ADVANCED EXCEL: LOOKUP FUNCTIONS

Excel has several Lookup and Reference functions available that are used to search through rows of data to locate specific values to display in a cell or to use in a formula. Today, we will be learning about the LOOKUP and HLOOKUP functions, but focus on the VLOOKUP function.

LOOKUP FUNCTIONS

LOOKUP vs HLOOKUP vs VLOOKUP

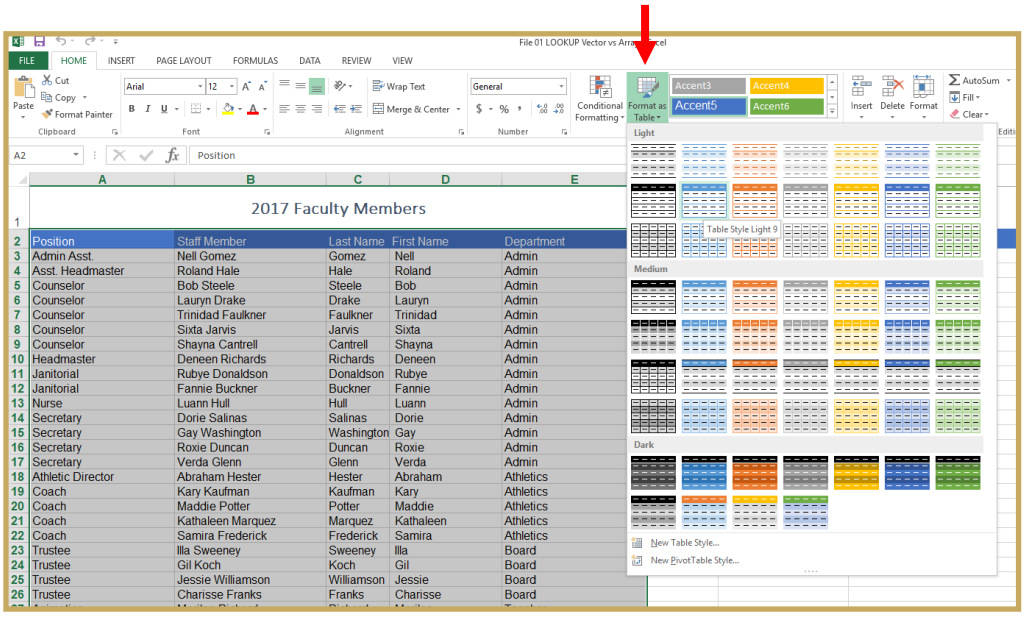
LOOKUP is a function used to go search through rows of data for specific values to display in a cell or to use in a formula. **LOOKUP** is for one dimensional tasks, when data being searched for is in a single row or column. There are two forms of the **LOOKUP** function: **vector** and **array**. The **vector LOOKUP** function requires three pieces of information: **LOOKUP value**, **LOOKUP vector**, and **result vector**. The **array LOOKUP** function uses an **array**, or a table of information, in the formula. **HLOOKUP** refers to "horizontal lookup" and is very similar to array LOOKUP, except that the data is laid out in a horizontal pattern. **VLOOKUP** refers to vertical lookup, with the data being laid out vertically. Microsoft recommends using HLOOKUP or VLOOKUP instead of the array function, with VLOOKUP being the most popular.

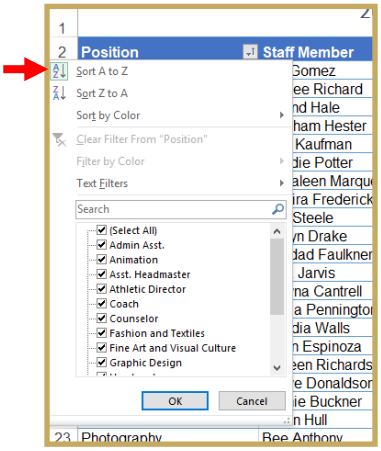
Vector LOOKUP

Open "**File 01 LOOKUP" Vector vs Array**." Before using the **LOOKUP** function, you will want to organize your data. The data you are searching or indexing, in our case the "**Position**," should be in **ascending order**. There are two ways to do this.

Option 1: Select cells **A3:A31** and right click to get a menu. From that menu, select **Sort** and chose "**Sort A to Z**."

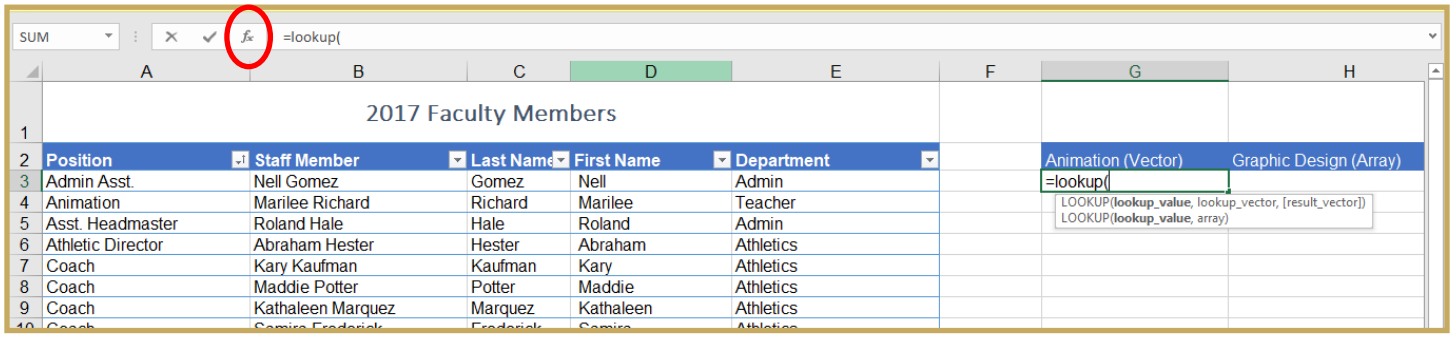
Option 2: Select cells **A2:E31** and select "**Format as Table**" from the **Home Ribbon**. Once the cells are formatted as a table, the column titles will have drop down arrows. Click on the drop down arrow and select "**Sort A to Z**."

