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Numerical Analysis of Home Ownership Loans Bank Interest Rates in Indonesia with Newton's Interpolation Method

Candra Ditasona[1], Bela Desy N[2*], Ruth Ririn V[3], Kornelius Anugrah Z[4]
1,2,3Pendidikan Matematika FKIP Universitas Kristen Indonesia
e-mail: *beladesynatalia@gmail.com

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Abstract
The demand of the Indonesian society to own homes and properties is increasing along with the growth of Indonesia's population. This has led to an increase in population density, causing property prices to rise. The way to own property or a house in accordance with monthly income is by using bank housing loans. Three Indonesian banks renowned for housing loan applications, namely BTN, Mandiri, and BSI, were selected as samples in this study. These three banks have their own advantages and different bank interest rates. Therefore, this research was created as a tool for consumers to make decisions by considering the advantages obtained when applying for a loan at one of the three banks. This study employs the Newton's interpolation method to generate formulas that can help solve consumer problems. The results of this study generally indicate that Mandiri bank has an advantage in terms of lower installment costs compared to BTN and BSI.

Keywords: Loans, Newton's Interpolation, Installment costs, Bank

1. Introduction

Indonesia's growth that wants to move from a developing country to a developed country will never be separated from Indonesia's economic growth. Until now, the banking sector has played a very important role in supporting economic growth and stability. This means that currently the banking sector has also entered the context of housing finance through Home Ownership Loans (KPR). Of course, the banking sector is interested in the context of housing because basically houses are a primary human need. Not only that, in fact, according to BPS statistical data, DKI Jakarta itself has decreased the percentage of households that have access to decent and affordable housing according to the Province.

Therefore, the banking sector is becoming more intense to try to attract customers in the property sector. The proof is that Bank Mandiri, which launched a digital expansion, actually influenced BSI to also engage in property, especially mortgages. This news is not new news because it has been discussed on August 21, 2023. But there is no need to worry because on January 11, 2024, mortgages will become friendly again, especially by BTN and Bank Mandiri. So what is the role of each bank on mortgages:

1. Bank Tabungan Negara (BTN)

   A bank devoted to housing finance for the community and supporting the development of the housing and construction sectors. BTN is also involved in the

government's program for subsidized mortgages, which aims to help low-income groups own their own homes.

2. Bank Syariah Indonesia (BSI)

   BSI as a sharia bank, now also provides alternative housing financing based on sharia principles. Thus, BSI is able to attract customers to perform Islamic financial services.

3. Bank Mandiri

   As one of the largest banks in Indonesia, Bank Mandiri is obliged to support mortgage financing. This is done because Bank Mandiri provides various mortgage products, including conventional and sharia housing financing. Thanks to this, Bank Mandiri can also collaborate with the government in implementing housing finance programs.

Through an important delegated role in housing finance. BTN, BSI, and Bank Mandiri contribute significantly to national economic growth. They not only support housing access for communities, but also contribute to national economic development, facilitate homeownership for communities, and support the goals of financial inclusion and development of the housing sector.

For some people, the use of mortgages requires great consideration to make the decision to own a house in installments. However, not everyone has a lot of time to calculate and consider which bank suits the ability and willingness of prospective mortgage users. Therefore, this study wants to produce a formula that can make it easier for someone to consider which bank should be chosen to do a mortgage. The banks used by researchers are still said to be limited because this study was only carried out to three banks.

This research has 3 problem formulations, 3 research objectives and 2 benefits. The formulation of the problem includes: How much monthly installments must be paid if consumers want to do a mortgage but not multiples of 5? Is there a short way to help mortgage consultants to decide which mortgage is suitable for consumers? In which bank are the most favorable conditions for consumers in doing mortgages? With this problem formulation, researchers aim to find out the amount of monthly installments that must be paid if consumers want to do mortgages but not multiples of 5. Know a brief way to help mortgage consultants to decide which mortgage is suitable for consumers. Knowing which bank is the most favorable condition for consumers in doing mortgages. so that from the formulation of the problem and objectives there are research benefits for ordinary people who do not have much time to consider the best mortgage, this study can be used, for consultants and financial analysis can facilitate work to find out a decent mortgage for consumers.

(Muhammad Rizal Satria, 2018) write Amir's ideas about Bank is a business entity that collects funds from the public in the form of deposits and distributes them to the public in the form of credit or other forms in order to improve the standard of living of many people. Population growth is increasingly dense from year to year, this has encouraged developers to compete to develop their businesses in the housing sector. Banks have a very important role in upholding the people's economy, because through bank units that have excess capital can be channelled to the community through mortgages (Fadli Alanshari, 2018). Agree with that (Heykal, 2014) said KPR is one type of

service provided by banks to customers who hope to get services to get loans in providing housing loans to its customers. KPR arises because of the high need among the community to can own a house without being balanced with an increase in purchasing power in the community. And another statement for (Rosyida, 2013) stated that for people who have financial capabilities, buying a house in cash is not an obstacle. But for people who have limited finances, buying a house in cash is an obstacle. So many people choose to buy a house on credit. This is because credit payments are considered lighter than cash payments. The many needs of the community.

