# kchxknixi

February 21, 2025

**Google Colab Link : https://colab.research.google.com/github/SmayanKulkarni/AI-and-ML-Course/blob/master/D100%20CMPM/exp-2.ipynb**

[2]:
```
def calc_mor_emi(p,r,n):
    mor_emi= (amt * r * (1+r)**n) / ((1+r)**n - 1)
    return mor_emi
```

[3]:
```
def calc_interest(bal, r):
    interest = bal * r
    return interest
```

[4]:
```
def calc_principal(emi, interest):
    princ = emi - interest
    return princ
```

[5]:
```
def calc_update_bal(bal,p,ep):
    newbal = bal - (p + ep)
    return newbal
```

## 1 Part 1

[6]:
```
amt = 5000000
r = 0.08 / 12
n = 240
emi = calc_mor_emi(amt, r,n)
print("The EMI for the details is: ", emi)
```

```
The EMI for the details is:  41822.00344967332
```

## 2 Part 2

[7]:
```
ep = 5000
bal = 5000000
intrest_breakdown = []
principal_breakdown = []
bal_breakdown = []
for i in range(n):
```

```
    temp_int = calc_interest(bal,r)
    temp_princ= calc_principal(emi, temp_int)
    bal = calc_update_bal(bal, temp_princ,ep)
    intrest_breakdown.append(temp_int)
    principal_breakdown.append(amt)
    if(bal<0):
        bal_breakdown.append(0)
        break
    bal_breakdown.append(bal)
    amt = amt - temp_princ
```

[8]:
```
bal_breakdown[:10]
```

[8]:
```
[4986511.32988366,
 4972932.735299878,
 4959263.616752204,
 4945503.370747545,
 4931651.389769522,
 4917707.062251645,
 4903669.7725503165,
 4889538.900917646,
 4875313.82347409,
 4860993.91218091]
```

[9]:
```
len(bal_breakdown)
```

[9]:
```
188
```

[10]:
```
import pandas as pd
import numpy as np
```

[11]:
```
df = pd.DataFrame()
```

[12]:
```
df['Balances'] = np.array(bal_breakdown)
```

[13]:
```
df['Intrest'] = np.array(intrest_breakdown)
```

[14]:
```
df['Princial'] = np.array(principal_breakdown)
```

[15]:
```
df.head(10)
```

[15]:

| | Balances | Intrest | Princial |
|---|---|---|---|
| 0 | 4.986511e+06 | 33333.333333 | 5.000000e+06 |
| 1 | 4.972933e+06 | 33243.408866 | 4.991511e+06 |
| 2 | 4.959264e+06 | 33152.884902 | 4.982933e+06 |
| 3 | 4.945503e+06 | 33061.757445 | 4.974264e+06 |
| 4 | 4.931651e+06 | 32970.022472 | 4.965503e+06 |

```
5  4.917707e+06  32877.675932  4.956651e+06
6  4.903670e+06  32784.713748  4.947707e+06
7  4.889539e+06  32691.131817  4.938670e+06
8  4.875314e+06  32596.926006  4.929539e+06
9  4.860994e+06  32502.092156  4.920314e+06
```