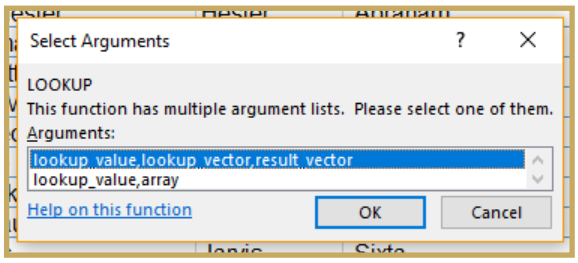




VECTOR LOOKUP

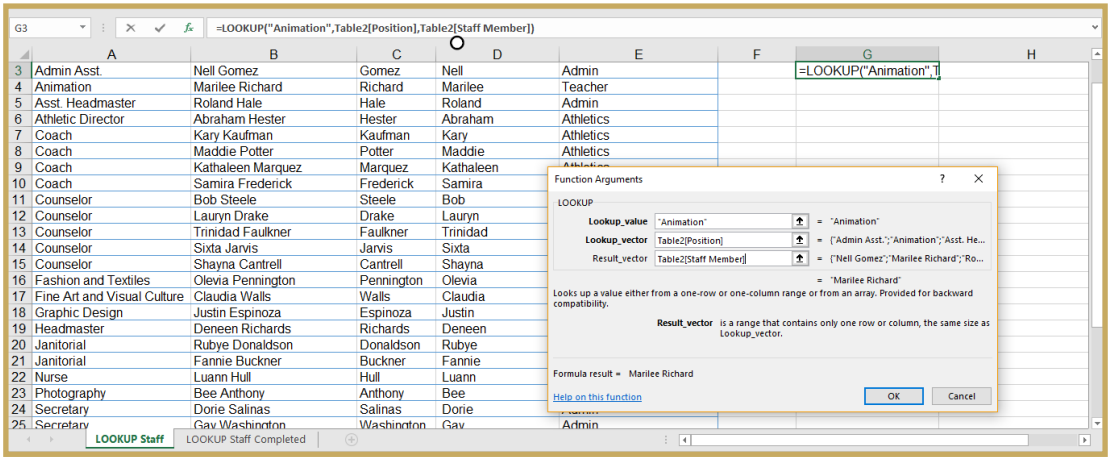
In our LOOKUP example, we will be using the **vector LOOKUP** function to find and input the name of the **Staff Member** who works **Animation**. Add the function in **G3** by typing **=LOOKUP(**. The **Equal (=)** symbol is always used to start a function. Followed by the name of the function LOOKUP. The parenthesis begins the part of the syntax values, arrays, and other information.





Since the LOOKUP function has multiple argument lists, we want to make sure we are using the right one. Select the **FX** icon to get the **Select Arguments** menu. Choose "**lookup_value, lookup_vector, result_vector**" from the menu and click "**OK**."

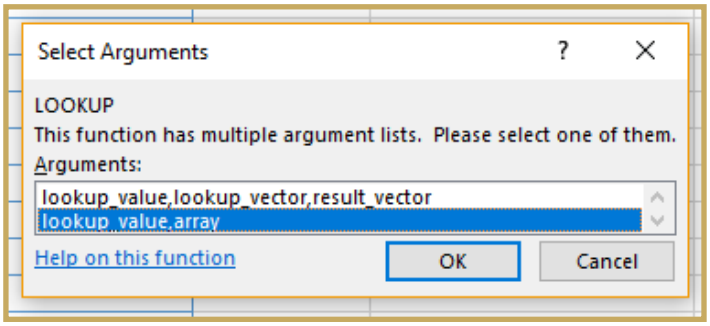
Lookup_value is the value Excel will find. In this case, we want Excel to specifically find the "**Animation**" position. This must be typed using quotations. Next, we need to indicate which row or column the value is located. Animation is listed in the "Position" column. In **Lookup_vector**, select cells **A3:A31** or type **Table2 [Position]**. Lastly, **result_vector** is where the information can be found. In this case, it's the "Staff Member" column. Type either **B3:B31** or **Table2[Staff Member]**. The answer should be Marliee Richard.
The formula in G3 should read **=LOOKUP("Animation", Table2[Position], Table2[Staff Member]**



