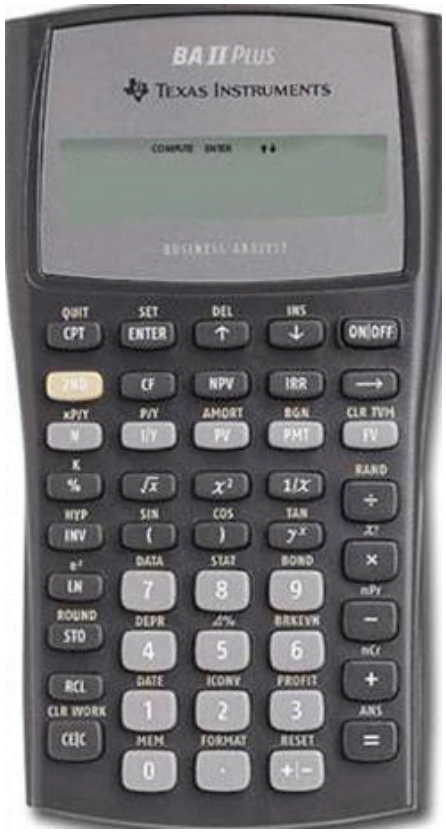
Texas BA II Calculator Workshop

Setting up your BAII

Calculator Workshop

Setting up your calculator (BAII Plus)



- Decimal places

  2nd [FORMAT] 5 ENTER

- Set to mathematical precedence

  2nd [FORMAT] ↑ 2nd ENTER

- No. of payments per year

  2nd I/Y 1

- Clear time value calculations

  2nd FV

Calculator Workshop

Memory function

- The calculator can store numbers for you

Example:

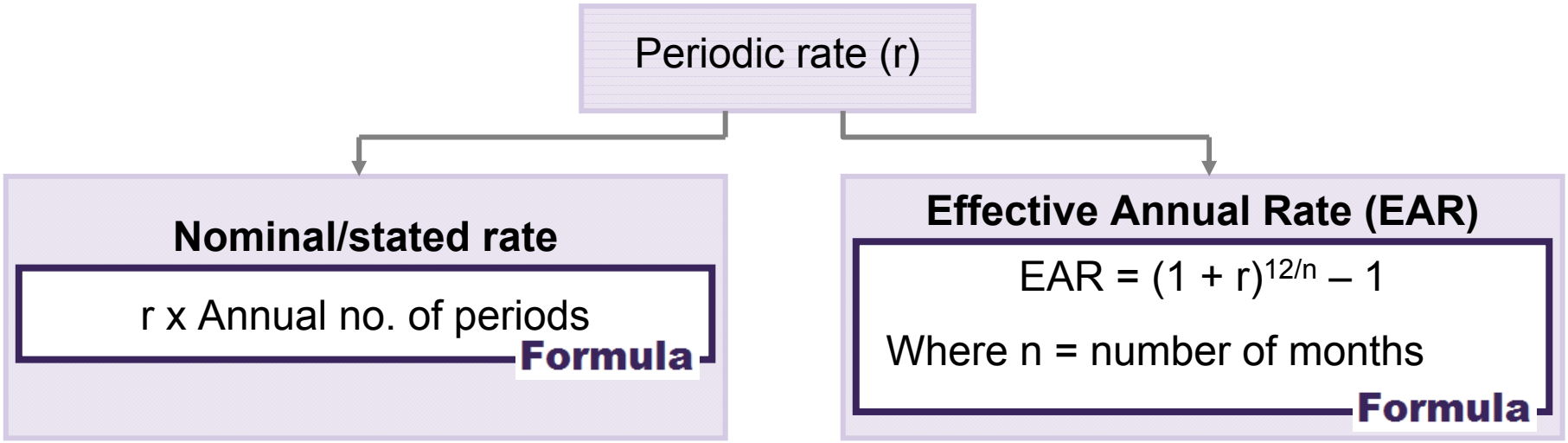
- You calculate the answer to 2 + 3.5 = 5.5 and then wish to store it
- Press [STO] then [1] (5.5 has now been stored and assigned to button [1]
- Having cleared the screen ([CE/C]), it is now possible to recall the number by pressing [RCL] then [1]

