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

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

$$= 1 - (1 - 2\%)^4$$

$$d = 7.763184\%$$

(i) $$\delta = -\ln(1-d)$$
$$= 8.081083\%$$

(ii) $$i = \frac{d}{1-d}$$
$$= 8.416578\%$$

(iii) $$d^{(12)} = 12\left[1 - (1-d)^{1/12}\right]$$
$$= 8.053934\%$$

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

(i) Amount due $= C =$ ₹ 1000

$$PV_0 = C \times v(t)$$
$$= 1000 \times e^{-\int_0^{10} 0.004t + 0.0002t^2}$$
$$= 1000 \times e^{-\left[0.002t^2 + 0.0002\frac{t^3}{3}\right]_0^{10}}$$
$$= 1000 \times e^{-0.266666667}$$
$$= 765.93$$

(ii) $$(1+i)^{10} = e^{0.266666667}$$
$$i = 2.7025403\%$$

Q3) i) The relationship $d = iv$, has an intersting vorbal interpreation. Inlist coened on an investment, paid at the beginning of the period is d, interest earned on an investment, paid at the end of period is i, Therefore if we discount i from the end of the period with the discounting factor v, we obtained d.

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

$d = 1 - (1 - 2.25\%)^4$

$d = 8.7007806\%$

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

$d^{(2)} = 8.89875\%$

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

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

$d = 1 - (1 - 10\%)^{1/2}$

$d = 5.1316702\%$

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

$d^{(2)} = 5.1992507\%$

iii) $v\left(0; \frac{91}{365}\right) = \frac{1}{(1+i)^{91/365}} = \left(1 - \frac{91}{365}d\right)$

$\frac{1}{(1.05)^{91/365}} = \left(1 - \frac{91}{365}d\right)$

$d = \frac{365}{91}\left(1 - \frac{1}{(1.05)^{91/365}}\right)$

$d = 4.849462\%$

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Q4) (i) The relationship $d = iv$, has an intersting Verbal interpretation. Interest erned on an investment, paid at the beginning of the period is d.
Interest erned on an investment, paid at the end of the period is i draining factor, we obtaind d.

ii) $i = 0.08$

(a) $d = \frac{i}{1+i} = 7.4074074071$

$d^{(12)} = 12\left[1-(1-d)^{1/12}\right]$

$d^{(12)} = 7.671478\%$

(b) $i^{(365)} = 365\left((1+i)^{1/365}-1\right)$

$= 7.696915\%$

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

$= 7.696104\%$

d) $i^{(0.5)} = \frac{1}{2}\left((1+i)^{1/1/2}-1\right)$

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

$= 8.32\%$

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

$d = 1-(1-1.5\%)$

$d = 5.866344937\%$

(a) $i = \frac{d}{1-d} = 6.231931538\%$

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$i^{(2)} = 2\left((1+i)^{1/2}-1\right)$
$i^{(2)} = 6.137752\%$

(b) $d^{(12)} = 12\left[1-(1-d)^{1/12}\right]$
$d^{(12)} = 6.030253\%$

(ii) $i = \frac{20,000}{2,00,000} \times 100 = 10\%$

No of days = 93 (excluding end date)

$AV_{93\ days} = 2,00,000 \times (1.1)^{93/365}$

$= 2,04,916.3564$

Q6 let the retail price box
If retailer pays cash = 70% (x)
then he has to pay
$P.V = 0.7x$
If retailer was the 6 month oudit
$= 75\% (x)$
~~mad~~ mode, the he has to pay
$AV = 0.75x$ in 6 months time
we need to find the retailer who pay in cash { i.e. cash is preffered rather than oudit mode }

Time 6 month $= \frac{1}{2}$ year.

