

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

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Article Info	Abstract
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https://doi.org/10.33541/edumatsains. v8i2.5584	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.
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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 mortgage 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 $N_n(x) = C_0 + C_1(x x_0) + C_2(x x_0)(x x_1) + \dots + C_n(x x_0)(x x_1)(x x_2) \dots (x x_n)$

Then obtained

$$N_0(x) = y_0$$



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



Sahabat Keluarga Indonesia KPR / KPA BTN PLATINUM

		TAB	EL ANGSURAN	1							
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	848,40					
110,000,000	3,621,400	2,356,700	1,428,400	1,137,300	1,004,200	933,30					
120,000,000	3,950,600	2,571,000	1,558,300	1,240,600	1,095,500	1,018,10					
130,000,000	4,279,800	2,785,200	1,688,100	1,344,000	1,186,800	1,103,00					
140,000,000	4,609,000	2,999,500	1,818,000	1,447,400	1,278,100	1,187,80					
150,000,000	4,938,200	3,213,700	1,947,800	1,550,800	1,369,400	1,272,60					
160,000,000	5,267,400	3,427,900	2,077,700	1,654,200	1,460,700	1,357,50					
170,000,000	5,596,700	3,642,200	2,207,500	1,757,600	1,552,000	1,442,30					
180,000,000	5,925,900	3,856,400	2,337,400	1,860,900	1,643,200	1,527,10					
190,000,000	6,255,100	4,070,700	2,467,200	1,964,300	1,734,500	1,612,00					
200,000,000	6,584,300	4,284,900	2,597,100	2,067,700	1,825,800	1,696,80					
210,000,000	6,913,500	4,499,200	2,726,900	2,171,100	1,917,100	1,781,70					
220,000,000	7.242.700	4,713,400	2,856,800	2,274,500	2,008,400	1,866,50					
230,000,000	7.571,900	4,927,700	2,986,600	2,377,800	2,099,700	1,951,30					
240,000,000	7,901,100	5,141,900	3,116,500	2,481,200	2,191,000	2,036,20					
250,000,000	8,230,400	5.356,100	3,246,300	2,584,600	2,282,300	2,121,00					
260,000,000	8,559,600	5,570,400	3,376,200	2,688,000	2,373,600	2,205,90					
270,000,000	8,888,800	5,784,600	3,506,000	2,791,400	2,464,800	2,290,70					
280,000,000	9,218,000	5,998,900	3,635,900	2,894,800	2,556,100	2,375,50					
290,000,000	9,547,200	6,213,100	3,765,700	2,998,100	2,647,400	2,460,40					
300,000,000	9,876,400	6,427,400	3,895,600	3,101,500	2,738,700	2,545,20					
350,000,000	11,522,500	7,498,600	4,544,800	3,618,400	3,195,200	2,969,40					
400,000,000	13,168,500	8,569,800	5,194,100	4,135,300	3,651,600	3,393,60					
450,000,000	14,814,600	9,641,000	5,843,300	4,652,300	4,108,000	3,817,80					
500,000,000	16,460,700	10,712,200	6,492,600	5,169,200	4,564,500	4,242,00					
550,000,000	18,106,700	11,783,500	7,141,800	5,686,100	5,020,900	4,666,20					
600,000,000	19,752,800	12,854,700	7,791,100	6,203,000	5,477,400	5,090,40					
650,000.000	21,398,800	13,925,900	8,440,300	6,719,900	5,933,800	5,514,60					
700,000,000	23,044,900	14,997,100	9,089,600	7,236,800	6,390,300	5,938,70					
750,000,000	24,691,000	16,068,300	9,738,800	7,753,700	6,846,700	6,362,90					
800,000,000	26,337,000	17,139,500	10,388,100	8,270,600	7,303,100	6,787,10					
850,000,000	27,983,100	18,210,800	11,037,300	8,787,600	7,759,600	7,211,30					
900,000,000	29,629,200	19,282,000	11,686,600	9,304,500	8,216,000	7,635,50					
950,000,000	31,275,200	20,353,200	12,335,800	9,821,400	8,672,500	8,059,70					
1,000,000,000	32,921,300	21,424,400	12,985,100	10,338,300	9,128,900	8,483,90					



