

Lesson 1: Understanding what is meant by average

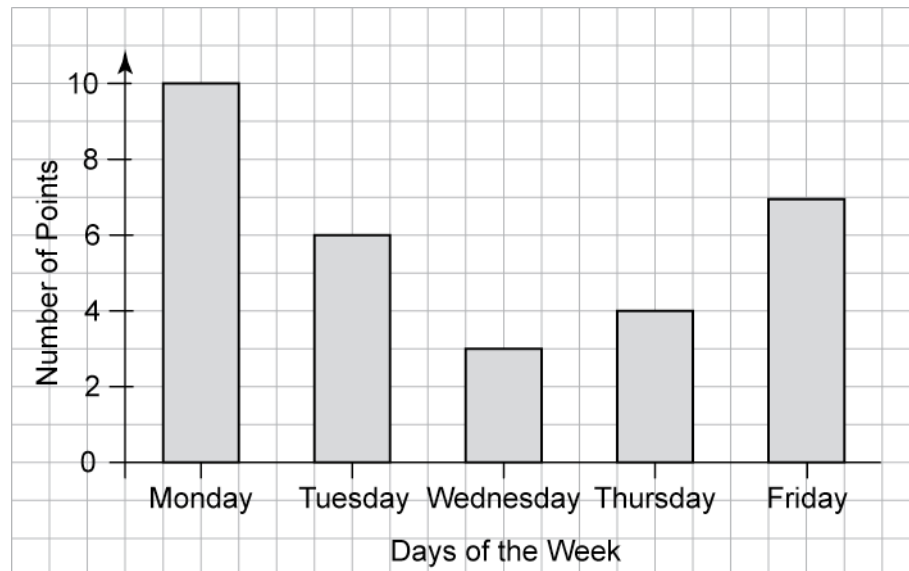
This story is designed to help you understand what is meant by the idea of *Average*.

Students earn points each day in class.

The points Shawna earned during her first week are shown in Table 1 and Graph 1.

Monday	Tuesday	Wednesday	Thursday	Friday
10	6	3	4	7

Table 1



Graph 1

1. Share the points that Shawna earned in the first week equally among each of the five days. Use the graph and the table to help you do this.

The quantity that is made by sharing the different numbers of points equally is called the *average*.

2. Copy and complete Table 2 to show the *average* number of points that Shawna earned per day in her first week:

<i>Actual number of points Shawna earned per day during her first week.</i>					<i>Average number of Points per day</i>
Monday	Tuesday	Wednesday	Thursday	Friday	
10	6	3	4	7	

Table 2

3. Table 3 shows the number of points per day that Shawna earned in her second week. Share these points equally among the five days using a method that works best for you.
4. Copy and complete Table 3 to show the *average* number of points that Shawna earned per day in her second week:

<i>Actual number of points Shawna earned per day during her second week.</i>					<i>Average number of Points per day</i>
Monday	Tuesday	Wednesday	Thursday	Friday	
10	4	0	0	0	

Table 3

5. Table 4 shows the number of points per day that Shawna earned in her third week. Share these points equally among each of the five days using a method that works best for you.
6. Copy and complete Table 4 to show the *average* number of points that Shawna earned per day in her third week:

<i>Actual number of points Shawna earned per day during her third week.</i>					<i>Average number of Points per day</i>
Monday	Tuesday	Wednesday	Thursday	Friday	
9	4	3	2	2	

Table 4

Lesson 2 Using the average to solve problems

1. Maria read a 210-page book in 7 days. On *average*, how many pages did Maria read each day?



2. The following table gives the diameter of each planet in the solar system.

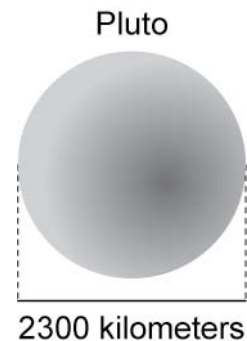


Name of Planet	Diameter in Kilometers
Mercury	4,900 Kilometers
Venus	12,100 Kilometers
Earth	12,800 Kilometers
Mars	6,800 Kilometers
Jupiter	143,000 Kilometers
Saturn	125,000 Kilometers
Uranus	51,100 Kilometers
Neptune	49,500 Kilometers

Find the *average* diameter for the 8 planets listed in the table.

3. In Fall of 2006, the International Astronomical Society (IAS) said Pluto was not a planet because its diameter was considerably smaller than the diameter of any of the other planets.

