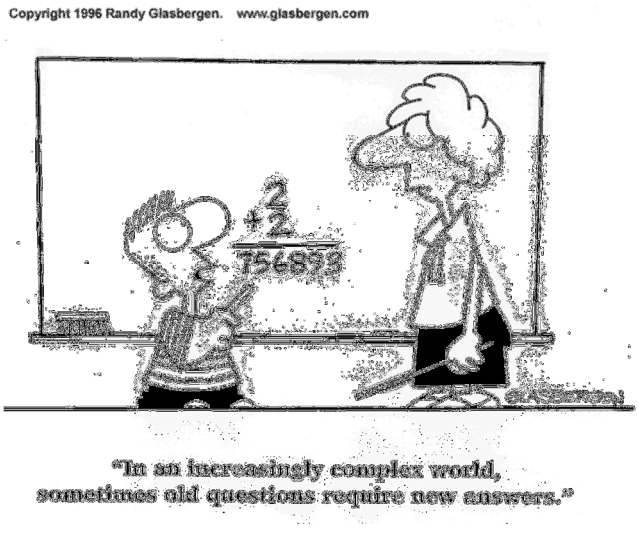
SIXTH GRADE MATHEMATICS

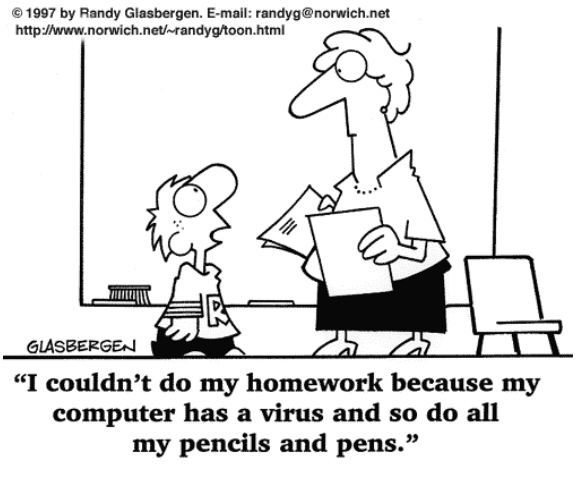
CHAPTER 1B

OPERATIONS WITH DECIMALS

TOPICS COVERED:

- Decimal Place Value
- Compare/Order Decimals
- Decimal Addition/Subtraction
- Decimal Multiplication
- Decimal Division
- Rounding
- Estimation

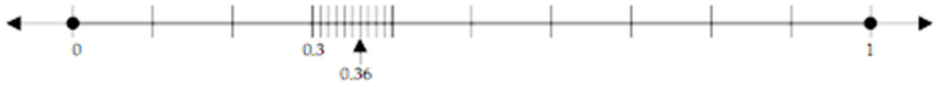




Created by Lance Mangham, 6th grade teacher, Carroll ISD

The number 0.3 is equal to the fraction $\frac{3}{10}$, so we need to cut the interval from 0 to 1 into ten equal intervals and locate 0.3 at the third interval marker.

The number 0.36 is equal to $\frac{36}{100}$, which can be written as $\frac{3}{10}+\frac{6}{100}$ in expanded form. Since 6 is in the hundredths place, we need to cut the interval from 0 to 1 into 100 equal intervals. But since 0 to 1 is already cut into ten intervals, we can cut each of those smaller intervals into ten even smaller intervals. The result is 100 equal intervals from 0 to 1. The number 0.36 is placed 6 small intervals beyond 0.3.



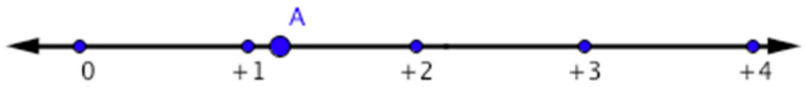
Finally, the number 0.362 is equal to $\frac{362}{1000}$.