Every bank has a different interest rate. Bank interest can be interpreted as remuneration by banks based on conventional principles customers who buy or sell products. Interest can also be interpreted as the price that must be paid to customers which the customer must pay to the bank (Tumangkeng, 2013). Same statement form (Tesar, 2019) Interest rates are used to discount the benefits stream, to assess fiscal sustainability, and to project income and outlays of the trust funds. It is well known that interest rates have fallen.

The interest rate is closely related to the inflation rate. In fact, the differences in interest rates that occur between several countries occur because of differences in inflation rates, (Jusmer Sihotang, 2020). So if you use KPR until 5 or maybe more than 5 years actually you must pay the inflation rate too, but you can calculate or deal with bank to use fixed rate. And we can calculate with Numerical Analysis.

In numerical analysis, we frequently need to examine the closeness of anumerical solution to the exact solution. To answer the question quantitatively, we need to have a measure on the magnitude of the difference between the numerical solution and the exact solution. A norm of a vectorin a linear space provides such a measure, (Kendall E.Atkinson, 2009). In numerical analysis, a Newtonian polynomial is the interpolation of a polynomial for a set of known data points. This polynomial is named after its discoverer, Isaac Newton. Sometimes, this polynomial is called Newton's divisible polynomial interpolation because the coefficients of the polynomial are calculated using Newton's divisible difference method.

2. Methods

Newton's interpolation or better known as Newtonian polynomial interpolation appears to make predictions of the value of the function if given a lot of data (Fraser, 1927; Gorodetski et al., 2006; Trifunov et al., 2021). Known $n+1$ different points $(x_0, y_0), (x_1, y_1),$
$(x_2, y_2) \dots (x_n, y_n)$. Polynomial interpolations of newton forms are arranged in stages:

- For a point (x_0, y_0) in search $N_0(x) = C_0$
- For a point (x_0, y_0) and(x_1, y_1) in search $N_1(x) = C_0 + C_1(x - x_0)$ by specifying a value C_1
- For a point $(x_0, y_0), (x_1, y_1)$ and (x_2, y_2) in search $N_2(x) = C_0 + C_1(x - x_0) + C_2(x - x_0)(x - x_1)$ by specifying a value C_2
- For a point $(x_0, y_0), (x_1, y_1), (x_2, y_2) \dots (x_n, y_n)$ in search $N_n(x) = C_0 + C_1(x - x_0) + C_2(x - x_0)(x - x_1) + \cdots + C_n(x - x_0)(x - x_1)(x - x_2) \dots (x - x_n)$

Then obtained

$N_0(x) = y_0$

$$N_k(x) = N_{k-1}(x) + C_k(x - x_0)(x - x_1) \dots (x - x_k) \text{ dengan } k \geq 1$$

Retrieved $N_n(x)$ is the interpolated polynomial of Newtonian form sought.

3. Result and Discussion

Home Ownership Credit or KPR is a credit facility provided by banks to individual customers who will buy or repair houses. Customers who take a mortgage do not need to provide funds in cash to buy a house, but simply provide a down payment or down payment. So far there are three methods of calculating interest in mortgage credit facilities, namely flat, effective, and annual and monthly annuities.

