Data Tables, Dates, and Time

Presented by Wayne Wilmeth

Data Tables

One Variable Data Tables

Two Variable Data Tables

Break Even Data Table

One Variable Data Table

Show the Possible Outcomes as you Vary a Single Data Cell

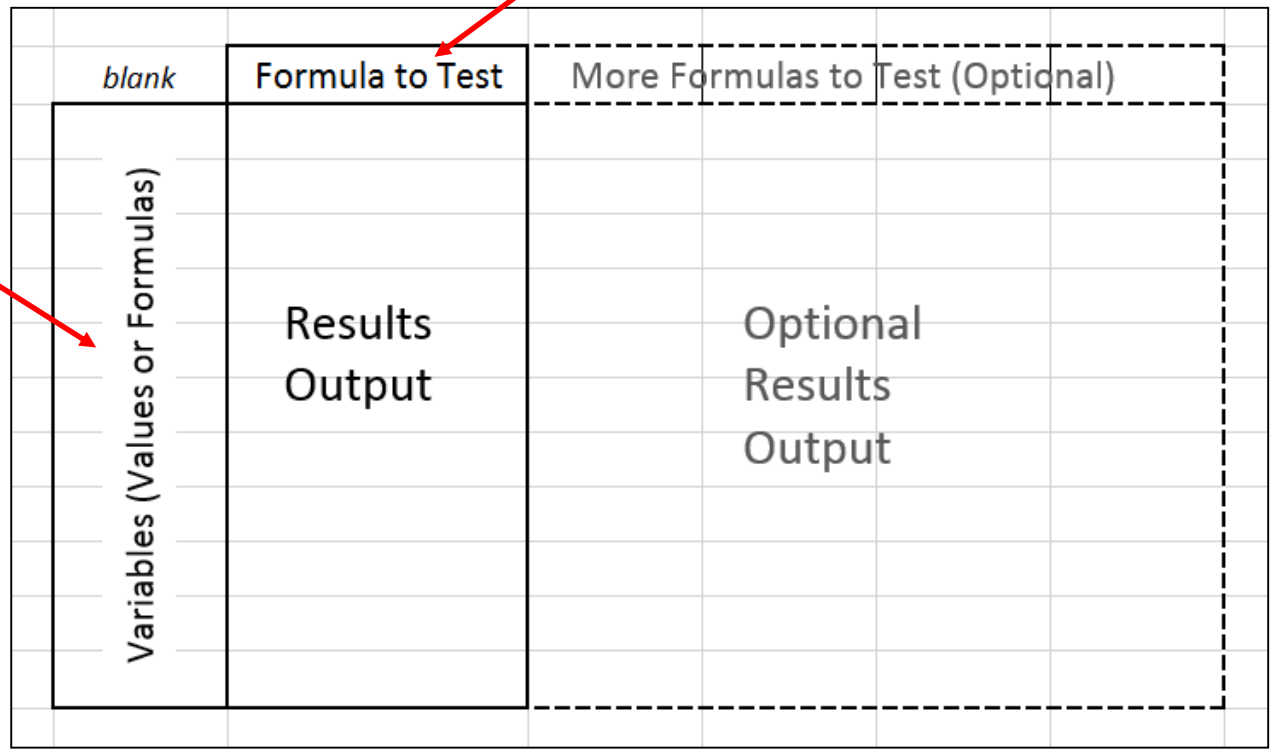
Structure of a One Variable Data Table

Structure of One Variable Data Table

These are the variables you wish to test. In this example they are the Units Sold. Each value in the column will be run through the cell containing our Units Sold (B6) to see what the corresponding Profit would be. B6 is our ***Column Input Cell*** *because our variables are in a column and they will be substituted into cell B6.*

This is the formula (or a link to the formula) that returns the results you are after. In this example it is the ***Profit*** *formula in B12 so we would type: =B12*

	A	B	C	D	E
1	**What Would Profit be for Different Units Sold?**				
2	*Assume Price is Steady at $33*				
3					
4				**Units**	**Profit**
5	Price	$ 33.00			$ 1,600.00
6	Units Sold	$ 200.00		-	
7	Revenue	$ 6,600.00		50	
8	Cost Per Unit ($15)	$ 15.00		100	
9	Variable Cost	$ 3,000.00		150	
10	Fixed Costs ($2,000)	$ 2,000.00		200	
11	Total Costs	$ 5,000.00		250	
12	Profit	$ 1,600.00		300	
13				350	
14				400	
15				450	



Exercise 1: One Variable Data Table – Units Vary

Find Profits for Various Units Sold

	A	B	C	D	E
1	**What Would Profit be for Different Units Sold?**				
2	*Assume Price is Steady at $33 and Start with Units Sold at 200.*				
3					
4				**Units**	**Profit**
5	Price	$ 33			=B12
6	Units Sold	200		-	
7	Revenue	$ 6,600.00	=B5*B6	50	
8	Cost Per Unit ($15)	$ 15.00		100	
9	Variable Cost	$ 3,000.00	=B6*B8	150	
10	Fixed Costs ($2,000)	$ 2,000.00		200	
11	Total Costs	$ 5,000.00	=B9+B10	250	
12	Profit	$ 1,600.00	=B7-B11	300	
13				350	
14				400	
15				450	

Part 1
Fill out the Spreadsheet as shown.

Exercise 1: One Variable Data Table – Vary Units

Find Profits for Various Units Sold

	A	B	C	D	E
1	**What Would Profit be for Different Units Sold?**				
2	*Assume Price is Steady at $33 and Start with Units Sold at 200.*				
3					
4				**Units**	**Profit**
5	Price	$ 33			$ 1,600.00
6	Units Sold	200		-	
7	Revenue	$ 6,600.00		50	
8	Cost Per Unit ($15)	$ 15.00		100	
9	Variable Cost	$ 3,000.00		150	
10	Fixed Costs ($2,000)	$ 2,000.00		200	
11	Total Costs	$ 5,000.00		250	
12	Profit	$ 1,600.00		300	
13				350	
14				400	
15				450	
16					

Part 2

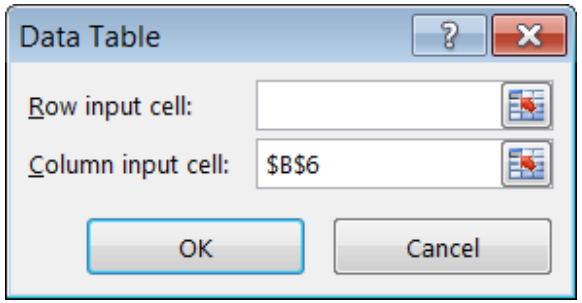
a.) Highlight D5:E15

b.) From the menu click: "**Data – What If Analysis – Data Table**".

c.) Set the "**Column input cell**" to **B6** (Units Sold) and click "**OK**".

d.) Click "**OK**".

	A	B	C	D	E
	uld Profit be for Different Units Sold?				
	ice is Steady at $33 and Start with Units Sold at 200.				
				Units	**Profit**
		$ 33			$ 1,600.00
6	Units Sold	200		-	$ (2,000.00)
7	Revenue	$ 6,600.00		50	$ (1,100.00)
8	Cost Per Unit ($15)	$ 15.00		100	$ (200.00)
9	Variable Cost	$ 3,000.00		150	$ 700.00
10	Fixed Costs ($2,000)	$ 2,000.00		200	$ 1,600.00
11	Total Costs	$ 5,000.00		250	$ 2,500.00
12	Profit	$ 1,600.00		300	$ 3,400.00
13				350	$ 4,300.00
14				400	$ 5,200.00
15				450	$ 6,100.00
16					



You should get the profits shown to the left. It tells you what your profits would be for each value of Units.

Student Exercise: Show Profit for Various Profits

Show what the Profits would be if you Vary Price

	A	B	C	D	E
1	**What Would Profit be for Different Prices?**				
2	*Assume Units Sold is Steady at 500 and start with a Price of $15.*				
3					
4				**Price**	**Profit**
5	Price	$ 15			$ (2,000.00)
6	Units Sold	500		15	$ (2,000.00)
7	Revenue	$ 7,500.00		16	$ (1,500.00)
8	Cost Per Unit ($15)	$ 15.00		17	$ (1,000.00)
9	Variable Cost	$ 7,500.00		18	$ (500.00)
10	Fixed Costs ($2,000)	$ 2,000.00		19	$ -
11	Total Costs	$ 9,500.00		20	$ 500.00
12	Profit	$ (2,000.00)		21	$ 1,000.00
13				22	$ 1,500.00
14				23	$ 2,000.00
15				24	$ 2,500.00

Exercise 2: One Variable, Two Formulas

Show Future Value for Various Monthly Deposits

	A	B	C	D	E	F
1	**Retirement Planning: FV(Rate/12,Months,Deposits)**					
2						
3					**No Investing**	**Investing**
4	Monthly Deposit	10			$3,600.00	$6,940.49
5	Years Until Retirement	30		100	$ 36,000	$ 69,405
6	Expected Monthly Avg Rate	4%		125	$ 45,000	$ 86,756
7				150	$ 54,000	$ 104,107
8				175	$ 63,000	$ 121,459
9				200	$ 72,000	$ 138,810
10				225	$ 81,000	$ 156,161
11				250	$ 90,000	$ 173,512
12				275	$ 99,000	$ 190,864
13				300	$ 108,000	$ 208,215
14				325	$ 117,000	$ 225,566
15				350	$ 126,000	$ 242,917

Determine how much money you would have in 30 years by depositing a specific monthly amount.

Show one column if you simply hid it under your mattress (12*30*Monthly deposit)

And another column if you invested it at 4%.
=FV(Rate,Periods,Pmt Amount)

Exercise 2: One Variable, Two Formulas

Show Future Value for Various Monthly Deposits

	A	B	C	D	E	F
1	**Retirement Planning: FV(Rate/12,Months,Deposits)**					
2						
3					**No Investing**	**Investing**
4	Monthly Deposit	10			=B5*12*B4	=-FV(B6/12,B5*12,B4)
5	Years Until Retirement	30		100		
6	Expected Monthly Avg Rate	4%		125		
7				150		
8				175		
9				200		
10				225		
11				250		
12				275		
13				300		
14				325		
15				350		

Part 1
Type the formulas shown in E4 and F4.

Exercise 2: One Variable, Two Formulas

Show Future Value for Various Monthly Deposits

	A	B	C	D	E	F
1	**Retirement Planning: FV(Rate/12,Months,Deposits)**					
2						
3					**No Investing**	**Investing**
4	Monthly Deposit	10			$3,600.00	$6,940.49
5	Years Until Retirement	30		100		
6	Expected Monthly Avg Rate	4%		125		
7				150		
8				175		
9				200		
10				225		
11				250		
12				275		
13				300		
14				325		
15				350		

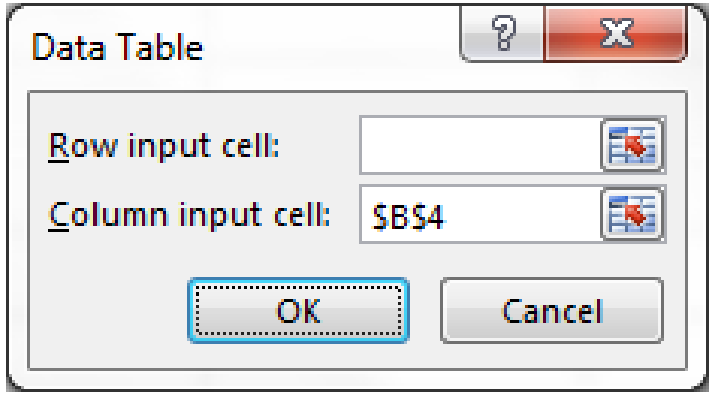
Part 2

a.) Highlight D4:F15

b.) From the menu click:
Data – What If Analysis – Data Table…

c.) Set the *Column Input* Cell to **B4**.

d.) Click "**OK**".



You should get the results shown on the first slide of this exercise.

Two Variable Data Table

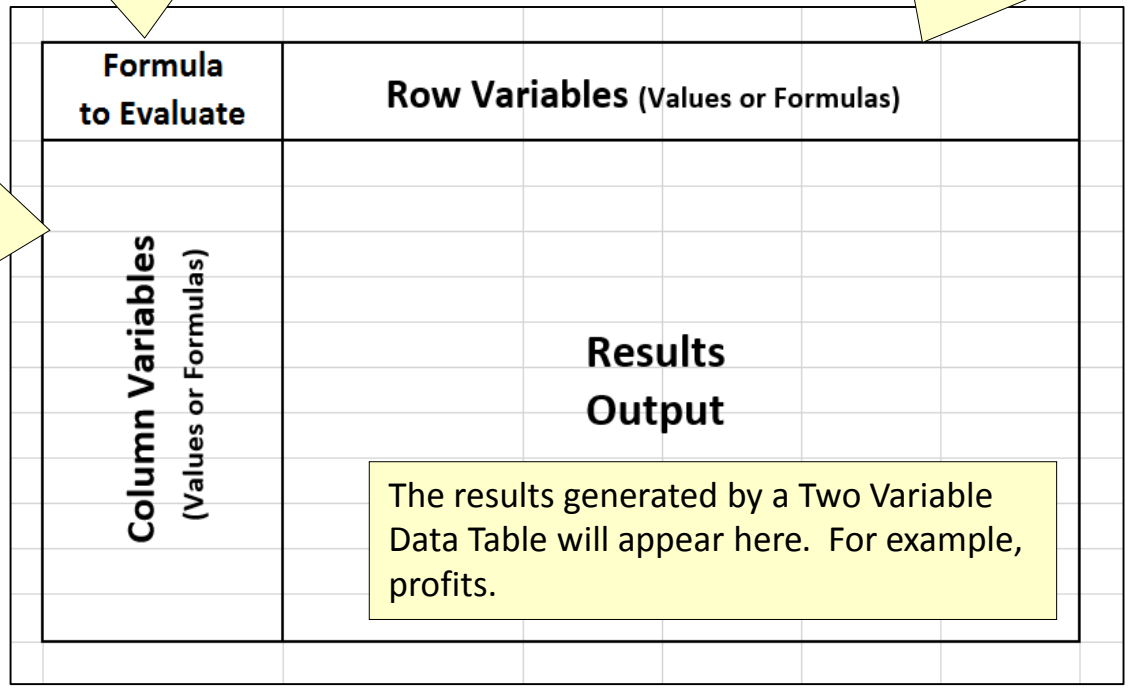
Show the Possible Outcomes as you Vary Two Data Cells

Structure of a Two Variable Data Table

Formula Whose Results You wish to Display
This corner of the structure must contain either the formula whose results you wish to display or a link to the cell containing the formula whose results you wish to display. For example, it might be a formula that returns *Profit* for given *Prices* and *Units Sold*.

