

# Loan Amortization

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# A Simple Amortization

- For the simplest loans (fixed/constant rate, fully amortizing), you only need 3 pieces of information:
  - Starting Balance
  - Term
  - (Flat) Interest Rate
- Think in terms of a ledger →

balance	1000					
term	24					
rate	3.50%					
		balbop	pmt	ipmt	ppmt	baleop
1/1/2022	1	1000	\$43.20	\$2.92	\$40.29	\$959.71
2/1/2022	2	\$959.71	\$43.20	\$2.80	\$40.40	\$919.31
3/1/2022	3	\$919.31	\$43.20	\$2.68	\$40.52	\$878.79
4/1/2022	4	\$878.79	\$43.20	\$2.56	\$40.64	\$838.15
5/1/2022	5	\$838.15	\$43.20	\$2.44	\$40.76	\$797.39
6/1/2022	6	\$797.39	\$43.20	\$2.33	\$40.88	\$756.51
7/1/2022	7	\$756.51	\$43.20	\$2.21	\$41.00	\$715.52
8/1/2022	8	\$715.52	\$43.20	\$2.09	\$41.12	\$674.40
9/1/2022	9	\$674.40	\$43.20	\$1.97	\$41.24	\$633.17
10/1/2022	10	\$633.17	\$43.20	\$1.85	\$41.36	\$591.81
11/1/2022	11	\$591.81	\$43.20	\$1.73	\$41.48	\$550.33
12/1/2022	12	\$550.33	\$43.20	\$1.61	\$41.60	\$508.74
1/1/2023	13	\$508.74	\$43.20	\$1.48	\$41.72	\$467.02
2/1/2023	14	\$467.02	\$43.20	\$1.36	\$41.84	\$425.18
3/1/2023	15	\$425.18	\$43.20	\$1.24	\$41.96	\$383.21
4/1/2023	16	\$383.21	\$43.20	\$1.12	\$42.09	\$341.13
5/1/2023	17	\$341.13	\$43.20	\$0.99	\$42.21	\$298.92
6/1/2023	18	\$298.92	\$43.20	\$0.87	\$42.33	\$256.59
7/1/2023	19	\$256.59	\$43.20	\$0.75	\$42.45	\$214.14
8/1/2023	20	\$214.14	\$43.20	\$0.62	\$42.58	\$171.56
9/1/2023	21	\$171.56	\$43.20	\$0.50	\$42.70	\$128.86
10/1/2023	22	\$128.86	\$43.20	\$0.38	\$42.83	\$86.03
11/1/2023	23	\$86.03	\$43.20	\$0.25	\$42.95	\$43.08
12/1/2023	24	\$43.08	\$43.20	\$0.13	\$43.08	\$0.00

# Excel Worksheet Functions

- PMT
- IPMT
- PPMT
- FV
- PV

## Note

Drag the equations down the Excel spreadsheet to fully amortize the loan

# Function Formulas

$$\text{monthly payment} = pmt = \frac{rate}{1 - (1 + rate)^{-term}} * balance$$

$$\text{monthly interest payment} = ipmt_t = balance_t * rate$$

$$\text{monthly principal payment} = ppmt_t = pmt - ipmt_t$$

$$\text{ending balance} = baleop_t = balance_t - ppmt_t = balance_{t+1}$$

# Floating Rates

Constant Rate:

$$pmt = \frac{rate}{1 - (1 + rate)^{-term_0}} * balance_0$$

Variable Rate:

$$pmt = \frac{rate_t}{1 - (1 + rate_t)^{-term_t}} * balance_t$$

# Day Counting Conventions

Day counting convention impacts the conversion of annual rate to monthly rate

30/360:

$$rate_{monthly} = rate_{annual} * \left( \frac{30}{360} \right) = \frac{rate_{annual}}{12}$$

Actual/360:

$$rate_{monthly} = rate_{annual} * \left( \frac{days\ in\ month}{360} \right)$$

Actual/Actual:

$$rate_{monthly} = rate_{annual} * \left( \frac{days\ in\ month}{days\ in\ year} \right)$$

