① $d^4 = 8\%$

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

$$= 1-\left(1-\frac{0.08}{4}\right)^4$$

$d = 0.07763184$

$i = \frac{d}{1-d} = 0.08416578 = 8.4165784\%$

i) $\delta = \log(1+0.08416578)$
$\delta = 0.080810828$
$= 8.0810828\%$
$\cancel{\delta = 1.0841657 83}$

ii) $i = 0.08416578 = 8.4165784\%$

iii) $d^{(12)} = p\left[1-(1-d)^{1/p}\right]$
$= 12\left[1-(1-0.07763184)^{1/12}\right]$
$= 0.080539339$
$= 8.0539339\%$

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

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

$= 1000 \cdot e^{-\left[0.004t^2/2 + 0.0002t^3/3\right]_0^{10}}$

$= 1000 \cdot e^{-\left[0.004(10)^2/2 + 0.0002(10)^3/3 - 0\right]}$

$= 1000 \cdot e^{-[0.2 + 0.06666]}$

$= 1000 \cdot e^{-[0.26666]}$

$= 765.9334446$

ii) $PV = 1000 \; v(0,10)$

$765.933446 = 1000 \cdot v(0,10)$

$v(0,10) = \dfrac{765.9334446}{1000}$

$v(0,10) = 0.765933444$

$\dfrac{1}{(1+i)^{10}} = 0.765933444$

$1.305596469 = (1+i)^{10}$

$i = 0.027024719$

③ i) Discounting i from the discounting factor v, we obtain d

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

ii) $d^{2} = ?$

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

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

$= 1 - \left(1 - 0.0225\right)^{4}$

$d = 0.087007806$

$d^{2} = 2(1-(1-0.087007806)^{1/2}))$

$d^{2} = 0.088987499$

b) $d = 1 - \left(1 - \frac{d^{1/2}}{1/2}\right)^{1/2} = 1 - \left(1 - \frac{0.05}{1/2}\right)^{2} = 5.13167\%$

$d^{2} = P[1-(1-0.051316701)^{1/P}] = 2(1-(1- \text{"})^{1/2})$

$= 5.1992506\%$

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

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

$= 0.04849619$

$= 4.849619\%$

4) ii) $i = 0.08$

a) $d^{12} =$

$\cancel{i = \frac{d}{1-d}} = \quad d = \frac{i}{1+i} = 0.074074074$

$d^{12} = 12\left[1 - (1 - 0.074074074)^{1/12}\right]$

$= 7.6714776\%$

b) $i^{365} = \left(365(1+0.08)^{1/365} - 1\right)$

$= 0.076969155$ or 7.6969155%

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

$= \log(1+0.08)$

$= 0.076961041 = 7.6961041\%$

d) $i^{(0.5)} = 0.5\left[(1+0.08)^{1/0.5} - 1\right]$
$= 8.32\%$

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

a) $i^{2} =$

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

$d = 1 - \left(1 - \frac{0.06}{4}\right)^4$

$d = 5.8663449\%$

$i = \frac{d}{1-d} = \frac{0.058663449}{1-0.058663449} = 6.2319336\%$

$i^{2} = 2\left((1+0.062319336)^{1/2} - 1\right)$
$= 6.1377535\%$

b) $d^{12} = 12\left[1 - (1-0.058663449)^{1/12}\right]$
$= 0.060302524$
$= 6.0302524\%$

ii) 200000 $AV(0,1) = 220,000$
$AV(0,1) = 220000 / 200000$
$AV(0,1) = 1.1$
$(1+i)^n = 1.1$
$i = 0.1$

a) $200,000 \times (1+0.1)^{93/365}$ $= ₹\ 204916.3564$

7) $20000 \cdot A(0,17) = 26000$

$A(0,17) = 1.3$

$(1+i)^{17/12} = 1.3$

$(1+i) = 1.3^{(12/17)}$

$i = 20.3457067\%$

i) $i^4 = 4\left((1+0.0203457067)^{1/4} - 1\right)$

$= 18.9552545\%$

ii) $d^2 =$

$d = \frac{i}{1+i} = 0.169060511$

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

$= 2\left(1 - (1 - 0.16906051)^{1/2}\right)$

$= 0.176882351$

iii) $i = 20.3457067\%$.