Row Variable List
This is a list of the different values you wish to substitute into a cell that the formula in the right corner references. For example, if the cell in the right corner returns *profit*, this row might contain *Unit Price*. Row variables should be values as formulas can produce incorrect results if they reference the same celled used to produce your results.

Column Variable List
This is a list of the different values you wish to substitute into a cell that the formula in the right corner references. For example, if the cell in the right corner returns *Profit*, this row might contain *Units Sold*. Column variables should be values as formulas can produce incorrect results if they reference the same celled used to produce your results.



Exercise: Two Variable Data Table

Show Future Value for Various Monthly Deposits and Various Rates

	A	B	C	D	E	F	G	H	I	J	K	L
1	**Two Variable Data Table: FV as Deposits and Rate Varies**											
2	**Deposits are Monthly for 30 Years in Equal Amounts**											
3												
4	Monthly Deposit	-100		$69,404.94	2%	3%	4%	5%	6%	7%	8%	9%
5	Years Until Retirement	30		-100	$ 49,273	$ 58,274	$ 69,405	$ 83,226	$100,452	$121,997	$149,036	$183,074
6	Expected Monthly Avg Rate	4%		-125	$ 61,591	$ 72,842	$ 86,756	$104,032	$125,564	$152,496	$186,295	$228,843
7	Value at Retirement (FV)	$69,404.94		-150	$ 73,909	$ 87,411	$104,107	$124,839	$150,677	$182,996	$223,554	$274,612
8				-175	$ 86,227	$101,979	$121,459	$145,645	$175,790	$213,495	$260,813	$320,380
9				-200	$ 98,545	$116,547	$138,810	$166,452	$200,903	$243,994	$298,072	$366,149
10				-225	$110,863	$131,116	$156,161	$187,258	$226,016	$274,493	$335,331	$411,917
11				-250	$123,181	$145,684	$173,512	$208,065	$251,129	$304,993	$372,590	$457,686
12				-275	$135,499	$160,253	$190,864	$228,871	$276,242	$335,492	$409,849	$503,454
13				-300	$147,818	$174,821	$208,215	$249,678	$301,355	$365,991	$447,108	$549,223
14				-325	$160,136	$189,389	$225,566	$270,484	$326,467	$396,491	$484,367	$594,992
15				-350	$172,454	$203,958	$242,917	$291,291	$351,580	$426,990	$521,626	$640,760

Exercise: Two Variable Data Table

Show Future Value for Various Monthly Deposits and Various Rates

	A	B	C	D	E	F	G	H	I	J	K	L
1	**Two Variable Data Table: FV as Deposits and Rate Varies**											
2	**Deposits are Monthly for 30 Years in Equal Amounts**											
3												
4	Monthly Deposit	-100		=B7	2%	3%	4%	5%	6%	7%	8%	9%
5	Years Until Retirement	30		-100								
6	Expected Monthly Avg Rate	4%		-125								
7	Value at Retirement (FV)	=FV(B6/12,B5*12,B4)		-150								
8				-175								
9				-200								
				-225								
				-250								
12				-275								
13				-300								
14				-325								
15				-350								

Part 1: Create the data cells and formulas shown.

Exercise: Two Variable Data Table

Show Future Value for Various Monthly Deposits and Various Rates

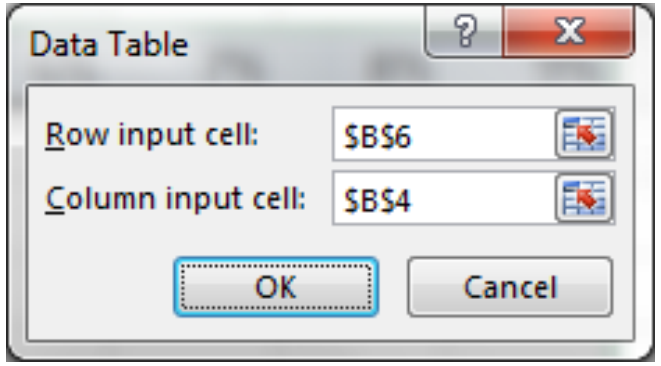
Part 2

a.) Highlight **D4:L15**.

b.) From the menu:
Data – What If Analysis – Data Table…

c.) Set Row Input Cell to: **B6**
Set Column Input Cell to **B4**

d. Click "**OK".**



	A	B	C	D	E	F	G	H	I	J	K	L
1	**Two Variable Data Table: FV as Deposits and Rate Varies**											
2	**Deposits are Monthly for 30 Years in Equal Amounts**											
3												
4	Monthly Deposit	-100		$69,405	2%	3%	4%	5%	6%	7%	8%	9%
5	Years Until Retirement	30		-100								
6	Expected Monthly Avg Rate	4%		-125								
7	Value at Retirement (FV)	$69,404.94		-150								
8				-175								
9				-200								
10				-225								
11				-250								
12				-275								
13				-300								
14				-325								
15				-350								

You should get the results shown on the first page of this exercise.

Using Data Tables (and some algebra) for a Break Even Analysis

What is Break Even Analysis?

The Point where your Sales Cover your Expenses

	A	B	C	D
1	**Break Even Analysis (Profit Goes to 0)**			
2	*If we produced 100 units, what price must we sell them at to break even?*			
3	*If Price is $25, how many units must we sell to break even?*			
4				
5	Price	**25**		
6	Units Sold	**100**		
7	Revenue	$ 2,500.00		
8	Cost Per Unit ($15)	$ 15.00		
9	Variable Cost	$ 1,500.00		
10	Fixed Costs ($2000)	$ 2,000.00		
11	Total Costs	$ 3,500.00		
12	Profit	$ (1,000.00)		

Goes to Zero at Break Even

- For a given price, how many units must you sell to break even?

or

- For a given number of units sold, what price must you charge to break even?

Exercise: Find Breakeven Prices for Various Units Sold

Using a One Variable Data Table

	A	B	C	D	E
1	**Break Even Analysis (Profit = 0)**				
2	*What Should Price be to break even if we vary Units?*			**Units Varied**	
3				Units	Prices Are:
4		**Units Varied**			$55.00
5	Price	$ 55.00		50	$55.00
6	Units Sold	**50**		100	$35.00
7	Revenue	$ 2,750.00		150	$28.33
8	Cost Per Unit ($15)	$ 15.00		200	$25.00
9	Variable Cost	$ 750.00		250	$23.00
10	Fixed Costs ($2000)	$ 2,000.00		300	$21.67
11	Total Costs	$ 2,750.00		350	$20.71
12	Profit	$ -		400	$20.00
13				450	$19.44
14				500	$19.00

We wish to generate a list of breakeven *Prices* for the *Units* listed. For example, at 300 Units the breakeven price is $21.67.

This example has two main requirements:

Part One: Building the Model
Create a model where typing almost any number in *Units Sold* will cause the formula in *Price* to return a value that causes the formula in *Profit* to return zero.

Part Two: Use of a One-Variable Data Table to generate Prices.

Exercise: Find Breakeven Prices for Various Units Sold

Algebraically Forcing Profit to Go to Zero when Units Sold Varies (Finding Price)

Price and *Units Sold* are both variables that affect *Profit*. If we state any value for **Units Sold** there is almost always a corresponding value we can assign to **Price** to make Profit go to zero.

Profit = Price * Units – Variable Cost Per Unit * Units – Fixed Costs

	A	B
4		
5	Price	$ 25.00
6	Units Sold	500
7	Revenue	$ 12,500.00
8	Cost Per Unit ($15)	$ 15.00
9	Variable Cost	$ 7,500.00
10	Fixed Costs ($2000)	$ 2,000.00
11	Total Costs	$ 9,500.00
12	Profit	$ 3,000.00

If we set Profit to Zero and Solve for Price, the equation will return the Price we need to charge for any given number of Units.

Exercise: Find Breakeven Prices for Various Units Sold

Part One: Setting Profit to Zero and Solving for Price

Profit = Price * Units - Var. Cost Per Unit * Units - Fixed Costs

0 = Price * Units - Var. Cost Per Unit * Units - Fixed Costs

Var. Cost Per Unit * Units + Fixed Costs = Price * Units

$$\text{Var. Cost Per Unit} + \frac{\text{Fixed Costs}}{\text{Units}} = \text{Price}$$

$$\text{Break Even Price} = \text{Var. Cost Per Unit} + \frac{\text{Fixed Costs}}{\text{Units}}$$

Note that if you want Break Even Units, use this Formula:

$$\text{Break Even Units} = \frac{\text{Fixed Costs}}{(\text{Price} - \text{Var. Cost Per Unit})}$$

Exercise: Find Breakeven Prices for Various Units Sold

Part one: Formula in Price sets Profit to Zero if Value in Units Sold Changes

	A	B	C
1	**Break Even Analysis (Profit = 0)**		
2	*What Should Price be to break even if we vary Units?*		
3			
4			
5	Price	$35	=B8+(B10/B6)
6	Units Sold	**$100**	
7	Revenue	$3,500	=B5*B6
8	Cost Per Unit ($15)	$15	
9	Variable Cost	$1,500	=B8*B6
10	Fixed Costs ($2000)	$2,000	
11	Total Costs	$3,500	=B9+B10
12	**Profit**	**$0**	=B7-B11

1. Copy the data from the previous exercise and edit it as shown. (Formula in B5 is the only difference.)

2. Type a value in *Units Sold* (B6). *Price* should update to force *Profit* to remain at zero.

Exercise: Find Breakeven Prices for Various Units Sold

Creating the Data Table Structure (Units Sold Varies)

	A	B	C	D	E
1	**Break Even Analysis (Profit = 0)**				
2	*What Should Price be to break even if we vary Units?*				
3				**Units Varied**	
4				Units	Prices Are:
5	Price	$35			$35.00
6	Units Sold	**$100**		50	
7	Revenue	$3,500		100	
8	Cost Per Unit ($15)	$15		150	
9	Variable Cost	$1,500		200	
10	Fixed Costs ($2000)	$2,000		250	
11	Total Costs	$3,500		300	
12	**Profit**	**$0**		350	
13				400	
14				450	
15				500	

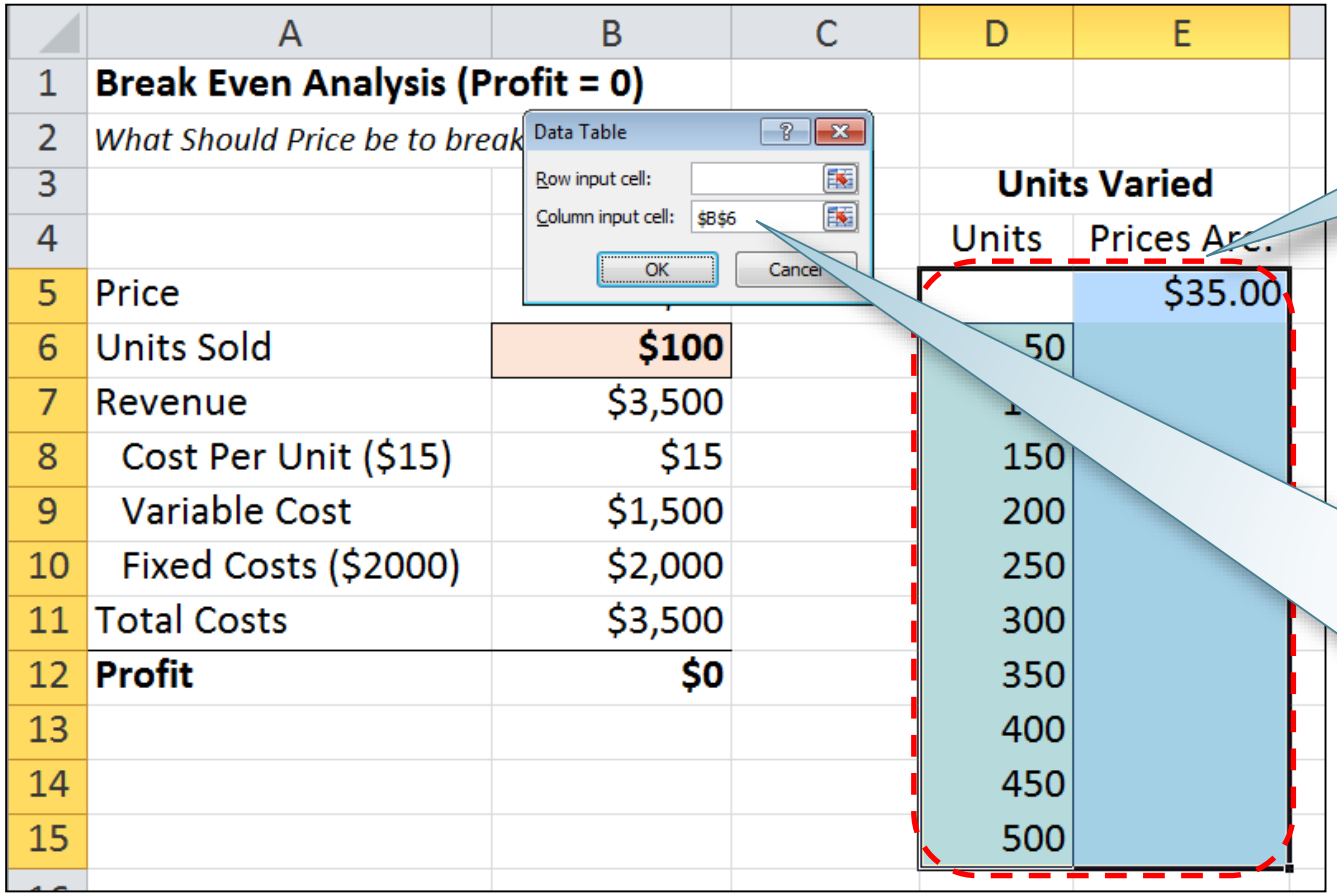
1. Create the table shown here.