[16]:
```
df.tail(10)
```

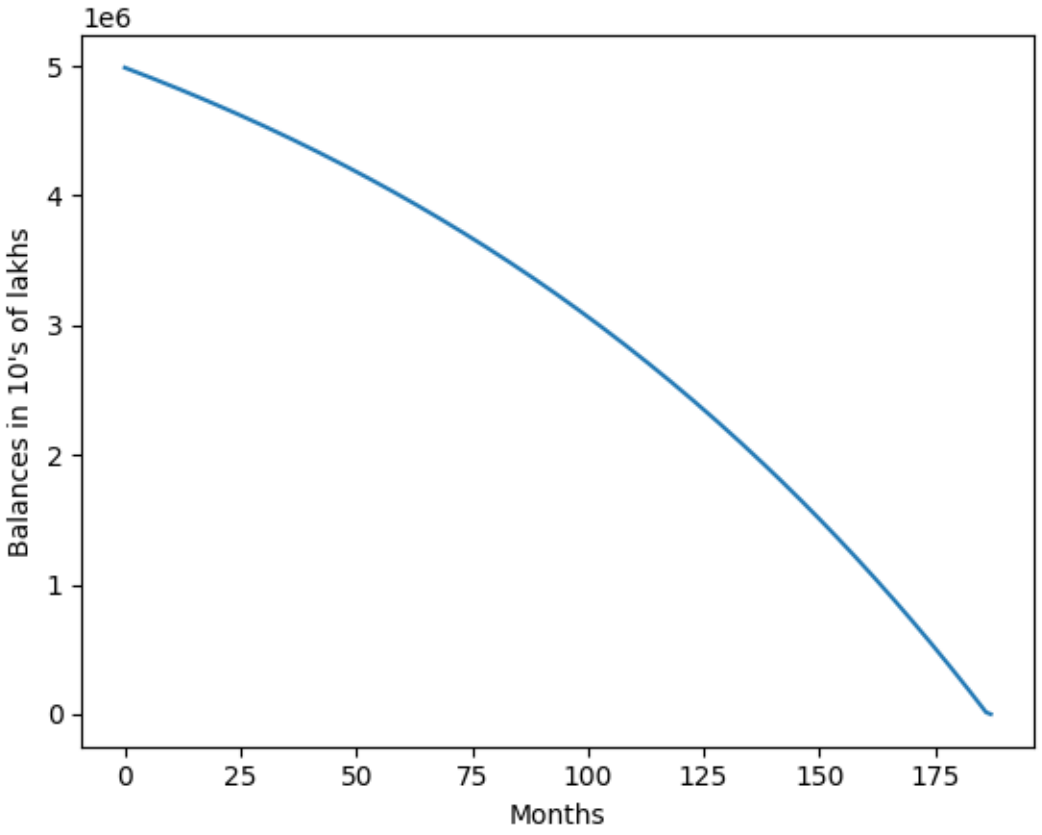
[16]:

| | Balances | Intrest | Princial |
|---|---|---|---|
| 178 | 376715.150153 | 2804.881812 | 1.310732e+06 |
| 179 | 332404.581037 | 2511.434334 | 1.271715e+06 |
| 180 | 287798.608128 | 2216.030540 | 1.232405e+06 |
| 181 | 242895.262066 | 1918.657388 | 1.192799e+06 |
| 182 | 197692.560363 | 1619.301747 | 1.152895e+06 |
| 183 | 152188.507316 | 1317.950402 | 1.112693e+06 |
| 184 | 106381.093915 | 1014.590049 | 1.072189e+06 |
| 185 | 60268.297758 | 709.207293 | 1.031381e+06 |
| 186 | 13848.082960 | 401.788652 | 9.902683e+05 |
| 187 | 0.000000 | 92.320553 | 9.488481e+05 |

[17]:
```
import seaborn as sns
import matplotlib.pyplot as plt
```

[18]:
```
sns.lineplot(df['Balances'])
plt.xlabel("Months")
plt.ylabel("Balances in 10's of lakhs")
```

[18]:
```
Text(0, 0.5, "Balances in 10's of lakhs")
```




[19]:
```
amt = 5000000
r = 0.08 / 12
n = 240
emi = calc_mor_emi(amt, r,n)
ep = 0
bal = 5000000
intrest_breakdown2 = []
principal_breakdown2 = []
bal_breakdown2 = []
for i in range(n):
    temp_int = calc_interest(bal,r)
    temp_princ= calc_principal(emi, temp_int)
    bal = calc_update_bal(bal, temp_princ,ep)
    intrest_breakdown2.append(temp_int)
    principal_breakdown2.append(amt)
    if(bal<0):
        bal_breakdown2.append(0)
        break
    bal_breakdown2.append(bal)
    amt = amt - temp_princ
```

[20]:
```
df2 = pd.DataFrame()
df2['Balances'] = np.array(bal_breakdown2)
df2['Intrest'] = np.array(intrest_breakdown2)
df2['Princial'] = np.array(principal_breakdown2)
```