It is always possible to recall the last answer from the calculator by pressing [2nd] and then [ANS]

Nominal vs. Effective Interest Rates

Calculator Workshop

Calculating nominal and effective rates



Example: Calculating nominal and effective rates

- Calculate the nominal rate from a 4% six-monthly periodic rate
- Calculate the EAR from a 4% six-monthly rate
- Calculate the EAR from a nominal rate of 8% paid quarterly

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Example:

- 8% paid 6-monthly is, in effect, 8.16%
- 8% paid quarterly is, in effect, 8.243%

$$FV = \$100\left(1+\frac{0.08}{4}\right)^{4} = \$108.243$$

$$\text{Effective rate} = \left(1+\frac{r}{n}\right)^{n} - 1$$

where r is the nominal rate

Formula

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- You can calculate effective rates from nominal rates using the BA-II [2nd][ICONV]

NOM = [8] [ENTER] [↑]
C/Y = [2] [ENTER] [↑]
EFF = [CPT]

Calculator Workshop

CONTINUOUS COMPOUNDING

Future value based on continuous compounding

- $1 for 1 year at 100% pa, single period → $2
- $1 for 1 year at 100% pa, two periods → $2.25
- $1 for 1 year at 100% pa, four periods → $2.44

→

- $1 for 1 year at 100% pa, 1,000 periods → $2.717

→

- $1 for 1 year at 100% pa, infinite periods → $2.71828…

e

Calculator Workshop

Future value based on continuous compounding

- $FV = PVe^{rt}$
- $PV = FVe^{-rt}$

- There are two ways to get the BAII to continuously compound / discount:
  - Compounding
    - [0] [.] [0] [8] [2nd] [LN] [×] [1] [0] [0] [=] 108.33
  - Discounting
    - [0] [.] [0] [8] [+/−] [2nd] [LN] [×] [1] [0] [8] [.] [3] [2] [8] [7] [1] [=]

Calculator Workshop

Cheating

- [2nd] [ICONV]

  NOM= [8] [ENTER] [↑]

  C/Y= [9] [9] [9] [9] [9] [ENTER] [↑]

  EFF= [CPT]

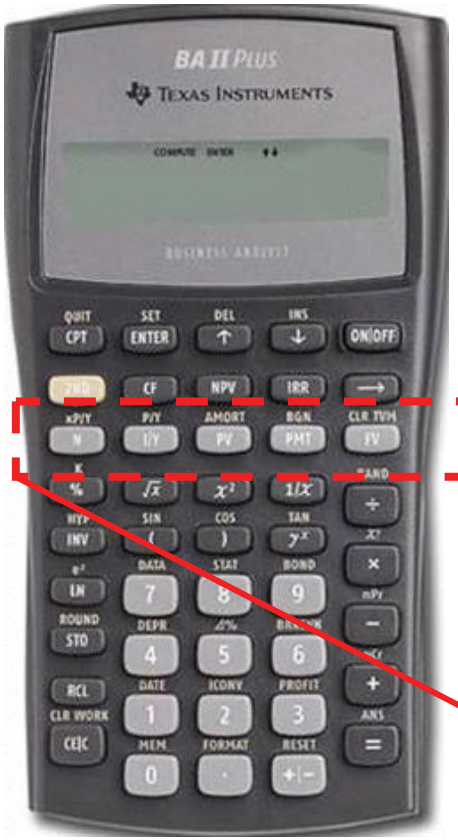
  $FV = PV\ (1 + i)^n$

Using the Present Value Function

Calculator Workshop

Example:

- $2,000 for five years at a compound interest rate of 4%?
- BEFORE YOU START CLEAR THE CALCULATOR [2nd] [CLR TVM]



> [N]

> [I/Y]

> [PV]

> [PMT]