2. In E5 type: **=B5**

3. Type these values in D6:D15.

Exercise: Find Breakeven Prices for Various Units Sold

Creating the Data Table Structure (Units Sold Varies)



	A	B	C	D	E
1	**Break Even Analysis (Profit = 0)**				
2	*What Should Price be to break*				
3				**Units Varied**	
4				Units	Prices Are:
5	Price				$35.00
6	Units Sold	**$100**		50	
7	Revenue	$3,500			
8	Cost Per Unit ($15)	$15		150	
9	Variable Cost	$1,500		200	
10	Fixed Costs ($2000)	$2,000		250	
11	Total Costs	$3,500		300	
12	**Profit**	**$0**		350	
13				400	
14				450	
15				500	

4. Highlight D4:E15

5. From the menu click: "**Data – What If Analysis – Data Tables**".

6. Set the **Column input cell** to **B6** (Units Sold). Leave Row *input cell* blank.
7. Click "OK".

Our variables will be substituted into B6 one by one to produce a corresponding Price for each. (For a one variable table you only have a column input cell.)

Exercise: Find Breakeven Prices for Various Units Sold

Find Breakeven Prices for Various Units Sold (Solution)

	A	B	C	D	E
1	**Break Even Analysis (Profit = 0)**				
2	*What Should Price be to break even if we vary Units?*				
3				**Units Varied**	
4				Units	Prices Are:
5	Price	$35			$35.00
6	Units Sold	**$100**		50	$55.00
7	Revenue	$3,500		100	$35.00
8	Cost Per Unit ($15)	$15		150	$28.33
9	Variable Cost	$1,500		200	$25.00
10	Fixed Costs ($2000)	$2,000		250	$23.00
11	Total Costs	$3,500		300	$21.67
12	**Profit**	**$0**		350	$20.71
13				400	$20.00
14				450	$19.44
15				500	$19.00

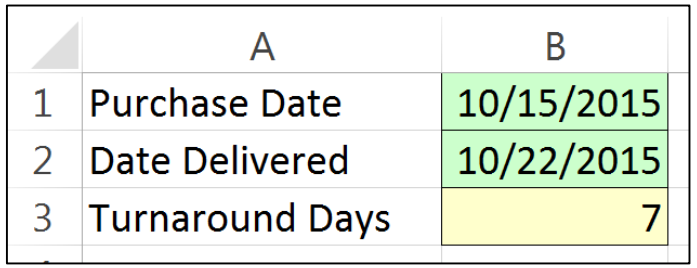
Excel will produce the price that will set profit to zero for each given number of units.

Note that if you type in different Units in column D your Prices will update to give you the corresponding break even price.

Working With Dates

(Workshop Designed for Excel for Windows Default 1900 Date Schema)

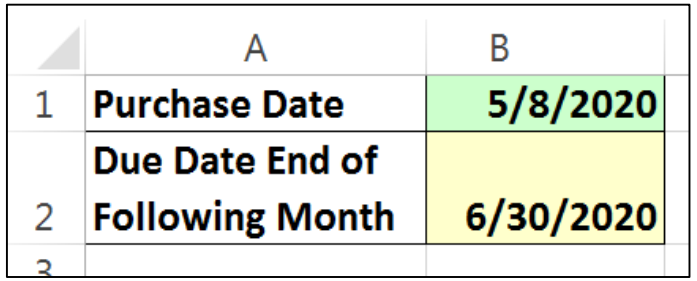
Why Use Dates & Times in Excel?



	A	B
1	Purchase Date	10/15/2015
2	Date Delivered	10/22/2015
3	Turnaround Days	7

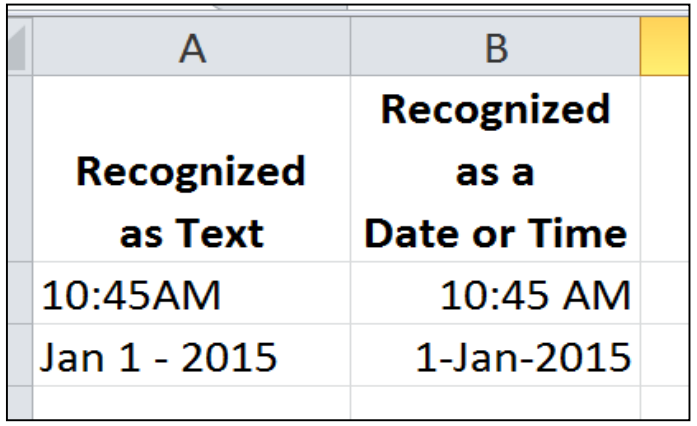
You can do Math with them:

=B2-B1



	A	B
1	**Purchase Date**	**5/8/2020**
2	**Due Date End of Following Month**	**6/30/2020**

You can manipulate them with functions: *=DATE(YEAR(B1),MONTH(B1)+2,0)*



A	B
Recognized as Text	**Recognized as a Date or Time**
10:45AM	10:45 AM
Jan 1 - 2015	1-Jan-2015

How you type in dates and times in Excel determines whether they are recognized as dates & times or not.

Date Exercise 1

Correctly Typing in Dates

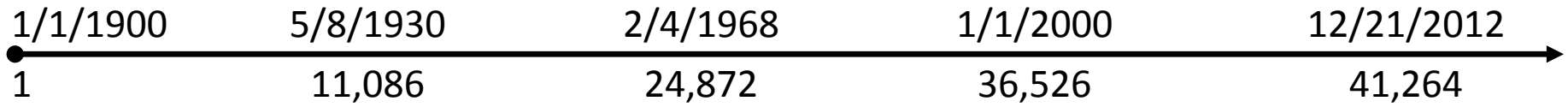
	A	B	C	D
1	**Type the Following Dates in the Yellow Areas**			
2				
3	Type 1/1/1900	1/1/1900		
4	Type 1/1/30	1/1/1930		
5	Type 1/1/29	1/1/2029		
6	Type 1/1/2030	1/1/2030		
7	Type 1/1/1929	1/1/1929		
8	Type **Control ;**	7/8/2015		
9				

Next: Format as "Comma"
Now format the dates you typed as "comma" format. Note you get large numbers.

	A	B	C	D
1	**Type the Following Dates in the Yellow Areas**			
2				
3	Type 1/1/1900	1.00		
4	Type 1/1/30	10,959.00		
5	Type 1/1/29	47,119.00		
6	Type 1/1/2030	47,484.00		
7	Type 1/1/1929	10,594.00		
8	Type **Control ;**	42,193.00		
9				

How Excel Stores Dates

Dates are Stored as Numbers



Dates Typed in Cells using the Formats Below are Recognized by Excel as Dates

12-15-2010	12/15/2010	December 15, 2010	Dec 15, 2010	15-December-2010
12-15-10	12/15/10	December 15, 10	Dec 15, 10	15-Dec-2010

Note: If Typing just Two Digits (instead of 4) for the Year there is a Breakpoint at 30

Typing 1/1/29	is seen as 1/1/2029	< 30 is seen as the current century
Typing 1/1/30	is seen as 1/1/1930	>= 30 is seen as previous century

Date Exercise 2: Difference Between Dates

Simple Subtraction: Answer Expressed in Days

	A	B
1	Purchase Date	10/15/2015
2	Date Delivered	10/22/2015
3		
4	Turnaround Days	7
5	Payment Due Date	11/14/2015
6		

Date Delivered - Purchase Date
=B2-B1

Purchase Date + 30
=B1+30

DateDif(StartDate,EndDate,"Units")

Subtracts Dates and Expresses the Result in the Units Specified

Note that DateDif() does not appear in the Insert Function Box but comes with Excel.

Date Exercise 2B: Difference Between Dates

Using **DateDif(*Start Date*, *End Date*, "*units*")**

Subtracts two Dates with Results Expresses in Units Specified.

	A	B
1	Start Date:	4/5/2015
2	End Date:	6/10/2018

UNITS

These unit specifications below return the difference in completed years, months, or Days.

Units	Description (Total Years, Months, or Days)	Example	Results
"**Y**"	Number of Complete **Years** Between two Dates	=DateDif(B1,B2,"Y")	**3** years
"**M**"	Number of Complete **Months** Between two Dates	=DateDif(B1,B2,"M")	**38** months
"**D**"	Number of **Days** Between Two Dates	=DateDif(B1,B2,"D")	**1162** days

Notes:

- DateDif() does not appear in Excel "Insert Function" area (Shift + F3).
- The *End Date* must be more recent than the *Start Date*.
- "Complete" means that an entire month or year has gone by. For example, DateDif() with "M" units, a start date of 4/25/2015 and end date of 5/10/2015 returns zero months because not a complete month has passed. In other words, it does not just subtract the 4 from the 5 and return 1, it looks at the entire date.

DateDif() Exercise A

DateDif(StartDate,EndDate,"Units") → "Y", "M", and "D"

	A	B	C
1	**Find the Difference Between the Dates in Years, Months, & Days**		
2	Use DateDif(StartDate,EndDate,"Units")		
3			
4	Start Date:	6/20/2015	
5	End Date:	8/2/2018	
6			
7	Years "Y"	3	=DATEDIF(B4,B5,"Y")
8	Months "M"	37	=DATEDIF(B4,B5,"M")
9	Days "D"	1139	=DATEDIF(B4,B5,"D")
10			

DateDif() Exercise B: Months Remainder

Using **DateDif(*Start Date*, *End Date*, "*units*")**

"YM" Returns the number of remaining **Months** between two dates as if they years were in the same year. "YM" is useful for finding any remaining months after whole years as you will never get an answer greater than 11.

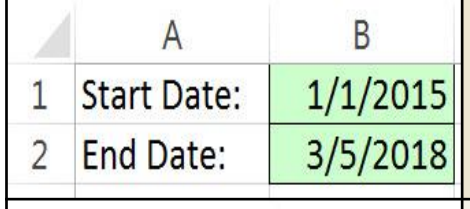
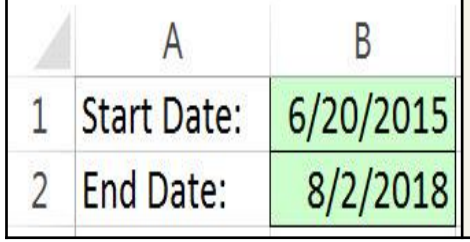
Example Dates	Formula	Result	Description
A B 1 Start Date: 4/10/2015 2 End Date: 6/5/2018	=DATEDIF(B1,B2,"YM")	Returns 1 month	Years are ignored (sort of) and there is only one complete month between the two dates.
A B 1 Start Date: 6/10/2015 2 End Date: 4/11/2018	=DATEDIF(B1,B2,"YM")	Returns 10 months	Years are ignored (sort of) * and there are 10 months between the two dates.

* Because the *Start Date* month (6) later than the End Date month (4), the End Year is treated as if it were in 2016. (Steps it back to on year after the Start Date.)

DateDif() Exercise B: Days Remainder

Using **DateDif(*Start Date*, *End Date*, "*units*")**

"MD" Returns the number of remaining **Days** between two dates. Years and Months are ignored (sort of). "MD" is useful for finding any remaining days after whole months as you will never get an answer greater than 30.

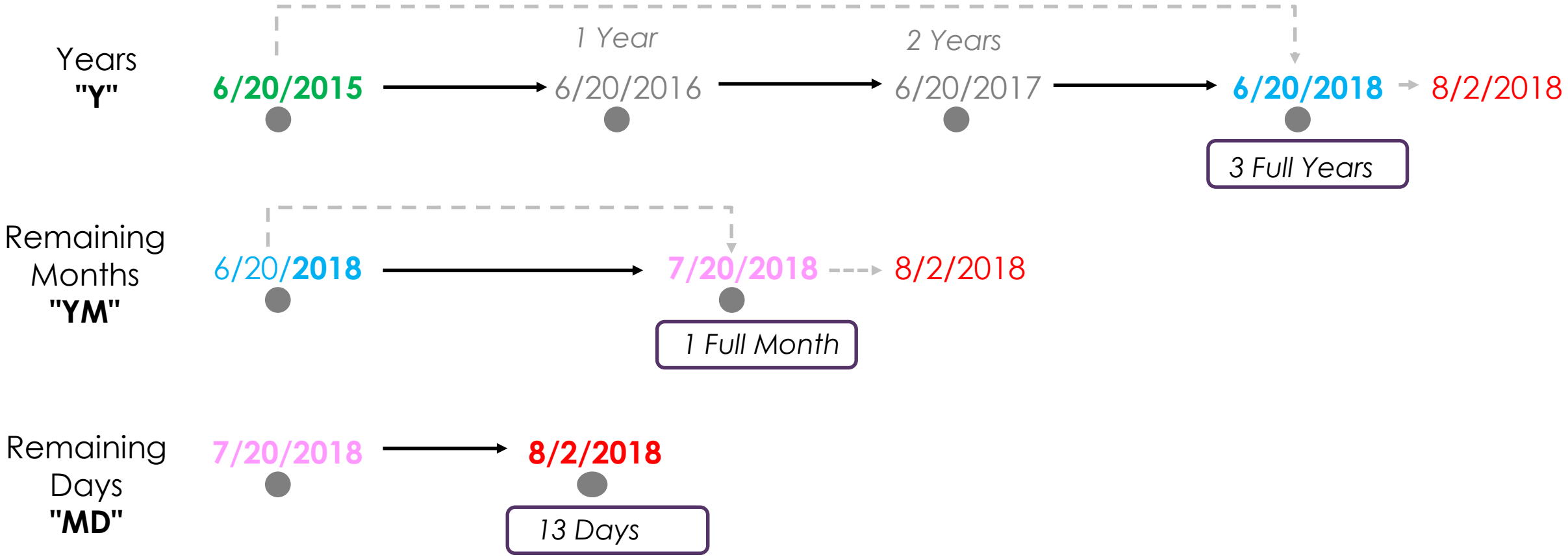
Example Dates	Formula	Result	Description
	=DATEDIF(B1,B2,"MD")	Returns 4 days	Treats the dates as if they were in the same year and month. So, the 5th – 1st = 4 days.
	=DATEDIF(B1,B2,"MD")	Returns 13 days	Treats the dates as if they were in the same month and year (sort of). Become: 8/2/2015 - 7/20/2015 and returns 13.