Since 2 is in the thousandths place, we need to cut the interval between 0.36 and 0.37 into ten equal sized intervals. 0.362 will be placed at the second interval beyond 0.36.

Now it is easy to compare decimals. Numbers further to the right are larger than numbers to the left. For example, 0.362 is bigger than 0.36, but smaller than 0.37.

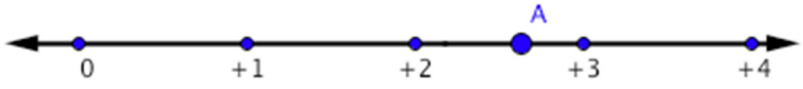
Which is the best estimation for the location of Point A on the number line?

1.5 1.9 1.19 0.5



Which is the best estimation for the location of Point A on the number line?

2.63 0.6 3.45 1.53



Activity 1-24: **Place Value** Name:

Mrs. Fauatea is off traveling again and visiting some of the best states!

	Traveling from…	**Finishing at…**	**Gas used (Gallons)**	**Key number**
1.	Charleston, West Virginia	Frankfort, Kentucky	9.851	5
2.	Frankfort, Kentucky	Nashville, Tennessee	10.4	1
3.	Nashville, Tennessee	Raleigh, North Carolina	27.15	7
4.	Raleigh, North Carolina	Columbia, South Carolina	11.328	8
5.	Columbia, South Carolina	Atlanta, Georgia	10.7	7
6.	Atlanta, Georgia	Tallahassee, Florida	13.59	3
7.	Tallahassee, Florida	Montgomery, Alabama	10.3605	5
8.	Montgomery, Alabama	Jackson, Mississippi	12.25	5
9.	Jackson, Mississippi	Baton Rouge, Louisiana	8.006	6
10.	Baton Rouge, Louisiana	Austin, Texas	21.4	2

Find the key number in each amount of gasoline in the table. Write the place value of the digit (tenths, hundredths, millions, etc.)

1. _____ 2. _____ 3. _____

4. _____ 5. _____ 6. _____

7. _____ 8. _____ 9. _____

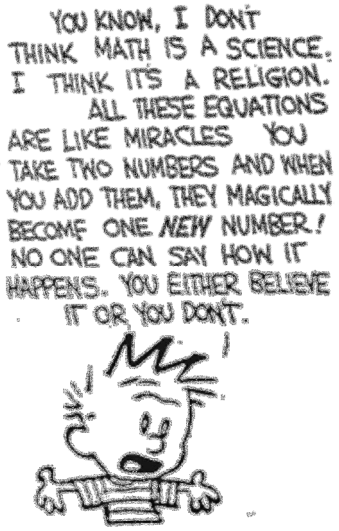
10. _____

	Start at…	**Finish at…**	**Gas used (Gallons)**	**Gas used (Gallons) in words**
11.	Austin	Santa Fe		Thirty-seven and twenty-five hundredths
12.	Santa Fe	Denver	19.015	
13.	Denver	Cheyenne		Five and five hundred forty-eight thousandths
14.	Cheyenne	Salt Lake City		Twenty-one and nine tenths
15.	Salt Lake City	Phoenix	35.47	
16.	Phoenix	Carson City	36.8503	
17.	Carson City	Sacramento	6.5	
18.	Sacramento	Salem	26.751	
19.	Salem	Olympia		Seven and two thousandths
20.	Olympia	Boise		Twenty-six and eighty-two hundredths

Activity 1-25: **Ordering Decimals** Name:

Write the correct letter for the number that makes the statement true.

