

Library Statistics **ANSWERS**

Lesson 1 of 6, work in pairs



How many books are in your school library? How many of those books have 1-word titles? What percent of the books in the library are nonfiction? If your librarian didn't know the answer, how would you figure it out?

You probably don't want to spend all day counting the books in the library! These lessons will help you learn how to predict the total number of items without having to count them all.

1. Before you go to the library, make four copies of the table shown below in your math journal.

Example only—Numbers will vary

Category of books: Nonfiction

Number of shelves	Number of bookcases (take notes, then add them all)	Total number of shelves
2	$2+1+1=4$	$4 \times 2=8$
3	$4+3+8=15$	$15 \times 3=45$
4	$1+2=3$	$3 \times 4=12$

Get permission from your teacher and the school librarian to do some data collection in the library.

*Materials Needed: Pencil
Math Journal or Notebook*

You have two tasks in the library. **Read both tasks before you start.**

Task 1. You will need to record data for each category of books at the library using the tables you drew in your notebook. **If your library has the categories of Fiction, Nonfiction, Everyone Reads, and Reference, you will have 4 different tables to fill. If you don't have enough tables to record the books, make more.** Fill in the tables with the number of bookcases with a certain number of shelves. If there are shelves that have no books on them, they don't count as shelves. For example, in a 3-shelf bookcase, if the bottom shelf is empty, count that as a bookcase with 2 shelves because only 2 shelves contain books. Also, if a bookcase is very long, but has dividers, count each divided section as one bookcase.

Task 2. Draw a diagram in your math journal that shows the location of all of the bookcases in the library, as well as the location of the different categories of books. This diagram should fill a page, because you'll have to add to it in the next several lessons.

Standards: Data collection, representation

Library Statistics **ANSWERS**

Lesson 2 of 6, work in pairs

To find out how many books there are in the library, you will have to count all of the books on a few shelves. Counting just some of the shelves, instead of all of them, is called *sampling* or *taking a sample*. The shelves that are chosen to be counted are called the *sample*.

You can't just go into the library to pick the shelves to count books. If you did that, you wouldn't pick a random sample of shelves. You would pick the ones that are convenient to you, but not every shelf has the same chance of getting picked, so just picking shelves is not a random sample. In this lesson, you will figure out which shelves you are going to sample, and in the next lesson you will count or categorize the books on those shelves.

First, you have to figure out how you would list the shelves in the library. One easy way is to start with the shelf nearest to a library entrance, and travel around the library listing shelves. It will probably be easiest to list all of the shelves in a particular bookcase first before going to the

*Materials Needed: Pencil
Math Journal or Notebook*

next bookcase. You should plan to do this so that if you were told "go to shelf 37" then you could enter the library, start counting shelves, and arrive at shelf 37 relatively quickly.

1. On your diagram of the library from lesson 1, use a different colored pen or pencil to show where you would start counting shelves and the path you would take through the library to count shelves.

Ensure students account for both sides of aisles

2. Figure out how many total shelves your library has.

Add the numbers in the tables from lesson 1

3. Now take one 6-sided die. Roll it 3 times, and record the rolls in your math journal. The order in which the numbers show up is important! Now compare your rolls with the chart on the next page. If the chart has you going to a shelf number that is larger than the number of shelves, eliminate that turn and roll again. **For example, if you roll a 2 then a 5 then a 3, you will write down Roll 2, 5, 3, go to shelf 63.**

Repeat this process 7 times so that you have 7 shelves that you will count in the library.