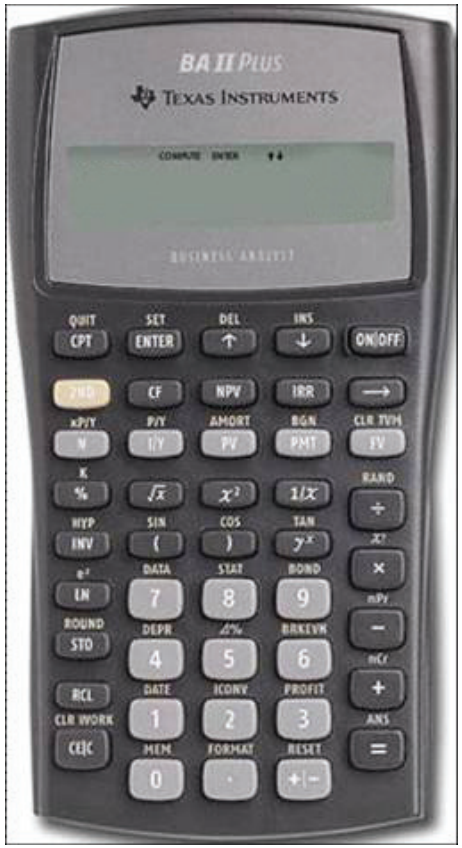
[CPT] > [FV]

NB : Signs

Calculator Workshop

Example:

- If $5,000 grows to $5,798.47 over three years, what is the six-monthly interest rate?
- BEFORE YOU START CLEAR THE CALCULATOR [2nd] [CLR TVM]



> [N]

[CPT] > [I/Y]

> [PV]

> [PMT]

> [FV]

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Future values of ordinary annuities

- For example, 3-year $5,000 annuity at 5%:

	>	N
	>	I/Y
	>	PV
	>	PMT
CPT	>	FV 15,762.50

Calculator workshop

Present value of ordinary annuities

- For example, 3-year $5,000 annuity at 5%:

	>	N
	>	I/Y
CPT	>	PV 13,616.24
	>	PMT
	>	FV

Calculator workshop

Example: Ordinary annuities: calculating an unknown variable

- 10yr $10,000 annuity, interest rates 5%. What is FV?
- 12yr annuity with a future value of $180,000 Interest rates are 5.5%. What are the annual payments?
- How many payments of $4,342.65 to get a future value of $60,000 at 7%?
- What interest rate would result in a future value of $50,445.05 over seven years with annual payments of $5,000?

Calculator Workshop

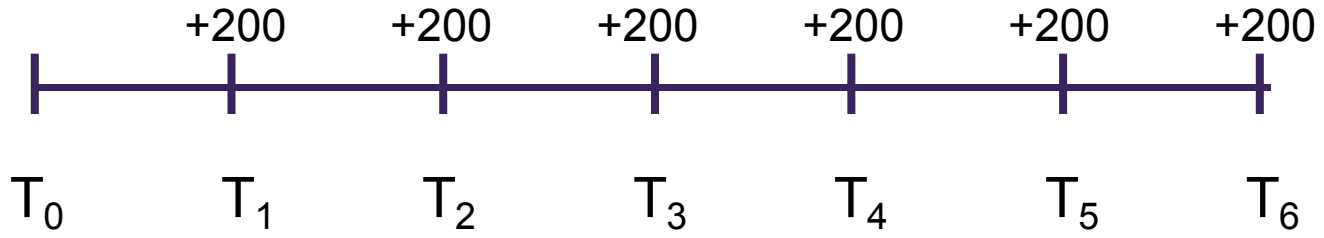
SERIES OF EVEN CASH FLOWS

Future Value/(Present Value) of an Annuity

- An annuity is something which pays regular cash flows at fixed periods, over a given period of time:

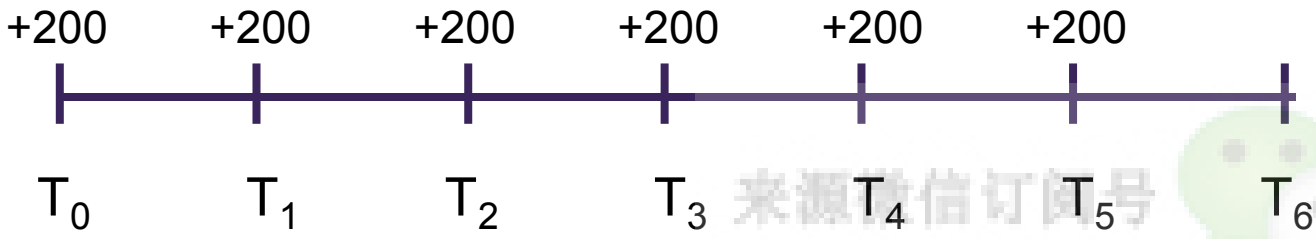
Ordinary Annuity

- The cash flows are made at the end of each period:



Annuity Due

- The payments are made at the beginning of each period:



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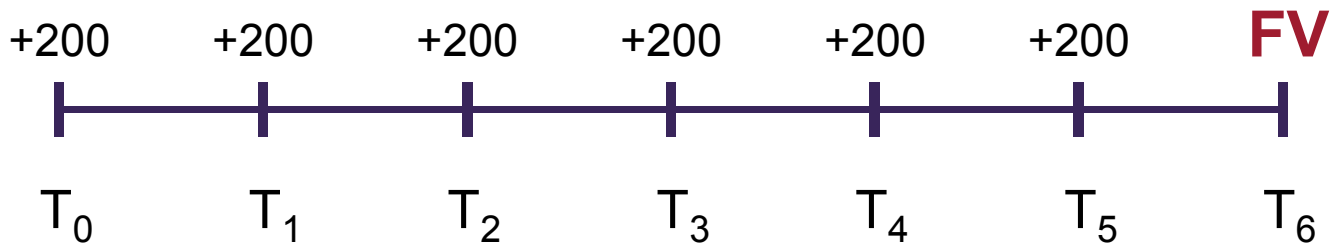
Future value of an annuity due

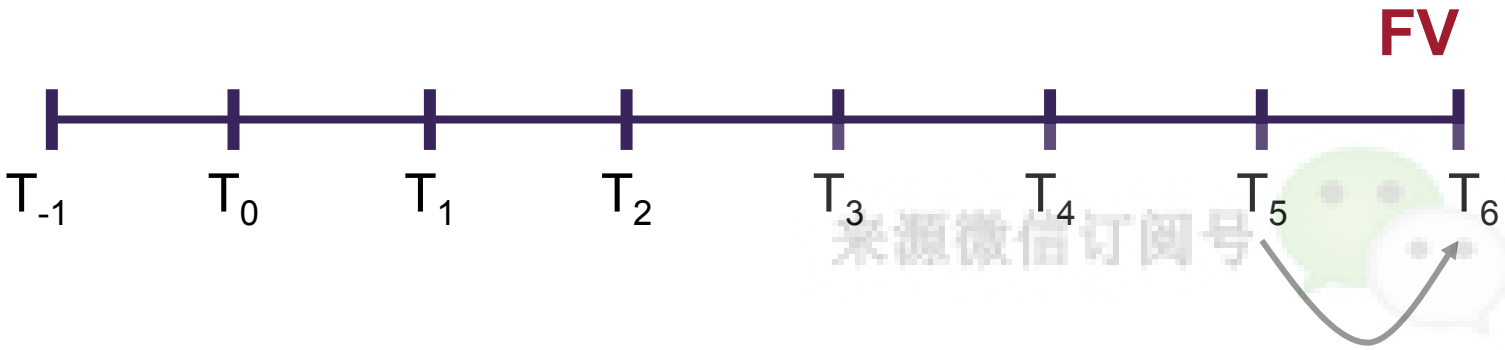
- Can use begin mode: 2nd [BGN] 2nd ENTER

- Future value is calculated at the end of the final period:



  - E.g. Six-year $200 annuity due, interest rates 8%

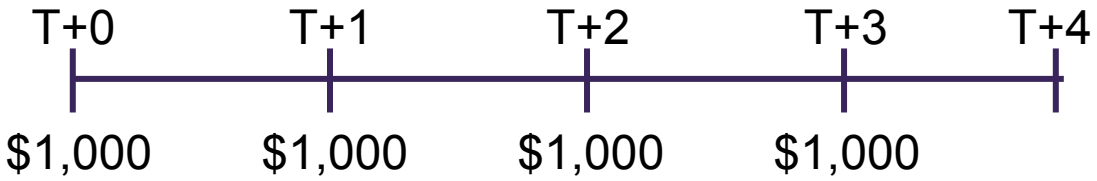
- Alternative method



Calculator Workshop

Example: Present value of an annuity due

- Compute the present value of a four year $1,000 annuity using a discount rate of 6% where the first payment is received today.