		A, B, or C	A	B	C
1.	0.4 < _____ < 0.6		0.05	0.5	0.4
2.	0.8 < _____ < 0.9		0.77	0.081	0.87
3.	0.24 < _____ < 0.28		0.255	0.204	0.3
4.	0.4 < _____ < 0.43		0.430	0.435	0.4223
5.	0.52 < _____ < 0.525		0.535	0.522	0.520
6.	0.17 < _____ < 0.181		0.18	0.187	0.0175
7.	26.4 < _____ < 26.406		26.43	26.405	26.399
8.	18.07 > _____ > 17.97		17.9	18.1	18.0
9.	216.452 > _____ > 216.451		216.4525	216.4512	216.45
10.	34.7 < _____ < 34.97		37.4	34.99	34.77
11.	20.1 < _____ < 20.21		20.01	20.22	20.201
12.	56.0 < _____ < 56.05		56.06	56.035	56.6
13.	89.75 < _____ < 89.77		89.57	89.755	89.87
14.	12.02 < _____ < 12.025		12.022	12.202	12.012
15.	44.66 < _____ < 44.7		44.06	44.76	44.677



Activity 1-26: **Adding & Subtracting Decimals** Name:

Solve the following decimal problems.

1.	2.135 + 1.5		2.	14.688 + 0.384	
3.	2.4 + 1.47		4.	32.4 + 10.82	
5.	3.45 + 4.18 + 5.21		6.	43.6 + 5.327	
7.	4.657 + 4.834		8.	32.5 + 54.78	
9.	12.003 + 5		10.	54.56 + 56.45	

Solve the following decimal subtraction problems.

11.	2.135 – 1.5		12.	14.688 – 0.384	
13.	2.4 – 1.47		14.	32.4 – 10.82	
15.	44.18 – 5.21		16.	43.6 – 5.327	
17.	4.834 – 4.657		18.	54.78 – 32.5	
19.	12 – 5.003		20.	56.45 – 54.56	

Solve the following decimal word problems.

21.	Jeff had $120.73 in his bank account. He wrote a check for $78.32 for two new tires. How much money is left in his account?	
22.	Subtract ninety-two and seven tenths from two hundred forty-eight and forty-six thousandths.	
23.	If the US produced 1.824 million bushels of soybeans one year and 1.966 million bushels the following year. How much more did the US produce in the second year?	
24.	Write the numbers six hundred eighty-three and twenty-three hundredths, fifty-nine and one hundred eleven thousandths, two hundred fourteen and seven tenths, and six thousand two. Find the sum.	
25.	Write the following sums of money in the form of decimals and find the sum. $2 and 3 cents, $26 and 8 dimes, 26 cents, $15, and 7 cents.	
26.	The largest cockroach ordered from Roasted Cockroaches was 5.1 cm. long. The shortest is 3.99 cm. long. What is their total length?	
27.	If buy a triple-decker burger, Roasted Roaches and a Cricket Cola separately it cost $4.27. The Super Sac Meal Deal with these same items is only $3.99. How much do you save by buying the Meal Deal?	
28.	When you fill your gas tank, the odometer read 2529.7. The next time you filled the tank, the odometer read 2760.1. How many miles did you travel?	
29.	A big company used 2.86 million sheets of paper for correspondence last year and 3.1 million this year. By how many million sheets of paper did their correspondence grow in one year?	

Activity 1-27: **Multiplying & Dividing Decimals by Whole Numbers** Name:

Solve the following decimal problems.

1.	$6 \bullet 0.35$		2.	$27 \bullet 0.21$	
3.	$2.24 \bullet 8$		4.	$26 \bullet 1.5$	
5.	$31 \bullet 2.26$		6.	$34 \bullet 4.2$	
7.	$756 \bullet 3.2$		8.	$1.45 \bullet 367$	
9.	$23 \bullet 4.52$		10.	$1.1 \bullet 5432$	

Solve the following decimal problems. Record all answers as decimals.