ARRAY LOOKUP

Array LOOKUP

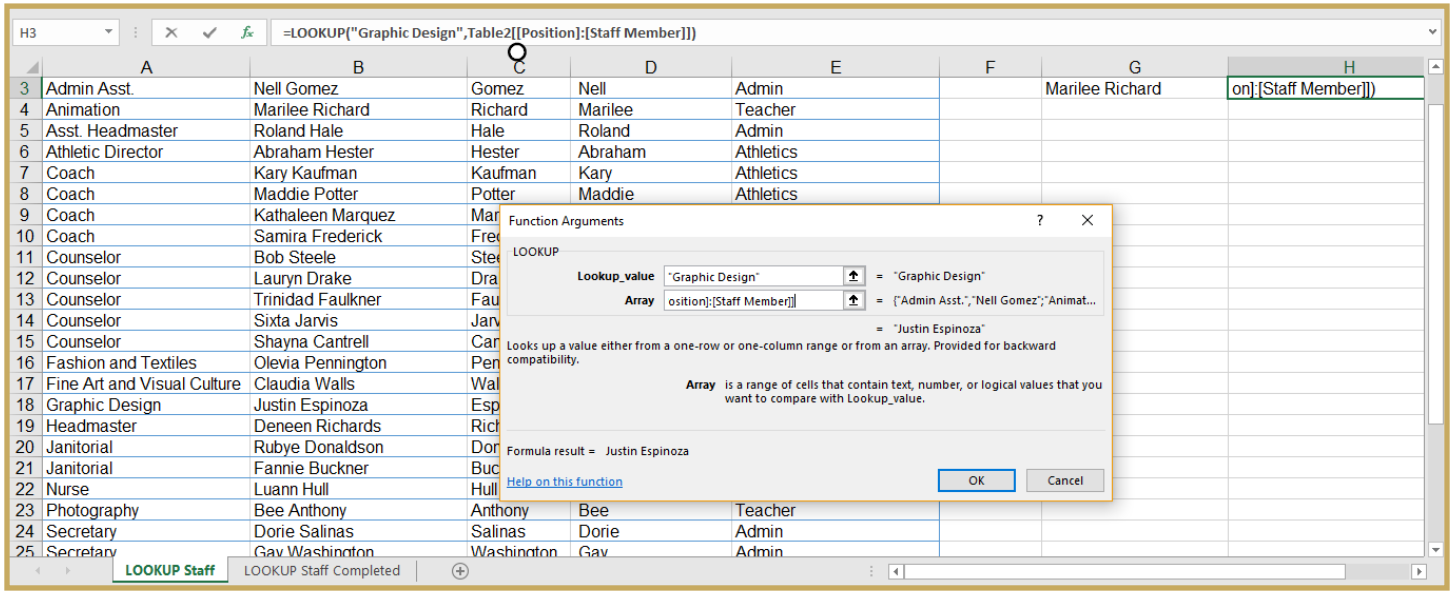
We will use the same LOOKUP function to determine the Staff Member who works the "Graphic Design" Position, but instead use the array argument. In **H3**, type **=LOOKUP(**, then click the **Fx** icon and chose "**lookup_value, array**" from the menu.



While the vector argument requires three pieces of information or syntax, the array function only requires two. Just like in the vector LOOKUP formula, the **Lookup_value** is what you want Excel to find. In this case, it will be the "**Graphic Design**" position, which must be typed in quotations. Next is the array. The **array** is a section of the table that has the information we want to search for and find. In this case, it is both the **Position** and **Staff Member** column because we want to search "Graphic Design" in the Position and find who the Staff Member is. In **Array**, select cells **A3:B31** or type **Table2[[Position]:[Staff Member]]**. The result should be Justin Espinoza.

The formula in **H3** should read **=LOOKUP("Graphic Design", Table2[[Position]:[Staff Member]])**

*Pro Tip: There is a simpler way to select a column without clicking and dragging the cells to select. To select an entire column, select the first cell in the column. The press **Ctrl + Shift + the down arrow**. The entire column will be selected.*



HLOOKUP

HLOOKUP

HLOOKUP is a horizontal lookup function used when data is laid out horizontally.

Open "**File 02 HLOOKUP**." In this example, the "Teach Staff" worksheet has the classes and teachers input in a horizontal matter. HLOOKUP is going to be used to pull this data and add it to the table located on the "Teaching Staff HLOOKUP" worksheet.

Select **B5** on the "**Teaching Staff HLOOKUP**" worksheet and begin typing the formula **=HLOOKUP(**.

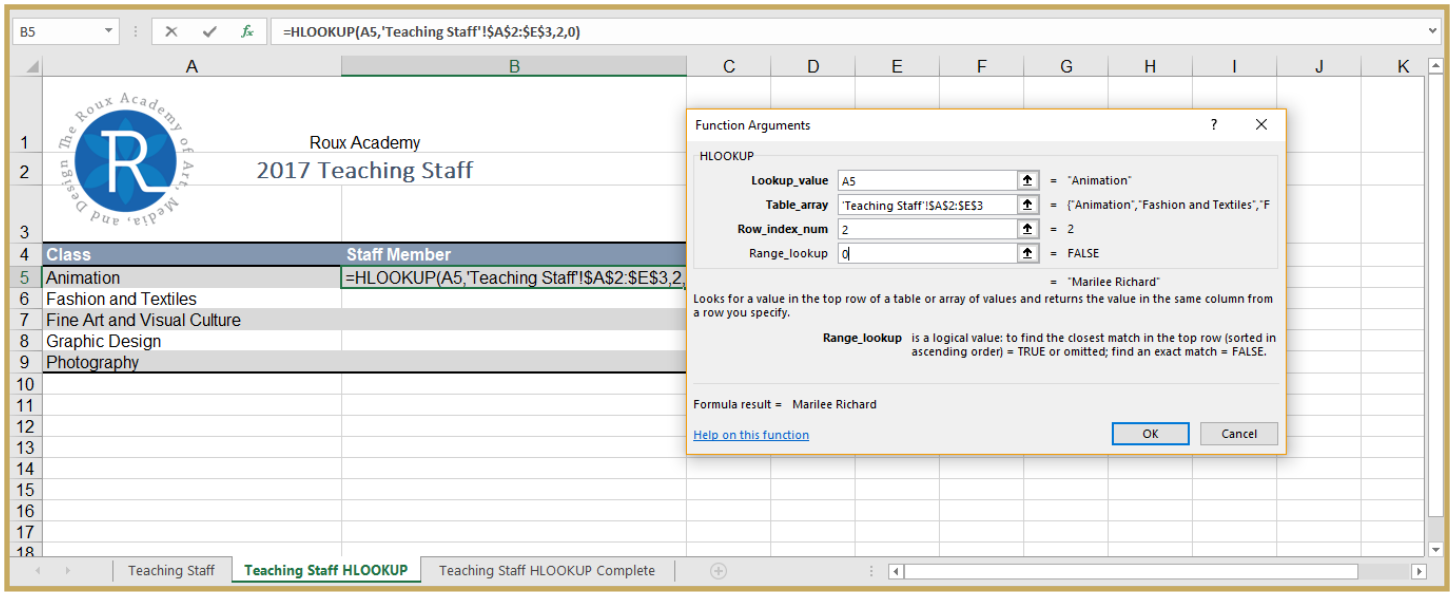
Click the **Fx** icon to open the **Functions Argument** window.