> N

> I/Y

CPT > PV $3,673.01

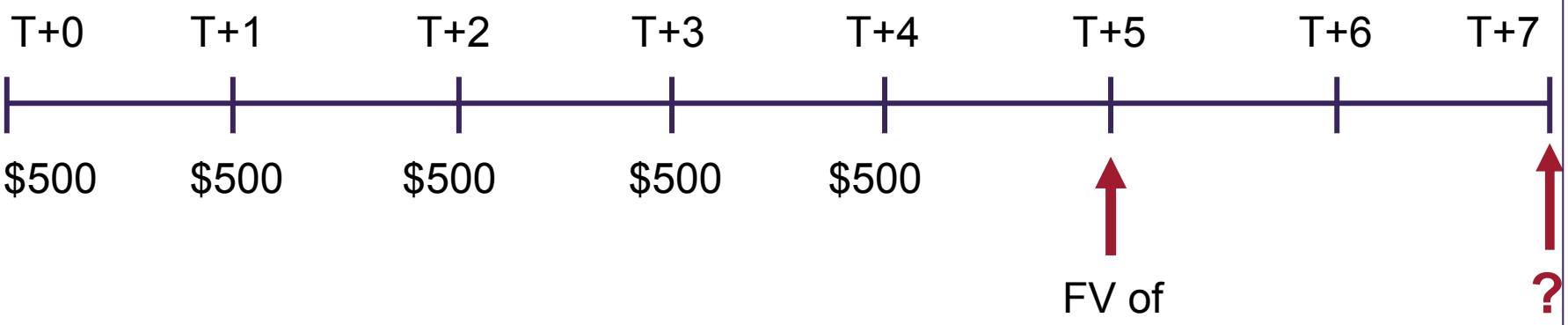
> PMT

> FV

Calculator Workshop

Example: Annuity due example

- You receive $500 now and at the beginning of the next four years
- What will be the value after seven years if interest rates are 5%?



= $3,198.30

> N

> I/Y

> PV

> PMT

CPT > FV

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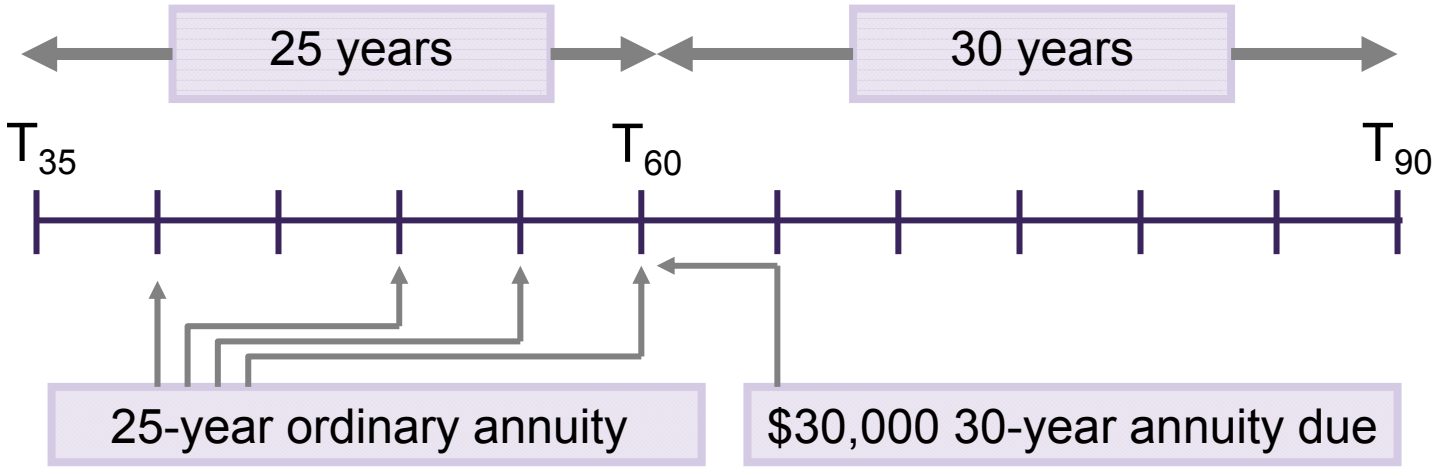
Example: Solving problems: funding a retirement program

