

Warm Up
 A bag contains 4 red, 8 blue, and 2 yellow marbles. Find each probability.

1. $P(\text{red}) = \frac{4}{14} = \frac{2}{7} = .29$ 2. $P(\text{blue}) = \frac{8}{14} = \frac{4}{7} = .57$
 3. $P(\text{red or yellow}) = \frac{6}{14} = \frac{3}{7} = .43$ 4. $P(\text{not red}) = \frac{10}{14} = \frac{5}{7} = .71$

Suppose you asked 20 children and adults whether they liked broccoli. The two-way table displays the data.

The **joint relative frequencies** are the values in each category divided by the total number of values.

| | | | |
|----------|-----|----|--|
| | Yes | No | |
| Children | 3 | 8 | |
| Adults | 7 | 2 | |

Directions: Rewrite the table showing the joint relative frequencies.

| | | | |
|---|-----|----|-----|
| | Y | N | T |
| C | .15 | .4 | .55 |
| A | .35 | .1 | .45 |
| T | .5 | .5 | 1 |

The **marginal relative frequencies** are found by adding the joint relative frequencies in each row and column.

| | | | |
|----------|------|-----|-------|
| | Yes | No | Total |
| Children | 0.15 | 0.4 | 0.55 |
| Adults | 0.35 | 0.1 | 0.45 |
| Total | 0.5 | 0.5 | 1 |

To find a **conditional relative frequency**, divide the joint relative frequency by the marginal relative frequency. Conditional relative frequencies can be used to find conditional probabilities.

| | | | |
|---|-------------------------|------------------------|-----------------------|
| | Y | N | T |
| C | $\frac{.15}{.55} = .27$ | $\frac{.4}{.55} = .73$ | $\frac{.55}{.55} = 1$ |
| A | $\frac{.35}{.45} = .78$ | $\frac{.1}{.45} = .22$ | $\frac{.45}{.45} = 1$ |
| T | $\frac{.5}{1} = .5$ | $\frac{.5}{1} = .5$ | 1 |

Example 1:

The table shows the results of randomly selected car insurance quotes for 125 cars made by an insurance company in one week. Make a table of the joint and marginal relative frequencies.

| | | |
|--------------|------|-------|
| | Teen | Adult |
| 0 accidents | 15 | 53 |
| 1 accident | 4 | 32 |
| 2+ accidents | 9 | 12 |

Example 1: Answer

| | | |
|--------------|------|-------|
| | Teen | Adult |
| 0 accidents | 15 | 53 |
| 1 accident | 4 | 32 |
| 2+ accidents | 9 | 12 |

| | | | |
|---------|-------|-------|-------|
| | Teen | Adult | Total |
| 0 acc. | 0.12 | 0.424 | 0.544 |
| 1 acc. | 0.032 | 0.256 | 0.288 |
| 2+ acc. | 0.072 | 0.096 | 0.168 |
| Total | 0.224 | 0.776 | 1 |

Example 2: Using Conditional Relative Frequency to Find Probability

A reporter asked 150 voters if they plan to vote in favor of a new library and a new arena.

| | | Library | |
|-------|-----|---------|----|
| | | Yes | No |
| Arena | Yes | 21 | 30 |
| | No | 57 | 42 |

$$\boxed{.14}$$

a. What is the probability that a voter will say yes to both the arena and the library?

$$\frac{21}{150}$$

Example 2: Using Conditional Relative Frequency to Find Probability

A reporter asked 150 voters if they plan to vote in favor of a new library and a new arena.

| | | Library | |
|-------|-----|---------|----|
| | | Yes | No |
| Arena | Yes | 21 | 30 |
| | No | 57 | 42 |

b. Given that a person says yes to a library, what is the probability that this person will also say yes to the arena?

$$\frac{21}{98} = \boxed{.21}$$

You go to a dance and help clean up afterwards. To help, you collect the soda cans, Coca-Cola and Sprite, and organize them. Some cans were on the table and some were in the garbage. Seventy-two total cans were found. 42 total cans were found in the garbage and fifty total cans were Coca-Cola. 14 Sprite cans were found on the table. Create a two-way table.

