

Notes: Two-Way Frequency Tables
Created for you by Ms. Nhatsoabanh

A **two-way table** shows data that pertain to two different categories. The data from one sample group is shown as it relates to two different categories.

Example of a Two-Way Table

	Play a Sport	Do Not Play a Sport	Total
Take a Foreign Language	14	23	14 + 23 or 37
Do Not Take a Foreign Language	10	3	10 + 3 or 13
Total	14 + 10 or 24	23 + 3 or 26	50

Relative frequency is the ratio of the value of a subtotal to the value of the total.

Frequency by Row	Play a Sport	Do Not Play a Sport	Total
Take a Foreign Language	$\frac{14}{37} \approx 0.38$	$\frac{23}{37} \approx 0.62$	1.00
Do Not Take a Foreign Language	$\frac{10}{13} \approx 0.77$	$\frac{3}{13} \approx 0.23$	1.00
Total	$\frac{24}{50} \approx 0.48$	$\frac{26}{50} = 0.52$	1.00

Ex. 1: What is the relative frequency of students that take a foreign language and play a sport to all students taking a foreign language?

Answer: The relative frequency is $\frac{14}{37}$ or about 0.38.

Frequency by Column	Play a Sport	Do Not Play a Sport	Total
Take a Foreign Language	$\frac{14}{24} \approx 0.58$	$\frac{23}{26} \approx 0.88$	$\frac{37}{50} = 0.74$
Do Not Take a Foreign Language	$\frac{10}{24} \approx 0.42$	$\frac{3}{26} \approx 0.12$	$\frac{13}{50} = 0.26$
Total	1.00	1.00	1.00

Ex. 2: What is the relative frequency of students that neither play a sport nor take a foreign language to all students that do not play a sport?

Answer: The relative frequency is $\frac{3}{26}$ or about 0.12

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Steps to Construct a Two-Way Table

Step 1: Create a table using the two categories: cell phones and MP3 players for example 1.

Step 2: Use the values given to fill in the table.

Step 3: Use reasoning to complete the table. Remember, the totals are for each row and column. The column labeled "Total" should have the same sum as the row labeled "Total."

Ex. 3: Logan surveyed students at his school. He found that 78 students own a cell phone and 57 of those students own an MP3 player. There are 13 students that do not own a cell phone, but own an MP3 player. Nine students do not own either device. Construct a two-way table summarizing the data.

	MP3 Player	No MP3 Player	Total
Cell Phone	57	21	78
No Cell Phone	13	9	22
Total	70	30	100

Ex. 4: There are 150 children at summer camp and 71 signed up for swimming. There were a total of 62 children that signed up for canoeing and 28 of them also signed up for swimming. Construct a two-way table summarizing the data.

	Canoeing	Not signed up for canoeing	Total
Swimming	28	43	71
Did not signed up for swimming	34	45	79
Total	62	88	150

Freq. by rows

	Math	English	Science	Totals
Girls	$\frac{50}{150} = 0.33$	$\frac{40}{150} = 0.27$	$\frac{60}{150} = 0.40$	$\frac{150}{150} = 1.00$
Boys	$\frac{65}{165} = 0.39$	$\frac{30}{165} = 0.18$	$\frac{70}{165} = 0.42$	$\frac{165}{165} = 1.00$
Totals	$\frac{115}{315} = 0.37$	$\frac{70}{315} = 0.22$	$\frac{130}{315} = 0.41$	$\frac{315}{315} = 1.00$

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Practice Problems:

The two-way frequency table, shown below, displays the data collected from a random group of high school students regarding whether they "liked" skateboards and/or "liked" snowmobiles. Answer the questions below, regarding this table.

	Like Skateboards	Do Not Like Skateboards	Totals
Like Snowmobiles	80	25	105
Do not like Snowmobiles	45	10	55
Totals	125	35	160

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- How many students participated in the survey?
a.) 55 b.) 105 c.) 125 d.) 160
- How many students said they "like" snowmobiles?
a.) 25 b.) 80 c.) 105 d.) 125
- How many of the students "like" snowmobiles, but "do not like" skateboards?
a.) 10 b.) 25 c.) 35 d.) 45
- How many students said they "do not like" skateboards?
a.) 10 b.) 25 c.) 35 d.) 45

Freshman girls and boys were surveyed to choose their favorite subject from the list of Math, English or Science. The results are shown in the two-way relative frequency table below (rounding to nearest hundredth). Answer the questions below, regarding the table to the left, follow the arrow.