Figure 2

Credit Installment of BSI



TABEL SIMULASI ANGSURAN BSI GRIYA

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

PLAFON	JANGKA WAKTU(TAHUN)															
P.D. OK	5	6	7	8	9	10	11	12	13	14	15	16	37	18	19	20
100.000.000	2.051,687	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	948.595	932.50
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	1,212,25
150.000.000	3.077.500	2,703333	2.413214	2.197.500	2.031389	1.900000	1.793864	1,706667	1.634.038	1,572,857	1.520.833	1.522500	1,485,294	1.451.944	1.422 895	1,3987
180,000,000	3,653,000	3,244,000	2,895,857	2 637.000	2.437,687	2 280 000	2,152,636	2.048.000	1.960,846	1.887.429	1,825,000	1,827,000	1,782 363	1,742,333	1,707,474	1.678.5
200,000,000	4,103,333	3,604,444	3,217.619	2.930.000	2,708,519	2,533,333	2,391,618	2.275,556	2,178,718	2.097,143	2.027,778	2.036 000	1,980,392	1,935,926	1,897,193	1,855.0
230,000.000	4.718,833	4,145,111	3,700,262	3,369,500	3,114,796	2,913,333	2,750,591	2,616,869	2,505.526	2,411,714	2,331,944	2,334,500	2,277,451	2,226,315	2,181,772	2,144.7
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	2,331,2
280.000.000	5,744,667	5.046.222	4,504,687	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	2,611.0
360.000.000	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	2,797,5
330,000,000	6.770.500	5.947.333	5,309.071	4,834,500	4,469,056	4,180,000	3,946,500	3 754 687	3.594.885	3.460.286	3,345,833	3.349.500	3.267.647	3,194,278	0,120,368	3.077.2
350.000.000	7.180.833	6,307,778	5.630.833	5.127,500	4,739,907	4,433,333	4,135,682	3.982.222	3,812,755	3.670.000	3,548,611	3.552.500	3,465,686	3.387.870	3.320.088	3,263.7
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	3,543.5
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	4.055.558	4.060.000	3,960,784	3.871,852	3,794,366	3,730.0
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	3.916.5
450,000,000	9,232,500	8,110,000	7.239,643	8.592.500	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	4,196,3
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	4,752,041	4,646,222	4.553.263	4,476.0
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	4,062.5
530.000.000	10.873.833	9551.778	0.526.690	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	4,942.2
550,000,000	11 284 167	9.912.222	6,648,452	8.057.500	7.448.426	6.965 867	6.577.500	6.257.778	5.991.474	5767,143	5.576.389	5.582.500	5.445 078	5.323.796	5217281	5.128.7
600.000.000																
700.000.000	14 361,867	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
800.000.000		1.555.000.000.000		1	10000000000	100103-000-00-00-00-00-00-00-00-00-00-00-00-	and the second second	11000010121	1000000000		8.111.111	200220-000	001040101010		10000	7.460.0
900.000.000	18.465.000	16,220,000	14,479,286	13 185 000	12 188.333	11,400,000	10,763,182	10 240 000	9.854.231	9.437.143	9,125,600	9.135.000	8.911.765	8.711.667	8 537 368	8:392 9
000 000 000	20.518.667	18.022.222	16 058 095	14 650 000	13 542 593	12 888 667	11 950 091	11 377 778			10.138.880				9.485.985	