Figure 1

Credit Installment of BTN

Bank BTN

Sahabat Keluarga Indonesia

KPR / KPA BTN PLATINUM

TABEL ANGSURAN						
SUKU BUNGA PROMOSI 9% FIX 5 TAHUN *)						
PLAFOND	3	5	10	15	20	25
100,000,000	3,292,200	2,142,500	1,298,600	1,033,900	912,900	848,400
110,000,000	3,621,400	2,356,700	1,428,400	1,137,300	1,004,200	933,300
120,000,000	3,950,600	2,571,000	1,558,300	1,240,600	1,095,500	1,018,100
130,000,000	4,279,800	2,785,200	1,688,100	1,344,000	1,186,800	1,103,000
140,000,000	4,609,000	2,999,500	1,818,000	1,447,400	1,278,100	1,187,800
150,000,000	4,938,200	3,213,700	1,947,800	1,550,800	1,369,400	1,272,600
160,000,000	5,267,400	3,427,900	2,077,700	1,654,200	1,460,700	1,357,500
170,000,000	5,596,700	3,642,200	2,207,500	1,757,600	1,552,000	1,442,300
180,000,000	5,925,900	3,856,400	2,337,400	1,860,900	1,643,200	1,527,100
190,000,000	6,255,100	4,070,700	2,467,200	1,964,300	1,734,500	1,612,000
200,000,000	6,584,300	4,284,900	2,597,100	2,067,700	1,825,800	1,696,800
210,000,000	6,913,500	4,499,200	2,726,900	2,171,100	1,917,100	1,781,700
220,000,000	7,242,700	4,713,400	2,856,800	2,274,500	2,008,400	1,866,500
230,000,000	7,571,900	4,927,700	2,986,600	2,377,800	2,099,700	1,951,300
240,000,000	7,901,100	5,141,900	3,116,500	2,481,200	2,191,000	2,036,200
250,000,000	8,230,400	5,356,100	3,246,300	2,584,600	2,282,300	2,121,000
260,000,000	8,559,600	5,570,400	3,376,200	2,688,000	2,373,600	2,205,900
270,000,000	8,888,800	5,784,600	3,506,000	2,791,400	2,464,800	2,290,700
280,000,000	9,218,000	5,998,900	3,635,900	2,894,800	2,556,100	2,375,500
290,000,000	9,547,200	6,213,100	3,765,700	2,998,100	2,647,400	2,460,400
300,000,000	9,876,400	6,427,400	3,895,600	3,101,500	2,738,700	2,545,200
350,000,000	11,522,500	7,498,600	4,544,800	3,618,400	3,195,200	2,969,400
400,000,000	13,168,500	8,569,800	5,194,100	4,135,300	3,651,600	3,393,600
450,000,000	14,814,600	9,641,000	5,843,300	4,652,300	4,108,000	3,817,800
500,000,000	16,460,700	10,712,200	6,492,600	5,169,200	4,564,500	4,242,000
550,000,000	18,106,700	11,783,500	7,141,800	5,686,100	5,020,900	4,666,200
600,000,000	19,752,800	12,854,700	7,791,100	6,203,000	5,477,400	5,090,400
650,000,000	21,398,800	13,925,900	8,440,300	6,719,900	5,933,800	5,514,600
700,000,000	23,044,900	14,997,100	9,089,600	7,236,800	6,390,300	5,938,700
750,000,000	24,691,000	16,068,300	9,738,800	7,753,700	6,846,700	6,362,900
800,000,000	26,337,000	17,139,500	10,388,100	8,270,600	7,303,100	6,787,100
850,000,000	27,983,100	18,210,800	11,037,300	8,787,600	7,759,600	7,211,300
900,000,000	29,629,200	19,282,000	11,686,600	9,304,500	8,216,000	7,635,500
950,000,000	31,275,200	20,353,200	12,335,800	9,821,400	8,672,500	8,059,700
1,000,000,000	32,921,300	21,424,400	12,985,100	10,338,300	9,128,900	8,483,900