Lookup_value is a value that must exist on both worksheets. It is the value that Excel will look for in both worksheets and use to complete the table. In this case, we want to use **A5** to indicate that the name of the class is the lookup value.

Table_array is the portion of the worksheet that has the original data. In this case, it exists on the "Teaching Staff" worksheet in cells **A2:E3**. The entire table needs to be selected so Excel can find the class name and retrieve the staff person's name. We will want to make the **table array absolute** by clicking **F4** or **adding dollar ($)** signs in the cell name. It should read **$A$2:$E$2** so that the range of the array doesn't change.

Row_index_num is used to indicate which row of the table array has the information you want as the result. In our case, row **2** has the staff person's name.

Range_lookup is used to determine exact match or approximant match. **Exact match is identified as a 0**.

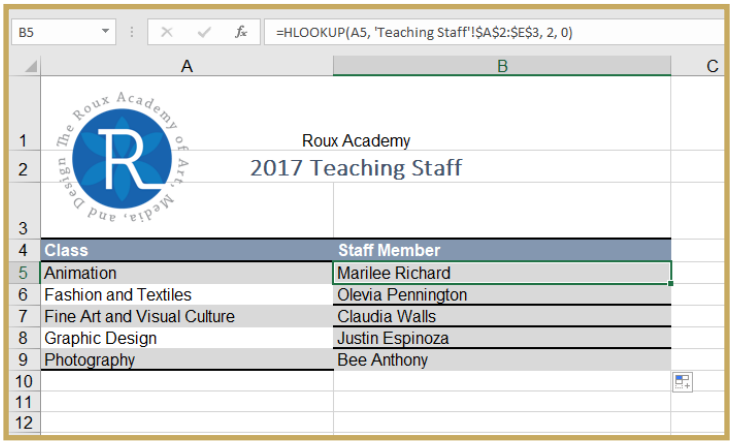


HLOOKUP

The formula in B5 should read
=HLOOKUP(A5, 'Teaching Staff'!$A$2;$E$3, 2, 0)

The result for the Staff Member who teaches Animation is Marilee Richard. To copy this formula for the remainder of the table, double click the "autofill" green square in the bottom right of cell B5.

The formula in **B6** should read
=HLOOKUP(A6, 'Teaching Staff'!$A$2:$E$3, 2, 0)



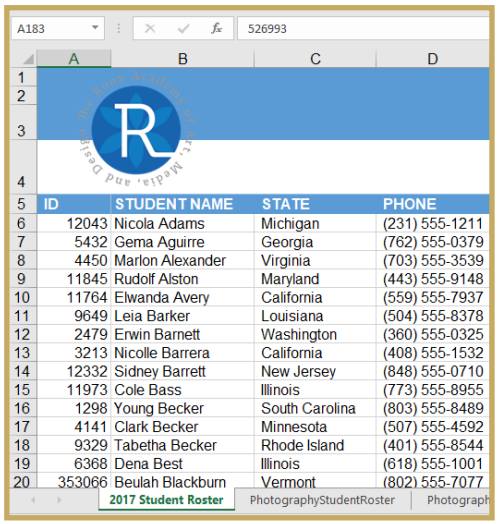
Class	Staff Member
Animation	Marilee Richard
Fashion and Textiles	Olevia Pennington
Fine Art and Visual Culture	Claudia Walls
Graphic Design	Justin Espinoza
Photography	Bee Anthony

The lookup value should have changed to A6 (Fashion and Textiles), but the table array should not have changed thanks to the absolute ($) symbols.

