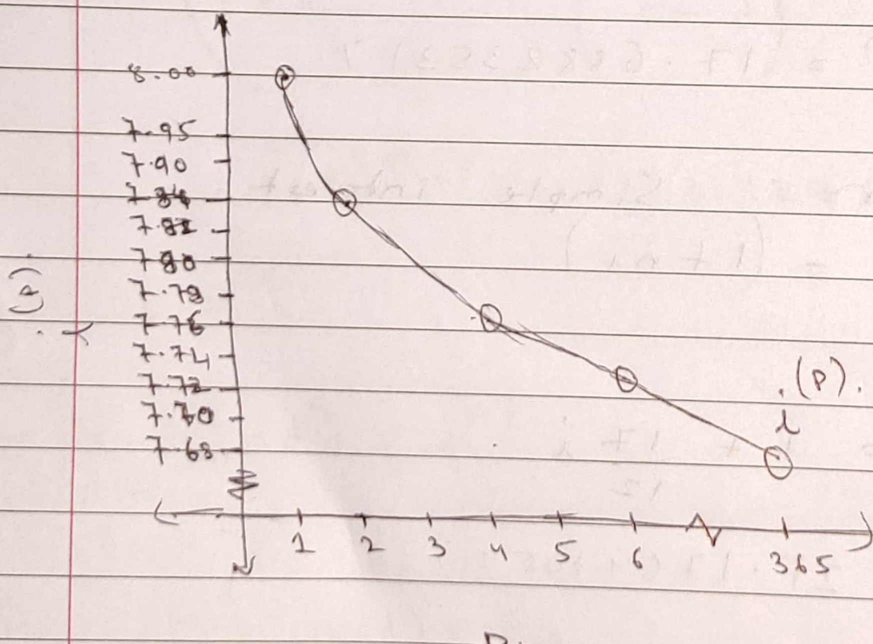
$i^{(4)} = 7.770618763$

$i^{(6)} = 7.745674178$

$i^{(12)} = 7.720836132$

$i^{(365)} = 7.696915541$.





The nominal rate of interest decreases as they are convertible pthy, where p is increasing.

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9. i) Force of interest refers to nominal rate of interest compounded infinite number of times or every moment per time period.

ii) $i^{(2)} = 0.0775$.

$i = ?$

$$(1+i) = \left(1 + \frac{i^{(2)}}{2}\right)^2$$

$$i = 0.079001 5625.$$

$\delta = ?$

$$\ln(1+i) = \delta$$

$$\delta = 0.0760361 3438.$$

$d^{(12)} = ?$

$$\left(1 - \frac{d^{(12)}}{12}\right)^{-12} = (1+i)$$

$$d^{(12)} = 0.0757957 468.$$

$i^{(1/2)} = ?$

$$\left(1 + \frac{i^{(1/2)}}{1/2}\right)^{1/2} = (1+i)$$

$$i^{(1/2)} = 0.0821221 8594.$$

Q11. $50{,}000(1-d)^n = PV.$

$50{,}000(1-0.18)^{9/12} = PV.$

$PV = 43085.42623$

$\therefore$ the amount initially lent to the borrower was 43085.42623.

b) i) $\delta = 6\%$. $d^{(12)} = ?$

$$\left(1-\frac{d^{(12)}}{12}\right)^{12} = e^{-\delta}$$

$d^{(12)} = 0.05985024969$

$= 5.985024969\%.$

ii) $d = 6\%$. $i^{(12)} = ?$ $i^{(4)} = ?$

$$(1-d)^{-1} = \left(1+\frac{i^{(12)}}{12}\right)^{12}$$

$i^{(12)} = 6.203520182\%.$

$i^{(4)} = 6.235645164\%.$

c. $\cancel{i < i^{(4)} < \delta < d}$.

$i > i^{(4)} > \delta > d.$

Q12 $FV = 7049 (A_{0,2})(A_{2,4.5})(A_{4.5,6})$

$= 7049 \left(1 + \frac{0.06}{12}\right)^{12\times 2} \left(1 + 2.5 \times 0.06\right) \times$

$\left(1 - \frac{0.06}{12}\right)^{12\times 1.5}$

$FV = 8348.842852.$

$\therefore$ The accumulated amount after 6 years is 8348.842852.

13Q. $2 = (1+i)^{n}$

$\ln(2) = n \ln(1+i)$

$\ln(2) = n \ln(1.1)$

$\frac{\ln(2)}{\ln(1.1)} = n.$

$n = 7.2725.$

$\therefore$ It would take around 7.27 years to double an investment at 10% rate of interest.