Standards: Representation, planning

Roll 1	Roll 2	Roll 3	Shelf	Roll 1	Roll 2	Roll 3	Shelf	Roll 1	Roll 2	Roll 3	Shelf	Roll 1	Roll 2	Roll 3	Shelf	Roll 1	Roll 2	Roll 3	Shelf
1	1	1	1	2	2	4	46	3	4	1	91	4	5	4	136	6	1	1	181
1	1	2	2	2	2	5	47	3	4	2	92	4	5	5	137	6	1	2	182
1	1	3	3	2	2	6	48	3	4	3	93	4	5	6	138	6	1	3	183
1	1	4	4	2	3	1	49	3	4	4	94	4	6	1	139	6	1	4	184
1	1	5	5	2	3	2	50	3	4	5	95	4	6	2	140	6	1	5	185
1	1	6	6	2	3	3	51	3	4	6	96	4	6	3	141	6	1	6	186
1	2	1	7	2	3	4	52	3	5	1	97	4	6	4	142	6	2	1	187
1	2	2	8	2	3	5	53	3	5	2	98	4	6	5	143	6	2	2	188
1	2	3	9	2	3	6	54	3	5	3	99	4	6	6	144	6	2	3	189
1	2	4	10	2	4	1	55	3	5	4	100	5	1	1	145	6	2	4	190
1	2	5	11	2	4	2	56	3	5	5	101	5	1	2	146	6	2	5	191
1	2	6	12	2	4	3	57	3	5	6	102	5	1	3	147	6	2	6	192
1	3	1	13	2	4	4	58	3	6	1	103	5	1	4	148	6	3	1	193
1	3	2	14	2	4	5	59	3	6	2	104	5	1	5	149	6	3	2	194
1	3	3	15	2	4	6	60	3	6	3	105	5	1	6	150	6	3	3	195
1	3	4	16	2	5	1	61	3	6	4	106	5	2	1	151	6	3	4	196
1	3	5	17	2	5	2	62	3	6	5	107	5	2	2	152	6	3	5	197
1	3	6	18	2	5	3	63	3	6	6	108	5	2	3	153	6	3	6	198
1	4	1	19	2	5	4	64	4	1	1	109	5	2	4	154	6	4	1	199
1	4	2	20	2	5	5	65	4	1	2	110	5	2	5	155	6	4	2	200
1	4	3	21	2	5	6	66	4	1	3	111	5	2	6	156	6	4	3	201
1	4	4	22	2	6	1	67	4	1	4	112	5	3	1	157	6	4	4	202
1	4	5	23	2	6	2	68	4	1	5	113	5	3	2	158	6	4	5	203
1	4	6	24	2	6	3	69	4	1	6	114	5	3	3	159	6	4	6	204
1	5	1	25	2	6	4	70	4	2	1	115	5	3	4	160	6	5	1	205
1	5	2	26	2	6	5	71	4	2	2	116	5	3	5	161	6	5	2	206
1	5	3	27	2	6	6	72	4	2	3	117	5	3	6	162	6	5	3	207
1	5	4	28	3	1	1	73	4	2	4	118	5	4	1	163	6	5	4	208
1	5	5	29	3	1	2	74	4	2	5	119	5	4	2	164	6	5	5	209
1	5	6	30	3	1	3	75	4	2	6	120	5	4	3	165	6	5	6	210
1	6	1	31	3	1	4	76	4	3	1	121	5	4	4	166	6	6	1	211
1	6	2	32	3	1	5	77	4	3	2	122	5	4	5	167	6	6	2	212
1	6	3	33	3	1	6	78	4	3	3	123	5	4	6	168	6	6	3	213
1	6	4	34	3	2	1	79	4	3	4	124	5	5	1	169	6	6	4	214
1	6	5	35	3	2	2	80	4	3	5	125	5	5	2	170	6	6	5	215
1	6	6	36	3	2	3	81	4	3	6	126	5	5	3	171	6	6	6	216
2	1	1	37	3	2	4	82	4	4	1	127	5	5	4	172				
2	1	2	38	3	2	5	83	4	4	2	128	5	5	5	173				
2	1	3	39	3	2	6	84	4	4	3	129	5	5	6	174				
2	1	4	40	3	3	1	85	4	4	4	130	5	6	1	175				
2	1	5	41	3	3	2	86	4	4	5	131	5	6	2	176				
2	1	6	42	3	3	3	87	4	4	6	132	5	6	3	177				
2	2	1	43	3	3	4	88	4	5	1	133	5	6	4	178				
2	2	2	44	3	3	5	89	4	5	2	134	5	6	5	179				
2	2	3	45	3	3	6	90	4	5	3	135	5	6	6	180				

Library Statistics: Chart to go with Lesson 2

Library Statistics **ANSWERS**

Lesson 3 of 6, work in pairs

Today you finally get to collect your data! **Once again, get permission from your classroom teacher and the school librarian to collect data in the library.**

Before you go to the library, make room to write your results in your math journal. You could organize your results in an easy-to-read format, so make sure you label any numbers you write with units. In the library, you have two tasks.

