

Exercise 12: Loan Analysis using One-Input Data Tables

After completing this exercise you will:

- better understand and be able to use Excel's PMT function.
 - be able to construct a one-input data table.
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Loan Analysis using the PMT Function

Most businesses need to borrow money at some stage in their development. A loan may be required to finance capital expenditure on new plant and machinery or on updating/improving existing office/production facilities. Either way the company needs to know the likely costs of borrowing so that it can budget for them. Excel's PMT function can be used to calculate the amounts required to payback a loan over a specified period of time.

Most of Excel's financial functions use a common set of arguments:

Common Arguments used by Excel's Financial Functions

rate	The interest rate per period.
per	The number of an individual payment period
nper	The number of payment periods.
pv	The present value of an investment, or the original amount invested.
fv	The future value of an investment, or the cash balance you want to attain after the last payment is made. If fv is omitted it is assumed to be zero (fv = 0 for a loan)
type	Indicates when payments are due: type= 0, payments due at end of period; type= 1, payments due at beginning of period; If omitted type is assumed to be zero.

PMT(rate,nper,pv,fv,type)

The **PMT function** calculates the payment needed each period to fully pay off a loan. fv and type are optional. If type is omitted it assumes that payment is made at the end of each period.

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For example, the monthly payments on a £57,500 loan payable over 20 years at a fixed annual interest rate of 10.5% (and paid on the last day of each month):
 $=\text{PMT}(10.5\%/12,20*12,57500) = -£574.07$



Note: that to calculate monthly payments you must divide the annual interest rate by 12, and multiply the number of years by 12.



Note: Excel returns a negative payment value = £-574.07.

This is because a payment is considered as an out-going, and therefore a negative value is returned. To convert this to a positive value (which is how we normally think of money) you can use the Absolute (ABS) function: =
 $\text{ABS}(\text{PMT}(10.5\%/12,20*12,57500)) = £574.07$

The loan payment calculated by PMT function includes principal and interest, but no taxes or fees that are sometimes associated with loans, i.e.

$\text{PMT} = \text{IPMT} + \text{PPMT}$ (this is covered in more detail in Exercise 14, which deals with Amortisation Tables).

The PMT function can also be used to calculate the amount of savings required to generate a lump sum at the end of a specified period of time. For example, if you wanted to save £100,000 over 25 years, assuming a fixed rate of interest of 5% pa, the amount you would have to save each month is given by: $=\text{ABS}(\text{PMT}(5\%/12,25*12,0,100000)) = £167.92$

What-If Calculations using Data Tables

The Data/Table command in Excel enables you to carry out simple 'What-If' analyses and examine the effect of changing certain variables on a particular calculation. There are two types of Data table:

A **single-input data table**, in which Excel calculates a formula a number of times replacing one variable with a series of different values. In this exercise you will construct a one-input data table which calculates the monthly repayments on a loan at different rates of interest. In this case the variable being replaced is the interest rate. See the figures below - all will become clearer as you work through the exercise!

A **two-input data table**, in which Excel calculates a formula a number of times replacing two variables, each with a series of different values. You will construct a two-input data table in Exercise 13 to calculate the monthly repayments on a differing loan amounts at different rates of interest. In this case the variables being replaced are the loan amount and the interest rate.

This exercise uses the PMT function to calculate the monthly payments on a loan of £40,000 at varying rates of interest over a period 10 years (called the term of the loan).

Open your itcExs.xls workbook and insert a new worksheet called Ex-12.

Using the figures (below) as reference create a spreadsheet which calculates the monthly repayments on a loan of £40,000 taken out over 10 years, assuming an interest rate of 9.00% per annum.

Enter a title in cell B2 and centre it across cells B2:G2.

