


IIT Madras
ONLINE DEGREE

Mathematics for Data Science 1
Professor. Neelesh S Upadhye
Department of Mathematics
Indian Institute of Technology, Madras
Week 08 - Tutorial 08

(Refer Slide Time: 0:14)


IIT Madras
ONLINE DEGREE

8. Ramya wants to have a sum of amount in her bank account for launching her own startup company. She currently has 12 lakh in her account and the bank provides interest at the rate of $x\%$ per annum. Assuming that the bank calculate the amount quarterly,

- find the total amount in terms of x (denoted by the function $f(x)$), in her account after n years.
- find a function $g(y)$ to calculate the required rate based on the amount Ramya required for launching her startup company after n years.

interest $\rightarrow x\%$

A

$P = A(1 + \text{quarterly rate})^{4n}$

$P = 12 \text{ lakh} (1 + \frac{x}{4 \times 100})^{4n}$

$f(x) = 12,00,000 (1 + \frac{x}{400})^{4n}$

12,00,000

For our eighth question Ramya wants to have a sum of amount in her bank account for launching her own startup company. She currently has 12 lakhs in her account, so currently she has 12 lakhs in an account and then bank provides interest at the rate of $x\%$ per annum, assuming that the bank calculate the amount quarterly, quarterly means after 3 months, find the total amount in terms of x denoted by the function $f(x)$ in her account after n years.

So, if she has amount A in her account at this time and she gets interest at rate of $x\%$, assuming that the bank calculate the quarterly, so find the amount in the terms of x . So, total amount P in her account after time A is represented as the amount $A(1 + \text{quarterly rate})$, rate is what, quarterly rate because we are getting spread by quarterly rate, quarterly then this will be this and how much years, n years. So, we know that the one year has 4 quarters, so n year will be having $4n$ quarters, quarterly year.

So, A is 12 lakh I will say lakh, then $1 +$ what will be the quarterly? So, x is annum so I will divide 4 and then 100, $4 \times n$, so this is the amount in Ramya account after n year if we calculate the

interest quarterly. Find this, so this is actually x , so it is represented by $f(x)$, so $f(x)$ 12 lakh means, so this will be the 12 lakh and $\left(1 + \frac{x}{400}\right)^{4n}$, this is the $f(x)$.

(Refer Slide Time: 2:41)

$$f(x) = 120000 \left(1 + \frac{x}{400}\right)^{4n}$$

$$x = 120000 \left(1 + \frac{y}{400}\right)^{\frac{1}{4n}}$$

$$\frac{x}{120000} = \left(1 + \frac{y}{400}\right)^{\frac{1}{4n}}$$

$$\frac{x}{120000} = \left(\frac{400 + y}{400}\right)^{\frac{1}{4n}}$$

$$\left(\frac{x}{120000}\right)^{4n} = \frac{400 + y}{400}$$

$$y = 400 \left\{ \left(\frac{x}{120000}\right)^{\frac{1}{4n}} - 1 \right\}$$

What is the second question? Find a function $g(y)$ to calculate the required rate based on the amount runway required for launching or startup after n years. So, this is a little thinking based question, what the question wants to say, find the function $g(y)$ to calculate the required rate, earlier we were given rate here and we were about to find the total sum, now the sum is given we need to find the rate, what we need to find the rate means, we need to find x and you know that when we need to find x we actually talk about the inverse function.

And how to calculate the inverse function you know, we just put $f(x)$, x and then 120000 1 plus we will replace x by some random variable y and then y so x divided by 1 you know this $4n$ will come here and this will be $\frac{4000+y}{400}$. So, y will be actually $400 \left[\left(\frac{x}{120000}\right)^{\frac{1}{4n}} - 1 \right]$.

(Refer Slide Time: 4:12)

$$\begin{aligned}\frac{x}{120000} &= \left(\frac{400+y}{400} \right)^{4n} \\ \left(\frac{x}{120000} \right)^{\frac{1}{4n}} &= \frac{400+y}{400} \\ y &= 400 \left\{ \left(\frac{x}{120000} \right)^{\frac{1}{4n}} - 1 \right\} \\ f(x) &= 400 \left\{ \left(\frac{x}{120000} \right)^{\frac{1}{4n}} - 1 \right\} = g(x) \\ \underline{g(y)} &= 400 \left\{ \left(\frac{y}{120000} \right)^{\frac{1}{4n}} - 1 \right\} \quad \underline{\text{Ans.}}\end{aligned}$$

So, this is the inverse function of x and I can write it as f inverse and it is given as 400 you can take common $\frac{x}{12}$ like 1 by $4n - 1$ and the question is about to ask in $g(y)$. So, x represents we will just replace y with x so $\frac{400y}{12} (4n - 1)$. So, do not get confused with this y and this one, both are different because here y is random variable and here we just gave that it could be $g(x)$ also, so we replace $g(x)$ with $g(y)$ here, so x is replaced by y . So, this is our the answer for the second question, thank you.