1. Record the data from your shelves. Make a table in your math journal like the one shown to the right. Your table has to have enough rows for the 7 randomly selected shelves. In the special notes, you may write down anything that is unusual about that shelf or leave that entry blank.

Materials Needed: Pencil
Math Journal or Notebook

Example only: your numbers will vary

Shelf number	Number of books on shelf	Fiction or nonfiction	Number of books with 1-word titles	Special notes
60	35	Fiction	0	
66	39	Fiction	8	
76	30	Fiction	2	
113	60	Nonfiction	0	sports
124	40	Nonfiction	0	biography
127	32	Nonfiction	0	
134	62	Nonfiction	0	

2. Ask the librarian if she or he knows
- The total number of books in the library
 - The total number of books with one-word titles
 - The total number of books that are nonfiction

The librarian may not know the answer to all of the questions. This makes your research more interesting—you will try to learn the answers!

Standards: Data collection

Library Statistics **ANSWERS**

Lesson 4 of 6, work in pairs

*Materials Needed: Pencil
Math Journal or Notebook*

Now, combine your data that you collected on Lesson 3 with the information you have about the number of shelves in the library that you collected on Lesson 1.

1. Write down your plan for how you are going to figure out the total number of books in the library.

One possible plan: Find the average number of books per shelf, then multiply by the total number of shelves.

2. Find the total number of books in the library using your method.

3. How does your total compare to the librarian's answer for the total number of books? What do you think is the reason for the different answers? Write your answers in your math journal.

The answers are probably different. There may be books checked out of the library. Students counted only a sample of the shelves, not every book.

4. Figure out what percentage of your sample has a one-word title.

Divide the total number of 1-word books in the sample by the total number of books in the sample.

5. Do you think that this is the exact percentage of books in the library with a one-word title? Why or why not? Explain in your math journal.

Answers will vary. Most students will realize that this is probably not the same as the whole library, but it is likely close.

Standards: Statistics, percentage, proportion

Library Statistics **ANSWERS**

Lesson 5 of 6, work in pairs

*Materials Needed: Pencil
Math Journal or Notebook*

Today you will use the data collected in the library on Lessons 1 and 3.

1. What percentage of bookshelves are devoted to nonfiction titles?

Go back to the Lesson 1 data and divide the number of nonfiction shelves by the total number of shelves.

2. Do you think that the number of bookshelves that have nonfiction books is the same as the percentage of books in the library that are nonfiction? Why or why not?

Most students will say that it is not. Maybe the nonfiction shelves have more books on each shelf than the fiction shelves do.

3. Look at the data from the shelves that you sampled in the library. Did you sample at least one shelf from the nonfiction section? If not, repeat the process to pick a sample from Lesson 2 and make sure that you get a nonfiction shelf to sample, and go to the library to count the number of books on that shelf.

4. Use the data from the sample to estimate the number of nonfiction books in the library. Then figure out what percentage of books in the library are nonfiction.

Make sure students use their data from Lesson 3. They should divide the number of nonfiction books in their sample by the total number of books in their sample.

Standards: Statistics, percentage, proportion

Library Statistics **ANSWERS**

Lesson 6 of 6, work in pairs

*Materials Needed: Pencil
Math Journal or Notebook*

Today you will evaluate how good your sampling technique was and what could be done to make it better.

1. In Lesson 5, you estimated the percentage of books in the library that are nonfiction in two different ways (see questions 1 and 4 of lesson 5). Compare those answers with what you learned from the librarian about the percentage of nonfiction books. How close are the three different results? Why are they similar or different? Write a few sentences to explain your answers.

2. In these lessons, you sampled by picking 7 shelves of the library to count. What do you think would have happened if you had sampled only 3 shelves? Would your answer have been closer to the actual values, or further from the actual values?

Students should recognize that increasing the number of shelves in the sample will increase the accuracy of the estimates.

3. How good do you think your sampling method was? What could you do to get more accurate results? Explain what you could do to get more accurate results.

Standards: Sampling, communication, planning