[21]:
```
df2.head(10)
```

[21]:

| | Balances | Intrest | Princial |
|---|---|---|---|
| 0 | 4.991511e+06 | 33333.333333 | 5.000000e+06 |
| 1 | 4.982966e+06 | 33276.742199 | 4.991511e+06 |
| 2 | 4.974364e+06 | 33219.773791 | 4.982966e+06 |
| 3 | 4.965704e+06 | 33162.425593 | 4.974364e+06 |
| 4 | 4.956987e+06 | 33104.695074 | 4.965704e+06 |
| 5 | 4.948212e+06 | 33046.579685 | 4.956987e+06 |
| 6 | 4.939378e+06 | 32988.076860 | 4.948212e+06 |
| 7 | 4.930485e+06 | 32929.184016 | 4.939378e+06 |
| 8 | 4.921533e+06 | 32869.898553 | 4.930485e+06 |
| 9 | 4.912521e+06 | 32810.217854 | 4.921533e+06 |

[22]:
```
df2.tail(10)
```

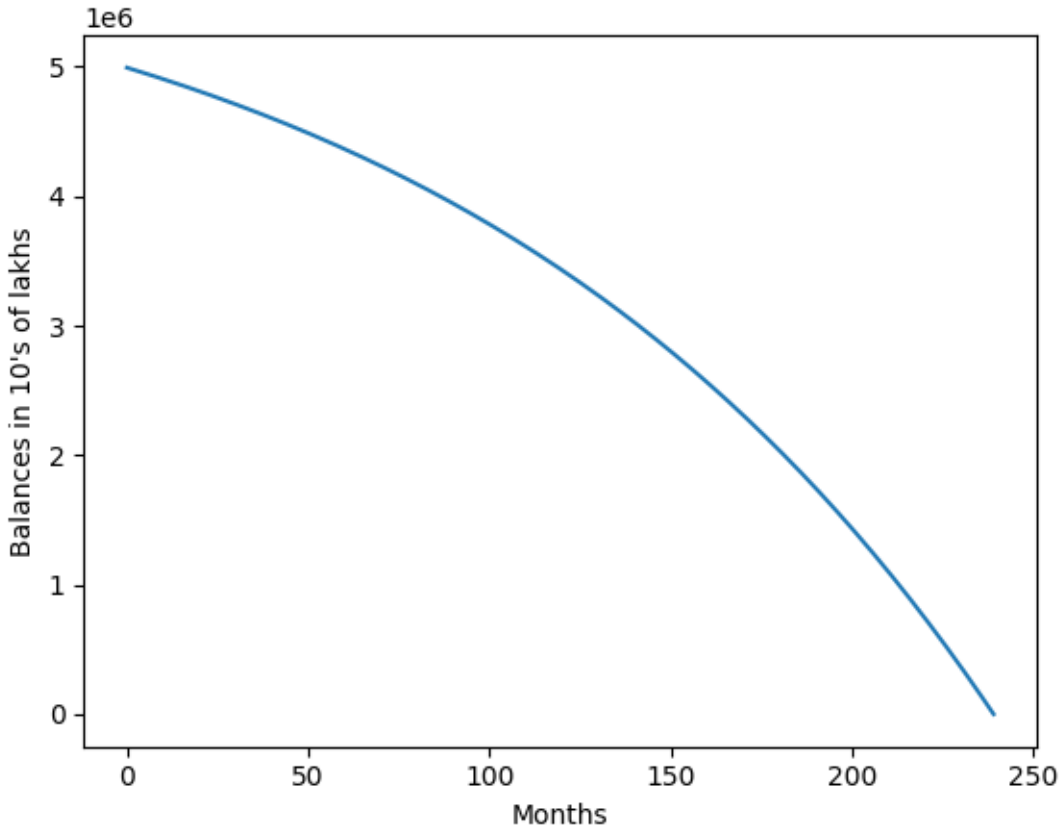
[22]:

| | Balances | Intrest | Princial |
|---|---|---|---|
| 230 | 364152.095500 | 2688.570192 | 403285.528758 |
| 231 | 324757.772687 | 2427.680637 | 364152.095500 |
| 232 | 285100.821056 | 2165.051818 | 324757.772687 |
| 233 | 245179.489746 | 1900.672140 | 285100.821056 |
| 234 | 204992.016228 | 1634.529932 | 245179.489746 |
| 235 | 164536.626220 | 1366.613442 | 204992.016228 |
| 236 | 123811.533612 | 1096.910841 | 164536.626220 |
| 237 | 82814.940386 | 825.410224 | 123811.533612 |
| 238 | 41545.036539 | 552.099603 | 82814.940386 |
| 239 | 0.000000 | 276.966910 | 41545.036539 |