Figure 2

Credit Installment of BSI

BSI BANK SYARIAH INDONESIA

TABEL SIMULASI ANGSURAN BSI GRIYA

ASN, CPNS, PNS, BUMN, BUMD, DOKTER, PEGAWAI RUMAH SAKIT

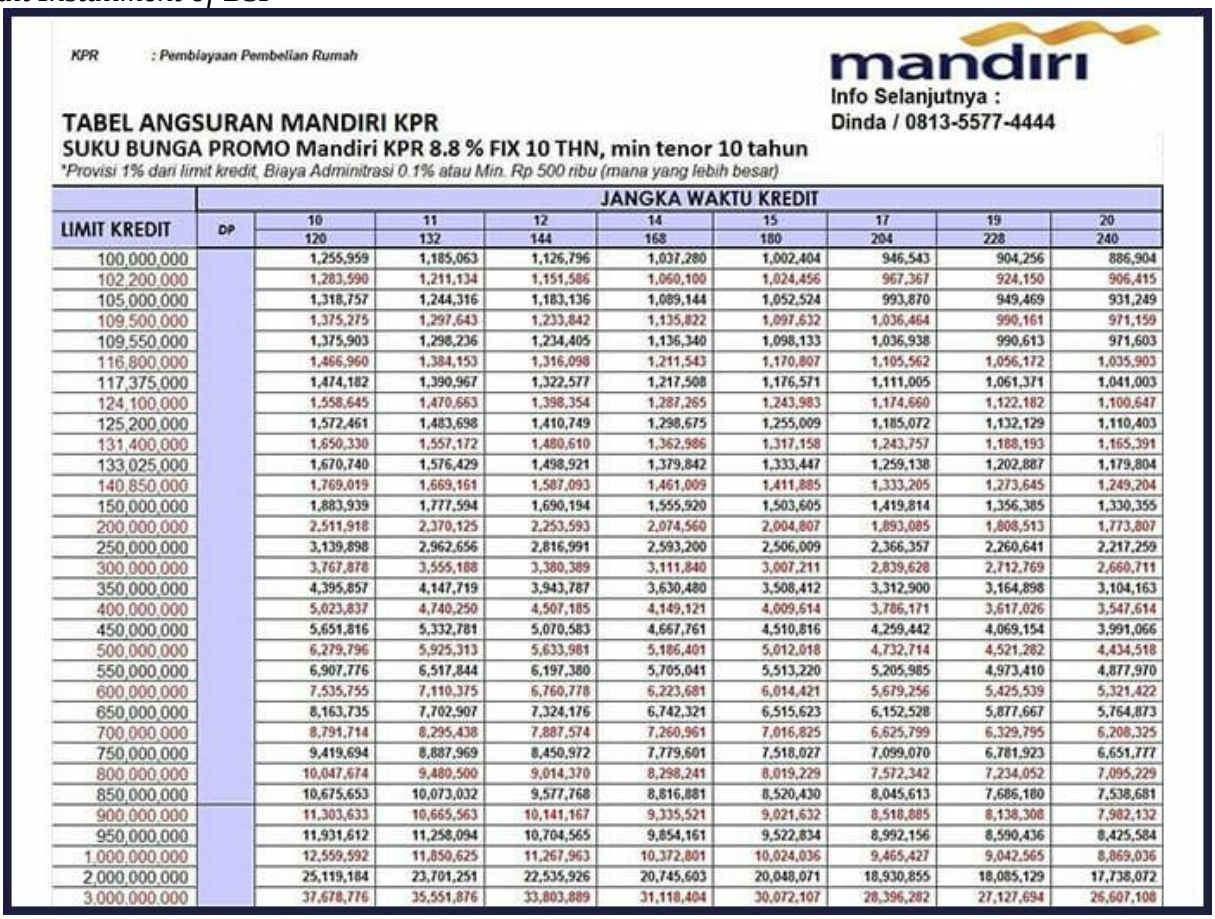
Angsuran perbulan*

PLAFON	JANGKA WAKTU (TAHUN)															
	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
100.000.000	2.051.667	1.802.222	1.608.810	1.465.000	1.354.259	1.266.667	1.195.909	1.137.778	1.089.359	1.048.571	1.013.889	1.015.000	990.196	967.963	948.596	932.500
130.000.000	2.667.167	2.342.889	2.091.452	1.904.500	1.760.537	1.646.667	1.554.682	1.479.111	1.416.167	1.363.143	1.318.056	1.319.500	1.287.255	1.258.352	1.233.175	1.212.250
150.000.000	3.077.500	2.703.333	2.413.214	2.197.500	2.031.389	1.900.000	1.793.864	1.706.667	1.634.038	1.572.857	1.520.833	1.522.500	1.485.294	1.451.944	1.422.895	1.398.750
180.000.000	3.693.000	3.244.000	2.895.857	2.637.000	2.437.667	2.280.000	2.152.636	2.048.000	1.960.846	1.887.429	1.825.000	1.827.000	1.782.353	1.742.333	1.707.474	1.678.500
200.000.000	4.103.333	3.604.444	3.217.619	2.930.000	2.708.519	2.533.333	2.391.818	2.275.556	2.178.718	2.097.143	2.027.778	2.030.000	1.980.392	1.935.926	1.897.193	1.865.000
230.000.000	4.718.833	4.145.111	3.700.262	3.369.500	3.114.796	2.913.333	2.750.591	2.616.889	2.505.526	2.411.714	2.331.944	2.334.500	2.277.451	2.226.315	2.181.772	2.144.750
250.000.000	5.129.167	4.505.556	4.022.024	3.662.500	3.385.648	3.166.667	2.989.773	2.844.444	2.723.397	2.621.429	2.534.722	2.537.500	2.475.490	2.419.907	2.371.491	2.331.250
280.000.000	5.744.667	5.046.222	4.504.667	4.102.000	3.791.926	3.546.667	3.348.545	3.185.778	3.050.205	2.936.000	2.838.889	2.842.000	2.772.549	2.710.296	2.656.070	2.611.000
300.000.000	6.155.000	5.406.667	4.826.429	4.395.000	4.062.778	3.800.000	3.587.727	3.413.333	3.268.077	3.145.714	3.041.667	3.045.000	2.970.588	2.903.889	2.845.789	2.797.500
330.000.000	6.770.500	5.947.333	5.309.071	4.834.500	4.469.056	4.180.000	3.946.500	3.754.667	3.594.885	3.460.286	3.345.833	3.349.500	3.267.647	3.194.278	3.130.368	3.077.250
350.000.000	7.180.833	6.307.778	5.630.833	5.127.500	4.739.907	4.433.333	4.185.682	3.982.222	3.812.756	3.670.000	3.548.611	3.552.500	3.465.686	3.387.870	3.320.088	3.263.750