* Because the *Start Date* day(20) is later than the End Date day (2), the End month is treated as if it were in July. (Steps it back to one month after the start month.)

	A	B
1	Start Date:	6/20/2015
2	End Date:	8/2/2018

Date Exercise 2B: Difference Between Dates

Understanding Remaining Months & Days ("YM" & "YD")



DateDif() Exercise B: Remainders

DateDif(StartDate,EndDate,"Units") → "Y", "YM", and "MD"

Return in Years, Remaining Months, and Remaining Days

	A	B	C
1	**Find the Difference Between the Dates in Years, Months, & Days**		
2	Use DateDif(StartDate,EndDate,"Units")		
3			
4	Start Date:	6/20/2015	
5	End Date:	8/2/2018	
6			
7	Years "Y"	3	
8	Months "M"	37	
9	Days "D"	1139	
10			
11	Remaining Months "YM"	1	=DATEDIF(B4,B5,"YM")
12	Remaining Days "MD"	13	=DATEDIF(B4,B5,"MD")
13			

DateDif() Exercise C: Date Text String

DateDif(StartDate,EndDate,"Units") → Build a Text String

	A	B	C	D	E	F	G	H	I	J	K
1	**Find the Difference Between the Dates in Years, Months, & Days**										
2	Use DateDif(StartDate,EndDate,"Units")										
3											
4	Start Date:	6/20/2015									
5	End Date:	8/2/2018									
6											
7	Years "Y"	3									
8	Months "M"	37									
9	Days "D"	1139									
10											
11	Remaining Months "YM"	1									
12	Remaining Days "MD"	13									
13											

Employee Report

8/3/2015

Tommy Trojan

Employment Duration: =B7&" year(s) "&B11&" month(s) and "&B12&" Days"

Comments:

NetWorkingDays(Start,End,[Holidays])

Ignore Weekends and Holidays (Optional)

Exercise: Ignore Weekends & Holidays

NetWorkingDays(StartDate, EndDate, Holidays)

	A	B	C	D	E	F	G	H	I
1	**Estimation of Student Worker Hours & Gross Pay**								
2	**Academic Year:**	2015							
3									
4	**Name**	**Rate**	**Est. Hours Per Day**	**Start Date**	**End Date**	**Days**	**Working Days**	**Working Hours**	**Gross Pay**
5	John	12.25	7.5	1/20/2015	5/5/2015	106	75	562.50	$ 6,890.63
6	Susan	14.5	4	8/12/2015	12/23/2015	134	92	368.00	$ 5,336.00
7	Tristan	10.75	4	1/20/2015	12/23/2015	338	236	944.00	$ 10,148.00
8	**Total**							**1,874.50**	**$ 22,374.63**
9									
10	**Holiday**	**Date**							
11	Memorial Day	5/25/2015							
12	Thanksgiving	11/26/2015							
13	Martin Luther King Jr. Day	1/19/2015							
14	President's Day	2/16/2015							
15	Labor Day	9/7/2015							
16	Columbus Day	10/12/2015							
17	Christmas	12/25/2015							
18	New Years Day	1/1/2015							
19	Independence Day	7/4/2015							
20	Veteran's Day	11/11/2015							

Exercise: Ignore Weekends & Holidays

Computing Working Hours & Gross Pay

Days
End Date-Start Date +1
=E5-D5+1

Working Hours
Est. Hours Per Day * Working Hours
=C5*G5

	A	B	C	D	E	F	G	H	I
4	**Name**	**Rate**	**Est. Hours Per Day**	**Start Date**	**End Date**	**Days**	**Working Days**	**Working Hours**	**Gross Pay**
5	John	12.25	7.5	1/20/2015	5/5/2015	106	75	562.50	$ 6,890.63
6	Susan	14.5	4	8/12/2015	12/23/2015	134	92	368.00	$ 5,336.00
7	Tristan	10.75	4	1/20/2015	12/23/2015	338	236	944.00	$ 10,148.00

Working Days
NetWorkingDays(StartDate,EndDate,Holidays)
=NETWORKDAYS(D5,E5,B$11:B$20)

Gross Pay
Rate * Working Hours
=B5*H5

Match()

Extract Matching Data from a Table

Show the Biweekly Pay Period for Each Date

Use Match(Lookup Value,Range,Type)

Employee	Date Worked	BW# Match()
Bobby	7/8/2015	15
Bobby	1/14/2015	2
Marsha	4/30/2015	10
Jan	4/1/2015	8
Cindy	12/14/2015	26
Peter	12/9/2015	26
Bobby	5/1/2015	10

USC Payroll Periods for 2015

Biweekly Payroll Number (BW#)	Month	Pay Period Begins	Pay Period Ends	Deductions Taken? Yes (Y)/No (N)		Pay Date
				Type A Deductions	Type B Deductions	
1	January	12/18/2014	12/31/2014	1/7/2015	Y	Y
2		1/1/2015	1/14/2015	1/21/2015	Y	Y
3	February	1/15/2015	1/28/2015	2/4/2015	Y	Y
4		1/29/2015	2/11/2015	2/18/2015	Y	Y
5	March	2/12/2015	2/25/2015	3/4/2015	Y	Y
6		2/26/2015	3/11/2015	3/18/2015	Y	Y
7		3/12/2015	3/25/2015	4/1/2015	Y	Y

Display the Biweekly Payroll Number associated with the *Date Worked*.

Match

Returns the Relative Position of what you are looking for in a Column or Row

=Match(Lookup Value , Range , Match Type)

This is what you are searching for.
Lookup Value can be:

Category	Example
• Cell Address	A1
• Value	10
• Text	"USC"
• Formula	Max(A1:A5)

This is the range to search. It must be a single column or single row (i.e. no blocks). Match returns the lookup value's relative position in the column or row.

Type of Search:

0	Exact Match
1	Largest value that is less than or equal to the lookup value.
-1	Smallest value that is less than or equal to the lookup value.

Exercise: Return Payroll # for Given Dates

Match(Lookup Value, Range, Match Type)

Determine the Biweekly Payroll number for the Dates Worked

a) We are looking for **1/14/2015**

b) …in this range.

c) **1/1/2015** is the largest number that is less than or equal to **1/14/2015** so Match() returns a **2** because it is in the second cell down in the range.

	A	B	C	D	E	F	G	H
1	Show the B		kly Pay Period for Each Date					
2	Use Match(Look		alue,Range,Type)				C Payroll Periods for	
3								
4								
5	Employee	Date W orked	BW# Match()		Biweekly Payroll Number (BW#)	Month	ay Period Begins	Pay Pe Ends
6	Bobby	7/8/2015	15		1	January	12/18/2014	12/31/2014
7	Bobby	1/14/2015	2		2		1/1/2015	1/14/2015
8	Marsha	4/30/2015	10		3	February	1/15/2015	1/28/2015
9	Jan	4/1/2015	8		4		1/29/2015	2/11/2015
10	Cindy	12/14/2015	26		5	March	2/12/2015	2/25/2015
11	Peter	12/9/2015	26		6		2/26/2015	3/11/2015
12	Bobby	5/1/2015	10		7	April	3/12/2015	3/25/2015
13	Jan	12/13/2015	26		8		3/26/2015	4/8/2015
14	Marsha	6/30/2015	14		9		4/9/2015	4/22/2015

Note that this only works due to a fortunate circumstance: our biweekly numbering starts with 1 and our "Pay Period Begins" dates are ordered to match this.
In our next example we won't be so fortunate

Exercise: Return Payroll # for Given Dates

Use Match(Lookup Value, Range, Match Type)

Match() will return the relative position of what you are looking for in a range.

In C6 type the formula below then copy down.

=Match(B6,G$6:G$31,1)

The contents of B6 is what to search for.

This is the range to search.

"1" indicates we want a <= search.

Match returns the relative position of the largest date that is less than or equal to the Date Worked we are looking for.

	A	B	C	D	E	F	G	H
1	**Show the Biweekly Pay Period for Each Date**							
2	**Use Match(Lookup Value,Range,Type)**				**USC Payroll Periods for 2**			
3								
4					**Biweekly Payroll Number (BW#)**	**Month**	**Pay Period Begins**	**Pay Period Ends**
5	**Employee**	**Date Worked**	**BW# Match()**					
6	Bobby	7/8/2015	15		1	January	12/18/2014	12/31/2014
7	Bobby	1/14/2015	2		2		1/1/2015	1/14/2015
8	Marsha	4/30/2015	10		3	February	1/15/2015	1/28/2015
9	Jan	4/1/2015	8		4		1/29/2015	2/11/2015
10	Cindy	12/14/2015	26		5	March	2/12/2015	2/25/2015
11	Peter	12/9/2015	26		6		2/26/2015	3/11/2015
12	Bobby	5/1/2015	10		7	April	3/12/2015	3/25/2015
13	Jan	12/13/2015	26		8		3/26/2015	4/8/2015
14	Marsha	6/30/2015	14		9		4/9/2015	4/22/2015
15	Cindy	3/8/2015	6		10	May	4/23/2015	5/6/2015
16	Peter	5/31/2015	12		11		5/7/2015	5/20/2015
17	Greg	2/1/2015	4		12	June	5/21/2015	6/3/2015
18	Cindy	6/1/2015	12		13		6/4/2015	6/17/2015
19	Greg	5/15/2015	11		14	July	6/18/2015	7/1/2015
20	Greg	9/15/2015	20		15		7/2/2015	7/15/2015
21	Jan	6/15/2015	13		16	August	7/16/2015	7/29/2015
22	Peter	2/15/2015	5		17		7/30/2015	8/12/2015
23	Marsha	1/3/2015	2		18		8/13/2015	8/26/2015
					19	September	8/27/2015	9/9/2015

Index()

Return the item Located in the Give X and Y Coordinate

	A	B	C	D	E	F	G	H
1	**Show the BAC Section for Each Date**							
2	**Use Match & Index()**							
3								
4								
5	**Employee**	**Date Worked**	**BAC Section Match() and Index()**		**BAC #**	**Biweekly Payroll Number (BW#)**	**Month**	**Pay Period Begins**
6	Bobby	7/8/2015	HC-102		A-555	1	January	12/18/2014
7	Bobby	1/14/2015	A-556		A-556	2		1/1/2015
8	Marsha	4/30/2015	BB-63		A-557	3	February	1/15/2015
9	Jan	4/1/2015	A-562		A-558	4		1/29/2015
10	Cindy	12/14/2015	ABC-103		A-559	5	March	2/12/2015
11	Peter	12/9/2015	ABC-103		A-560	6		2/26/2015
12	Bobby	5/1/2015	BB-63		A-561	7		3/12/2015
13	Jan	12/13/2015	ABC-103		A-562	8	April	3/26/2015

USC Payroll Period

Return the BAC Section # based on the Date Worked and Pay Period Begins column.

Index

Index() returns the contents of a cell within a range given its X and Y coordinate within that range.

=Index(Range , Row Position , Column Position)

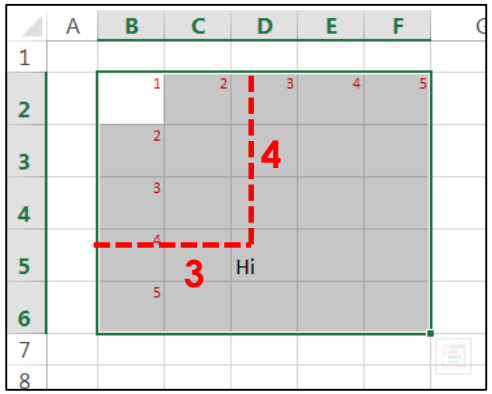
This is the Block of Cells Involved.

This is the relative number of rows to move down.

Relative number of columns to move right.