## 3 Part 3

[23]:
```
sns.lineplot(df2['Balances'])
plt.xlabel("Months")
plt.ylabel("Balances in 10's of lakhs")
```

[23]:
```
Text(0, 0.5, "Balances in 10's of lakhs")
```




**It is seen here that with extra payment the balance is cleared out in 188 months but without th extra paymnets it takes 238 months to clear out the balance.**

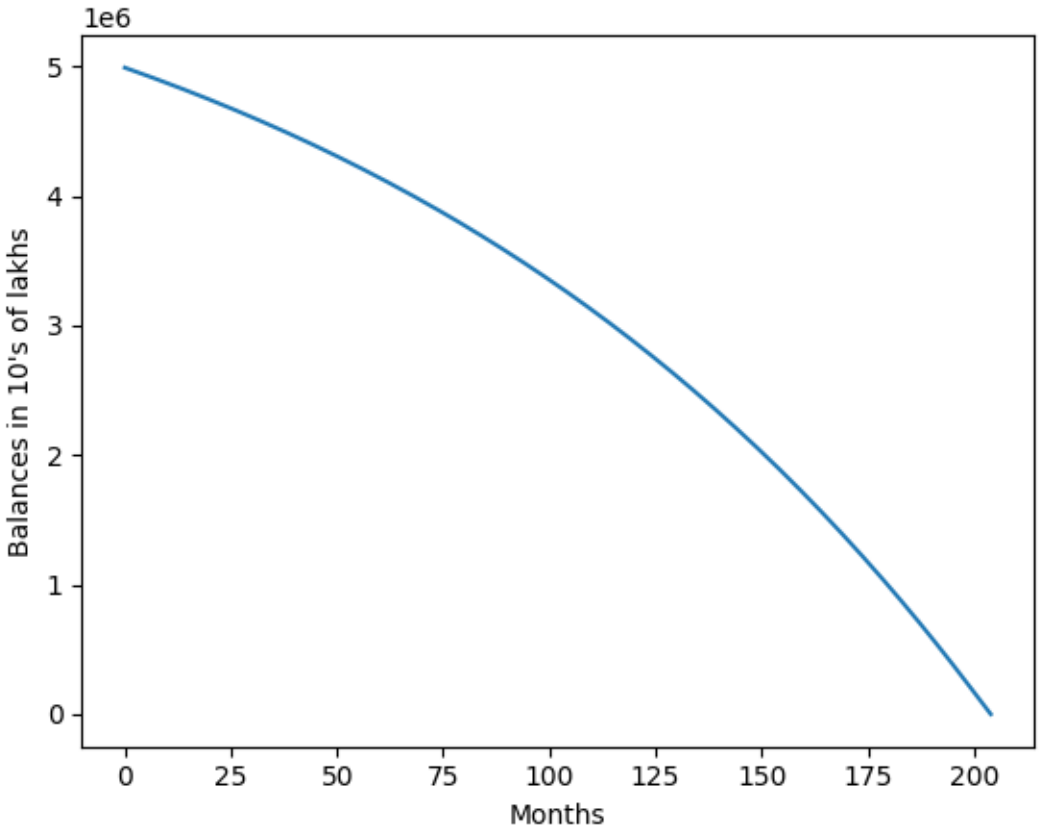
## 4 Part 4

[24]:
```
amt = 5000000
r = 0.08 / 12
n = 240
emi = calc_mor_emi(amt, r,n)
ep = 3000
bal = 5000000
intrest_breakdown2 = []
principal_breakdown2 = []
bal_breakdown2 = []
for i in range(n):
    temp_int = calc_interest(bal,r)
    temp_princ= calc_principal(emi, temp_int)
    bal = calc_update_bal(bal, temp_princ,ep)
    intrest_breakdown2.append(temp_int)
```

```
    principal_breakdown2.append(amt)
    if(bal<0):
        bal_breakdown2.append(0)
        break
    bal_breakdown2.append(bal)
    amt = amt - temp_princ
df2 = pd.DataFrame()
df2['Balances'] = np.array(bal_breakdown2)
df2['Intrest'] = np.array(intrest_breakdown2)
df2['Princial'] = np.array(principal_breakdown2)
print(df2.head(10))
print(df2.tail(10))
# Part 3
sns.lineplot(df2['Balances'])
plt.xlabel("Months")
plt.ylabel("Balances in 10's of lakhs")
```

```
       Balances       Intrest      Princial
0  4.988511e+06  33333.333333  5.000000e+06
1  4.976946e+06  33256.742199  4.991511e+06
2  4.965304e+06  33179.640458  4.982946e+06
3  4.953584e+06  33102.024704  4.974304e+06
4  4.941786e+06  33023.891513  4.965584e+06
5  4.929909e+06  32945.237433  4.956786e+06
6  4.917953e+06  32866.058993  4.947909e+06
7  4.905917e+06  32786.352697  4.938953e+06
8  4.893801e+06  32706.115025  4.929917e+06
9  4.881605e+06  32625.342435  4.920801e+06
          Balances      Intrest      Princial
195  385246.839668  2848.138034  1.012221e+06
196  342993.148482  2568.312264  9.732468e+05
197  300457.766023  2286.620990  9.339931e+05
198  257638.814346  2003.051773  8.944578e+05
199  214534.402992  1717.592096  8.546388e+05
200  171142.628896  1430.229353  8.145344e+05
201  127461.576306  1140.950859  7.741426e+05
202   83489.316698   849.743842  7.334616e+05
203   39223.908693   556.595445  6.924893e+05
204       0.000000   261.492725  6.512239e+05
```

[24]: Text(0, 0.5, "Balances in 10's of lakhs")