380.000.000	7.796.333	6.848.444	6.113.476	5.567.000	5.146.185	4.813.333	4.544.455	4.323.556	4.139.564	3.984.571	3.852.778	3.857.000	3.762.745	3.678.259	3.604.667	3.543.500
400.000.000	8.206.667	7.208.889	6.435.238	5.860.000	5.417.037	5.066.667	4.783.636	4.551.111	4.357.436	4.194.286	4.055.556	4.060.000	3.960.784	3.871.852	3.794.386	3.730.000
420.000.000	8.617.000	7.569.333	6.757.000	6.153.000	5.687.889	5.320.000	5.022.818	4.778.667	4.575.308	4.404.000	4.258.333	4.263.000	4.158.824	4.065.444	3.984.105	3.916.500
450.000.000	9.232.500	8.110.000	7.239.643	6.592.500	6.094.167	5.700.000	5.381.591	5.120000	4.902.115	4.718571	4.562.500	4.567.500	4455.882	4.355.833	4.268684	4.196.250
480.000.000	9.848.000	8.650.667	7.722.286	7.032.000	6.500.444	6.080.000	5.740.364	5.461.333	5.228.923	5.033.143	4.866.667	4.872000	4.752.941	4.646.222	4.553.263	4.476.000
500.000.000	10.258.333	9011.111	8.044.048	7.325.000	6.771.296	6333.333	5.979.545	5.688889	5.446.795	5.242.857	5069.444	5.075.000	4.950.980	4.839.815	4.742.982	4.662.500
530.000.000	10.873.833	9551.778	8.526.690	7.764.500	7.177.574	6713.333	6.338.318	6.030222	5.773.803	5.557.429	5373.611	5.379.500	5.248.039	5.130.204	5.027.561	4.942.250
550.000.000	11.284.167	9.912.222	8.848.452	8.057.500	7.448.426	6.966.667	6.577.500	6.257.778	5.991.474	5767.143	5.576.389	5.582.500	5.446.078	5.323.796	5.217.281	5.128.750
600.000.000	12.310.000	10.813.333	9.652.857	8.780.000	8.125.556	7.600.000	7.175.455	6.828667	6.536.154	6.291.429	6.083.333	6.090.000	5.941.176	5.807.778	5.691.579	5.595.000
700.000.000	14.361.667	12.615.556	11.261.667	10.255.000	9.479.815	8.866.667	8.371.364	7.964.444	7.625.513	7.340.000	7.097.222	7.105.000	6.931.373	6.775.741	6.640.175	6.527.500
800.000.000	16.413.333	14.417.778	12.870.476	11.720.000	10.834.074	10.133.333	9.567.273	9.102.222	8.714.872	8.388.571	8.111.111	8.120.000	7.921.569	7.743.704	7.588.772	7.460.000
900.000.000	18.465.000	16.220.000	14479.286	13.185.000	12.188.333	11.400.000	10.763.182	10.240.000	9.804.231	9.437.143	9.125.000	9.135.000	8.911.765	8.711.667	8.537.368	8.392.500
1.000.000.000	20.518.667	18.022.222	16.088.095	14.650.000	13.542.593	12.666.667	11.959.091	11.377.778	10.893.590	10.485.714	10.138.889	10.150.000	9.901.961	9.679.630	9.485.965	9.325.000