$PV_0 = AV(1-d)^n$

$0.7x = 0.75x(1-d)^{1/2}$

$d = 1 - \left(\frac{0.7}{0.75}\right)^2$

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$d = 12.888889\%$

ii) a) $d^{(12)} = 12\left[1-(1-d)^{1/12}\right]$

$d^{(12)} = 13.719544\%$

(b) $i = \dfrac{d}{1-d} = 14.79591837\%$

$i^{(2)} = 2\left[(1+i)^{1/2} - 1\right]$

$i^{(2)} = 14.285714\%$

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

$\delta = 13.798574\%$

Q7) $Amt = C = 20{,}000$

$AV_{17month} = 26{,}000$

$17\ month = 1 + \dfrac{5}{12}\ years$

$= 1.416666667\ years.$

$AV = C(1+i)^n$

$\cancel{26000}\ 13 = \cancel{20000}\ 10\ (1+i)^{1.416666667}$

$i = 20.34570672\%$

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

$i^{(4)} = 18.955255\%$

ii) $d = \dfrac{i}{1+i} = 16.90605114\%$

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

$d^{(2)} = 17.688235\%$

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iii) $26000 = 20000\,(1 + 1.416666667\, i_s)$

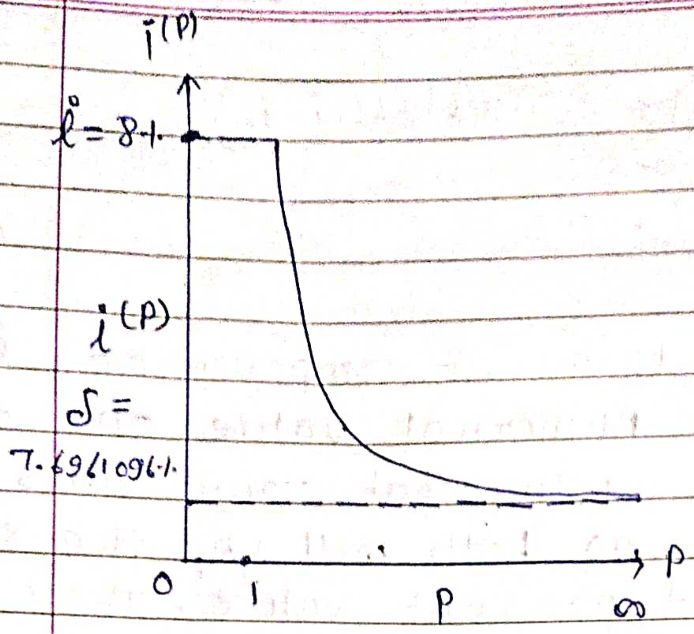
$i_s = 21.1764706\,\%$

iv) Numarically, in forms of compounding, i is the highest numerical value and d in the lowest numerical value This is Just numerically, as both will yeild the same accomulation and present value. The simple interest on interest is grater there because, since there is no interest on interest accumulation in simple interest it has to comperate for the compounding effect and hence it has to be greater than i

Q8) $i = 8\,\%$

$i^{(p)} = p\left[(1.08)^{1/p} - 1\right]$

p	$i^{(p)}$
1	8 %
2	7.84609 %
3	7.79567 %
4	7.77062 %
12	7.72084 %
100	7.69907 %
365	7.69691 %
∞	7.696104 %



- More frequently the compounding takes place ~~is the higest numerical value and d in the lowest~~ the smallest is the equivalent nominal annual rate $i^{(P)} \propto \frac{1}{P}$

- when continuous compounding takes place i.e. when P approches infinity then $i^{(P)}$ has a limiting value known as the force of interest or δ.

Q9) i) Force of interest : The measure of interest at individual moment of time or at any instant of time is known as force of interest.

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

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

$i = 7.900156\ \%$

b) $d = \frac{i}{1+i} = 7.3217282760\ \%$

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

$= 7.321728276\ \%$

$d^{(12)} = 12\left[1-(1-d)^{1/12}\right]$

$d^{(12)} = 7.579575\ \%$

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

$= 8.212219\ \%$

Q10 $\delta(t) = \begin{cases} 0.08 & 0 \le t \le 5 \\ 0.06 & 5 \le t \le 10 \\ 0.04 & t \ge 10 \end{cases}$