- How many girls participated in the survey?
a.) 50 b.) 60 c.) 150 d.) 315
- What percentage of the boys chose "Science"?
a.) 41% b.) 42% c.) 4.1% d.) 4.2%
- This table shows relative frequencies based upon _____.
a.) the whole table b.) the rows c.) the columns
- What percentage of the girls chose "Math"?
a.) 27% b.) 33% c.) 39% d.) 40%
- What percentage of the students chose "English"?
a.) 27% b.) 18% c.) 22% d.) 41%

Notes: Two-Way Frequency Tables 2
Created for you by Ms. Nhotsoubanh

Joint frequencies – entries in the body of the table.

Marginal frequencies – the cells which contain the sum of the initial counts by row and by column.

	Sport Utility Vehicle (SUV)	Sports Car	Totals
male	21	39	60
female	135	45	180
Totals	156	84	240

Joint Frequency	Sport Utility Vehicle (SUV)	Sports Car	Totals	Marginal Frequency
male	21	39	60	
female	135	45	180	
Totals	156	84	240	

- How many people responded to the survey? 240
- How many males responded to the survey? 60
- How many people chose an SUV? 156
- How many females chose a sports car? 45
- How many males chose an SUV? 21
- Which of the following values is referred to as a "marginal frequency"?
 a) 135 b) 21 c) 60 d) 240
- Which of the following values is referred to as a "joint frequency"?
 a) 156 b) 39 c) 180 d) 240

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	Sport Utility Vehicle (SUV)	Sports Car	Totals
male	$\frac{21}{240} = 0.09$	$\frac{39}{240} = 0.16$	$\frac{60}{240} = 0.25$
female	$\frac{135}{240} = 0.56$	$\frac{45}{240} = 0.19$	$\frac{180}{240} = 0.75$
Totals	$\frac{156}{240} = 0.65$	$\frac{84}{240} = 0.35$	$\frac{240}{240} = 1.00$

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9. What percentage of the survey takers was female? 75%
10. What is the relative frequency of males choosing a sports car? $\frac{39}{240}$ or about 0.16
10. Was there a higher percentage of males or females choosing an SUV?

higher percentage of female

Two-Way Frequency Table

	Always wears glasses	Sometimes wears glasses	Never wears glasses	Total
Boys	40	48	161	249
Girls	36	55	144	235
Total	76	103	305	484

11. A principal of a school with 484 students collected information about how many of the students wear glasses.

- a. Complete the table
- b. How many boys sometimes wear glasses? 48
- c. How many students wear glasses some of the time? 103
- d. How many students never wear glasses? 305
- e. Are there more boys or girls in the school? boys

Two-Way Relative Frequency Table

	Always wears glasses	Sometimes wears glasses	Never wears glasses	Total
Boys	$\frac{40}{484}$	$\frac{48}{484}$	$\frac{161}{484}$	0.51
Girls	$\frac{36}{484}$	$\frac{55}{484}$	$\frac{144}{484}$	0.49
Total	$\frac{76}{484}$	$\frac{103}{484}$	$\frac{305}{484}$	1.00

12. Create a two-way relative frequency table for the above data.
- a. What is the relative frequency of boys who sometimes wear glasses? $\frac{48}{484} \approx 0.10$
- b. What percentage of girls never wear glasses? 30%
- c. What percentage of students are boys? 51%
- d. What percentage of students always wear glasses? 16%

	Speak a Foreign Language	Do Not Speak a Foreign Language	Totals
Math Average ≥ 90	70	15	85
Math Average NOT ≥ 90	10	50	60
Totals	80	65	145

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13. How many students were surveyed?
a.) 65 b.) 85 c.) 145 d.) 80
14. What percentage of the students speak a foreign language and have a math average greater than or equal to 90?
a.) 41% b.) 48% c.) 82% d.) 88%
15. What percentage of the students with a math average greater than or equal to 90 do not speak a foreign language?
a.) 10% b.) 18% c.) 23% d.) 25%
16. How many of the students do not speak a foreign language?
a.) 15 b.) 50 c.) 60 d.) 65