Figure 2

Credit Installment of BSI

Provisi 1% dari lim		I MANDIRI 10 Mandiri K Biaya Adminitras	(PR 8.8 % F			D O tahun	nfo Selanjut inda / 0813					
	JANGKA WAKTU KREDIT											
LIMIT KREDIT	DP	10	11	12	14	15	17	19	20			
	1336	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	886,90			
102,200,000		1,283,590	1,211,134	1,151,586	1,060,100	1,024,456	967,367	924,150	906,41			
105,000,000	-	1,318,757	1,244,316	1,183,136	1,089,144	1,052,524	993,870	949,469	931,24			
109,500,000	-	1,375,275	1,297,643	1,233,842	1,135,822	1,097,632	1,036,464	990,161	971,15			
109,550,000		1,375,903	1,298,236	1,234,405	1,135,340	1,098,133	1,036,938	990,613	971,60			
116,800,000	-	1,466,960	1,384,153	1,316,098	1,211,543	1,170,807	1,105,562	1,056,172	1,035,90			
117,375,000		1,474,182	1,390,967	1,322,577	1,217,508	1,176,571	1,111,005	1,061,371	1,041,00			
124,100,000	-	1,558,645	1,470,653	1,398,354	1,287,265	1,243,983	1,174,660	1,122,182	1,100,64			
125,200,000		1,572,461	1,483,698	1,410,749	1,298,675	1,255,009	1,185,072	1,132,129	1,110,40			
131,400,000	-	1,650,330	1,557,172	1,480,610	1,362,986	1,317,158	1,243,757	1,188,193	1,165,39			
133,025,000		1,670,740	1,576,429	1,498,921	1,379,842	1,333,447	1,259,138	1,202,887	1,179,80			
140,850,000	-	1,769,019	1,669,161	1,587,093	1,461,009	1,411,885	1,333,205	1,273,645	1,249,20			
150,000,000	-	1,883,939	1,777,594	1,690,194	1,555,920	1,503,605	1,419,814	1,356,385	1,330,35			
200,000,000	-	2,511,918	2,370,125	2,253,593	2,074,560	2,004,807	1,893,085	1,808,513	1,773,80			
250,000,000	-	3,139,898	2,962,656	2,816,991	2,593,200	2,506,009	2,366,357	2,260,641	2,217,25			
300,000,000	-	3,767,878	3,555,188	3,380,389	3,111,840	3,007,211	2,839,628	2,712,769	2,660,71			
350,000,000	-	4,395,857	4,147,719	3,943,787	3,630,480	3,508,412	3,312,900	3,164,898	3,104,16			
400,000,000	-	5,023,837	4,740,250	4,507,185	4,149,121	4,009,614	3,786,171	3,617,026	3,547,61			
450,000,000		5,651,816	5,332,781	5,070,583	4,657,761	4,510,816	4,259,442	4,069,154	3,991,06			
500,000,000	-	6,279,796	5,925,313	5,633,981	5,186,401	5,012,018	4,732,714	4,521,282	4,434,51			
550,000,000	-	6,907,776	6,517,844	6,197,380	5,705,041	5,513,220	5,205,985 5,679,256	4,973,410	4,877,97			
600,000,000	-	7,535,755	7,110,375	6,760,778	6,223,681 6,742,321	6,014,421 6,515,623	11/2 A 200 C 21/2 C 20		5,321,42			
650,000,000	-	8,163,735	8,295,438	7,324,176	7,260,961	7,016,825	6,152,528 6,625,799	5,877,667	5,764,87			
700,000,000	-	9,419,694	8,235,438	8,450,972	7,260,961	7,518,027	7,099,070	6,781,923	6,651,77			
750,000,000	-	and the second se	and a local design of the	9,014,370	the second	8,019,229	7,099,070	7,234,052	7,095,22			
800,000,000	-	10.047.674	9,480,500	9,577,768	8,298,241 8,816,881	and the second se	8.045.613	7,686,180	7,095,22			
850,000,000		11,303,633	and the second se	and the second second second second	9,335,521	8,520,430	and the second and the second second	and the second sec	and the second sec			
900,000,000	-	11,931,612	10,665,563	10,141,167	9,335,521	9,522,834	8,518,885	8,138,308	7,982,13			
950,000,000	-	12,559,592	11,258,094	and the second real real real real real real real real	10,372,801	10,024,036	9,465,427	9.042.565	and the second second second			
1,000,000,000	-	25,119,184	23,701,251	11,267,963 22,535,926	20,745,603	20,048,071	9,465,427	9,042,565	8,869,03			
2,000,000,000 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	26,607,10			