- A 35-year old investor wishes to retire at 60, and draw $30,000 per year (at the beginning of each year), the last payment being on her 89th birthday
- Assuming that expected returns will be 8% prior to retirement and 7% during retirement what is the amount she needs to deposit at the end of each year until retirement?



Using the Cash Flow Function

Calculator Workshop

SERIES OF UNEVEN CASH FLOWS

Present value of a series of uneven cash flows

- What is the present value of the following cash flows below using a discount rate of 6%?

Cost	$1,000
Revenue	
Year 1	$700
Year 2	$800
Year 3	$900
Year 4	$900

[CF] [2nd] [CLR WORK]

[1] [0] [0] [0] [+/–] [ENTER] [↓]

[7] [0] [0] [ENTER] [↓] [↓]

[8] [0] [0] [ENTER] [↓] [↓]

[9] [0] [0] [ENTER] [↓] [2] [ENTER]

Calculator Workshop

Input	Display shows	Input
NPV	I = 0.00000	6 ENTER ↓
	NPV = 0.00000	CPT
	NPV = 1,840.91616	
IRR	IRR = 0.00000	CPT

Calculator Workshop

Example: Net Present Value

	0	1	2	3
Project A	(2,000)	1,500	700	400
Project B	(2,000)	800	1,500	500

- Calculate the NPV and IRR of both projects assuming a cost of capital of 10%

	NPV	IRR
Project A	242.67	18.69
Project B	342.60	19.92

Calculator Workshop

Example: MWRR

An investor buys a stock in XYZ Inc for $100. After 1 year another share in XYZ Inc. is bought for $150. At the end of year 2 both shares are sold for $180 each. During both years, a $4 dividend is paid on each stock. Calculate the dollar-weighted rate of return:

Cf0	C01	C02
(100)	(150)	360
	4	8
	(146)	368

Enter the cash flows into the calculator

[CF] [2nd] [CLR WORK]
[1] [0] [0] [+/−] [ENTER] [↓]
[1] [4] [6] [+/−] [ENTER] [↓] [↓]
[3] [6] [8] [ENTER]

Use the IRR function to solve for the DWRR

[IRR] [CPT]

Answer = 32.25%

Standard Deviation

Calculator Workshop

USING SAMPLE AND POPULATION DATA

Using the BA II plus in statistical calculations

- Calculate the average, standard deviation and variance of the following array:

30% 12% 25% 20% 23%

[2nd] [DATA] [2nd] [CLR WORK]

[3] [0] [ENTER] [↓] [↓]

[1] [2] [ENTER] [↓] [↓]

[2] [5] [ENTER] [↓] [↓]

[2] [0] [ENTER] [↓] [↓]

[2] [3] [ENTER]

Calculator Workshop

USING SAMPLE AND POPULATION DATA

Using the BA II plus in statistical calculations

- Retrieve:

  [2nd] [STAT] [2nd] [ENTER]

  Repeat [2nd] [ENTER] until the display shows 1-V

$\overline{X}$ = Mean

n = number of items input

Sx = Sample standard deviation

σ = population standard deviation

[x^2] Turns standard deviation to variance

Probability Weighted Standard Deviation

Calculator Workshop

PORTFOLIO EXPECTED RETURN AND VARIANCE

Scenario risk and probability

- Assigning probabilities to outcomes can be dealt with in a mathematical fashion

Example:

- A stock may exhibit differing returns dependent on the state of the world oil market. Higher oil prices will give rise to bad results and lower prices will give rise to good results.