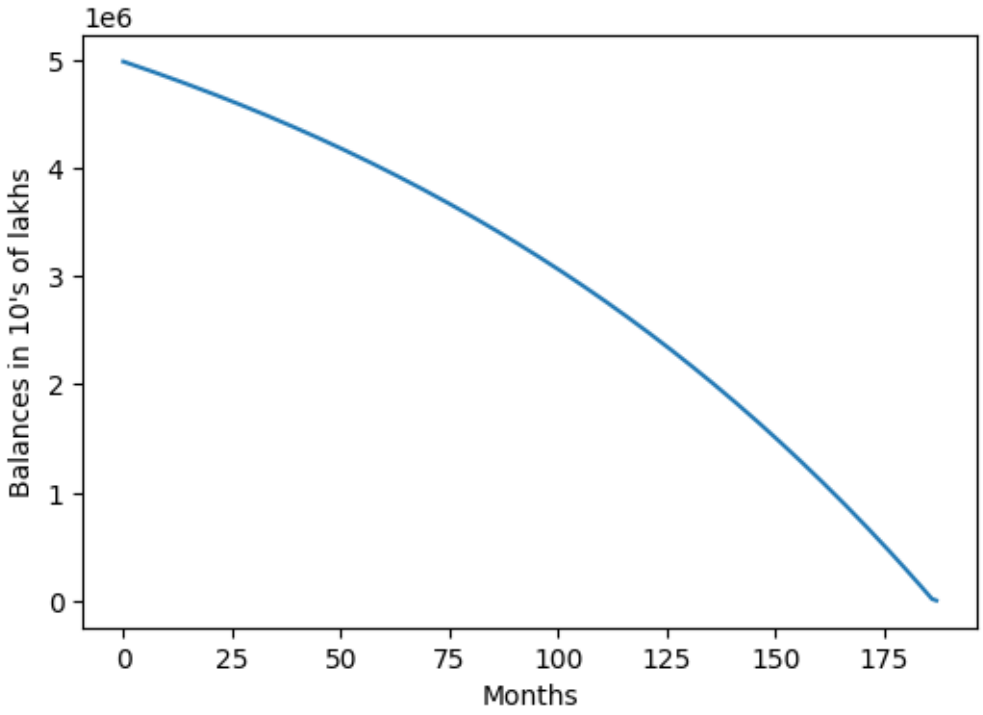



[25]:
```
amt = 5000000
r = 0.08 / 12
n = 240
emi = calc_mor_emi(amt, r,n)
ep = 5000
bal = 5000000
intrest_breakdown2 = []
principal_breakdown2 = []
bal_breakdown2 = []
for i in range(n):
    temp_int = calc_interest(bal,r)
    temp_princ= calc_principal(emi, temp_int)
    bal = calc_update_bal(bal, temp_princ,ep)
    intrest_breakdown2.append(temp_int)
    principal_breakdown2.append(amt)
    if(bal<0):
        bal_breakdown2.append(0)
        break
    bal_breakdown2.append(bal)
    amt = amt - temp_princ
```

```
df2 = pd.DataFrame()
df2['Balances'] = np.array(bal_breakdown2)
df2['Intrest'] = np.array(intrest_breakdown2)
df2['Princial'] = np.array(principal_breakdown2)
print(df2.head(10))
print(df2.tail(10))
# Part 3
plt.figure(figsize=(6,4))
sns.lineplot(df2['Balances'])
plt.xlabel("Months")
plt.ylabel("Balances in 10's of lakhs")
```

```
       Balances       Intrest      Princial
0  4.986511e+06  33333.333333  5.000000e+06
1  4.972933e+06  33243.408866  4.991511e+06
2  4.959264e+06  33152.884902  4.982933e+06
3  4.945503e+06  33061.757445  4.974264e+06
4  4.931651e+06  32970.022472  4.965503e+06
5  4.917707e+06  32877.675932  4.956651e+06
6  4.903670e+06  32784.713748  4.947707e+06
7  4.889539e+06  32691.131817  4.938670e+06
8  4.875314e+06  32596.926006  4.929539e+06
9  4.860994e+06  32502.092156  4.920314e+06
          Balances      Intrest      Princial
178  376715.150153  2804.881812  1.310732e+06
179  332404.581037  2511.434334  1.271715e+06
180  287798.608128  2216.030540  1.232405e+06
181  242895.262066  1918.657388  1.192799e+06
182  197692.560363  1619.301747  1.152895e+06
183  152188.507316  1317.950402  1.112693e+06
184  106381.093915  1014.590049  1.072189e+06
185   60268.297758   709.207293  1.031381e+06
186   13848.082960   401.788652  9.902683e+05
187       0.000000    92.320553  9.488481e+05
```

[25]: Text(0, 0.5, "Balances in 10's of lakhs")

