



FRM **Math 1030 #10c** *ARM*

Loans, Credit Cards and Mortgages

Mortgages

Installment Loan

Payday Loan

Mortgages

A mortgage is an installment loan to finance a home.

The down payment is the amount of money you must pay up front to be given the loan.

Closing costs are fees you must pay to be given the loan.

direct costs

fees charged as points, 1% of the loan amount.

One type is a fixed rate mortgage (FRM) where you have a guaranteed interest rate for the life of the loan.

EX 1: Compare the monthly payments and total loan cost for these two loans. You borrow \$150,000 for a home.

$$P = 150000$$

$$n = 12$$

$$PMT = \frac{P \cdot \left(\frac{APR}{n}\right)}{\left[1 - \left(1 + \frac{APR}{n}\right)^{-nY}\right]}$$

30-year with APR of 7.25%

$$APR = 0.0725, Y = 30$$

$$PMT = \frac{150000 \left(\frac{0.0725}{12}\right)}{1 - \left(1 + \frac{0.0725}{12}\right)^{-12(30)}} \\ \approx \$1023.26$$

$$\text{total payments} = \\ 1023.26(12)(30) \\ = \$368,375.19$$

15-year with APR of 6.8%

$$Y = 15, APR = 0.068$$

$$PMT = \frac{150000 \left(\frac{0.068}{12}\right)}{1 - \left(1 + \frac{0.068}{12}\right)^{-12(15)}} \\ \approx \$1331.53$$

$$\text{total payments} \\ = 1331.53(12)(15) \\ = \$239,674.66$$

EX 2: Consider these options for a \$180,000 mortgage. Calculate the monthly payments and total closing costs for each.

$$PMT = \frac{P \cdot \left(\frac{APR}{n}\right)}{\left[1 - \left(1 + \frac{APR}{n}\right)^{-nY}\right]}$$

$P = 180000$
 $n = 12$
 $Y = 30$

30-year FRM 7.5%
with \$1200 direct cost
and no points

$$PMT = \frac{180000 \left(\frac{0.075}{12}\right)}{1 - \left(1 + \frac{0.075}{12}\right)^{-12(30)}} \approx \$1258.59$$

closing costs
= 1200

total cost
= $1258.59(12)(30) + 1200$
= \$454,292.40

30-year FRM 6%

with \$1500 direct costs
and 4 points

$$PMT = \frac{180000 \left(\frac{0.06}{12}\right)}{1 - \left(1 + \frac{0.06}{12}\right)^{-12(30)}} \approx \$1079.19$$

closing costs
= $1500 + 0.04(180000)$
= \$8700

total cost
= $1079.19(12)(30) + 8700$
= \$397,208.40

An Adjustable Rate Mortgage (ARM) is one in which the interest rate changes whenever prevailing rates change.

$$PMT = \frac{P \cdot \left(\frac{\Delta PR}{n}\right)}{\left[1 - \left(1 + \frac{\Delta PR}{n}\right)^{-nY}\right]}$$

EX 3: Compare these two options for a \$125,000 30-year loan.

Summarize the payments for the first two years. $P = 125000$

(A)

FRM at 8.5%

$$APR = 0.085$$

$$PMT = \frac{125000 \left(\frac{0.085}{12}\right)}{1 - \left(1 + \frac{0.085}{12}\right)^{-12(30)}} \approx \$961.14$$

$$\begin{aligned} &\text{total payments for} \\ &\text{first 2 years} \\ &= 961.14(12)(2) \\ &= \$23,067.36 \end{aligned}$$

(B)

ARM with first year 5.5%

and second year at 10%

year 1: $APR = 0.055$

$$PMT_1 = \frac{125000 \left(\frac{0.055}{12}\right)}{1 - \left(1 + \frac{0.055}{12}\right)^{-12(30)}} \approx \$709.74$$

year 2:

Note: we used a spreadsheet w/ amortization table to compute the loan balance after the first 12 payments from year 1)

$$P = 123,316.10, Y = 29$$

$$PMT_2 = \frac{123316.10 \left(\frac{0.10}{12}\right)}{1 - \left(1 + \frac{0.10}{12}\right)^{-12(29)}} \approx \$1088.24$$

$$\begin{aligned} &\text{total paid in first 2 yrs} \\ &= 709.74(12) + 1088.24(12) \\ &= \$21,575.76 \end{aligned}$$