iv) $i > i^4 > d^2 > d$

9) i) Force of interest is interest earned during a very short time period. It is not possible in real life.

ii) $i^{2} = 0.0775$

$$i = \left(1 + \frac{0.0775}{2}\right)^2 - 1$$

$$i = (1.03875)^2 - 1$$

$i = 0.079001562 = 7.9001562\%$

$\delta = \log(1 + i) = 0.076036133$

$= 7.6036133\%$

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$d^{12} =$

$d = \frac{i}{1+i} = 0.073217282$

$d^{12} = 12\left(1-(1-0.073217282)^{1/12}\right)$

$= 0.075795745$

$= 7.5795745\,\%$

$i^{1/2} = \frac{1}{2}\left(\left(1+0.079001562\right)^{2}-1\right)$

$= 0.082122185$

$= 8.2122185$

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11) a) $PV.(1+0.18)^{3/4} = 50000$

$\frac{50000}{(1.18)^{3/4}} = PV = \frac{50000}{1.132169642}$

$= 44162.99302$ //

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

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

$d = 0.058235466$

$d^{12} = 12\left(1-(1-0.058235466)^{1/12}\right)$

$= 5.98502491\%$

ii) $d^4 = 6\%$

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

$= 1-\left(1-\frac{0.06}{4}\right)^4$

$d = 0.058663449$; $i = \frac{d}{1-d} = 0.062319314$

$i^{12} = 12\left((1+0.062319314)^{1/12}-1\right)$

$= 0.06060691$

$= 6.060691\%$

$i^4 = 4\left((1+0.062319314)^{1/4}-1\right)$

$= 0.060913704$

$= 6.0913704\%$

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

12)

$i^{(12)} = 6\%$ $\quad i^{(4)}/4 = 1.5\%$ $\quad d^{(12)} = 6\%$

0 $\qquad$ 2 $\qquad$ 4.5

$i^{(12)} = 6\%$ $\qquad i = \left(1 + \frac{0.06}{12}\right)^{12} - 1$

$= 0.061677811$

$= 7049(1 + 0.061677811)^2$

$= 7945.34925$

$\frac{i^{(4)}}{4} = 1.5$ $\qquad i = \left(1 + 0.015\right)^4 - 1$

$i = 0.0613635$

$= 6.13635\%$ $\qquad = 7945.34925\,(1 + 2.5 \times 0.061363$

$= 9164.235347$

$d^{(12)} = 6\%$ $\qquad d = 1 - \left(1 - \frac{d^{(12)}}{12}\right)^{12}$

$= 1 - \left(1 - \frac{0.06}{12}\right)^{12} = 1 - (0.941622806)$

$= 0.058377194$

$\frac{9164.235347}{(1 - 0.058377194)^{1.5}}$

$= \frac{9164.235347}{0.913724884}$

$= 10029.53461$

13)

i) $x \cdot (1+0.10)^n = 2x$

$(1.10)^n = 2$

$\log(1.10)^n = \log 2$

$n \log(1.1) = 0.69314718$

$n \times 0.095310179 = 0.69314718$

$n = 0.69314718 / 0.095310179 = 7.2754$

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

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

$= 1 - \left(1 - \frac{0.10}{12}\right)^{12}$

$= 0.095541699$

$x \cdot 1/(1-0.095541699)^n = 2x$

$\cancel{n \log 0.904458301 = 0.69314718}$

$\frac{x}{(1-0.095541699)^n} = 2$

$1 \times (1-0.095541699)^{-n} = 2$

$-n \log 0.904458301 = \log 2$

$-n = -\frac{0.69314718}{0.100419076}$

$n = 6.9025\ 94891$