Example:

Index(B2:F6,4,3)

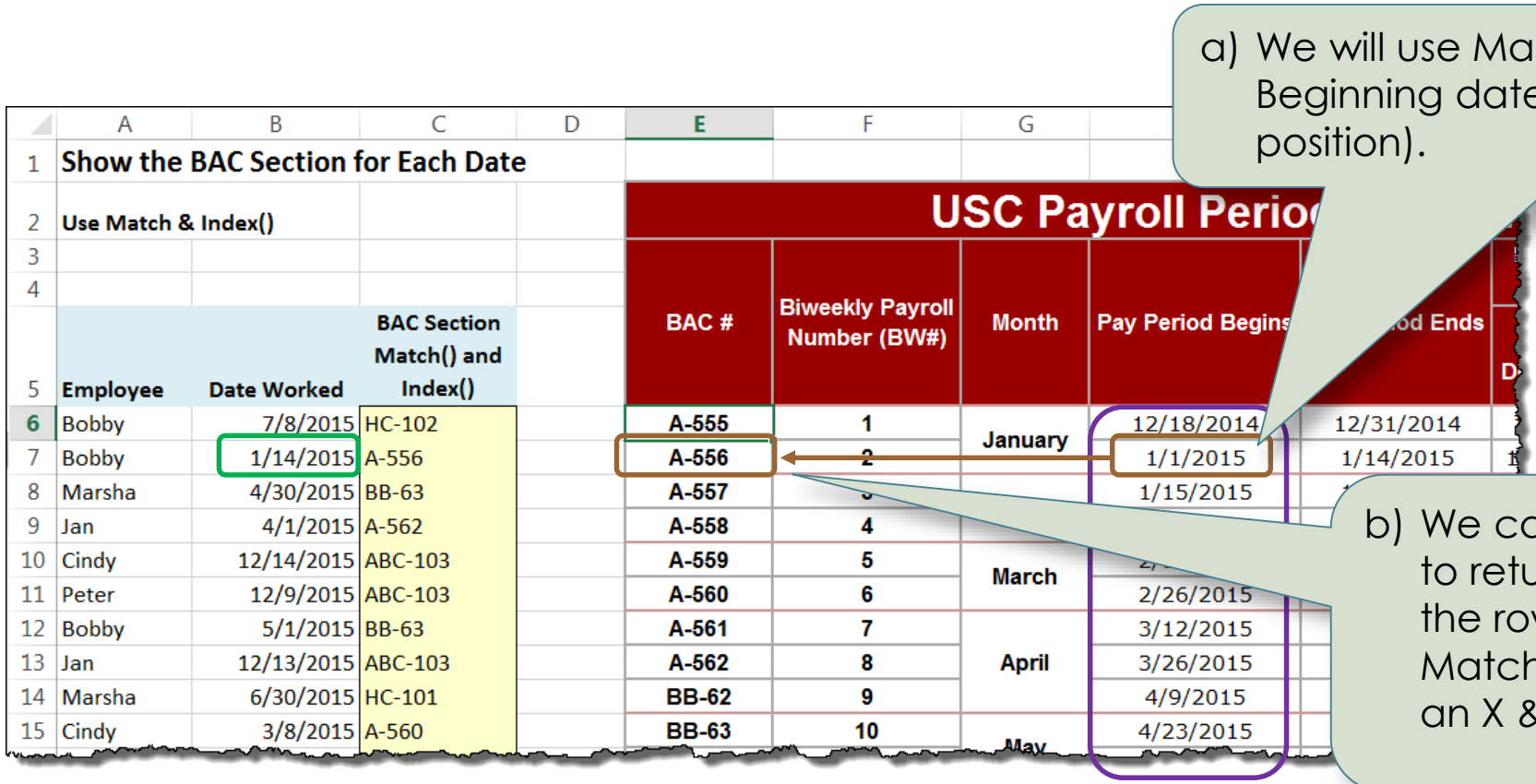


Returns "Hi" because in the block it is 4 rows down and 3 columns over.

Exercise: Return BAC # for a Given Date

Using Match() and Index()

We wish to return the BAC # associated with the Date Worked



	A	B	C	D	E	F	G
1	Show the BAC Section for Each Date						
2	Use Match & Index()						
3							
4							
5	Employee	Date Worked	BAC Section Match() and Index()		BAC #	Biweekly Payroll Number (BW#)	Month
6	Bobby	7/8/2015	HC-102		A-555	1	January
7	Bobby	1/14/2015	A-556		A-556	2	
8	Marsha	4/30/2015	BB-63		A-557	3	
9	Jan	4/1/2015	A-562		A-558	4	
10	Cindy	12/14/2015	ABC-103		A-559	5	March
11	Peter	12/9/2015	ABC-103		A-560	6	
12	Bobby	5/1/2015	BB-63		A-561	7	
13	Jan	12/13/2015	ABC-103		A-562	8	April
14	Marsha	6/30/2015	HC-101		BB-62	9	
15	Cindy	3/8/2015	A-560		BB-63	10	May

USC Payroll Perio

Pay Period Begins	od Ends	D
12/18/2014	12/31/2014	
1/1/2015	1/14/2015	1
1/15/2015		
2/26/2015		
3/12/2015		
3/26/2015		
4/9/2015		
4/23/2015		

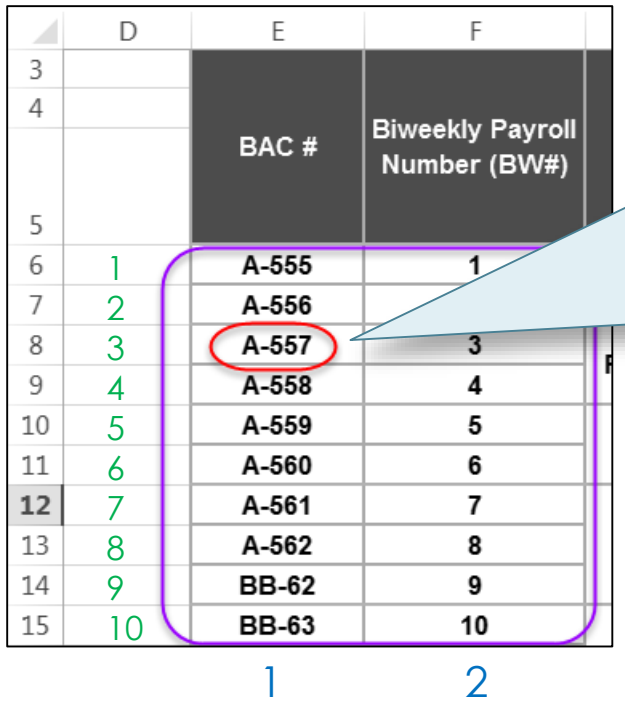
a) We will use Match() to find the Pay Period Beginning date's position in the list (row position).

b) We can then use Index() to return the BAC # within the row returned by Match(). Index() requires an X & Y coordinate.

Exercise: Return BAC # for a Given Date

Index() returns the contents of a cell within a range given its X and Y coordinate within that range.

Index(Range, RowPosition, ColumnPosition)



	D	E	F
3			
4		BAC #	Biweekly Payroll Number (BW#)
5			
6	1	A-555	1
7	2	A-556	2
8	3	A-557	3
9	4	A-558	4
10	5	A-559	5
11	6	A-560	6
12	7	A-561	7
13	8	A-562	8
14	9	BB-62	9
15	10	BB-63	10
		1	2

For Example:

Index(E6:F15,3,1) would return the contents of E8 because it is 3 rows down in the range and in the 1st column of the range.

Match()
We will use Match() to find the *RowPostion* and will our range will just be column E so our column position will be "1".

Exercise: Return BAC # for a Given Date

Match(Search by, Range to Search, 1) and Index(Range, RowPosition, ColPostion)

=**INDEX(**E$6:E$31,MATCH(B6,H$6:H$31,1),**1)**

Range | Row Position | Column Position

	A	B	C	D	E	F	G	H	I	J	K	L
3												
4												
5	Employee	Date Worked	BAC Section Match() and Index()		BAC #	Biweekly Payroll Number (BW#)	Month	Pay Period Begins	Pay Period Ends	Deductions Taken? Yes (Y)/No (N)		Pay Date
										Type A Deductions	Type B Deductions	
6	Bobby	7/8/2015	HC-102		A-555	1	January	12/18/2014	12/31/2014	1/7/2015	Y	Y
7	Bobby	1/14/2015	A-556		A-556	2		1/1/2015	1/14/2015	1/21/2015	Y	Y
8	Marsha	4/30/2015	BB-63		A-557	3	February	1/15/2015	1/28/2015	2/4/2015	Y	Y
9	Jan	4/1/2015	A-562		A-558	4		1/29/2015	2/11/2015	2/18/2015	Y	Y
10	Cindy	12/14/2015	ABC-103		A-559	5	March	2/12/2015	2/25/2015	3/4/2015	Y	Y

Match() determines the row position of the date we are looking for. Index() then uses that and column positin 1 to return the corresponding BAC #.

Exercise: Return BAC # for a Given Date

Final Results

Show the BAC Section for Each Date

Use Match & Index()

Employee	Date Worked	BAC Section Match() and Index()
Bobby	7/8/2015	=INDEX(E$6:E$31,MATCH(B6,H$6:H$31,1),1)
Bobby	1/14/2015	A-556
Marsha	4/30/2015	BB-63
Jan	4/1/2015	A-562
Cindy	12/14/2015	ABC-103
Peter	12/9/2015	ABC-103
Bobby	5/1/2015	BB-63
Jan	12/13/2015	ABC-103
Marsha	6/30/2015	HC-101
Cindy	3/8/2015	A-560
Peter	5/31/2015	BB-65
Greg	2/1/2015	A-558
Cindy	6/1/2015	BB-65
Greg	5/15/2015	BB-64
Greg	9/15/2015	MMM-201
Jan	6/15/2015	HC-100
Peter	2/15/2015	A-559
Marsha	1/3/2015	A-556

USC Payroll Periods for 2015

BAC #	Biweekly Payroll Number (BW#)	Month	Pay Period Begins	Pay Period Ends	Deductions Taken? Yes (Y)/No (N)		Pay Date
					Type A Deductions	Type B Deductions	
A-555	1	January	12/19/2014	12/31/2014	1/7/2015	Y	Y
A-556	2		1/1/2015	1/14/2015	1/21/2015	Y	Y
A-557	3	February	1/15/2015	1/28/2015	2/4/2015	Y	Y
A-558	4		1/29/2015	2/11/2015	2/18/2015	Y	Y
A-559	5	March	2/12/2015	2/25/2015	3/4/2015	Y	Y
A-560	6						
A-561	7	April					
A-562	8						
BB-62	9						
BB-63	10	May					
BB-64	11						
BB-65	12	June					
HC-100	13						
HC-101	14	July					
HC-102	15						
HC-103	16	August					
HC-104	17						
HC-105	18	September					
MMM-200	19						
MMM-201	20						
MMM-202	21	October					
MMM-203	22						
MMM-204	23	November					
ABC-101	24						
ABC-102	252	December	11/9/2015	12/2/2015	12/9/2015	Y	Y
ABC-103	26		12/3/2015	12/16/2015	12/23/2015	Y	Y

Show the BAC Section for Each Date

Use Match & Index()

Employee	Date Worked	BAC Section Match() and Index()
Bobby	7/8/2015	=INDEX(E$6:E$31,MATCH(B6,H$6:H$31,1),1)
Bobby	1/14/2015	A-556
Marsha	4/30/2015	BB-63
Jan	4/1/2015	A-562

Using Dates in Formulas

Manipulating Dates when Dates are Not in Cells

Date(*year,month,day***)**

Date() allows you to:

- Type a date in a formula rather than referencing a cell containing a date.
- Manipulate the different sections of a date (i.e. year, month, or day).

Today()

Returns the current date. Will update when workshop recalculates or you press F9.

Exercise: Using Dates in Formulas

Manipulating Dates when Dates are Not in Cells

	A	B	C	D
1	**Using Dates in Formulas**			
2				
3	**Using Date(yyyy,mm,dd)**			
4	Due Date is 30 Days after 12/24/2015: Date() + 30	1/23/2016		
5				
6	**Using Today()**			
7	Due Date is 30 Days after Today's Date: Today() + 30	8/27/2015		
8				
9	**Using Date() - Today()**			
10	Days until next election (11/8/2016):	469		
11				
12	**Construct a Serial Date from the three Columns: Date()**			
13		***Month***	***Day***	***Year***	***Date***
14		1	25	2015	1/25/2015
15		6	14	2012	6/14/2012

=DATE(2015,12,24)+30

=TODAY()+30

=DATE(2016,11,8)-TODAY()

=DATE(C14,A14,B14)
=DATE(C15,A15,B15)

Exercise: Date in a Text String

Both Date() and Today() can be Used in a Text String

- Use **&** to "glue" different parts of a text string together.
- Place quotes **" "** around extra text, spaces, etc. (i.e. anything that is not a formula or cell address).

	A	B	C	D
16				
17	**Construct a Text String using Today() and Text()**			
18	Example: *Payment Due date is: 08/23/2015*	Payment Due Date is: 08/27/2015		
19				

="Payment Due Date is: "&TODAY()+30

="Payment Due Date is: "&TEXT(TODAY()+30,"mm/dd/yyyy")

Note you get something like:
30 days from Today is: 42239

You need to format the serial date as a date using Text().

EOMonth(StartDate,Months)

Returns the **Last Day** of the Month X Number of Months Before or After a Given Month. For example:

If **A1** Contained **5/15/2020** then:

EOMonth(A1,2)	Returns	7/31/2020
EOMonth(A1,-3)	Returns	2/29/2020
EOMonth(A1,0)	Returns	5/31/2020
EOMonth(A1,0)+1	Returns	6/1/2020

Its advantage over the previous exercise is that it is often shorter.