Table 1

Credit Installment of All Bank

Jumlah Angsuran		Cicilan Setiap B	ulan	
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, 253333) 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 + 665554(x - 10)(x - 15)
N_2(x) = 3544443 - 101111x + 6655,54(x^2 - 25x + 150)
N_2(x) = 3544443 - 101111x + 665554 x^2 - 166389x + 998331
N_2(x) = 4542774 - 267500x + 665554x^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
 $N_1(x) = N_0(x) + C_1(x - x_0)$
 $N_1(x) = 2511918 - 101422,2(x - 10)$
 $N_1(x) = 2511918 - 101422,2x + 1014222$
 $N_1(x) = 3526140 - 101422,2x$
Obtained $N_1(x) = 3526140 - 101422,2x$
For $(x_0, y_0) = (10, 2511918); (x_1, y_1) = (15, 2004807)$ and $(x_3, y_3) = (20, 1773807)$
 $N_2(x) = N_1(x) + C_2(x - x_0)(x - x_1)$
 $N_2(x) = 3526140 - 101422,2(20) + C_2(20 - 10)(x - 15)$
 $N_2(20) = 3526140 - 101422,2(20) + C_2(20 - 10)(20 - 15)$
 $1773807 = 1497696 + C_2(10 \times 5)$
 $1773807 - 1497696 = C_2(50)$
 $276111 = C_2(50)$
 $\frac{276111}{50} = C_2$
 $5522,22 = C_2$
 $N_2(x) = N_1(x) + C_2(x - x_0)(x - x_1)$
 $N_2(x) = 3526140 - 101422,2x + 5522,22(x^2 - 25x + 150)$
 $N_2(x) = 3526140 - 101422,2x + 5522,22x^2 - 138056x + 828333$
 $N_2(x) = 4354473 - 239478x + 5522,22x^2$
Obtained $N_2(x) = 5522,22x^2 - 239478x + 4354473$
Polynomial Equation:
BTN: *obtained* $P(x) = 6555,54x^2 - 267500x + 4518400$
 $BSI:$ obtained $P(x) = 5522,22x^2 - 239478x + 4354473$

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

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

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

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

• 10 years $\rightarrow P(10) = 6655,54(10)^2 - 267500(10) + 4542774 = Rp 2.533.333$

• 15 years $\rightarrow P(15) = 6655,54(15)^2 - 267500(15) + 4542774 = Rp 2.027.778$

• 20 years
$$\rightarrow P(20) = 6655,54(20)^2 - 267500(20) + 4542774 = Rp 2.004.807$$

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

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



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* $P(x) = 5750x^2 - 249630x + 4518400$ *BSI*: **obtained** $P(x) = 6655,54x^2 - 267500x + 4542774$ *Mandiri*: **obtained** $P(x) = 5522,22x^2 - 239478x + 4354473$ 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** P(7) = 5750(7) - 249630(7) + 4518400 = Rp 3.052.740BSI: **Obtained** $P(7) = 6655,54(7)^2 - 267500(7) + 4542774 = Rp 2.996.399$ Mandiri: **Obtained** $P(7) = 5522,22(7)^2 - 239478(7) + 4354473 = Rp 2.948.718$

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* $P(x) = 5750x^2 - 249630x + 4518400$ BSI: **obtained** $P(x) = 6655,54x^2 - 267500x + 4542774$ Mandiri: **obtained** $P(x) = 5522,22x^2 - 239478x + 4354473$

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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