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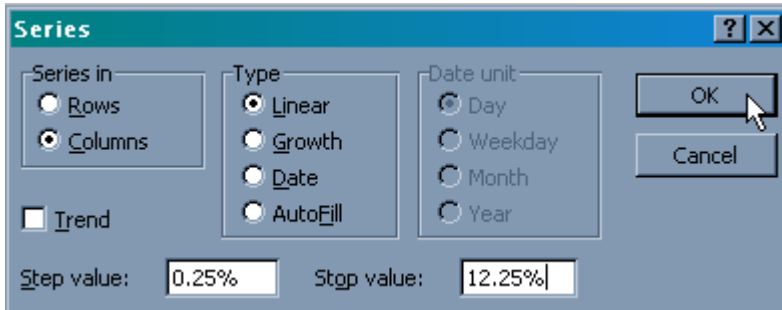
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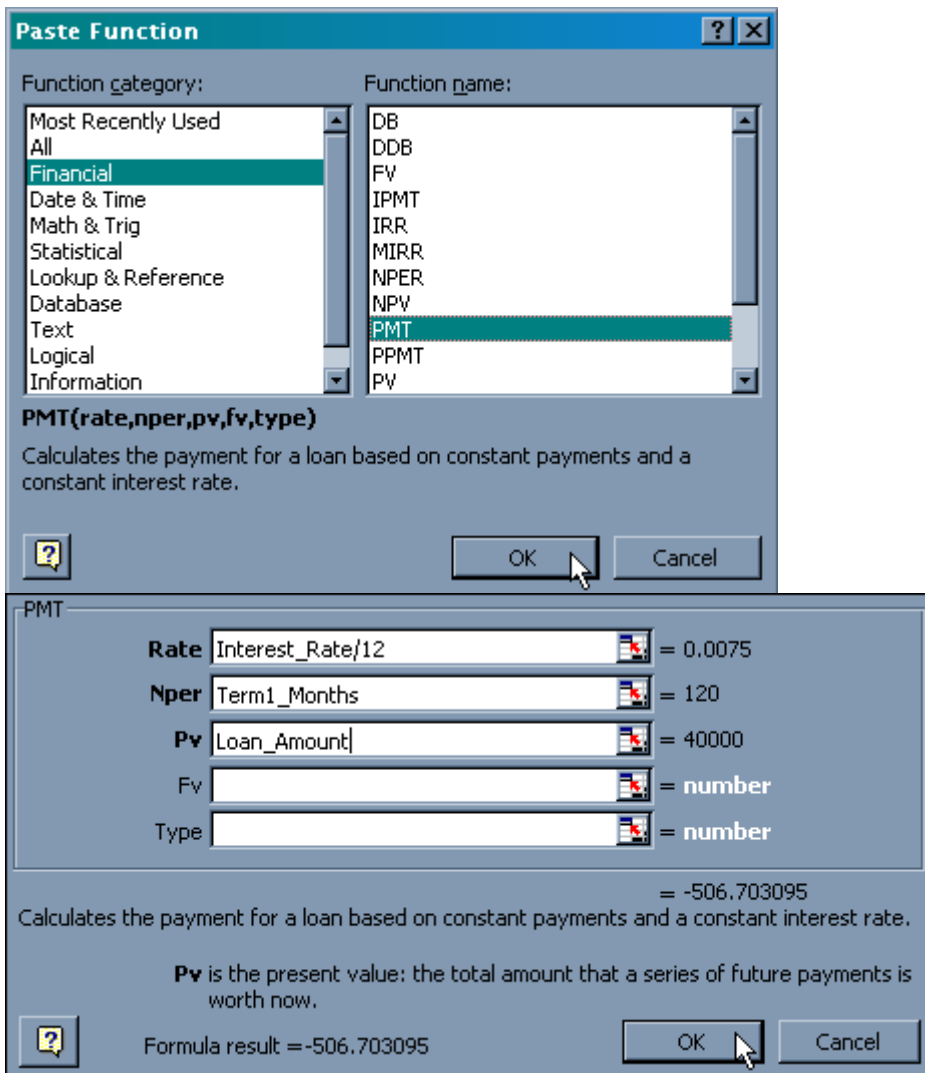
Create an Input Block by entering the Loan Amount, Interest Rate, Term (Years) and Term (Months) in cells D4:E7.