| | Coca-Cola | Sprite | Total |
|---------|-----------|--------|-------|
| Table | 16 | 14 | 30 |
| Garbage | 34 | 8 | 42 |
| Total | 50 | 22 | 72 |

A public survey was given to a population regarding whether seat belts should be required in pickup trucks. The results are found in the following two way frequency table. Complete the entries in the table.

| | For | Against | No Opinon | TOTAL |
|-------------------|------------|-----------|-----------|------------|
| Ages 18-27 | 25 | 20 | 5 | 50 |
| Ages 28-37 | 30 | 30 | 15 | 75 |
| Ages 38-47 | 50 | 20 | 5 | 75 |
| TOTAL | 105 | 70 | 25 | 200 |

1) In the 18-37 age group, what percentage of the population surveyed supports the requirements of seat belts in pickup trucks?

$$\frac{55}{125} = .44 \Rightarrow \text{44\%}$$

2) What are the marginal frequencies?

add row & column joint relative Freq.

| | For | Ag. | N. O | Tot. |
|-------|-------------------------|------------------------|-------------------------|------|
| 18-27 | $\frac{25}{200} = .125$ | $\frac{20}{200} = .1$ | $\frac{5}{200} = .025$ | .25 |
| 28-37 | $\frac{30}{200} = .15$ | $\frac{30}{200} = .15$ | $\frac{15}{200} = .075$ | .375 |
| 38-47 | $\frac{50}{200} = .25$ | $\frac{20}{200} = .1$ | $\frac{5}{200} = .025$ | .375 |
| Tot | .525 | .35 | .125 | 1 |

3) What are the joint frequencies?

$\frac{\text{data}}{\text{total}}$

4) Why are joint and marginal frequencies important when describing trends or associations of data?

tell us the probability that an event will occur.

5) What percentage of people between ages 38-47 are against the requirement of seatbelts?

$$\frac{20}{75} = .27 \Rightarrow \text{27\%}$$

6) How many people do not care about the requirement of seatbelts in pickup trucks?

25

The table below gives the responses of 50 teachers in a survey asking which type of program they enjoy watching the most on television. Complete the entries in the table.

| | Dance | Sports | Movies | TOTAL |
|--------|-------|--------|--------|-------|
| Female | 16 | 6 | 8 | 30 |
| Male | 2 | 10 | 8 | 20 |
| TOTAL | 18 | 16 | 16 | 50 |

7) Construct a table displaying conditional frequencies.

| | Dance | Sports | Movies | Total |
|-------|-----------------------|-----------------------|-----------------------|---------------------|
| Fem | $\frac{16}{30} = .53$ | $\frac{6}{30} = .2$ | $\frac{8}{30} = .27$ | $\frac{30}{30} = 1$ |
| male | $\frac{2}{20} = .1$ | $\frac{10}{20} = .5$ | $\frac{8}{20} = .4$ | $\frac{20}{20} = 1$ |
| total | $\frac{18}{50} = .36$ | $\frac{16}{50} = .32$ | $\frac{16}{50} = .32$ | $\frac{50}{50} = 1$ |

8) How many male teachers enjoy watching sports?

10

9) Female teacher responses comprised what percentage of this survey?

$$\frac{30}{50} = .6 \rightarrow 60\%$$

10) What is the relative frequency of male teachers who enjoy watching dance on television?

$$\frac{2}{20} = .1$$

11) What percentage of teachers enjoy watching movies on television.

$$\frac{16}{50} = .32 \rightarrow 32\%$$

12) What percentage of females enjoy watching sports on television?

$$\frac{6}{30} = .2$$

13) For those participants that enjoy watching sports on television, what percentage are males?

$$\frac{10}{16} = .625 = 62.5\%$$

14) What is the percentage of participants who are female and do not enjoy watching dance?

$$\frac{14}{50} = .28 \rightarrow 28\%$$

15) What is the relative frequency of teachers who are females that enjoy sports?

$$\frac{6}{50} = .12$$