Find the *average* diameter of the 9 planets that existed when Pluto was still considered a planet.



4. Schools record the number of students attending class each day. Here is the number of students attending one class for an entire week.

Monday	Tuesday	Wednesday	Thursday	Friday
30	24	28	30	26

What is the *average* number of students attending this class each day?

5. Important discussion question:

Explain why it makes sense to give your answer in Question 4 as a decimal rather than round it to the nearest whole number.

6. The table below shows the *average* number of points that Shawna earned per day in her fourth week of school. This table also shows the actual number of points earned each day except Friday.

Figure out the number of points that Shawna earned on Friday of that week.

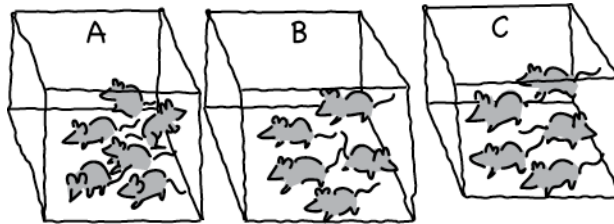
<i>Actual number of Points Shawna earned per day during her fourth week.</i>					<i>Average number of Points per day</i>
Monday	Tuesday	Wednesday	Thursday	Friday	
10	7	4	6	?	7

Lesson 3: Using Average to find Per Unit Quantity

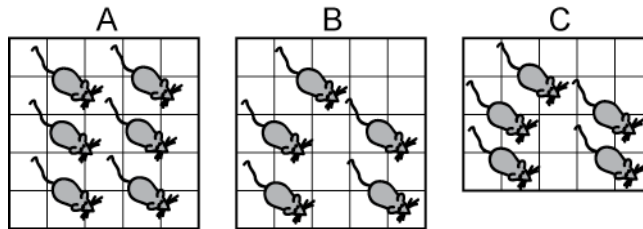
In this lesson, you will learn how calculation of *average* is based on calculation of *per unit quantity*.

A calculation of *per unit quantity* can help you decide if one area is more densely populated than another area.

Suppose that you go to the pet shop and see cages of mice. You might wonder if the mice in one cage have more space than the mice in another cage.



If you share the area of the cage equally among the mice in the cage, you will get a sense of how much space each mouse has for itself.



Another way to think of this is to calculate the *average* amount of area that each mouse has in a cage.

	Area in Square feet	Number of mice
Cage A	25	6
Cage B	25	5
Cage C	20	5

You can tell that Cage A is more densely populated than Cage B because both cages have the same area, but Cage A has more mice. You can see this more clearly by doing the following calculations:

If you divide the area of Cage A by the number of mice, you will find the area of the cage for each mouse:

$$\frac{25}{6} = 4.17 \text{ square feet per mouse}$$

There are 4.17 square feet per mouse in Cage A.

If you divide the area of Cage B by the number of mice you will find the area of the cage for each mouse:

$$\frac{25}{5} = 5 \text{ square feet per mouse}$$

There are 5 square feet per mouse in Cage B.

Cage A is more densely populated because each mouse in Cage A has less area than each mouse in Cage B.

Area per mouse is an example of a *per unit quantity*.

You can use a different calculation to illustrate that the mice in Cage A have less room than the mice in Cage B.

If you divide the number of mice in Cage A by the area of the cage, you will find the number of mice per square foot of area:

$$\frac{6}{25} = 0.24 \text{ mice per square foot}$$

There are 0.24 mice per square foot in Cage A.

If you divide the number of mice in Cage B by the area of the cage, you will find the number of mice per square foot of area:

$$\frac{5}{25} = 0.2 \text{ mice per square foot}$$

There are 0.2 mice per square foot in Cage B.

Cage A is more densely populated because there are more mice per square foot in Cage A than in Cage B.

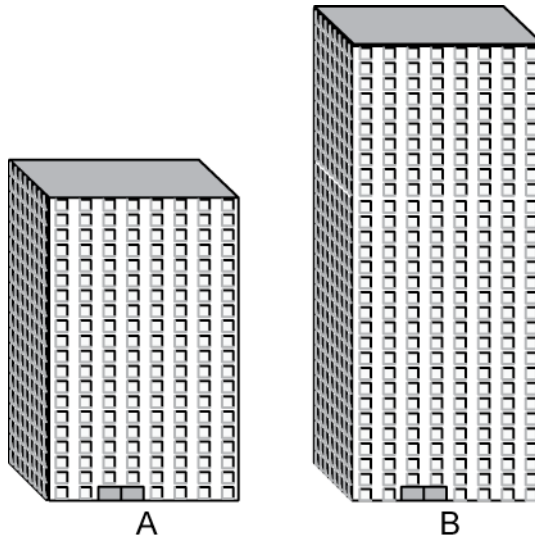
Number of mice per square foot is an example of a *per unit quantity*.