Results Outcome	Return (r) %	(P)	p*r	r – E(r)	P(r - E(r))²
Bad	3.000	0.2	0.6	-7.0	9.8
OK	8.000	0.3	2.4	-2.0	1.2
Good	14.000	0.5	7.0	4	8.0
		E(r)	**10**		
				Variance	**19**
				SD	**4.36%**

Calculator Workshop

Input	Display shows	Input	Display shows
2nd [DATA] 2nd [CLR WORK]	X01	3 ENTER ↓	Y01= 1.00000
2 0 ENTER ↓	X02	8 ENTER ↓	Y02=
3 0 ENTER ↓	X03	1 4 ENTER ↓	Y03=
5 0 ENTER			

Calculator Workshop

Input	Display shows	
2nd [STAT]	1-V	If it doesn't press 2nd ENTER until it does.
↓	n = 100.00000	If it doesn't you've not put the probabilities in correctly
↓	$\overline{X}$ = 10.00000	
↓ ↓	σ x = 4.3589	The probability adds up to 100% so we've got all possible values; don't use the sample standard deviation

Using the AMORT Function

Calculator Workshop

USING THE AMORT FUNCTION

- Amortizing bonds

Example:

- BigCorp Inc. issues at par a $200,000 8.5% coupon (annual coupon) 30-year fixed rate amortising bond. How much interest is paid off in year one?

Year	Opening	Payment	Interest	Ending	Principal
1	$200,000	($18,610)	$17,000	$198,390	$1,610
2	$198,390	($18,610)	$16,863	$196,643	$1,747

Calculator Workshop

- Work out the payment that will amortize the bond to zero over it's life

[N] = 30 [I/Y] = 8.5 [PV] = 200,000 [FV] = 0 [CPT] [PMT] = 18,610.12

2. Now we use the amortization function to observe the bond

[2nd] [AMORT]
[1] [ENTER] [↓]
[1] [ENTER] [↓] BAL = $198,389.88
[↓] PRN = $1,610.12
[↓] INT = $17,000

Lease Accounting Using the AMORT Function

Calculator Workshop

Example: Accounting for leases by a lessee

- Equipment is leased for 4 years on 1/1/03
- Lease payments: $1,000 due on 31/12
- Rate implicit in the lease: 10%
- Economic life of the asset: 5 years
- Current fair market value of the asset: $3,500

- Show the effect of the above lease on the financial statements

Calculator Workshop

1. Enter the details of the lease into the calculator:

[N] = 4 [I/Y] = 10 [PMT] = 1,000 [FV] = 0 [CPT] [PV] = 3,169.87

2. Now we use the amortization function to observe details of the lease at different time periods

[2nd] [AMORT]
[1] [ENTER] [↓]
[1] [ENTER] [↓] BAL = $2,486.85
[↓] PRN = $683.01
[↓] INT = $316.99

Calculator Workshop

Example: Accounting for leases by a lessee

Period	Opening balance	Interest expense (income statement) @ 10%	Cash payment	Closing balance (balance sheet)
1	3170	317	(1,000)	2487
2	2487			
3				
4				

Calculator Workshop

Solution: Accounting for leases by a lessee

Period	Opening balance	Interest expense (income statement) @ 10%	Cash payment	Closing balance (balance sheet)
1	3,170	317	(1,000)	2,487
2	2,487	249	(1,000)	1,736
3	1,736	174	(1,000)	910
4	910	90	(1,000)	Nil

Bond Basics

Calculator Workshop

Example: Calculating the present value of the cash flows

How much would you pay for a seven-year 4% coupon bond with a face value of $1,000 and where the YTM is 8%?

Answer:

N		=
I/Y		=
PMT		=
FV		=
CPT	PV	=

Calculator Workshop

Example: Calculating the present value of the cash flows

Using the YTM valuation approach, what is the price of a two-year bond with a semi-annual coupon of 6% matured at $1000 with a YTM of 4%?

[N] =

[I/Y] =

[PMT] =

[FV] =

[CPT] [PV] =

Example: Calculating the present value of the cash flows

Using the YTM valuation approach, what is the price of a two-year bond with a semi-annual coupon of 6% matured at $1000 with a YTM of 8%?