11.	$\frac{1.2}{6}$		12.	$\frac{3.00}{12}$	
13.	$\frac{3.8}{10}$		14.	$\frac{0.9}{2}$	
15.	$\frac{2.46}{12}$		16.	$\frac{1.8}{8}$	
17.	$\frac{0.05}{10}$		18.	$\frac{0.99}{6}$	
19.	$\frac{0.0079}{2}$		20.	$\frac{5.04}{14}$	

21.	The cost of 12 gallons of gas is \$14.28. How much would you pay per gallon?	
22.	Your car travels an average of 19.7 miles per gallon in the city and 23.8 miles per gallon on the highway. On an 11-gallon tank of gas how much farther can you travel on the highway than in the city?	
23.	A seed company sold 7.126 million packets of seeds last year and 8.4 million packets this year. How many more packets did they sell this year?	
24.	Subtract eighty and five tenths from one hundred thirty and fifty-two thousandths.	
25.	Find the sum of three thousand forty-two and seven tenths, three hundred forty-two and seventeen hundredths, thirty-four and two hundred seventeen thousandths, and three and four thousand two hundred seventeen ten-thousandths.	
26.	Brian worked four days last week doing odd jobs. He earned \$4.50, \$5.75, \$6.50, and \$6.10. How much did Brian earn last week?	
27.	Your dad spends \$14.39 at McMealworms and your sister spends another \$4.99. What is their total cost?	
28.	You find once cockroach that weighs 0.321 grams and another that weighs 0.4 grams. What is the difference in their weights?	
29.	Your car gets about 19.8 miles to the gallon. If you buy 12 gallons of gas, how many miles can you expect to drive?	
30.	You took a car trip that was exactly 496.8 miles. The trip took 9 hours. What was your average speed per hour?	

Activity 1-28: **Multiplying & Dividing Decimals** Name: _____

Solve the following decimal problems.

1.	$0.66 \bullet 0.35$		2.	$2.7 \bullet 0.21$	
3.	$2.24 \bullet 0.8$		4.	$2.6 \bullet 1.5$	
5.	$3.1 \bullet 2.26$		6.	$3.4 \bullet 4.2$	
7.	$7.56 \bullet 3.2$		8.	$1.45 \bullet 3.67$	
9.	$23.1 \bullet 4.52$		10.	$1.1 \bullet 5.4321$	

Solve the following decimal problems. Record all answers as decimals.

11.	$\frac{1.2}{6}$		12.	$\frac{3.00}{12}$	
13.	$\frac{3.8}{10}$		14.	$\frac{0.9}{2}$	
15.	$\frac{2.46}{12}$		16.	$\frac{1.8}{8}$	
17.	$\frac{0.05}{10}$		18.	$\frac{0.99}{6}$	
19.	$\frac{0.0079}{2}$		20.	$\frac{5.04}{14}$	

21.	The cost of 12 gallons of gas is $14.28. How much would you pay per gallon?	
22.	Your car travels an average of 19.7 miles per gallon in the city and 23.8 miles per gallon on the highway. On an 11-gallon tank of gas how much farther can you travel on the highway than in the city?	
23.	A seed company sold 7.126 million packets of seeds last year and 8.4 million packets this year. How many more packets did they sell this year?	
24.	Subtract eighty and five tenths from one hundred thirty and fifty-two thousandths.	
25.	Find the sum of three thousand forty-two and seven tenths, three hundred forty-two and seventeen hundredths, thirty-four and two hundred seventeen thousandths, and three and four thousand two hundred seventeen ten-thousandths.	
26.	Brian worked four days last week doing odd jobs. He earned $4.50, $5.75, $6.50, and $6.10. How much did Brian earn last week?	
27.	Your dad spends $14.39 at McMealworms and your sister spends another $4.99. What is their total cost?	
28.	You find once cockroach that weighs 0.321 grams and another that weighs 0.4 grams. What is the difference in their weights?	
29.	Your car gets about 19.8 miles to the gallon. If you buy 12 gallons of gas, how many miles can you expect to drive?	
30.	You took a car trip that was exactly 496.8 miles. The trip took 9 hours. What was your average speed per hour?	

