Student, House, and Car Loans

- words with mort are often deadly & among them are:
  mortgage="death pledge"
  amortize a debt=to "kill the debt"
- events described all actually happened and the same language is purposely used
- when our own future is at stake, most of us want to use every approach we can—many cases require the critical and creative analysis of a variety of interpretations in order to fully consider the implications
- notice the loan rates are higher than the savings rates, factoring in risk

Loan Payments

lender earns what it could elsewhere, we pay in installments:

lump sum of loan = periodic payment of our installments

Loan Payments

lender earns what it could elsewhere, we pay in installments:

lump sum of loan = periodic payment of our installments

$$\text{loan } (1+r)^n = \frac{\text{installment payment}((1+r)^n - 1)}{r}$$

r = periodic rate (like $\frac{.05}{12}$)

n = # times actually compounded (like 120 or 360)

Loan Payments

lender earns what it could elsewhere, we pay in installments:

lump sum of loan = periodic payment of our installments

$$\text{loan } (1+r)^n = \frac{\text{installment payment}((1+r)^n - 1)}{r}$$

r = periodic rate (like $\frac{.05}{12}$)

n = # times actually compounded (like 120 or 360)

1. solve for payment by reciprocals, exponents, and distribution. First mult both sides by reciprocal $\frac{r}{(1+r)^n-1}$

Loan Payments

lender earns what it could elsewhere, we pay in installments:

lump sum of loan = periodic payment of our installments

$$\text{loan } (1+r)^n = \frac{\text{installment payment}((1+r)^n - 1)}{r}$$

r = periodic rate (like $\frac{.05}{12}$)

n = # times actually compounded (like 120 or 360)

1. solve for payment by reciprocals, exponents, and distribution. First mult both sides by reciprocal $\frac{r}{(1+r)^n-1}$

$$\text{installment payment} = \text{loan } r \frac{(1+r)^n}{(1+r)^n - 1}$$

Loan Payments

lender earns what it could elsewhere, we pay in installments:

lump sum of loan = periodic payment of our installments

$$\text{loan } (1+r)^n = \frac{\text{installment payment}((1+r)^n - 1)}{r}$$

r = periodic rate (like $\frac{.05}{12}$)

n = # times actually compounded (like 120 or 360)

1. solve for payment by reciprocals, exponents, and distribution. First mult both sides by reciprocal $\frac{r}{(1+r)^n-1}$

$$\text{installment payment} = \text{loan } r\frac{(1+r)^n}{(1+r)^n - 1}$$

2. reduce further by multiplying both the numerator and denominator by $(1+r)^{-n}$ so the top reduces by exponents:

Loan Payments

lender earns what it could elsewhere, we pay in installments:

lump sum of loan = periodic payment of our installments

$$\text{loan } (1+r)^n = \frac{\text{installment payment}((1+r)^n - 1)}{r}$$

r = periodic rate (like $\frac{.05}{12}$)

n = # times actually compounded (like 120 or 360)

1. solve for payment by reciprocals, exponents, and distribution. First mult both sides by reciprocal $\frac{r}{(1+r)^n-1}$

$$\text{installment payment} = \text{loan } r\frac{(1+r)^n}{(1+r)^n - 1}$$

2. reduce further by multiplying both the numerator and denominator by $(1+r)^{-n}$ so the top reduces by exponents:

$$= \text{loan } r\frac{(1+r)^{-n}(1+r)^n}{(1+r)^{-n}((1+r)^n - 1)} = \text{loan } r\frac{1}{(1+r)^{-n}(1+r)^n - (1+r)^{-n}}$$

Loan Payments

lender earns what it could elsewhere, we pay in installments:

lump sum of loan = periodic payment of our installments

$$\text{loan } (1+r)^n = \frac{\text{installment payment}((1+r)^n - 1)}{r}$$

r = periodic rate (like $\frac{.05}{12}$)

n = # times actually compounded (like 120 or 360)