NB. JUMLAH ANGSURAN DAN PERSYARATAN ADMINISTRASI DAPAT BERUBAH / TIDAK MENGIKAT SEBELUM PEMBIAYAAN DISETUJUI BANK.

Figure 2

Credit Installment of BSI



KPR : Pembiayaan Pembelian Rumah

mandiri

Info Selanjutnya :
Dinda / 0813-5577-4444

TABEL ANGSURAN MANDIRI KPR

SUKU BUNGA PROMO Mandiri KPR 8.8 % FIX 10 THN, min tenor 10 tahun

*Provisi 1% dari limit kredit, Biaya Adminitrasi 0.1% atau Min. Rp 500 ribu (mana yang lebih besar)

LIMIT KREDIT	DP	JANGKA WAKTU KREDIT							
		10	11	12	14	15	17	19	20
		120	132	144	168	180	204	228	240
100,000,000		1,255,959	1,185,063	1,126,796	1,037,280	1,002,404	946,543	904,256	886,904
102,200,000		1,283,590	1,211,134	1,151,586	1,060,100	1,024,456	967,367	924,150	906,415
105,000,000		1,318,757	1,244,316	1,183,136	1,089,144	1,052,524	993,870	949,469	931,249
109,500,000		1,375,275	1,297,643	1,233,842	1,135,822	1,097,632	1,036,464	990,161	971,159
109,550,000		1,375,903	1,298,236	1,234,405	1,136,340	1,098,133	1,036,938	990,613	971,603
116,800,000		1,466,960	1,384,153	1,316,098	1,211,543	1,170,807	1,105,562	1,056,172	1,035,903
117,375,000		1,474,182	1,390,967	1,322,577	1,217,508	1,176,571	1,111,005	1,061,371	1,041,003
124,100,000		1,558,645	1,470,663	1,398,354	1,287,265	1,243,983	1,174,660	1,122,182	1,100,647
125,200,000		1,572,461	1,483,698	1,410,749	1,298,675	1,255,009	1,185,072	1,132,129	1,110,403
131,400,000		1,650,330	1,557,172	1,480,610	1,362,986	1,317,158	1,243,757	1,188,193	1,165,391
133,025,000		1,670,740	1,576,429	1,498,921	1,379,842	1,333,447	1,259,138	1,202,887	1,179,804
140,850,000		1,769,019	1,669,161	1,587,093	1,461,009	1,411,885	1,333,205	1,273,645	1,249,204
150,000,000		1,883,939	1,777,594	1,690,194	1,555,920	1,503,605	1,419,814	1,356,385	1,330,355
200,000,000		2,511,918	2,370,125	2,253,593	2,074,560	2,004,807	1,893,085	1,808,513	1,773,807
250,000,000		3,139,898	2,962,656	2,816,991	2,593,200	2,506,009	2,366,357	2,260,641	2,217,259
300,000,000		3,767,878	3,555,188	3,380,389	3,111,840	3,007,211	2,839,628	2,712,769	2,660,711
350,000,000		4,395,857	4,147,719	3,943,787	3,630,480	3,508,412	3,312,900	3,164,898	3,104,163
400,000,000		5,023,837	4,740,250	4,507,185	4,149,121	4,009,614	3,786,171	3,617,026	3,547,614
450,000,000		5,651,816	5,332,781	5,070,583	4,667,761	4,510,816	4,259,442	4,069,154	3,991,066
500,000,000		6,279,796	5,925,313	5,633,981	5,186,401	5,012,018	4,732,714	4,521,282	4,434,518
550,000,000		6,907,776	6,517,844	6,197,380	5,705,041	5,513,220	5,205,985	4,973,410	4,877,970
600,000,000		7,535,755	7,110,375	6,760,778	6,223,681	6,014,421	5,679,256	5,425,539	5,321,422
650,000,000		8,163,735	7,702,907	7,324,176	6,742,321	6,515,623	6,152,528	5,877,667	5,764,873
700,000,000		8,791,714	8,295,438	7,887,574	7,260,961	7,016,825	6,625,799	6,329,795	6,208,325
750,000,000		9,419,694	8,887,969	8,450,972	7,779,601	7,518,027	7,099,070	6,781,923	6,651,777
800,000,000		10,047,674	9,480,500	9,014,370	8,298,241	8,019,229	7,572,342	7,234,052	7,095,229
850,000,000		10,675,653	10,073,032	9,577,768	8,816,881	8,520,430	8,045,613	7,686,180	7,538,681
900,000,000		11,303,633	10,665,563	10,141,167	9,335,521	9,021,632	8,518,885	8,138,308	7,982,132
950,000,000		11,931,612	11,258,094	10,704,565	9,854,161	9,522,834	8,992,156	8,590,436	8,425,584
1,000,000,000		12,559,592	11,850,625	11,267,963	10,372,801	10,024,036	9,465,427	9,042,565	8,869,036
2,000,000,000		25,119,184	23,701,251	22,535,926	20,745,603	20,048,071	18,930,855	18,085,129	17,738,072
3,000,000,000		37,678,776	35,551,876	33,803,889	31,118,404	30,072,107	28,396,282	27,127,694	26,607,108

Table 1

Credit Installment of All Bank

Jumlah Angsuran	Cicilan Setiap Bulan		
Rp 200.000.000	10 Tahun	15 Tahun	20 Tahun
BTN	2597100	2067700	1825800
BSI	2533333	2027778	1855000
Mandiri	2511918	2004807	1773807

1. BTN

For $(x_0, y_0) = (10, 2597100)$ obtained

$$N_0(x) = 2597100$$

For $(x_0, y_0) = (10, 2597100)$ and $(x_1, y_1) = (15, 2067700)$

$N_1(x) = N_0(x) + C_1(x - x_0)$

$N_1(15) = 2597100 + C_1(15 - 10)$

$N_1(15) = 2597100 + C_1(5)$

$2067700 = 2597100 + C_1(5)$

$2067700 - 2597100 = C_1(5)$

$-529400 = C_1(5)$

$$-\frac{529400}{5} = C_1$$

$-105880 = C_1$

$N_1(x) = N_0(x) + C_1(x - x_0)$

$N_1(x) = 2597100 - 105880\,(x - 10)$

$N_1(x) = 2597100 - 105880\,x + 1058800$

$N_1(x) = 3655900 - 105880x$

Obtained $N_1(x) = 3655900 - 105880x$

For $(x_0, y_0) = (10, 2597100)$; $(x_1, y_1) = (15, 2067700)$ and $(x_3, y_3) = (20, 1825800)$