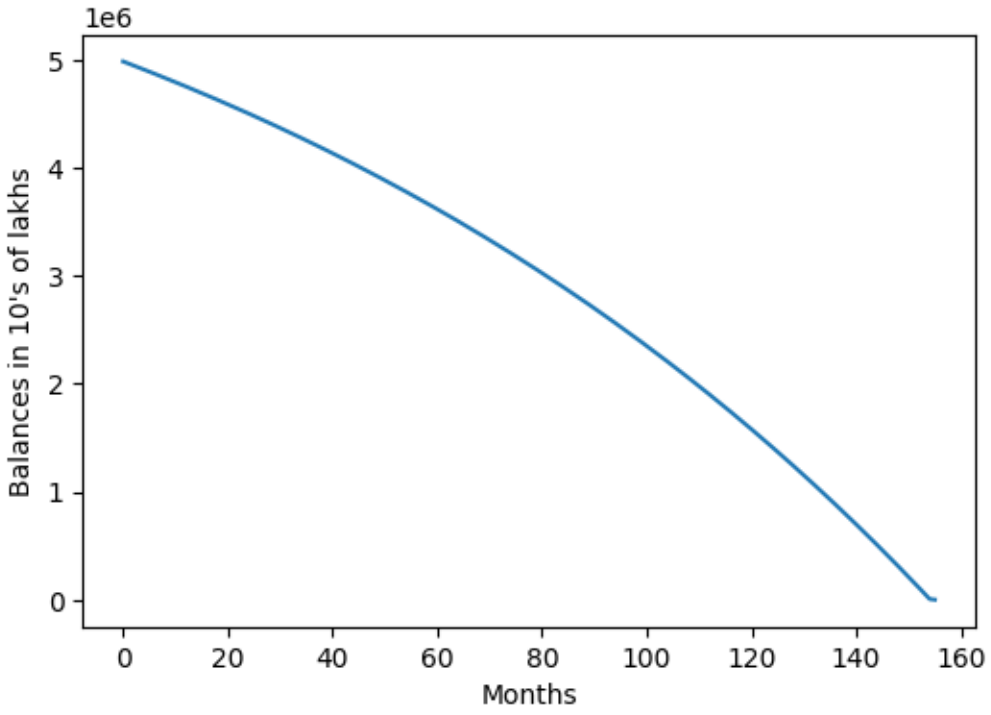



## 5 Part 5

[26]:
```
amt = 5000000
r = 0.08 / 12
n = 240
emi = calc_mor_emi(amt, r,n)
ep = 10000
bal = 5000000
intrest_breakdown2 = []
principal_breakdown2 = []
bal_breakdown2 = []
for i in range(n):
    temp_int = calc_interest(bal,r)
    temp_princ= calc_principal(emi, temp_int)
    bal = calc_update_bal(bal, temp_princ,ep)
    intrest_breakdown2.append(temp_int)
    principal_breakdown2.append(amt)
    if(bal<0):
        bal_breakdown2.append(0)
        break
    bal_breakdown2.append(bal)
    amt = amt - temp_princ
df2 = pd.DataFrame()
```

```
df2['Balances'] = np.array(bal_breakdown2)
df2['Intrest'] = np.array(intrest_breakdown2)
df2['Princial'] = np.array(principal_breakdown2)

# Part 3
plt.figure(figsize=(6,4))
sns.lineplot(df2['Balances'])
plt.xlabel("Months")
plt.ylabel("Balances in 10's of lakhs")
```

[26]: Text(0, 0.5, "Balances in 10's of lakhs")




[27]:
```
df2.head(10)
```

[27]:

| | Balances | Intrest | Princial |
|---|---|---|---|
| 0 | 4.981511e+06 | 33333.333333 | 5.000000e+06 |
| 1 | 4.962899e+06 | 33210.075533 | 4.991511e+06 |
| 2 | 4.944163e+06 | 33085.996013 | 4.982899e+06 |
| 3 | 4.925302e+06 | 32961.089297 | 4.974163e+06 |
| 4 | 4.906316e+06 | 32835.349869 | 4.965302e+06 |
| 5 | 4.887203e+06 | 32708.772179 | 4.956316e+06 |
| 6 | 4.867962e+06 | 32581.350637 | 4.947203e+06 |
| 7 | 4.848593e+06 | 32453.079618 | 4.937962e+06 |

```
8  4.829095e+06  32323.953459  4.928593e+06
9  4.809467e+06  32193.966459  4.919095e+06
```

[28]:
```
df2.tail(10)
```

[28]:
```