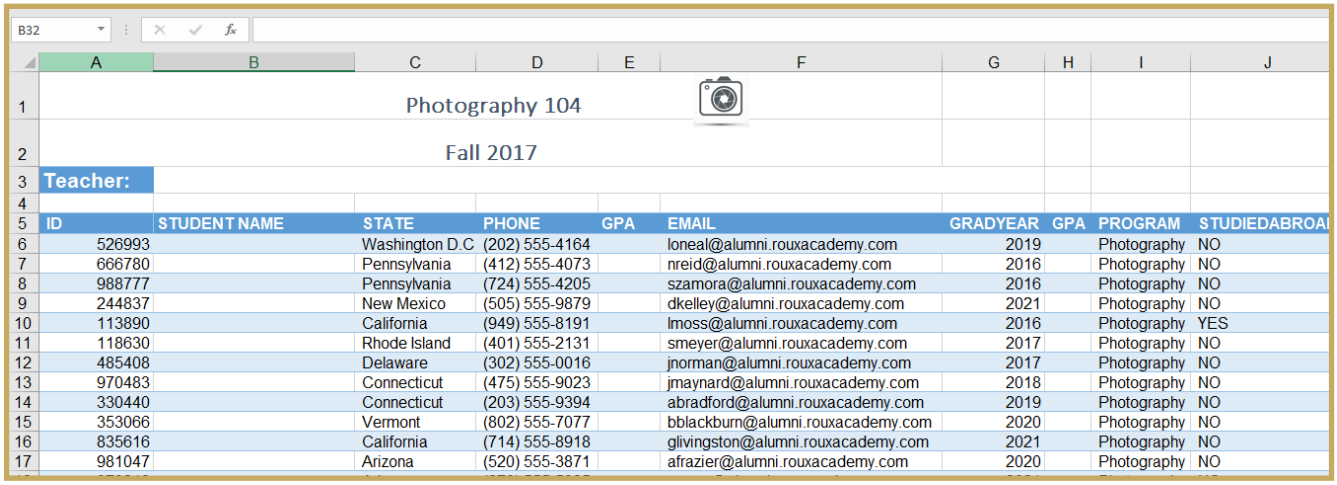
VLOOKUP Exact

VLOOKUP is a vertical lookup function used when data is laid out vertically.

Open "**File 03 VLOOKUP Basic**." This file has two worksheets: **2017 Student Roster** and **Photography Student Roster**. They both have a column for "ID." However, the column for "Student Name" in Photography Student Roster is currently empty. We are going to used the VLOOKUP function to locate the ID numbers on both pages and automatically add the Student Name into the empty column.



ID	STUDENT NAME	STATE	PHONE
12043	Nicola Adams	Michigan	(231) 555-1211
5432	Gema Aguirre	Georgia	(762) 555-0379
4450	Marlon Alexander	Virginia	(703) 555-3539
11845	Rudolf Alston	Maryland	(443) 555-9148
11764	Elwanda Avery	California	(559) 555-7937
9649	Leia Barker	Louisiana	(504) 555-8378
2479	Erwin Barnett	Washington	(360) 555-0325
3213	Nicolle Barrera	California	(408) 555-1532
12332	Sidney Barrett	New Jersey	(848) 555-0710
11973	Cole Bass	Illinois	(773) 555-8955
1298	Young Becker	South Carolina	(803) 555-8489
4141	Clark Becker	Minnesota	(507) 555-4592
9329	Tabetha Becker	Rhode Island	(401) 555-8544
6368	Dena Best	Illinois	(618) 555-1001
353066	Beulah Blackburn	Vermont	(802) 555-7077



ID	STUDENT NAME	STATE	PHONE	GPA	EMAIL	GRADYEAR	GPA	PROGRAM	STUDIEDABROAD
526993		Washington D.C	(202) 555-4164		loneal@alumni.rouxacademy.com	2019		Photography	NO
666780		Pennsylvania	(412) 555-4073		nreid@alumni.rouxacademy.com	2016		Photography	NO
988777		Pennsylvania	(724) 555-4205		szamora@alumni.rouxacademy.com	2016		Photography	NO
244837		New Mexico	(505) 555-9879		dkelley@alumni.rouxacademy.com	2021		Photography	NO
113890		California	(949) 555-8191		lmoss@alumni.rouxacademy.com	2016		Photography	YES
118630		Rhode Island	(401) 555-2131		smeyer@alumni.rouxacademy.com	2017		Photography	NO
485408		Delaware	(302) 555-0016		jnorman@alumni.rouxacademy.com	2017		Photography	NO
970483		Connecticut	(475) 555-9023		jmaynard@alumni.rouxacademy.com	2018		Photography	NO
330440		Connecticut	(203) 555-9394		abradford@alumni.rouxacademy.com	2019		Photography	NO
353066		Vermont	(802) 555-7077		bblackburn@alumni.rouxacademy.com	2020		Photography	NO
835616		California	(714) 555-8918		glivingston@alumni.rouxacademy.com	2021		Photography	NO
981047		Arizona	(520) 555-3871		afrazier@alumni.rouxacademy.com	2020		Photography	NO

VLOOKUP

B6 is the first cell in the “Photography Student Roster” worksheet missing a name. In **B6**, begin the VLOOKUP formula by typing **=VLOOKUP(**. Then click the **Fx** icon to open the **Function Arguments** menu.

Lookup_value must be a value that exists on both worksheets. Excel will lookup the value indicated in the formula, and then locate that same value on the other worksheet and produce a student name. In this case, the lookup value is in **B5**. This will tell Excel to lookup the ID number 526993.