1. Copy and complete this table showing the two per unit quantities for Cage C. Is Cage A more densely populated than Cage C?

	Area in Square feet	Number of mice	Square feet per mouse	Mice per square foot of cage
Cage A	25	6	$\frac{25}{6} = 4.17$ square feet per mouse	$\frac{6}{25} = 0.24$ mice per square foot
Cage B	25	5	$\frac{25}{5} = 5$ square feet per mouse	$\frac{5}{25} = 0.2$ mice per square foot
Cage C	20	5		

2. Suppose that you have two office blocks:

Office Block A is a twenty-story building with 300,000 square feet of available office space. Office Block A houses 2,000 workers.



Office Block B is a thirty-story building with 400,000 square feet of available office space. Office Block B houses 2,500 workers.

Which of the two Office Blocks is more crowded?

Make sure that you show all of your reasoning and calculations.

3. We all know that Rhode Island is the smallest state in the United States because it is the state with the smallest land area. However, it is the 43rd largest state in population. Use the data in this table to compare the land area and the population of Rhode Island and California

	Land Area in Square Miles	Population
Rhode Island	1,045	1,080,632
California	155,959	35,893,799

4. The number of people who live in an area of 1 square mile is called the population density.

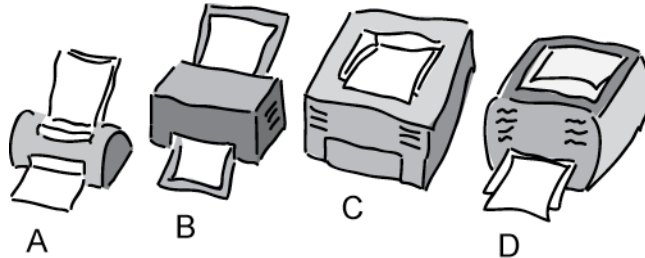
What is the population density of Rhode Island?

What is the population density of California?

Is Rhode Island more or less densely populated than California?

Lesson 4: Using per unit quantities to solve problems

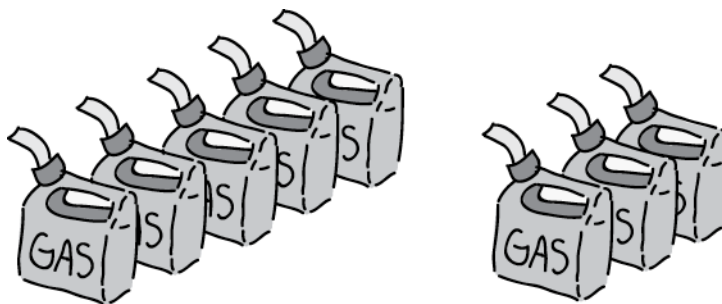
1. The chart below describes the speed of four desktop printers:



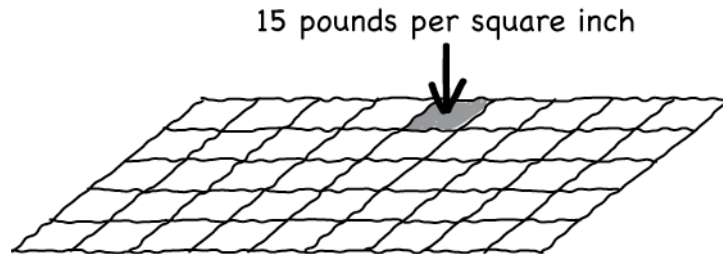
Printer	Description
A	Prints 1 page per second
B	Prints 10 pages in 1 minute
C	Prints 3 pages per 10 seconds
D	Prints 90 pages in 3 minutes

Which printer is the *fastest*?

2. Car A can go 100 miles on 5 gallons of gas. Car B can go 93 gallons on 3 gallons. Which car is more fuel efficient (i.e. can go more miles on one gallon of gas)?