          Balances      Intrest      Principal
146  407955.362081  3044.883215  1.916732e+06
147  358853.061045  2719.702414  1.877955e+06
148  309423.411336  2392.353740  1.838853e+06
149  259664.230628  2062.822742  1.799423e+06
150  209573.322050  1731.094871  1.759664e+06
151  159148.474080  1397.155480  1.719573e+06
152  108387.460458  1060.989827  1.679148e+06
153   57288.040078   722.583070  1.638387e+06
154    5847.956895   381.920267  1.597288e+06
155       0.000000    38.986379  1.555848e+06
```

## 6 Part 6

[29]:
```
def rule_of_72(rate):
    return 72 / rate
r = 6
t = rule_of_72(r)
print("Time to double (in years) =",t)
```

```
Time to double (in years) = 12.0
```

[30]:
```
p = 50000
r = 6/100
si = p
t = (si)/(p*r)
print("Time to double (in years) using SI =",t)
```

```
Time to double (in years) using SI = 16.666666666666668
```

## 7 Part 7

[31]:
```
import math
p = 50000
r = 6/100
a = 2*p
t1 = math.log(a/p)/math.log(1+r)
print("Annually :")
print("Time to double (in years) using CI =",t1)
```

```
Annually :
Time to double (in years) using CI = 11.895661045941875
```

[32]:
```
p = 50000
r = 6/100
a = 2*p
t2 = math.log(a/p)/(2*math.log(1+(r/2)))
print("Semi-annualy:")
print("Time to double (in years) using CI =",t2)
```

```
Semi-annualy:
Time to double (in years) using CI = 11.724886125218868
```

[33]:
```
p = 50000
r = 6/100
a = 2*p
t3 = math.log(a/p)/(4*math.log(1+(r/4)))
print("Quarterly:")
print("Time to double (in years) using CI =",t3)
```

```
Quarterly:
Time to double (in years) using CI = 11.638881407701545
```