Use good worksheet practice and create appropriate names for the cells containing the Loan Amount, Interest Rate and Term (Months). Use these names in your worksheet formulas.

Select cell B11 and enter 9.00%. Then use Excel's Edit/Fill/Series to enter a series of interest rates, into cells (B11:B24). Step Value = 0.25%; Stop Value = 12.25%:



Move to cell C11 and use the Insert/Function command to enter the PMT function:



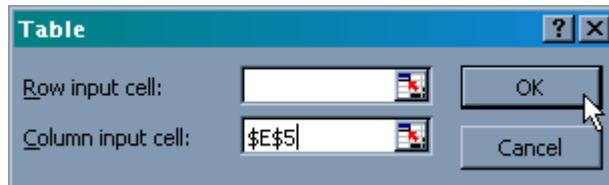
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Note: The PMT function calculates the loan payment on the basis of three variables: interest rate, term and loan amount. Because payments represents a negative cash flow, the PMT function returns a negative value. However, you will find it less confusing if payments are displayed as positive values. The ABS function can be used for this purpose, i.e. $=ABS(PMT(rate,nper,PV,fv,type))$ or the formula can be multiplied by -1 to make it positive, i.e. $=-PMT(rate,nper,PV,fv,type)$.

Select the block of cells (B11:C24) and use the Data/Table command to complete the table. In this example the data is being placed into a column so enter E5 as the Column Input Cell and leave the box for the Row Input Cell blank:



Enter a formula in D11 to calculate the total amount payable ($= \text{Gross_Monthly_Payment} \times \text{Term1_Months}$) and Drag and drop the formula down to D24 in order to complete the table.

Because *type* was omitted from the PMT function Excel assumes $type=0$. The values calculated by the PMT function thus correspond to payments at the end of the month. You can now extend your table to examine the effect of making payments at the beginning of each month.

Copy the column labels from cells (B10:D10) and paste into (E10:G10).

Copy the interest rate values and paste into cells (E11:E24).

Enter the modified PMT function into cell F11;
 $=ABS(PMT(Interest_Rate/12,Term1_Months,Loan_Amount,0,1))$.

Select block (E11:F24) and use the Data/Table command to complete this part of the table. The Column Input Cell is E5:

Format the table and add appropriate documentation: cell comments that explain your calculations and a header/footer.

Set the Print Area. Use Print Preview to see what your work will look like when printed out. When you are happy with its appearance Save your work and then Print it out.

	A	B	C	D	E	F	G	H	I
2	LOAN ANALYSIS								
3	Monthly Repayments at Varying Interest Rates								
4				Loan Amount:	£40,000				
5				Interest Rate:	9.0%				
6				Term (Years):	10				
7				Term (Months):	120				
8									
9	Payments due at end of period			Payments due at beginning of period					
		Interest Rate	Gross Monthly Payment	Total Amount Payable		Interest Rate	Gross Monthly Payment	Total Amount Payable	
10									
11		9.00%	£506.70	£60,804		9.00%	£502.93	£60,352	
12		9.25%	£512.13	£61,456					
13		9.50%	£517.59	£62,111					
14		9.75%	£523.08	£62,770					
15		10.00%	£528.60	£63,432		10.00%	£524.23	£62,908	
16		10.25%	£534.16	£64,099		10.25%	£529.63	£63,556	
17		10.50%	£539.74	£64,769		10.50%	£535.06	£64,207	
18		10.75%	£545.35	£65,443		10.75%	£540.51	£64,862	
19		11.00%	£551.00	£66,120		11.00%	£546.00	£65,519	
20		11.25%	£556.68	£66,801					
21		11.50%	£562.38	£67,486					
22		11.75%	£568.12	£68,174					
23		12.00%	£573.88	£68,866		12.00%	£568.20	£68,184	
24		12.25%	£579.68	£69,562		12.25%	£573.82	£68,859	
25									
26									

Uses PMT function to calculate the monthly repayment.
 =ABS(PMT(Interest_Rate/12,Term1_Months,Loan_Amount))

Data Table
 (=TABLE(E5))