1. solve for payment by reciprocals, exponents, and distribution. First mult both sides by reciprocal $\frac{r}{(1+r)^n-1}$

$$\text{installment payment} = \text{loan } r\frac{(1+r)^n}{(1+r)^n - 1}$$

2. reduce further by multiplying both the numerator and denominator by $(1+r)^{-n}$ so the top reduces by exponents:

$$= \text{loan } r\frac{(1+r)^{-n}(1+r)^n}{(1+r)^{-n}((1+r)^n - 1)} = \text{loan } r\frac{1}{(1+r)^{-n}(1+r)^n - (1+r)^{-n}}$$

$$\text{installment payment} = \text{loan } r\frac{1}{1-(1+r)^{-n}} =$$

Loan Payments

lender earns what it could elsewhere, we pay in installments:

lump sum of loan = periodic payment of our installments

$$\text{loan } (1+r)^n = \frac{\text{installment payment}((1+r)^n - 1)}{r}$$

r = periodic rate (like $\frac{.05}{12}$)

n = # times actually compounded (like 120 or 360)

1. solve for payment by reciprocals, exponents, and distribution. First mult both sides by reciprocal $\frac{r}{(1+r)^n-1}$

$$\text{installment payment} = \text{loan } r\frac{(1+r)^n}{(1+r)^n - 1}$$

2. reduce further by multiplying both the numerator and denominator by $(1+r)^{-n}$ so the top reduces by exponents:

$$= \text{loan } r\frac{(1+r)^{-n}(1+r)^n}{(1+r)^{-n}((1+r)^n - 1)} = \text{loan } r\frac{1}{(1+r)^{-n}(1+r)^n - (1+r)^{-n}}$$

$$\text{installment payment} = \text{loan } r\frac{1}{1-(1+r)^{-n}} = \frac{\text{loan } r}{1-(1+r)^{-n}}$$

Loan Payments and Amortization

$$\frac{\text{loan amount } r}{1-(1+r)^{-n}} = \text{loan payment}$$

- total paid= payment $\times$# times compounded - overpayment
- total interest = total paid - loan

Loan Payments and Amortization

$$\frac{\text{loan amount } r}{1-(1+r)^{-n}} = \text{loan payment}$$

- total paid= payment $\times$# times compounded - overpayment
- total interest = total paid - loan
- interest each period on a loan is computed just as in savings:
  account balance $\times$ periodic rate
  but now we pay it back rather than earn it

Congratulations—Now Feed Me Your Loan Payments!

https://www.brookings.edu/blog/up-front/2020/04/16/whats-the-government-done-to-relieve-student-loan-borrowers-

Dear Sarah J Greenwald

At this time you have a choice of repayment terms for your student loan \$4795.00 at 8% compounded monthly:

Graduated Repayment Plan

# PMTS	PMT AMT
24	34.05
24	44.79
24	58.92
24	77.50
23	101.94
1	96.92
total	\$ 7607.78

Level Payment Plan

# PMTS	PMT AMT
119	58.18
1	57.55
total	\$ 6980.97

Student Loan

student loan \$4795.00 at 8% compounded monthly:

$$\text{installment payment} = \frac{\text{loan } r}{1-(1+r)^{-n}}$$

$$= \frac{4795\frac{.08}{12}}{(1-(1+\frac{.08}{12})^{-120})} =$$

Student Loan

student loan \$4795.00 at 8% compounded monthly:

$$\text{installment payment} = \frac{\text{loan } r}{1-(1+r)^{-n}}$$

$$= \frac{4795\frac{.08}{12}}{(1-(1+\frac{.08}{12})^{-120})} = 58.176581\ldots$$

amortization table for level payment plan

mo.	payment	interest paid	principal paid	loan balance
1	58.18	$4795\frac{.08}{12} = 31.97$	58.18 - 31.97	4795-26.21=4768.79
		balance$\times$periodic rate	payment$-$int	balance$-$principal
2	58.18			