3. The atmosphere normally exerts a pressure of about 15 pounds per square inch on surfaces at sea level. About how much pressure (in pounds per square inch) does the atmosphere exert on a surface 45 square inches in area at sea level?



4. Gary practices Aikido, a compassionate form of self-defense. The table below shows the amount of time that Gary trains each day.

Mon	Tues	Wed	Thurs	Fri	Sat	Sun
45 minutes	1 hour 45 minutes	45 minutes	2 hour 45 minutes	0	1 hour 30 minutes	1 hour 30 minutes

On *average*, how much time does Gary spend training per day?

5. This table shows the number of participation points that Peter earned in his first week of school:
Find the *average* number of points that Peter earned per day.

<i>Actual number of points Peter earned per day during his first week.</i>				
Monday	Tuesday	Wednesday	Thursday	Friday
7	5	3	4	7

6. This table shows the *average* number of participation points that Peter earned in his second week of school. The table also shows the actual number of points that Peter earned each day except Friday.
How many points did Peter earn on Friday? Explain how you know.

<i>Actual number of points Peter earned during his second week.</i>					<i>Average number of points per day</i>
Monday	Tuesday	Wednesday	Thursday	Friday	
10	8	7	8	?	8

Lesson 5: End of unit project

Use the data in the table below to find the population density of each of the states in the U.S. Rank the US states from most to least densely populated.

State	Land Area (in Square Miles) ¹	Population ²
Alabama	50,744.00	4,530,182
Alaska	571,951.26	655,435
Arizona	113,634.57	5,743,834
Arkansas	52,068.17	2,752,629
California	155,959.34	35,893,799
Colorado	103,717.53	4,601,403
Connecticut	4,844.80	3,503,604
Delaware	1,953.56	830,364
Dist. Of Columbia	61.4	553,523
Florida	53,926.82	17,397,161
Georgia	57,906.14	8,829,383
Hawaii	6,422.62	1,262,840
Idaho	82,747.21	1,393,262
Illinois	55,583.58	12,713,634
Indiana	35,866.90	6,237,569
Iowa	55,869.36	2,954,451
Kansas	81,814.88	2,735,502
Kentucky	39,728.18	4,145,922
Louisiana	43,561.85	4,515,770
Maine	30,861.55	1,317,253
Maryland	9,773.82	5,558,058
Massachusetts	7,840.02	6,416,505

¹ Data collected from www.factmonster.com/ipka/A0108355.html

² Population count from July 2004. Data from www.factmonster.com/ipka/A0004986.html

Michigan	56,803.82	10,112,620
Minnesota	79,610.08	5,100,958
Mississippi	46,906.96	2,902,966
Missouri	68,885.93	5,754,618
Montana	145,552.43	926,865
Nebraska	76,872.41	1,747,214
Nevada	109,825.99	2,334,771
New Hampshire	8,968.10	1,299,500
New Jersey	7,417.34	8,698,879
New Mexico	121,355.53	1,903,289
New York	47,213.79	19,227,088
North Carolina	48,710.88	8,541,221
North Dakota	68,975.93	634,366
Ohio	40,948.38	11,459,011
Oklahoma	68,667.06	3,523,553
Oregon	95,996.79	3,594,586
Pennsylvania	44,816.61	12,406,292
Rhode Island	1,044.93	1,080,632
South Carolina	30,109.47	4,198,068
South Dakota	75,884.64	770,883
Tennessee	41,217.12	5,900,962
Texas	261,797.12	22,490,022
Utah	82,143.65	2,389,039
Vermont	9,249.56	621,394
Virginia	39,594.07	7,459,827
Washington	66,544.06	6,203,788
West Virginia	24,077.73	1,815,354
Wisconsin	54,310.10	5,509,026
Wyoming	97,100.40	506,529

New England Common Assessment Program type practice

The questions in this section reflect the New England Common Assessment Program (NECAP).