[N] =

[I/Y] =

[PMT] =

[FV] =

[CPT] [PV] =

Calculator Workshop

CALCULATING THE PRESENT VALUE OF THE CASH FLOWS

Valuing zero-coupon bonds

Example:

How much would you pay for a seven-year zero coupon bond with a face value of $1,000 and where the YTM is 8%?

- Answer:

  [N] =

  [I/Y] =

  [FV] =

  [CPT] [PV] =

Calculator Workshop

YIELD TO MATURITY

- The interest rate that will make the present value of a bond's cash flows equal to it's market price
- An application of the IRR

Example:

What is the YTM on a bond which is currently priced at $802.07 with a 6% semi-annual coupon, which is to be redeemed at par in 20 years at $1000?

[N] =

[PV] =

[PMT] =

[FV] =

[CPT] [I/Y] =

Calculator Workshop

Example: Cash flow yield

A MBS is currently trading at $99 and has three months to maturity. The expected cash flows for the remaining three months are $30, $35, $40. Calculate the cash flow yield.

Calculator Workshop

Solution: Cash flow yield

A MBS is currently trading at \$99 and has three months to maturity. The expected cash flows for the remaining three months are \$30, \$35, \$40. Calculate the cash flow yield.

CF0	=	-99
C01	=	30
C02	=	35
C03	=	40

CF 2nd [CLR WORK]

9 9 +/− ENTER ↓

3 0 ENTER ↓ ↓

3 5 ENTER ↓ ↓

4 0 ENTER

IRR CPT → 2.86%

(1.0286^6)-1 = 18.44% is the 6-monthly compounded rate

18.44% x 2 = **36.88%** is the cash flow yield annualized on a BEY basis

Bond Accounting Using the AMORT Function

Calculator Workshop

Example:

- A firm issues a three year bond with a face value of $40,000
  - Semi-annual coupon rate: 8%
  - Market interest rate: 9%
  - Initial receipt (PV of future cash flows, discounted at the market rate)
- How much would the firm have raised at issuance?

6 [N] 4.5 [I/Y] 1600 [PMT] 40000 [FV] [CPT] [PV]

- Show the interest expense (income statement) and the value of the liability (balance sheet) over the three year term of the bond

Calculator Workshop

Example:

Period	Opening balance	Interest expense (income statement) @4.5%	Cash payment	Closing balance (balance sheet)
1	38968	1754	(1600)	39122
2	39122			
3				
4				
5				
6				

Calculator Workshop

Solution:

Period	Opening balance	Interest expense (income statement) @4.5%	Cash payment	Closing balance (balance sheet)
1	38968	1754	(1600)	39122
2	39122	1760	(1600)	39282
3	39282	1768	(1600)	39450
4	39450	1775	(1600)	39625
5	39625	1783	(1600)	39808
6	39808	1792	(1600)	40000

Calculator Workshop

Input	Display shows	Input (for Yr 1)
2nd [AMORT]	P1 =	1 ENTER ↓
	P2 =	2 ENTER ↓
	BAL= -39,282.49	↓
	PRN= -314.07	↓
	INT= -3,514.06	

- The input for P1 is the start time period and P2 the end time period so for the second year P1 and P2 should be set to 3 and 4 respectively (remember each year is 2 time periods)

Depreciation Methods

Calculator Workshop

Depreciation methods using the calculator

- The calculator can be used to calculate the following methods of depreciation expense
  - Straight line
  - Double-declining balance

Example:

- Fixed asset cost: $10,000
- Salvage value: $2,000
- Useful life: 4 years per 2,500 units per year

- Calculate the depreciation expense for years 1 to 4 using the following depreciation methods:
  - Straight line
  - Double-declining balance

Calculator Workshop

Input	Screen Displays	Meaning	Input
2nd [DEPR]	SL	Straight line depreciation	2nd ENTER to change
↓	LIF=	Life	4 ENTER
↓ ↓	CST=	Cost	1 0 0 0 0 ENTER
↓	SAL=	Salvage value	2 0 0 0 ENTER
↓	YR=	Year of life you are calculating for	
↓	DEP	Depreciation expense for that year	
	RBV	Residual Book Value at the end of that year	