Activity 1-29: **Decimals** Name: _____

Look at this decimal: 0.12

1.	Write a decimal that is 10 times greater.	
2.	Write a decimal that is about three times greater.	
3.	Write a decimal that is double this decimal plus 20.	
4.	Write a decimal that is about half this decimal.	
5.	Write a decimal that is closer to one.	

Write a decimal that is….

6.	Between 0.25 and 0.3.	
7.	Greater than 1.26 but less than 1.27.	
8.	Less than 5 but greater than 4.75.	
9.	Very close to 0.	

Look at these decimals: 0.55 0.48 0.25 0.95 1.10 0.01

10.	Write the decimal that is closest to 0.	
11.	Write the decimal that is closet to $\frac{1}{2}$.	
12.	Write the decimal that is closest to 1.	
13.	Write the decimal that is greater than 1.	

Write two decimals that….

14.	Have a sum less than 1.	
15.	Have a product less than 1.	
16.	Have a difference equal to $\frac{1}{2}$.	
17.	Have a quotient equal to 0.5.	

Look at this decimal: 20.02

18.	Write a decimal that is 10 times greater.	
19.	Write a decimal that is 100 times greater.	
20.	Write a decimal that is 2 more than this decimal.	
21.	Write a decimal that is 2 tenths more.	
22.	Write a decimal that is 2 hundredths more.	

Activity 1-30: **Dividing by Decimals** Name:

What do you notice about the answers to the following problems? What happens to both the numerator and denominator in each problem?

$$\frac{5}{1} \quad \frac{50}{10} \quad \frac{500}{100} \quad \frac{5000}{1000}$$

How about $\frac{.05}{.01}$? Dividing by a decimal is difficult, so to make the problem easier, one can multiply both the numerator and denominator by a power of 10 so that the decimal in the denominator goes away. In this problem we can multiply by 100 (multiplying by 100 moves the decimal over two spaces). The problem then becomes the same as the example above. The answer is still 5.

Example #2: $\frac{30.5}{.005} \rightarrow \frac{\bullet\ 1000}{\bullet\ 1000} = \frac{30500}{5} = 6100$

