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

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

$$monthly\ interest\ payment = ipmt_t = balance_t * rate$$

$$monthly\ principal\ payment = ppmt_t = pmt - ipmt_t$$

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

Floating Rates

Constant Rate:

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

Variable Rate:

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

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:

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