when $0 \le t \le 5$

$v(t) = e^{-\int_0^t 0.08}$

$e^{-0.08t}$

when $5 \le t \le 10$

$v(t) = e^{-\int_0^5 0.08 - \int_5^t 0.06}$

$= e^{[0.08t]_5^0 + [0.06t]_t^5}$

$= e^{-0.4+0.3-0.06t}$

$= e^{-0.06t-0.1}$

when $t \ge 10$

$v(t) = e^{-\int_0^5 0.08 - \int_5^{10} 0.06 - \int_{10}^t 0.04}$

$= e^{[0.08t]_5^0 + [0.06t]_{10}^5 + [0.04t]_t^{10}}$

$= e^{-\cancel{0.4}+0.3-0.6+\cancel{0.4}-0.04t}$

$= e^{-0.04t-0.3}$

$=$

Q11) (a) $t = \frac{\cancel{9}\,3}{\cancel{12}\,4} = \frac{3}{4}$ years

Amt Due $= C = 50,000$

$d = 18\%$

$PV_0 = (1-d)^t$

$PV_0 = 43,085.42623$

$= 43085.43$

(b) i) $\delta = 6\%$

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

$= 5.823546624\%$

$d^{(12)} = 12\left[1 - (1-d)^{1/12}\right]$

$d^{(12)} = 5.985025\%$

ii) $d^{(4)} = 6\%$

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

$d = 5.866349937\%$

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

$i = 6.231931537\%$

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

$i^{(4)} = 6.0913705\%$

$i^{(12)} = 12\left[(1+i)^{1/12} - 1\right]$

$i^{(12)} = 6.060709\%$

(c) Ascending order $d < \delta < i^{(4)}$
d will always be the smallest numerical value as it change d in the beginning of the term. so due to time value of money $d < \delta$ and $d < i^{(4)}$ δ rates to continuous compounding i.e. more compounding than $i^{(4)}$ if $\delta = i^{(4)}$. Thus δ has to be smaller than $i^{(4)}$ to yield the same accumulated value
Thus, $\delta < i^{(4)}$ and hence $d < \delta < i^{(4)}$

(d) the relationship $d = iv$ has an inlisting vobal interpretation interest earned on an inverstment, paid at the beginning of the period is d, Interest earned on an investment, Paid at the end of the period is i, Therefore if we discounted i from the end of the period with the the discounting factor v, we obtain d

Q12) Amt invested = C = 7049
$AV_6 = C \cdot A(0,6)$
$= 7046 \cdot A(0,2) \times A(2,4.5) \times A(4.5,6)$

→ for $A(0,2)$
$i^{(12)} = 6\%$
$i^{(12)}/12 = 0.5\%$
$A(0,2) = (1.005)^{24}$

→ For $A(2,4.5)$
$A(2,4.5) = 1.5\%$

$A(2, 4.5) = (1 + 10(0.015)) = (1.15)$

→ for $A(4.5, 6)$

$d^{(12)} = 6\%$

$d^{(12)}/12 = 0.5\%$

$$A(4.5, 6) = \frac{1}{(1-0.005)^{18}}$$

$AV_6 = 7049 \times A(0,2) \times A(2,4.5) \times A(4.5,6)$

$= 7049(1.005)^{24} \times (1.15) \times \frac{1}{(1-0.005)^{18}}$

$AV_6 = 9999.894$

Q13) let amt invested $= C = x$

$AV_n = 2x$

Time $= n$ years.

i) $AV_n = C(1+i)^n$

$i = 10\%$

$2x = x(1.1)^n$

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

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

$n = 7.27$ years.

ii) $AV_n = \dfrac{C}{(1-d)^n}$

$d^{(12)} = 10\%$

$d^{(12)}/12 = 0.833333333\%$

$$AV_n = \frac{C}{\left(1 - \frac{d^{(12)}}{12}\right)^{12n}}$$

$$2x = \frac{\cancel{x}}{\left(1 - \frac{d^{(12)}}{12}\right)^{12n}}$$

$$\left(1 - \frac{d^{(12)}}{12}\right)^{12n} = \frac{1}{2}$$

$$12n \ln\left(1 - \frac{d^{(12)}}{12}\right) = \ln\left(\frac{1}{2}\right)$$

$n = 6.902$ years.