Student Loan

student loan \$4795.00 at 8% compounded monthly:

$$\text{installment payment} = \frac{\text{loan } r}{1-(1+r)^{-n}}$$

$$= \frac{4795\frac{.08}{12}}{(1-(1+\frac{.08}{12})^{-120})} = 58.176581\ldots$$

amortization table for level payment plan

mo.	payment	interest paid	principal paid	loan balance
1	58.18	$4795\frac{.08}{12} = 31.97$	58.18 - 31.97	4795-26.21=4768.79
		balance$\times$periodic rate	payment$-$int	balance$-$principal
2	58.18	$4768.79\frac{.08}{12} = 31.79$		

Student Loan

student loan \$4795.00 at 8% compounded monthly:

$$\text{installment payment} = \frac{\text{loan } r}{1-(1+r)^{-n}}$$

$$= \frac{4795\frac{.08}{12}}{(1-(1+\frac{.08}{12})^{-120})} = 58.176581...$$

amortization table for level payment plan

mo.	payment	interest paid	principal paid	loan balance
1	58.18	$4795\frac{.08}{12} = 31.97$	58.18 - 31.97	4795-26.21=4768.79
		balance$\times$periodic rate	payment$-$int	balance$-$principal
2	58.18	$4768.79\frac{.08}{12} = 31.79$	58.18-31.79	

Student Loan

student loan \$4795.00 at 8% compounded monthly:

$$\text{installment payment} = \frac{\text{loan } r}{1-(1+r)^{-n}}$$

$$= \frac{4795\frac{.08}{12}}{(1-(1+\frac{.08}{12})^{-120})} = 58.176581\ldots$$

amortization table for level payment plan

mo.	payment	interest paid	principal paid	loan balance
1	58.18	$4795\frac{.08}{12} = 31.97$	58.18 - 31.97	4795-26.21=4768.79
		balance$\times$periodic rate	payment$-$int	balance$-$principal
2	58.18	$4768.79\frac{.08}{12} = 31.79$	58.18-31.79 =26.39	4768.79$-$26.39 =4742.4

Student Loan

student loan \$4795.00 at 8% compounded monthly:

$$\text{installment payment} = \frac{\text{loan } r}{1-(1+r)^{-n}}$$

$$= \frac{4795\frac{.08}{12}}{(1-(1+\frac{.08}{12})^{-120})} = 58.176581\ldots$$

amortization table for level payment plan

mo.	payment	interest paid	principal paid	loan balance
1	58.18	$4795\frac{.08}{12} = 31.97$	58.18 - 31.97	4795-26.21=4768.79
		balance$\times$periodic rate	payment$-$int	balance$-$principal
2	58.18	$4768.79\frac{.08}{12} = 31.79$	58.18-31.79	4768.79$-$26.39
			=26.39	=4742.4

last months payment: $58.18 - .63 = 57.55$

Student Loan

student loan \$4795.00 at 8% compounded monthly:

$$\text{installment payment} = \frac{\text{loan } r}{1-(1+r)^{-n}}$$

$$= \frac{4795\frac{.08}{12}}{(1-(1+\frac{.08}{12})^{-120})} = 58.176581\ldots$$

amortization table for level payment plan

mo.	payment	interest paid	principal paid	loan balance
1	58.18	$4795\frac{.08}{12} = 31.97$	58.18 - 31.97	4795-26.21=4768.79
		balance $\times$ periodic rate	payment $-$ int	balance $-$ principal
2	58.18	$4768.79\frac{.08}{12} = 31.79$	58.18-31.79 =26.39	4768.79$-$26.39 =4742.4

last months payment: $58.18 - .63 = 57.55$

total paid: $58.18 \times 120 - .63 = 6980.97$

Student Loan

student loan \$4795.00 at 8% compounded monthly:

$$\text{installment payment} = \frac{\text{loan } r}{1-(1+r)^{-n}}$$

$$= \frac{4795\frac{.08}{12}}{(1-(1+\frac{.08}{12})^{-120})} = 58.176581\ldots$$

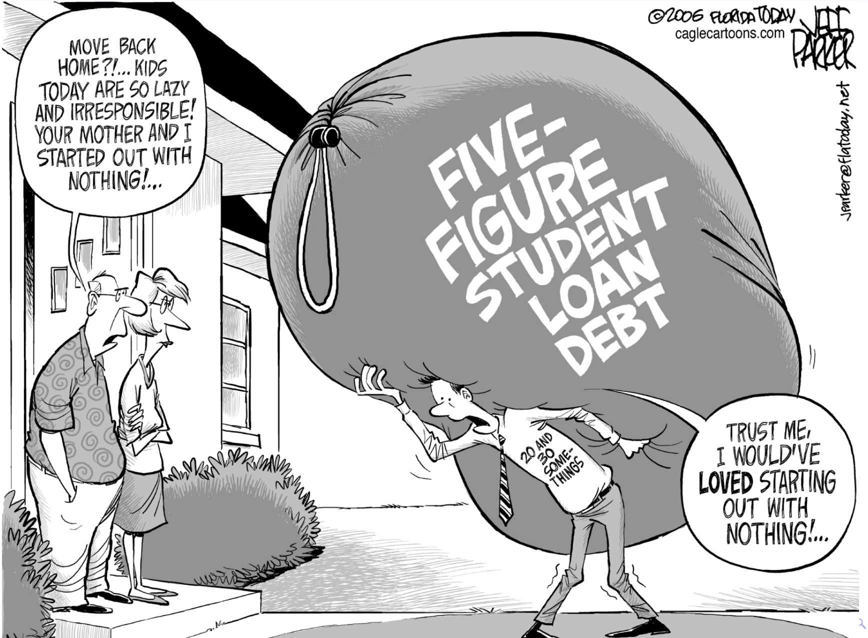
amortization table for level payment plan

mo.	payment	interest paid	principal paid	loan balance
1	58.18	$4795\frac{.08}{12} = 31.97$	58.18 - 31.97	4795-26.21=4768.79
		balance$\times$periodic rate	payment$-$int	balance$-$principal
2	58.18	$4768.79\frac{.08}{12} = 31.79$	58.18-31.79 =26.39	4768.79$-$26.39 =4742.4

last months payment: $58.18 - .63 = 57.55$

total paid: $58.18 \times 120 - .63 = 6980.97$

total interest: $6980.97 - 4795$



©2006 FLORIDA TODAY
caglecartoons.com
JEFF PARKER
jparker@flatoday.net
MOVE BACK HOME?!... KIDS TODAY ARE SO LAZY AND IRRESPONSIBLE! YOUR MOTHER AND I STARTED OUT WITH NOTHING!...
FIVE-FIGURE STUDENT LOAN DEBT
20 AND 30 SOME-THINGS
TRUST ME, I WOULD'VE LOVED STARTING OUT WITH NOTHING!...

- Write down the loan payment formula with numbers filled in for an 84212 loan for 30 years compounded at 6.75% monthly.
- Solve for the monthly payment.

  $$\frac{\text{loan amount } r}{1-(1+r)^{-n}} = \text{loan payment}$$
- Calculate the first two rows of the amortization table.

month	payment	interest paid	principal paid	loan balance

- Write down the loan payment formula with numbers filled in for an 84212 loan for 30 years compounded at 6.75% monthly.
- Solve for the monthly payment.

$$\frac{\text{loan amount } r}{1-(1+r)^{-n}} = \text{loan payment}$$

- Calculate the first two rows of the amortization table.

month	payment	interest paid	principal paid	loan balance

	A	B	C	D	E
1	condo cost	105265	monthly rate	0.005625	
2	loan amt	84212	1st years total interest	$5,656.88	
3	payment	$546.20	total interest 30 years	$112,419.07	
4					
5	month #	End of Month Payment	Interest Paid that Month	Principal Paid that Month	Loan Balance
6	1	$546.20	473.6925	$72.50	$84,139.50
7	2	$546.20	$473.28	$72.91	$84,066.58