$N_2(x) = N_1(x) + C_2(x - x_0)(x - x_1)$

$N_2(x) = 3655900 - 105880x + C_2(x - 10)(x - 15)$

$N_2(20) = 3655900 - 105880(20) + C_2(20 - 10)(20 - 15)$

$1825800 = 1538300 + C_2(10 \times 5)$

$1825800 - 1538300 = C_2(50)$

$287500 = C_2(50)$

$$\frac{287500}{50} = C_2$$

$5750 = C_2$

$N_2(x) = N_1(x) + C_2(x - x_0)(x - x_1)$

$N_2(x) = 3655900 - 105880x + 5750(x - 10)(x - 15)$

$N_2(x) = 3655900 - 105880x + 5750\,(x^2 - 25x + 150)$

$N_2(x) = 3655900 - 105880x + 5750x^2 - 143750x + 862500$

$N_2(x) = 4518400 - 249630x + 5750x^2$

Obtained $N_2(x) = 5750x^2 - 249630x + 4518400$

2. BSI

For $(x_0, y_0) = (10, 2533333)$ obtained

$$N_0(x) = 2533333$$

For $(x_0, y_0) = (10, 2533333)$ and $(x_1, y_1) = (15, 2027778)$

$$N_1(x) = N_0(x) + C_1(x - x_0)$$
$$N_1(15) = 2533333 + C_1(15 - 10)$$
$$N_1(15) = 2533333 + C_1(5)$$
$$2027778 = 2533333 + C_1(5)$$
$$2027778 - 2533333 = C_1(5)$$
$$-505555 = C_1(5)$$
$$-\frac{505555}{5} = C_1$$
$$-101111 = C_1$$
$$N_1(x) = N_0(x) + C_1(x - x_0)$$
$$N_1(x) = 253333 - 101111\ (x - 10)$$
$$N_1(x) = 253333 - 101111\ x + 1011110$$
$$N_1(x) = 3544443 - 101111x$$

Obtained $N_1(x) = 3544443 - 101111x$

For $(x_0, y_0) = (10, 253333)$; $(x_1, y_1) = (15, 2027778)$ and $(x_3, y_3) = (20, 1855000)$

$$N_2(x) = N_1(x) + C_2(x - x_0)(x - x_1)$$
$$N_2(x) = 3544443 - 101111x + C_2(x - 10)(x - 15)$$
$$N_2(20) = 3544443 - 101111(20) + C_2(20 - 10)(20 - 15)$$
$$1855000 = 1522223 + C_2(10 \times 5)$$
$$1855000 - 1522223 = C_2(50)$$
$$332777 = C_2(50)$$
$$\frac{332777}{50} = C_2$$
$$6655{,}54 = C_2$$
$$N_2(x) = N_1(x) + C_2(x - x_0)(x - x_1)$$
$$N_2(x) = 3544443 - 101111x + 6655{,}54(x - 10)(x - 15)$$
$$N_2(x) = 3544443 - 101111x + 6655{,}54\ (x^2 - 25x + 150)$$
$$N_2(x) = 3544443 - 101111x + 6655{,}54\ x^2 - 166389x + 998331$$
$$N_2(x) = 4542774 - 267500x + 6655{,}54x^2$$

Obtained $N_2(x) = 6655{,}54x^2 - 267500x + 4542774$

3. Mandiri Bank

For $(x_0, y_0) = (10, 2511918)$ obtained

$$N_0(x) = 2511918$$

For $(x_0, y_0) = (10{,}2511918)$ and $(x_1, y_1) = (15, 2004807)$

$$N_1(x) = N_0(x) + C_1(x - x_0)$$
$$N_1(10) = 2511918 + C_1(15 - 10)$$
$$N_1(10) = 2511918 + C_1(5)$$
$$2004807 = 2511918 + C_1(5)$$
$$2004807 - 2511918 = C_1(5)$$

$$-\frac{507111}{5} = C_1$$
$$-101422{,}2 = C_1$$
$$N_1(x) = N_0(x) + C_1(x - x_0)$$
$$N_1(x) = 2511918 - 101422{,}2(x - 10)$$
$$N_1(x) = 2511918 - 101422{,}2\,x + 1014222$$
$$N_1(x) = 3526140 - 101422{,}2x$$

Obtained $N_1(x) = 3526140 - 101422{,}2x$

For $(x_0, y_0) = (10, 2511918)$; $(x_1, y_1) = (15, 2004807)$ and $(x_3, y_3) = (20, 1773807)$

$$N_2(x) = N_1(x) + C_2(x - x_0)(x - x_1)$$
$$N_2(x) = 3526140 - 101422{,}2x + C_2(x - 10)(x - 15)$$
$$N_2(20) = 3526140 - 101422{,}2(20) + C_2(20 - 10)(20 - 15)$$
$$1773807 = 1497696 + C_2(10 \times 5)$$
$$1773807 - 1497696 = C_2(50)$$
$$276111 = C_2(50)$$
$$\frac{276111}{50} = C_2$$
$$5522{,}22 = C_2$$
$$N_2(x) = N_1(x) + C_2(x - x_0)(x - x_1)$$
$$N_2(x) = 3526140 - 101422{,}2x + 5522{,}22(x - 10)(x - 15)$$
$$N_2(x) = 3526140 - 101422{,}2x + 5522{,}22\,(x^2 - 25x + 150)$$
$$N_2(x) = 3526140 - 101422{,}2x + 5522{,}22x^2 - 138056x + 828333$$
$$N_2(x) = 4354473 - 239478x + 5522{,}22x^2$$

Obtained $N_2(x) = 5522{,}22x^2 - 239478x + 4354473$

Polynomial Equation:

BTN: ***obtained*** $\boldsymbol{P(x)} = 5750x^2 - 249630x + 4518400$

BSI: **obtained** $\boldsymbol{P(x)} = 6655{,}54x^2 - 267500x + 4542774$

$Mandiri$: **obtained** $\boldsymbol{P(x)} = 5522{,}22\,x^2 - 239478x + 4354473$

To prove it can include data for years that have existed in the previous table:

BTN: **Obtained** $\boldsymbol{P(x)} = 5750x^2 - 249630x + 4518400$

- 10 years → $\boldsymbol{P(10)} = 5750(10)^2 - 249630(10) + 4518400 = Rp2.597.100$
- 15 years → $\boldsymbol{P(15)} = 5750(15)^2 - 249630(15) + 4518400 = Rp2.067.700$
- 20 years → $\boldsymbol{P(20)} = 5750(25)^2 - 249630(20) + 4518400 = Rp1.825.800$

BSI: **Obtained** $\boldsymbol{P(x)} = 6655{,}54x^2 - 267500x + 4542774$

- 10 years → $\boldsymbol{P(10)} = 6655{,}54(10)^2 - 267500(10) + 4542774 = Rp\ 2.533.333$
- 15 years → $\boldsymbol{P(15)} = 6655{,}54(15)^2 - 267500(15) + 4542774 = Rp\ 2.027.778$
- 20 years → $\boldsymbol{P(20)} = 6655{,}54(20)^2 - 267500(20) + 4542774 = Rp\ 2.004.807$

$Mandiri$: **Obtained** $\boldsymbol{P(x)} = 5522{,}22\,x^2 - 239478x + 4354473$

- 10 years → $\boldsymbol{P(10)} = 5522{,}22\ (10)^2 - 239478(10) + 4354473 = Rp\ 2.511.918$
- 15 years → $\boldsymbol{P(15)} = 5522{,}22\ (15)^2 - 239478(15) + 4354473 = Rp\ 2.004.807$
- 20 years → $\boldsymbol{P(20)} = 5522{,}22\ (20)^2 - 239478(20) + 4354473 = Rp\ 1.773.807$

From the results we can see the similarity of the value of monthly installments with the data at the beginning, so it can be said that the formula obtained tends to be correct or almost close to the truth. So that it can make it easier for someone to make a decision when they want to take a house mortgage:

BTN: ***obtained*** $\boldsymbol{P(x)} = 5750x^2 - 249630x + 4518400$

BSI: **obtained** $\boldsymbol{P(x)} = 6655{,}54x^2 - 267500x + 4542774$

$Mandiri$: **obtained** $\boldsymbol{P(x)} = 5522{,}22\,x^2 - 239478x + 4354473$

Ket: x is the number of years you want to take during the instalment

Lack of formula. This formula can only be used if the consumer takes a mortgage of IDR 200,000,000.00 so that for other nominals it must be done as in the discussion division. This formula can also only be used if the instalments taken are fixed rate. So this formula only helps part of the work of mortgage consultants. When consumers want to buy a house with a nominal value of IDR 200,000,000.00 But do not want multiples of 5 years, for example, consumers want to pay in instalments for 7 years, it can be used and compared to which bank is the cheapest. $x = \ years\ 7$

BTN: **Obtained** $\boldsymbol{P(7)} = 5750(7) - 249630(7) + 4518400 = Rp\ 3.052.740$

BSI: **Obtained** $\boldsymbol{P(7)} = 6655{,}54(7)^2 - 267500(7) + 4542774 = Rp\ 2.996.399$

$Mandiri$: **Obtained** $\boldsymbol{P(7)} = 5522{,}22(7)^2 - 239478(7) + 4354473 = Rp\ 2.948.718$

It can be seen from the calculations that have been done, Bank Mandiri has instalments with fewer costs than other banks. So that consumers can make transactions with independent banks if they want to find the lowest mortgage instalments.

4. Conclusion

From the results of the study, results and discussion we can make a brief formula for a person or group who wants to make mortgage installments with a total installment of IDR 200,000,000.00, but does not have much time to consider which bank is the cheapest. Then the results of our study can help. A person who wants to do the mortgage just enters the number of years desired to pay off the installments into x as input.

BTN: ***obtained*** $\boldsymbol{P(x)} = 5750x^2 - 249630x + 4518400$

BSI: **obtained** $\boldsymbol{P(x)} = 6655{,}54x^2 - 267500x + 4542774$

$Mandiri$: **obtained** $\boldsymbol{P(x)} = 5522{,}22\,x^2 - 239478x + 4354473$

This formula can be used by people who are unfamiliar with finance or people who work in the field of mortgage consultants to shorten their work. This formula is still said to be limited because it can only be used when the nominal installment is IDR 200,000,000.00. If beyond that this formula cannot be used, but people can just follow the methods and steps in the discussion section and be assisted by excel. Advice to readers if interested in continuing this research, it will be very useful to make it easier for people to know the nominal installments. Maybe it can be developed into technology through programming languages. The calculation and formula produced are only for nominal or total installments of IDR 200,000,000.00 so that they cannot be used when the total installments change. This study also does not intend to find the best or worst of the 3 banks sampled so that cheap does not mean bad or expensive service does not mean it is not worth it, all back to

other indicators provided by banks for consumers.

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