1. Celie has 5 cats. The oldest cat is 10 years old.

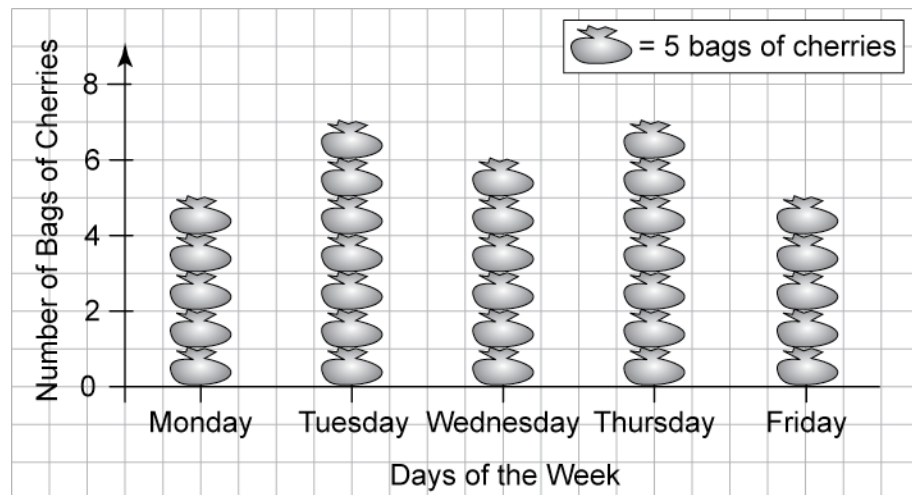
The youngest cat is 2 years old.

The *average* of the cats' ages is 6 years old.



List the possible ages of Celie's five cats.

2. The pictograph shows the number of bags of cherries that were sold at a fair. In total students sold 150 bags of cherries. On *average* how many bags of cherries did the students sell each day?



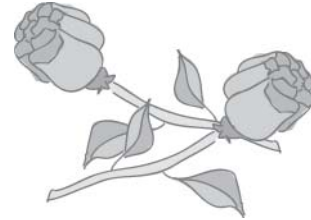
3. A baker made some pies. She used 56 apples to make all the pies. She used the same number of apples to make each pie. How many apples per pie *could* the baker have used?



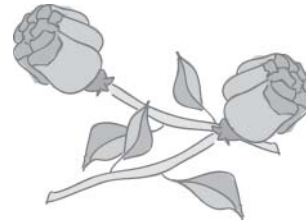
4. in the landmass of Rhode Island is reported to be 658,000 acres. About 404,800 acres of land in Rhode Island is forest.

About how much forest is there per acre of landmass in Rhode Island?

5. Students are selling flowers at the fair. They sell roses 4 for a dollar. At this rate what is the price of a dozen roses?

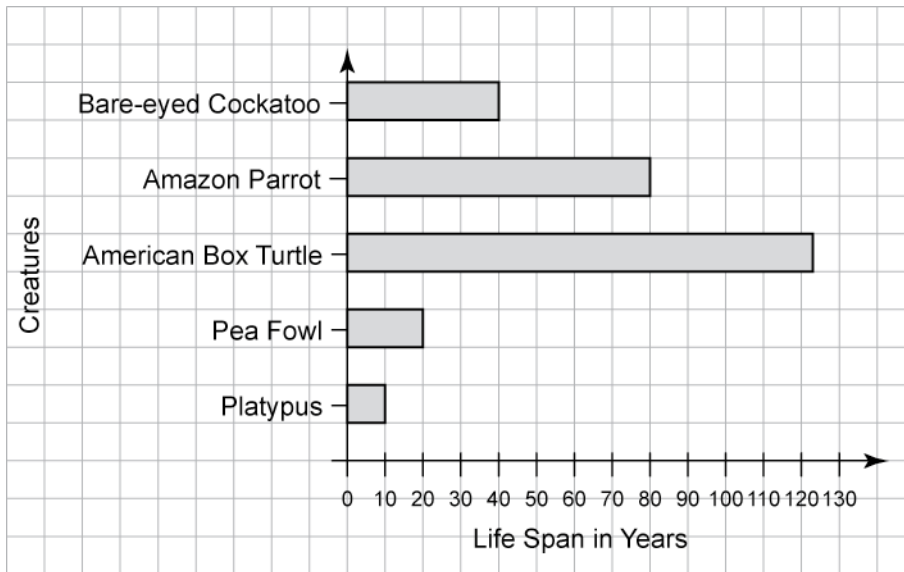


6. The students plan on selling 500 flowers per day. On the first day they sold 547 flowers. On the second day they sold 655 flowers. How many flowers do they need to sell on day three, the last day, in order to meet their goal of 500 flowers per day?



- A. 202
- B. 500
- C. 298
- D. 547

7. The bar graph below shows the *average* life span of some creatures:



Which animal has an *average* life span that is 4 times the lifespan of the Pea Fowl?

- A. Platypus
- B. Bare eyed Cockatoo
- C. American Box Turtle
- D. Amazon Parrot