Exercise: EOMonth(StartDate,Months)

Find the Dates Required using EOMonth()

	A	B	C
1	**Manipulate the Purchase Date as Requested**		
2	**Purchase Date:**	**5/15/2020**	
3			
4	**Use EOMonth(Start, ± Months) to Manipulate the Purchase Date**		
5	Last Day of Previous Month	4/30/2020	=EOMONTH(B2,-1)
6	Last Day of Current Month	5/31/2020	=EOMONTH(B2,0)
7	Last Day of Next Month	6/30/2020	=EOMONTH(B2,1)
8			
9	**Use EOMonth(Start, ± Months) to Manipulate the Purchase Date**		
10	First Day of Current Month	5/1/2020	=EOMONTH(B2,-1)+1
11	First Day of Next Month	6/1/2020	=EOMONTH(B2,0)+1
12	First Day of Previous Month	4/1/2020	=EOMONTH(B2,-2)+1
13	The 15th of Next Month	6/15/2020	=EOMONTH(B2,0)+15
14			

No Due Dates on Weekends

Change the Due Date if it Falls on a Saturday or Sunday

Weekday(*Date***)**

Returns the weekday as a number (1-7)

IF(*Condition,True,False***)**

Performs one of two Possible Actions Depending whether a Condition is True of False

Choose(*Index Number, Position1,Postion2,Postion3,etc…***)**

Returns the Content of the Position that Matches the Index Number

Exercise: No Due Date on Weekends

=WeekDay(Date, *Optional Return Type*)

Tells you if a Date is on a Sunday, Monday, Tuesday, etc., by returning a #

Unless you Specify an Optional Return Type, the Default Sequence is:

Sunday	= 1
Monday	= 2
Tuesday	= 3
Wednesday	= 4
Thursday	= 5
Friday	= 6
Saturday	= 7

Exercise: No Due Dates on Weekends

The Due Date is 30 Days from the Purchase Date
If Due Date falls on a Weekend (1 or 7), make the Due Date the Following Monday

Weekday() Sequence

Sunday	= 1
Monday	= 2
Tuesday	= 3
Wednesday	= 4
Thursday	= 5
Friday	= 6
Saturday	= 7

	A	B	C	D	E	F
5	Order ID	Purchase Date	Potential Day Due WeekDay()	Due Date IF()	Actual Due Day WeekDay()	Day Name Choose()
6	1	2/5/2020	6	3/6/2020	6	Fri
7	2	3/7/2020	2	4/6/2020	2	Mon
8	3	3/22/2020	3	4/21/2020	3	Tues
9	4	3/26/2020	7	4/27/2020	2	Mon

=WEEKDAY(B6+30)

=IF(C6=1,B6+31,IF(C6=7,B6+32,B6+30))

=WeekDay(D6)

=CHOOSE(E6,"Sun","Mon","Tues","Wed","Thurs","Fri","Sat")

Working With Time

Time Exercise: How Excel Stores Time

Time Entry and How Serial Time Works

a) Type in the times as shown.

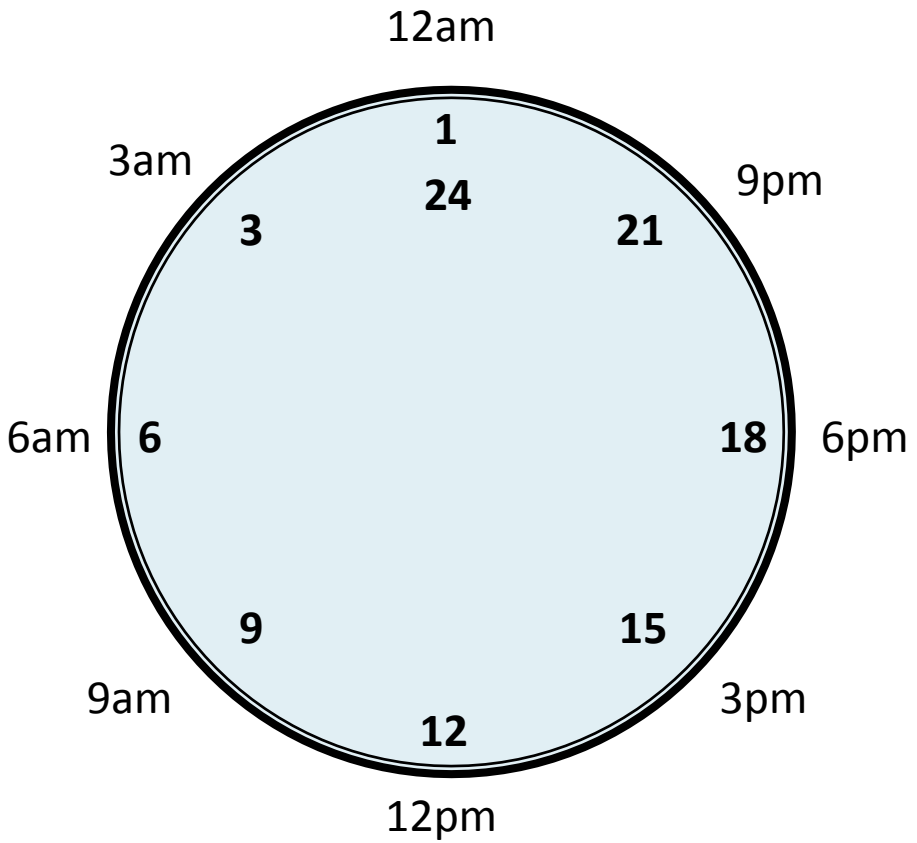
	A	B	C
1	**Type the Times Below Exactly as Shown**		
2			
3	Type: 6:00	6:00	
4	Type: 6 AM	6:00 AM	
5	Type: 6 PM	6:00 PM	
6	Type: 12:00	12:00	
7	Type: 12 AM	12:00 AM	
8	Type: 12 PM	12:00 PM	

b) Format the times as comma (or clear the formats).

	A	B	C
1	**Type the Times Below E… …ly as Shown**		
2			
3	Type: 6:00	0.25	
4	Type: 6 AM	0.25	
5	Type: 6 PM	0.75	
6	Type: 12:00	0.50	
7	Type: 12 AM	-	
8	Type: 12 PM	0.50	

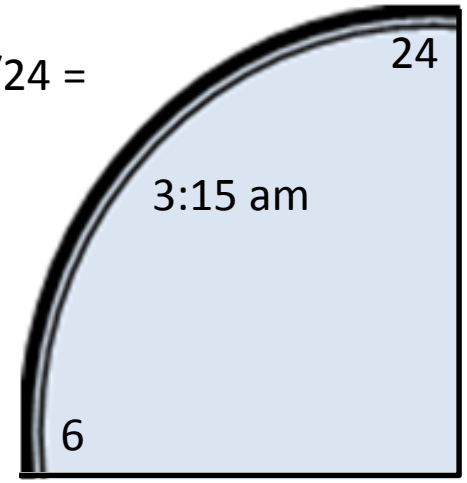
Excel Uses a 24 Hour Clock

e.g. 11am=11, 12pm=12, 1pm=13, 2pm=14, 3pm=15, etc.



Excel Stores Time as "Serial" Time

3/24 + 15/60/24 =
0.135417



Serial Hours = Integer Hours / 24

Hours are converted to serial time by dividing by 24.

3:00 AM → **3**/24 → 0.125

Serial Minutes = Integer Minutes / 60 / 24

Since there are 60 minutes in an hour and hours are converted to serial time by dividing by 24, minutes are divided by 60 then 24.

3:15 AM → **3**/24 + **15**/60/24 → .135417

Serial Seconds: Integer Seconds / 60 / 60 / 24

Since there are 60 seconds in a minute and 60 minutes in an hour and hours are converted to serial time by dividing by 24, seconds are divided by 60, then 60 again, then 24.

3:15:30 AM → **3**/24 + **15**/60/24 + **30**/24/60/60 → .135764

Note that Excel converts to serial time for you if you type in time properly.

Durations are also Stored as Serial Time

Hours:Minutes:Seconds

Durations

Time durations are also stored in serial format. For example 20 hours, 15 minutes, and 30 seconds is typed as: **20:15:30**

And is stored as:

20/24 + 15/60/24 + 30/60/60/24 = **.84097**

Days

Days Should be entered in Hours: for example, 2 Days & 12 hours is typed as:
48:12:00

And is stored as:

48/24 + 12/60/24 = **2.00833**

Typing Serial Durations

Hours:Minutes:Seconds

Correctly Entering Durations

It is recommended that you use all three sections to avoid mishaps.
(If you just two sections, Excel assumes you are starting with hours.)

Typed As		Interpreted As
15:0	→	15 hours
0:15	→	15 minutes
0:0:15	→	15 seconds
15:30	→	15 hours and 30 minutes
0:15:30	→	15 minutes and 30 seconds
0:15:00	→	15 minutes

Add and Format Time

Time and Durations are Typed in Cells

Time Exercise: Add & Format Time

Add and Format Time Durations

	A	B
1	**Addig Time Durations**	
2	Type in the Date in Green	
3		**Time Entry**
4	Arrival Date/Time	1/1/2013 22:00
5	Preparation Time	
6	Refuel	3:00
7	Food Restock	2:30
8	Inspection	30:00:00
9	Total Prep Time	
10		
11	Departarture Time	
12		

a) Type Times shown in green cells.

	A	B
1	**Addig Time Durations**	
2	Type in the Date in Green	
3		**Time Entry**
4	Arrival Date/Time	1/1/2013 22:00
5	Preparation Time	
6	Refuel	3:00
7	Food Restock	2:30
8	Inspection	30:00:00
9	Total Prep Time	11:30
10		
11	Departarture Time	

b) In B9 Total the Prep Time: **=Sum(B6:B8)**

c) Format B9 as: **37:30:55** to display durations over 24:00

Inspection	30:00:00
Total Prep Time	35:30:00

Time Exercise: Add and Format Time

Adding and Formatting Time Durations

	A	B
1	**Addig Time Durations**	
2	Type in the Date in Green	
3		**Time Entry**
4	Arrival Date/Time	1/1/2013 22:00
5	Preparation Time	
6	Refuel	3:00
7	Food Restock	2:30
8	Inspection	30:00:00
9	Total Prep Time	35:30:00
10		
11	Departarture Time	1/3/13 9:30 AM

d) Get Departure Time:

=Arrival DateTime + Total Prep Time

= B4+B9

Exercise: Add a Duration to Serial Time
(Duration is in a Cell)

Add **3 Hours** and **15 Minutes** to the Order Time

	A	B	C	D	E
1	**Adding Hours, Minutes, or Seconds to Serial Time**				
2	Both Time and Duration are in Cells as Serial Time				
3					
4	**Add 3 Hours & 15 Minutes to Order Time**				
5	**Duration:**	3:15:00			
6					
7	**Order Time**	**Due Out**			
8	1:30 PM	4:45 PM	=A8+B$5		
9	11:59 PM	3:14 AM	=A9+B$5		
10	8:50 AM	12:05 PM	=A10+B$5		
11	1:00 AM	4:15 AM	=A11+B$5		
12	6:30 AM	9:45 AM	=A12+B$5		
13					

Add and Format Time

Durations are in Formulas Rather than Cells

- Hours /24 + Minutes /24/60 + Seconds /24/60/60
- Time(Hours,Minutes,Seconds)

Time() does the conversion to serial for you.

Exercise: Add a Duration to Serial Time

Duration in Formula rather than Cell Using Basic Math

Add **3 Hours** & **15 Minutes** to the Order Time: **Time + Hours/24 + Minutes/24/60**

	A	B	C	D	E	F
1	**Adding Hours, Minutes, or Seconds to Serial Time**					
2	Use Decimal to Serial Converstions when Time in is a Formula					
3						
4	**Add 3 Hours & 15 Mintues to Order Time where Duration isn't in a Cell**					
5						
6	**Order Time**	**Due Out**				
7	1:30 PM	4:45 PM	=A7+3/24+15/24/60			
8	11:59 PM	3:14 AM	=A8+3/24+15/24/60			
9	8:50 AM	12:05 PM	=A9+3/24+15/24/60			
10	1:00 AM	4:15 AM	=A10+3/24+15/24/60			
11	6:30 AM	9:45 AM	=A11+3/24+15/24/60			
12						

Using Time(Hours,Minutes,Seconds)

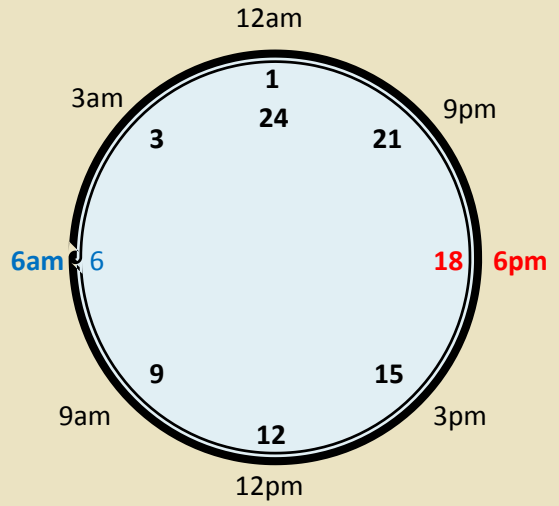
Time() Converts Non-Serial Numbers into Serial Time for you

Examples

Time(6,30,0) → 6:30:00 AM or 0.27833

Time(18,45,0) → 6:45:00 PM or 0.78125

Note that hours must be typed using the 24 hour clock (AKA "military time"). For example, 6 am = 6 and 6 pm = 18



Exercise: Add a Duration to Serial Time

Duration in Formula rather than Cell Using Time()

Add **3 Hours** & **15 Mintues** to the Order Time: **Time(Hours,Mintues,Seconds)**

	A	B	C	D	E	F	G
1	**Adding Hours, Minutes, or Seconds to Serial Time**						
2	Use Decimal to Serial Converstions when Time in is a Formula						
3							
4	**Add 3 Hours & 15 Mintues to Order Time using Time(Hours,Minutes,Seconds)**						
5							
6	**Order Time**	**Due Out**					
7	1:30 PM	4:45 PM	=A7+TIME(3,15,0)				
8	11:59 PM	3:14 AM	=A8+TIME(3,15,0)				
9	8:50 AM	12:05 PM	=A9+TIME(3,15,0)				
10	1:00 AM	4:15 AM	=A10+TIME(3,15,0)				
11	6:30 AM	9:45 AM	=A11+TIME(3,15,0)				
12							

Time(Hrs,Mins,Sec)

Time() allows you to type *hours*, *minutes* and *seconds* as decimal numbers and it will convert them to serial time for you.