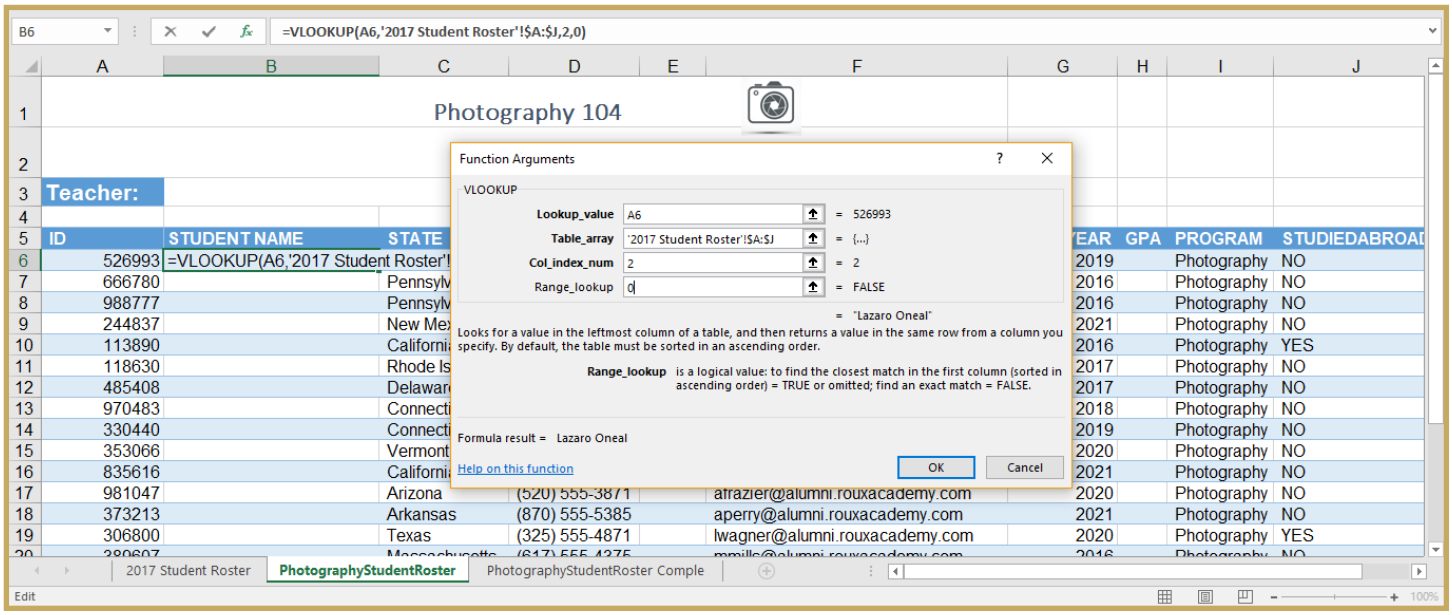
The **Table_array** is the table of data Excel will search through to find the lookup value indicated above. In this case, it is the entire table located on the 2017 Student Roster worksheet. This can be identified by typing **‘2017 Student Roster’!$A:$J**. It is important to use the **absolute ($) symbols** so that the table range does not shift when you autofill the formula in a later step.

Col_index_number is the column number of the table array that has the data you are seeking. In this case, it is column number **2** because **Student Name** is the second column in ‘2017 Student Roster’!$A:$J.

Range_lookup is used to determine if you want an exact match or approximate match. For this example, we want to exactly match the ID to the Student Name. **Exact match is identified as a 0.**

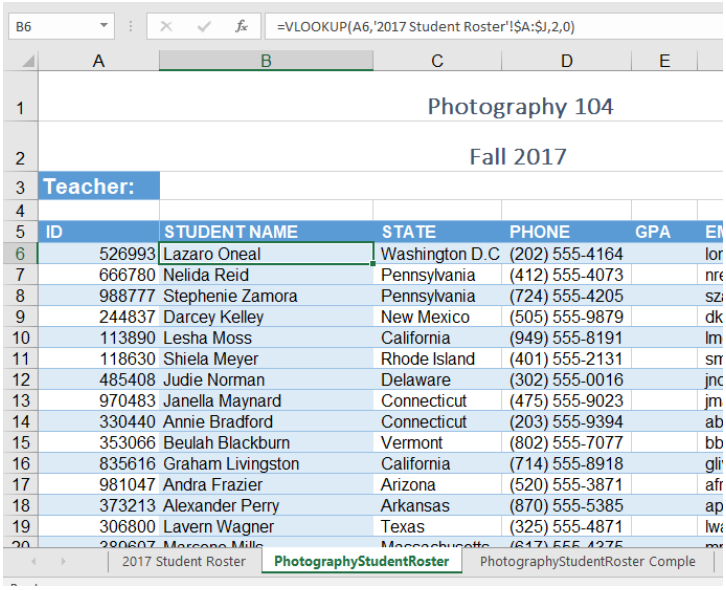
The formula in **B6** should read **=VLOOKUP(A6, ‘2017 School Roster’!$A:$J, 2, 0)**

The result should be Lazaro Oneal.



VLOOKUP

Double click the “autofill” green square at the bottom of cell B6 to complete the VLOOKUP formula for the remainder of the Student Name column.