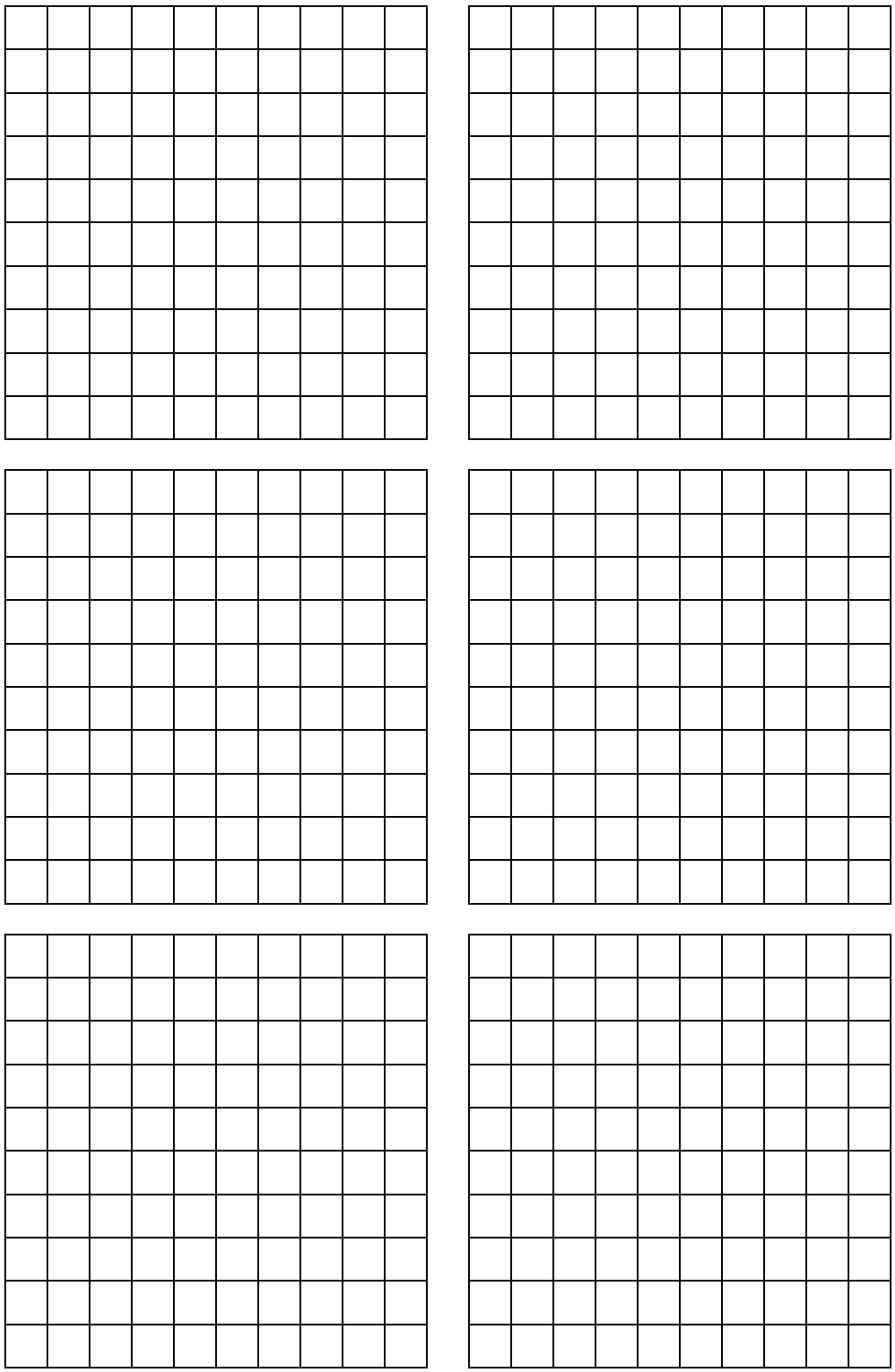
Find each quotient or product. Show all work on a separate sheet of paper.

1.	$3 \div 0.12$		2.	$7.28 \div 9.1$		3.	$78 \div 15.6$	
4.	$0.9\overline{)1.35}$		5.	$0.5\overline{)0.935}$		6.	$19.95 \div 1.9$	
7.	$5.84 \div 0.8$		8.	$0.936 \div 7.2$		9.	$\frac{0.159}{5.3}$	
10.	$\frac{4.10}{.05}$		11.	$\frac{0.832}{5.2}$		12.	$\frac{0.16397}{0.019}$	
13.	$\frac{8.05}{0.1}$		14.	$\frac{141.62}{0.73}$		15.	$\frac{0.0006}{0.01}$	
16.	$0.4 \div 0.02$		17.	$0.21 \div 0.003$		18.	$2.05 \div 0.05$	
19.	$\frac{628.2}{34.9}$		20.	$0.68 \div 0.2$		21.	$\frac{308.64}{0.48}$	
22.	$\frac{0.105}{0.00005}$		23.	$\frac{1.593}{0.27}$		24.	$2.279 \div 5.3$	
25.	$20.7 \bullet 11.4$		26.	$33.2 \bullet 9.2$		27.	$922.2 \bullet 0.4$	

Don't worry about figuring out the answer, just tell me how many digits are in the whole number part of the decimal answer.