Subtracting Time

(Not as Easy as you would Think)

Time Sheet Exercise 1: Subtracting Time

Calculate Total Hours and Gross (Store Open 8am-5pm)

Duration = Time Out – Time In

	A	B	C	D	E	F	G	H
1	**Determine "Total Hours" and "Gross"**							
2	Timesheet for 08/06/2015							
3	(Store Hours are 8 am - 5 pm)							
4								
5			**Before Lunch**		**After Lunch**			
6	**Name**	**Hr. Rate**	**Time In**	**Time Out**	**Time In**	**Time Out**	**Total Hours**	**Gross**
7	Marsha	$ 10.00	8:00 AM	11:30 AM	1:30 PM	4:30 PM	6:30	$ 65.00
8	Greg	$ 15.00	9:30 AM	1:30 PM			4:00	$ 60.00
9	Peter	$ 16.00	8:00 AM	11:00 AM	12:00 PM	4:00 PM	7:00	$ 112.00
10	Cindy	$ 18.00	9:00 AM	12:00 PM			3:00	$ 54.00
11	Jan	$ 12.50	9:30 AM	11:45 AM	1:00 PM	4:30	5:45	$ 71.88
12	Bobby	$ 13.25			1:00 PM	5:0	4:00	$ 53.00
13	**Total Time**						**0:15:00**	**$ 415.88**
14								

Gross
Total Hours * 24 * Hr. Rate
=G7*24*B7

Total Hours
Time Out – Time In + Time Out –Time In
=F7-E7+D7-C7

Note that there are no night shifts.

Time Sheet Exercise 2: Subtracting Time

Calculate Total Hours and Gross (Store Open 24 Hours Per Day)

	A	B	C	D	E	F	G	H	I
1	**Determine "Total Hours" and "Gross"**								
2	Timesheet for 10/09/2015								
3	**Store Open 24 Hours**								
4									
5			**First Shift**		**Second Shift**				
6	**Name**	**Hr. Rate**	**Time In**	**Time Out**	**Time In**	**Time Out**	**Total Hours**	**Gross**	
7	Marsha	$ 10.00	8:00 AM	11:30 AM	1:30 PM	4:30 PM	6:30	$ 65.00	
8	Greg	$ 15.00	9:30 AM	1:30 PM			4:00	$ 60.00	
9	Peter	$ 16.00	9:00 PM	1:00 AM	2:00 AM	6:00 AM	##########	$ (256.00)	
10	Cindy	$ 18.00	9:00 AM	12:00 PM			3:00	$ 54.00	
11	Jan	$ 12.50	9:30 AM	11:45 AM	1:00 PM	4:	5:45	$ 71.88	
12	Bobby	$ 13.25			9:00 PM		##########	$ (238.50)	
13	**Total Time**						##########	**$ (243.63)**	

Gross
Total Hours * 24 * Hr. Rate
=G7*24*B7

Total Hours
Time Out – Time In + Time Out –Time In
=F7-E7+D7-C7

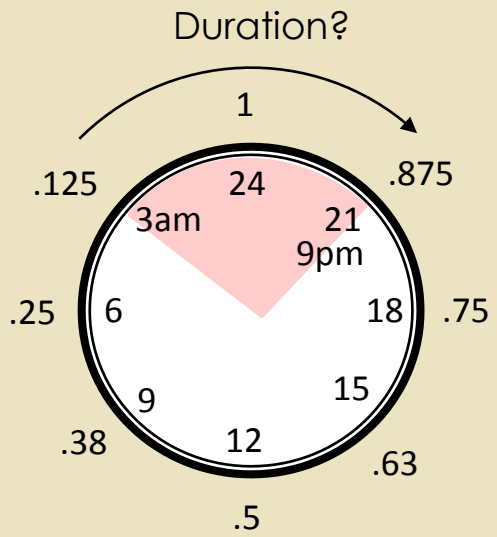
Subtraction Issue: Start Time > Stop Time

The Issue Occurs when:

- The serial time involved does not include a date.

  AND

- The serial time being subtracted is larger than the serial number you are subtracting from.
  (In other words, when the subtraction involves crossing midnight.)



How many hours between 3 am and 9 pm?

For Example:
3 am – 9 pm → .125 - .25 = - .125

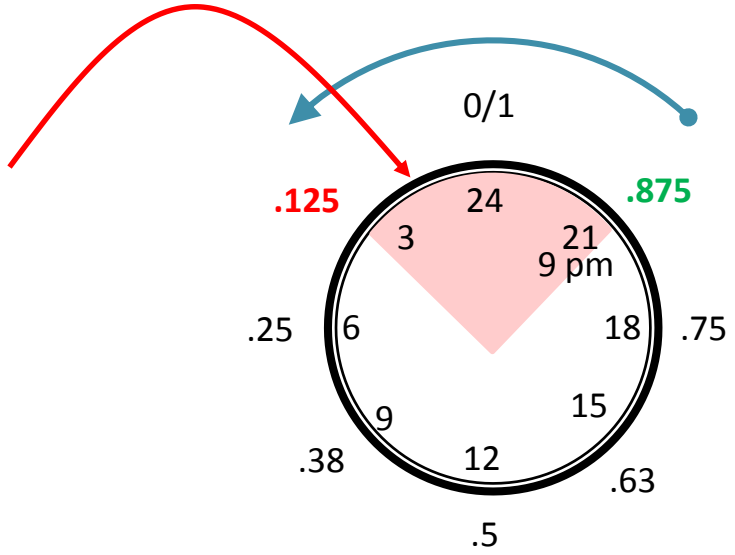
Excel does not recognize negative time!
(The answer should be 0.25 or 6 hours)

(FYI: 9 pm – 3 am doesn't work either.)

Solving the Subtraction Issue

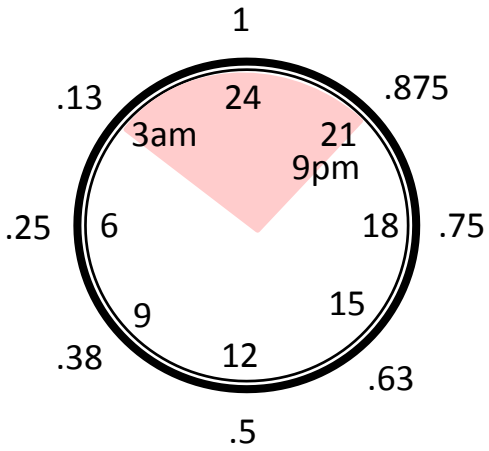
Goal:
We stated work at **9 pm** and ended work at **3 am**.
How many hours did we work?

We need to know the duration in pink.



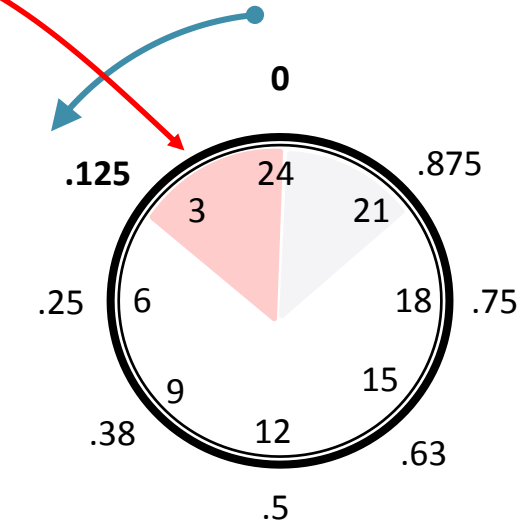
Solving the Subtraction Issue

Goal:
We stated work at **9 pm** and ended work at **3 am**.
How many hours did we work?



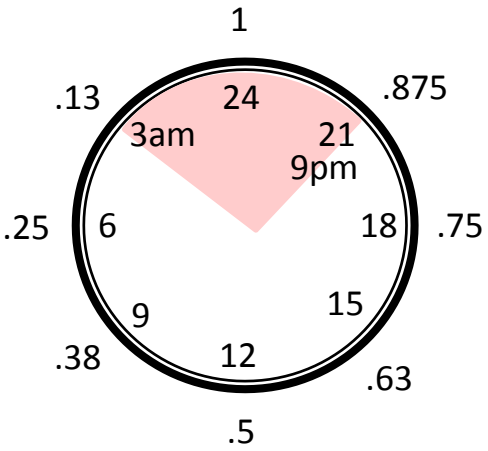
The duration in the morning is easy to get. The serial duration from 0 to 3 am is **.125**

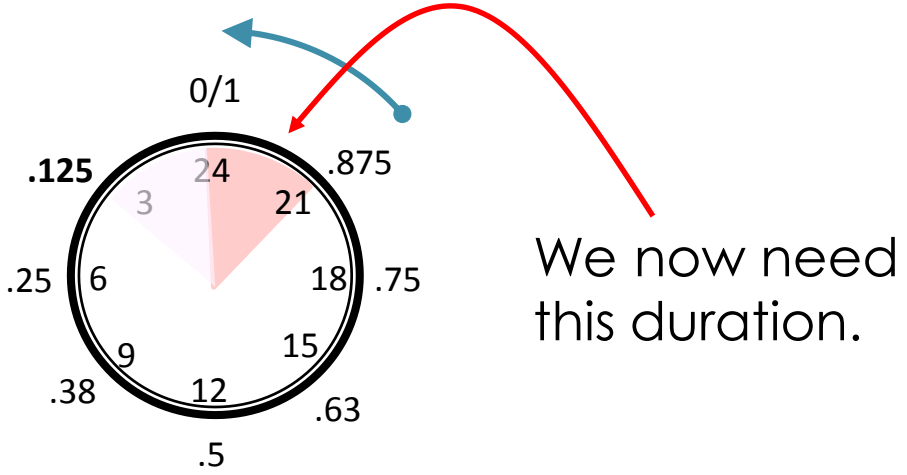
(3:00 am converts directly to .125)



Solving the Subtraction Issue

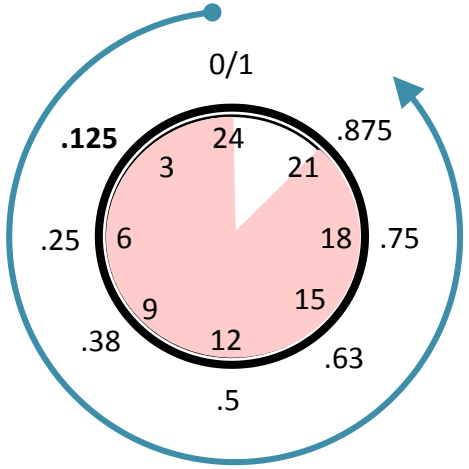
Goal:
We stated work at **9 pm** and ended work at **3 am**.
How many hours did we work?



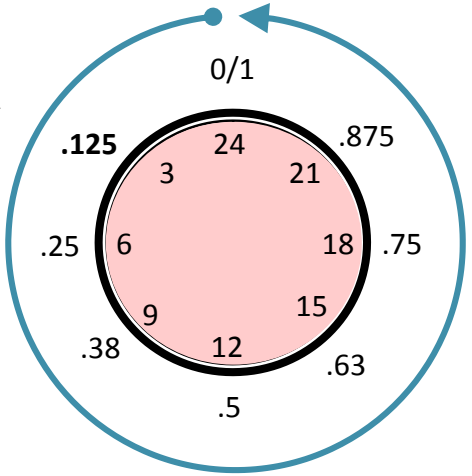


Solving the Subtraction Issue

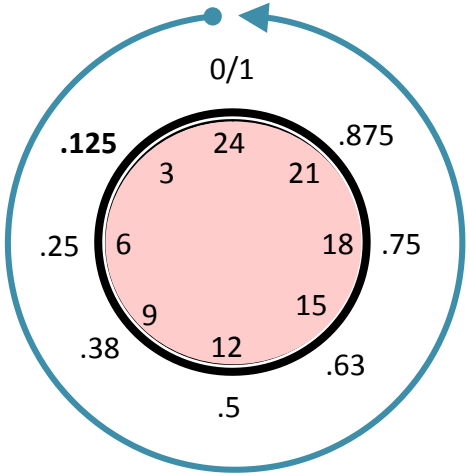
The duration from midnight (0) to 9pm is:
.875