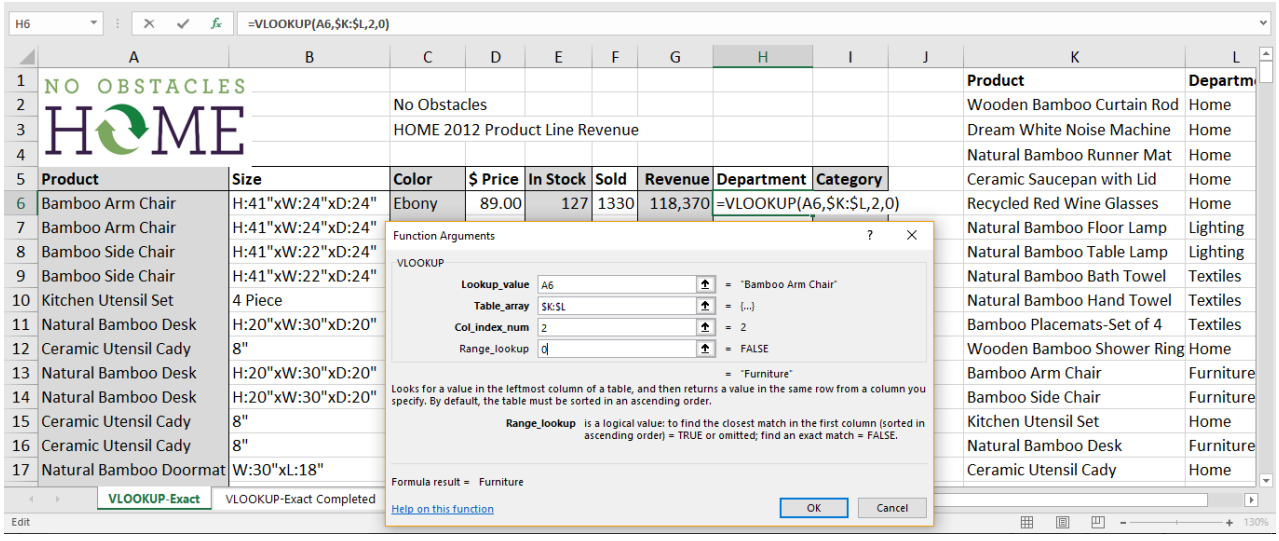
On Your Own Activity

Use the **VLOOKUP** formula to fill in the “**GPA”** column of “Photography Student Roster” worksheet with the “**GPA”** column in 2017 Student Roster worksheet. *(Hint: The GPA column in “2017 Student Roster” is column number 6 of the table.)*

File 02 VLOOKUP Exact

“**File 02 VLOOKUP Exact**” is another workbook that needs **VLOOKUP** to complete a the **Department** and **Category** columns using an exact match. For the Department column, our lookup value is going to be found in column A, beginning with **A6**. The Products in column A will be searched in the Products in column K and matched to the Department in Column L. Therefore, our **Table_array** will be **$K:$L** and the **Col_index_num** will be **2**. **Range_lookup** will be **0** in order to product an **exact match**.
The formula in **H6** should read **=VLOOKUP(A6, $K:$L, 2, 0)**

Use a **VLOOKUP** function to fill the **Category** column. *(Hint: The Table_array and Col_index_num will change.)*

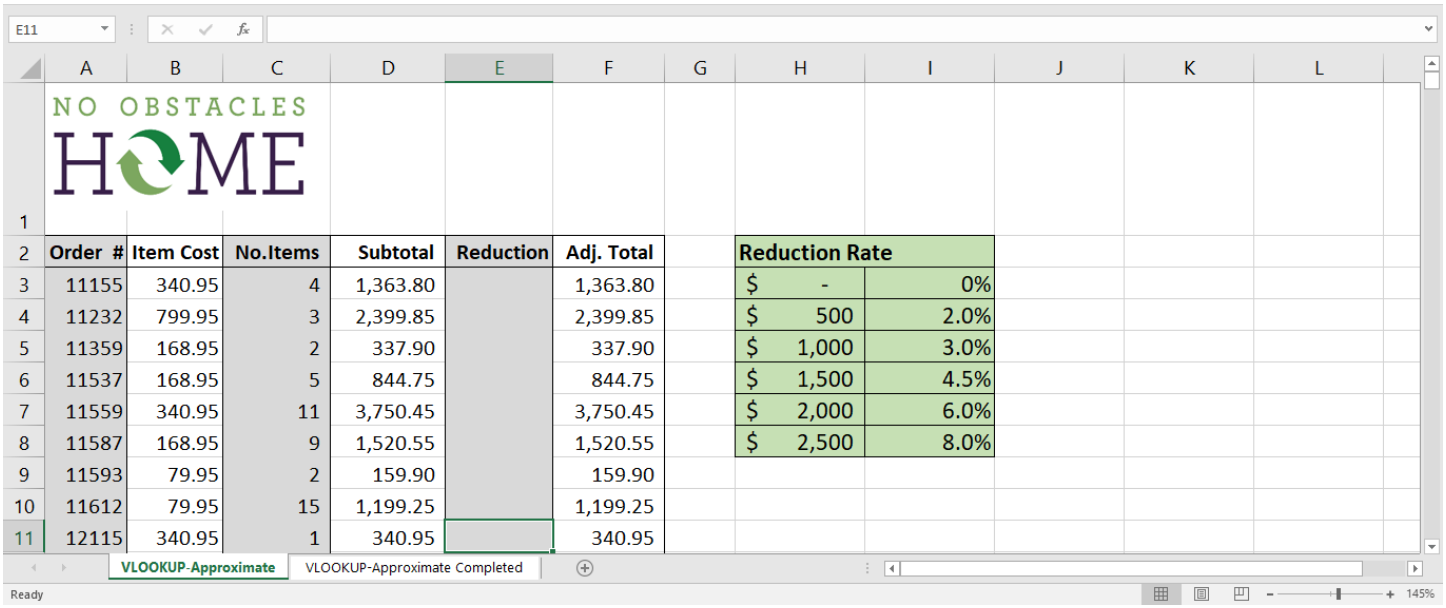


VLOOKUP

VLOOKUP Approximate

So far, we have been using the HLOOKUP and VLOOKUP functions to find exact matches. The exact match option is great for matching text, names, or ID numbers, but is not as useful when using VLOOKUP for sales and inventory numbers.