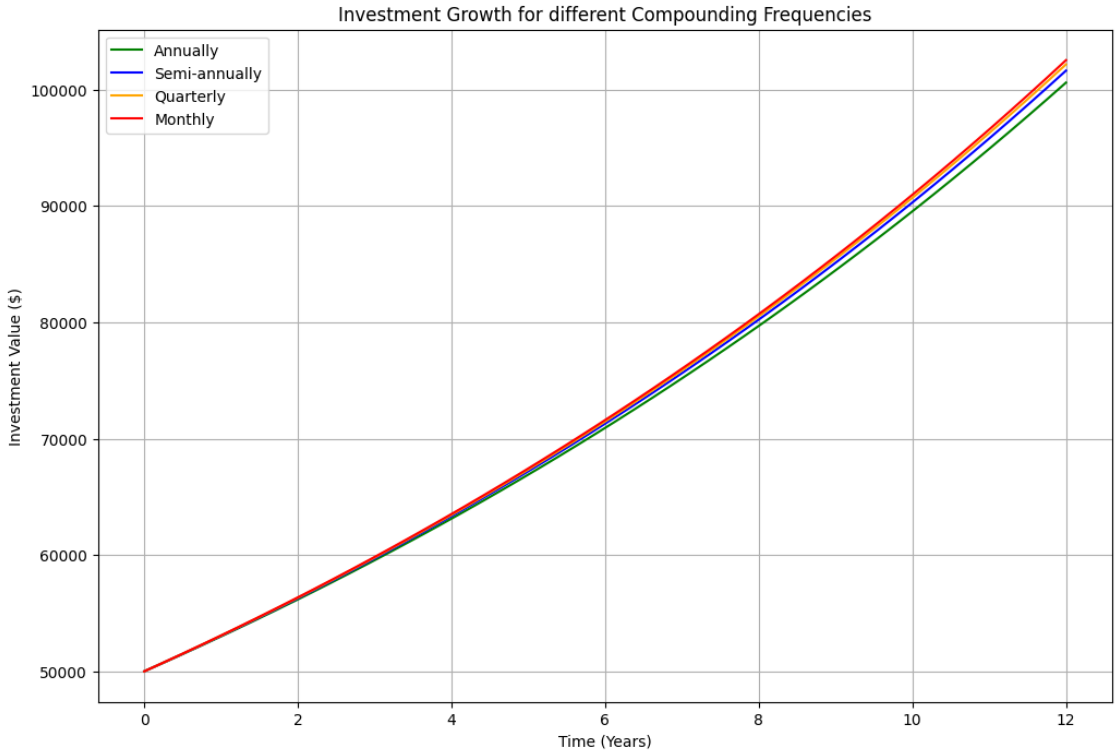
[34]:
```
p = 50000
r = 6/100
a = 2*p
t4 = math.log(a/p)/(12*math.log(1+(r/12)))
print("Monthly:")
print("Time to double (in years) using CI =",t4)
```

```
Monthly:
Time to double (in years) using CI = 11.581310134224728
```

# 8 Part 8

[35]:
```
t = np.linspace(0, 12)

P = 50000
r = 0.06
n_a = 1
n_s = 2
n_q = 4
n_m = 12

compound_annual = P * (1 + r / n_a) ** (n_a * t)
compound_semi_annual = P * (1 + r / n_s) ** (n_s * t)
compound_quarterly = P * (1 + r / n_q) ** (n_q * t)
```

```
compound_monthly = P * (1 + r / n_m) ** (n_m * t)

plt.figure(figsize=(12, 8))
plt.plot(t, compound_annual, label="Annually", color='green')
plt.plot(t, compound_semi_annual, label="Semi-annually", color='blue')
plt.plot(t, compound_quarterly, label="Quarterly", color='orange')
plt.plot(t, compound_monthly, label="Monthly", color='red')

plt.title("Investment Growth for different Compounding Frequencies")
plt.xlabel("Time (Years)")
plt.ylabel("Investment Value ($)")
plt.legend()
plt.grid(True)
plt.show()
```




[36]:
```
P = 50000
r = 0.06

simple_interest = P * (1 + (r * t))

compound_interest = P * ((1 + r) ** t)

plt.figure(figsize=(12,8))
```

```
plt.plot(t, simple_interest, label="Simple Interest", color='blue',␣
 ↪linestyle='--')
plt.plot(t, compound_interest, label="Compound Interest (Annually)",␣
 ↪color='green')

plt.title("Simple Interest vs Compound Interest Over Time")
plt.xlabel("Time (Years)")
plt.ylabel("Investment Value ($)")
plt.legend()
plt.grid(True)
plt.show()
```