And the duration for the entire day is **1**

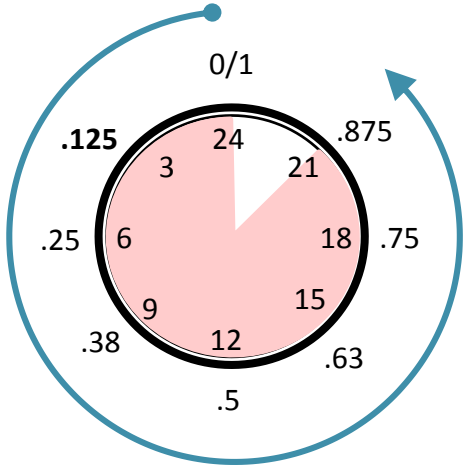


So…



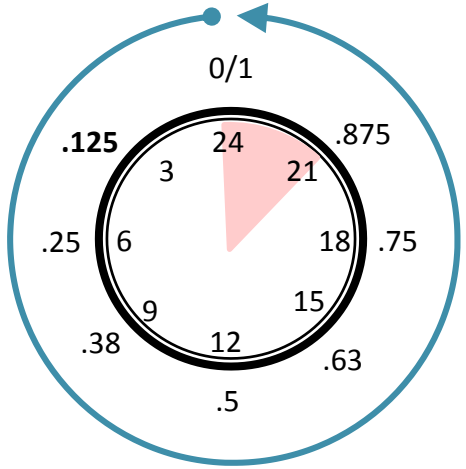
1

−



0.875

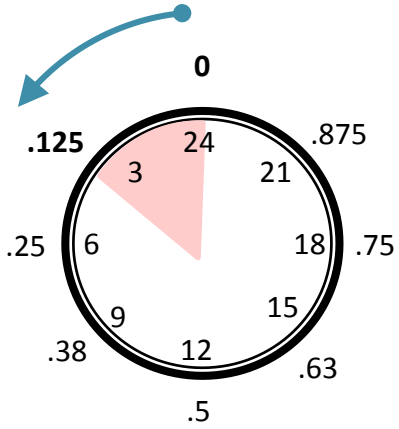
=



.125

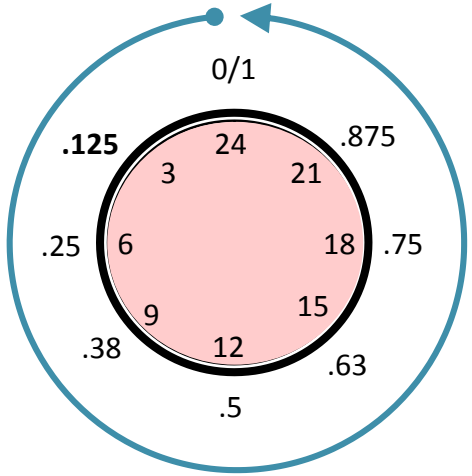
And Finally…

Solving the Subtraction Issue



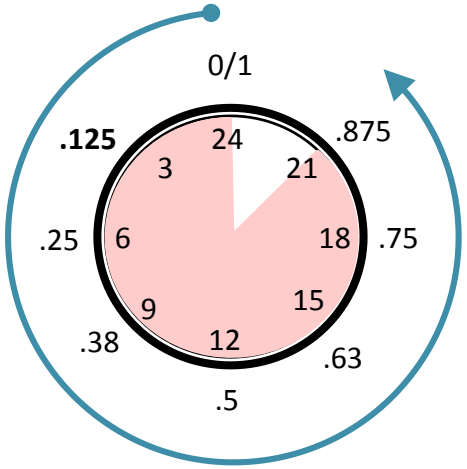
.125

+



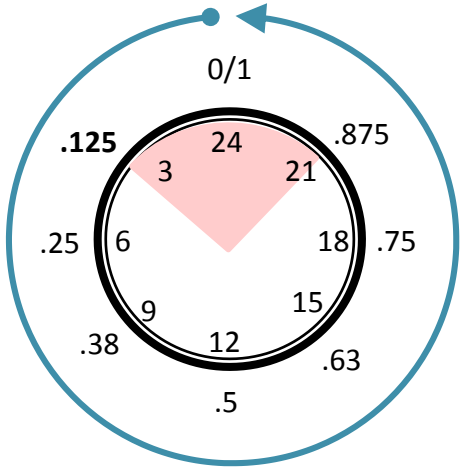
1

−



0.875

=

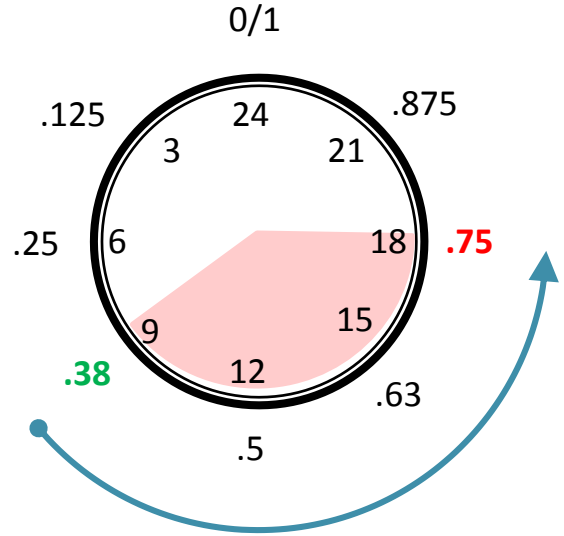


.25
or 6 hours

End Time + 1 − Start Time = Duration

Subtraction Issue: Summary

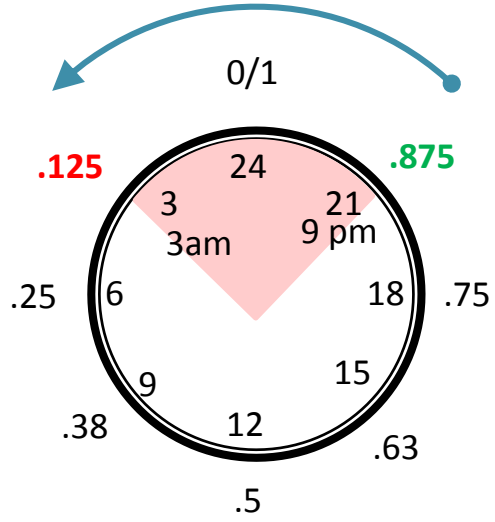
Determining Duration from Start and Stop Times



End Time > Start Time

When subtraction does not cross midnight or you are including dates with times, use this formula:

Duration = End Time – Start Time



End Time < Start Time

When subtraction crosses midnight and you are not including dates, use this formula:

Duration = End Time + 1 – Start Time

Solving the Subtraction Issue: Two Approaches

Here are two methods of handling the Subtraction Issue (that don't involve including dates with the time):

- Using an **If()** Statement to Specify which formula to use:
  Stop Time – Start Time or *Start Time + 1 – Stop Time*

- Using some Tricky Properties of **Time()** to Solve it

Subtraction Solution: Using IF()

If…then…Else

IF() returns either what is in the *True Section* or *False Section* depending upon whether or not the *Condition* is true or false

=If(Condition , True Section , False Section)

This is a statement that equates to either true or false. Examples:

- A5>=B3
- F10 < 100
- G4 = "Cats"
- A5>Average(B10:B15)
- OR(A1="Cats",A1="Dogs")

The contents of this area is only returned if the Condition is true. Examples:

- "USC Rules"
- 100
- B6-10
- Average(A1:100)

The contents of this area is only returned if the Condition is false. Examples:

- "Fight on"
- 1500
- B6+25
- Average(B1:B100)

Subtraction Solution: Using IF()

Using an IF(Condition,True,False) Statement

	A	B	C	D	E	F	G	H
1	**Determine "Total Hours" and "Gross"**							
2	Timesheet for 10/09/2015							
3	**Store Open 24 Hours**							
4								
5			**First Shift**		**Second Shift**			
6	**Name**	**Hr. Rate**	**Time In**	**Time Out**	**Time In**	**Time Out**	**Total Hours**	**Gross**
7	Marsha	$ 10.00	8:00 AM	11:30 AM	1:30 PM	4:30 PM	=IF(D7<C7,D7+1-C7,D7-C7)+IF(F7<E7,F7+1-E7,F7-E7)	$ 65.00
8	Greg	$ 15.00	9:30 AM	1:30 PM			4:00	$ 60.00
9	Peter	$ 16.00	9:00 PM	1:00 AM	2:00 AM	6:00 AM		128.00
10	Cindy	$ 18.00	9:00 AM	12:00 PM				
11	Jan	$ 12.50	9:30 AM	11:45 AM	1:00 PM	4:30 PM		
12	Bobby	$ 13.25			9:00 PM	3:00 AM		
13	**Total Time**							

Gross
Total Hours * 24 * Hr. Rate
=G7*24*B7

Total Hours
= IF(D7<C7,D7+1-C7,D7-C7)+IF(F7<E7,F7+1-E7,F7-E7)

=IF(TimeOut<TimeIn**,** TimeOut +1–TimeIn **,** TimeOut-TimeIn**)** + **IF(**TimeOut<TimeIn**,** TimeOut +1–TimeIn **,** TimeOut-TimeIn**)**

Condition Section
checks to see if Time Out is less than Time In.

True section
formula when times span two days.

False Section
formula when times occur in the same day.

This does the same thing but for the "Second Shift" and adds it to the total duration for the "First Shift".

Note on Blank Cells and the IF() Statement

	A	B	C	D	E	F	G
1	**Determine "Total Hours" and "Gross"**						
2	Timesheet for 10/09/2015						
3	**Store Open 24 Hours**						
4							
5			**First Shift**		**Second Shift**		
6	**Name**	**Hr. Rate**	**Time In**	**Time Out**	**Time In**	**Time Out**	**Total Hours**
7	Marsha	$ 10.00	8:00 AM	11:30 AM	1:30 PM	4:30 PM	=IF(D7<C7,D7+1-C7,D7-C7)+IF(F7<E7,F7+1-E7,F7-E7)
8	Greg	$ 15.00	9:30 AM	1:30 PM			4:00
9	Peter	$ 16.00	9:00 PM	1:00 AM	2:00 AM	6:00 AM	8:00
10	Cindy	$ 18.00	9:00 AM	12:00 PM			3:00
11	Jan	$ 12.50	9:30 AM	11:45 AM	1:00 PM	4:30 PM	5:45
12	Bobby	$ 13.25			9:00 PM	3:00 AM	6:00

We must put **OutTime + 1 – InTime** in the **True** section of our if statement to avoided getting a 1 for cells that contain blank shifts. This way, should cells be blank then the condition will go to the false section (because 0 is not greater than 0) and the formula would be: 0-0=0 which would have no effect.

If however we put **OutTime + 1 – InTime** in the **False** section then anywhere we have blanks we would get a "1" because zero is not greater than 0 and the formula activated would be: 0+1-0 and return 1.

Subtraction Solution: Using Time(H,M,S)

Finding Duration based on Start and Stop Time

Time(Hours,Mintues,Seconds): Converts Non-Serial Time into Serial Time

Example

Time(6,30,0) → 6:30:00 AM or 0.27833
Time(18,45,0) → 6:45:00 PM or 0.78125

For Time that Spans Midnight: EndTime + 1 – StartTime

Example

If Start Time is 9pm (21) and End Time is 3am

Time(3 + 24 - 21,0,0) → Time(6,0,0) → 6:00 hrs or 0.25

*The non-serial equivalent of 1 is 24 (i.e. 1 * 24)*

Subtraction Solution: Using Time(H,M,S)

Finding Duration based on Start and Stop Time

But, What about Duration when Start & Stop Times are in the same Day?

If Time(h,m,s) has an hour over 23, the hour is divided by 24 and <u>just the remainder</u> is returned.

12 pm Start
4 pm (16) Stop

=Time(16+24 -12,0,0) → Time(28,0,0) →

$$24 \overline{)\,28}\quad 1,\ -24,\ 4$$

→ 4 Hours or 0.1667

So, we can use: **Time(StopTime+1-StartTime , minutes ,seconds)**

For Start and Stop Times in the same day or that cross midnight!

One other thing though…

Morning Shift		Afternoon Shift	
Time In	Time Out	Time In	Time Out
8:00 AM	12:00 PM	1:00 PM	5:00 PM
9:30 AM	11:45 AM	1:00 PM	4:30 PM
		1:00 PM	5:00 PM
3:00 AM	7:00 AM		

Our In / Out entries are in Serial Time and the Time(h,m,s) function requires non-serial time. So, we need to use **Hour()** & **Minute()** to convert the serial hours and serial minutes into non serial time so we can use Time(). Therefore, to find the duration of any shift:

=Time(Hour(*TimeOut***) + 24 – Hour(***TimeIn***) , Minute(***TimeOut***)-Minute(***TimeIn***) , 0)**

Extracts and calculates the hours between the two times.
(i.e. TimeOut + 1 – TimeIn)

Extracts and calculates the minutes between the two times.
(i.e. TimeOut – TimeIn)

Subtraction Solution: Using Time()

Using Time() to Get Duration

	A	B	C	D	E	F	G	H
1	**Determine "Total Hours" and "Gross"**							
2	Timesheet for 10/09/2015							
3	**Store Open 24 Hours**							
4								
5			**First Shift**		**Second Shift**			
6	**Name**	**Hr. Rate**	**Time In**	**Time Out**	**Time In**	**Time Out**	**Total Hours**	**Gross**
7	Marsha	$ 10.00	8:00 AM	11:30 AM	1:30 PM	4:30 PM	6:30	$ 65.00
8	Greg	$ 15.00	9:30 AM	1:30 PM			4:00	$ 60.00
9	Peter	$ 16.00	9:00 PM	1:00 AM	2:00 AM	6:00 AM	8:00	$ 128.00
10	Cindy	$ 18.00	9:00 AM	12:00 PM			3:00	$ 54.00
11	Jan	$ 12.50	9:30 AM	11:45 AM	1:00 PM	4:30 PM	5:45	$ 71.88
12	Bobby	$ 13.25			9:00 PM	3:00 AM	6:00	$ 79.50
13	**Total Time**						**33:15:00**	**$ 458.38**

Gross
Total Hours * 24 * Hr. Rate
=G7*24*B7

```
=TIME(HOUR(D7)+24-HOUR(C7),MINUTE(D7)-MINUTE(C7),0)
+ TIME(HOUR(F7)+24-HOUR(E7),MINUTE(F7)-MINUTE(E7),0)
```

1st Shift

2nd Shift

Note on Time() and Negative Minutes

Time(H,M,S) will Subtract any Negative Minutes from the Hours

=Time(Hour(*TimeOut*) + 24 – Hour(*TimeIn*) , Minute(*TimeOut*)-Minute(*TimeIn*) , *0*)

Example

Time In is: 3:45 AM
Time Out is: 8:30 AM

1st Pass

= Time(Hour(8)+24-Hour(3), Minute(30)-Minute(45),0)

2nd Pass

= Time(Hour(5), Minute(-15) , 0)

Note that 5 full hours have not gone by.

Note that negative time is not allowed.

3rd Pass

= Time(Hour(4), Minute(45) , 0)

Because minutes are negative, Time() subtracts 1 from the Hour to get 3 and for the minutes subtracts 15 from 60 to get 45.
The duration is: 4 hours and 45 minutes.