Open "**File 06 VLOOKUP Approximate**." This file is an example of when **VLOOKUP approximate** would be used instead of the exact match function. We can see that this chart is being used to track order numbers and costs. In this scenario, customers will receive a reduction in cost based on the subtotal of their order. To the right of the table is a separate table indicating the reduction rate based on the subtotal range. Instead of manually entering a reduction rate, we will use the VLOOKUP function to find the **Subtotal** from column D and compare it to the subtotal ranges in column H to produce the Reduction Rate that will appear in column E. The **Reduction Rate** in column E will then be used in a formula with the **Subtotal** to create an **Adjusted Total** for column F.



Order #	Item Cost	No.Items	Subtotal	Reduction	Adj. Total
11155	340.95	4	1,363.80		1,363.80
11232	799.95	3	2,399.85		2,399.85
11359	168.95	2	337.90		337.90
11537	168.95	5	844.75		844.75
11559	340.95	11	3,750.45		3,750.45
11587	168.95	9	1,520.55		1,520.55
11593	79.95	2	159.90		159.90
11612	79.95	15	1,199.25		1,199.25
12115	340.95	1	340.95		340.95

Reduction Rate	
$ -	0%
$ 500	2.0%
$ 1,000	3.0%
$ 1,500	4.5%
$ 2,000	6.0%
$ 2,500	8.0%

*Pro Tip: When you type formulas in the function bar, Excel will start recommending formulas with the same character. If the formula you are looking for is top of Excel's recommendation list, you can press the **Tab** key to "lead" into the formula and have it Excel autotype the formula for you.*

For More Resources

Visit elmlib.org/lynda for additional tutorials and example files on Excel.

lynda.com

VLOOKUP

To begin, select **E3** and type **=VLOOKUP(**. Then click the **Fx** icon to open the **Function Arguments** window.

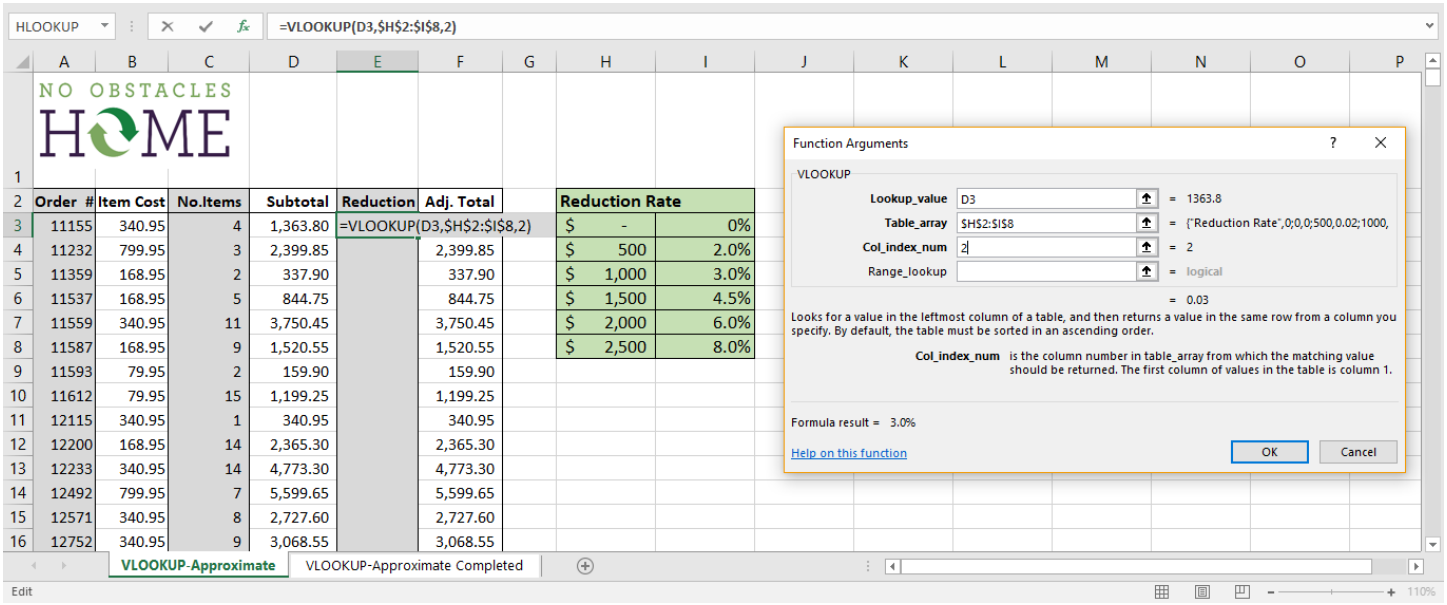
Since we want to find the **Reduction Rate** based on the **Subtotal** of Order # 11155, the **Lookup_valeu** will be **D3**. Excel will then look for D3 (or, 1,363.80) in the table array.

The **Table_array** will be the table to the right, identified as cells **$H$2:$I$8**. The **absolute ($)** symbols will be important so that the table array doesn't shift when we autofill the VLOOKUP formula for the remainder of column E.

Col_index_num will be **2**, since the Reduction Rate is located in the second column of the table array $H$2:$I$8.

Range_lookup will be left blank. This is the different between VLOOKUP using exact match versus approximate. When range lookup is left blank, **VLOOKUP** will take the value found in **Subtotal** and compare it to the ranges found in the **Reduction Rate** table. Therefore, the result in **E3** will be **3.0%**.

The formula in **E3** should read **=VLOOKUP(D3, $H$2:$I$8, 2)**

Autofill the remainder of column E. You should notice the Adjust Totals have changed. Adjust the format in "**Item Cost**," "**Subtotal**," and "**Adj. Total**" to **Currency** or **Accounting**.

Note: The range will only work if it is in ascending order.