28.	$\frac{43.5}{3}$		29.	$\frac{11.7}{0.9}$		30.	$\frac{399.5}{1.7}$	
31.	$\frac{0.4117}{0.023}$		32.	$\frac{8.3}{0.002}$		33.	$\frac{3281.668}{28.3}$	
34.	$\frac{25056}{4.5}$		35.	$\frac{4448.84}{0.98}$				

Activity 1-31: **Multiplying/Dividing Decimals w/ Models** Name:



1. $0.3 \bullet 0.7$ 2. $0.4 \bullet 0.9$ 3. $0.8 \bullet 0.5$ 4. $\frac{0.8}{0.2}$ 5. $\frac{0.9}{0.09}$ 6. $\frac{0.4}{0.02}$

Activity 1-32: **Rounding** Name:

Number	**Rounded to the nearest…**				
	Ten	**One/Unit**	**Tenth**	**Hundredth**	**Thousandth**
6.43					
17.19					
43.751					
0.5059					
6.6666					
37.3274					
354.9009					
$7.752					
30.07777					
99.909					
99.099					
592.5					
192.354009					
7.98					
15.20072					
0.48649					
0.00772					
816.63451					
5.375					
789					
654					
61.75					
3.1736404					
28.2525252					

Activity 1-33: **Really Big Numbers!** Name: ____________________

Everyone has heard of the website Google, right? Well, how did they come up with the name "Google'?

Google is a play on the word googol, which was coined by Milton Sirotta, nephew of American mathematician Edward Kasner, and was popularized in the book, "Mathematics and the Imagination" by Kasner and James Newman. It refers to the number represented by the numeral 1 followed by 100 zeros. Google's use of the term reflects the company's mission to organize the immense, seemingly infinite amount of information available on the web.

So a googol is:
10000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000

So what about a googolplex? A googolplex is much bigger than a googol, much bigger than a googol times a googol. A googol times a googol would be 1 with 200 zeros, but a googolplex is 1 with a googol of zeros. Can you imagine how big that is? Think you can write it down? If you wrote 1 zero every inch there would not be enough room to write this number if you went to the farthest star in the universe. Your homework tonight is to start writing a googolplex. ☺

So what are some other large numbers?

Thousand	1 with 3 zeros
Million	1 with 6 zeros
Billion	1 with 9 zeros
Trillion	1 with 12 zeros

Quadrillion, then Quintillion, Sextillion, Septillion, Octillion, Nontillion, Decillion, Undecillion, and a Duodecillion would be 1 with 39 zeros

Continuing

Tredecillion	42 zeros
Quattuordecillion	45 zeros
Quidecillion	48 zeros
Sexdecillion	51 zeros
Septendecillion	54 zeros
Octadecillion	57 zeros
Novemdecillion	60 zeros
Vigintillion	63 zeros
Unvigintillion	66 zeros
Duovigintillion	69 zeros
Trevigintillion	72 zeros
Quattuorvigintillion	75 zeros

Q: On what day will you celebrate having been alive for one billion seconds? How old will you be?

1. Latrelle bought 4 shirts priced at $23.98 each, including tax. Which is the best estimate of the total cost of the shirts?

   A. Between $20 and $40
   B. Between $40 and $60
   C. Between $60 and $80
   D. Between $80 and $100
   E. More than $100

2. Malika read 36 to 40 pages of her book each day. Which could be the total number of days it took her to read all 228 pages of her book?

   A. 2
   B. 4
   C. 6
   D. 8
   E. 10

3. Marian bought 17 dozen cookies for a school party. The price of the cookies ranged from $4 to $6 per dozen. Which could be the total cost of the cookies, not including tax?

   A. $30
   B. $60
   C. $90
   D. $120
   E. $150

4. Kevin bought 4 books at a garage sale. The books cost $3 to $6 each. Which could be the total cost of the 4 books?

   A. $5
   B. $9
   C. $16
   D. $27
   E. $36

5. An electronics store collected $4140 in October, $4870 in November, and $5802 in December from sales of televisions. Which is the best estimate of the total amount collected from sales of televisions during these months?

   A. $12,000
   B. $13,000
   C. $14,000
   D. $15,000
   E. $16,000

6. Mr. Garza has 5 spools of nylon rope. Each spool has from 45 to 55 feet of rope on it. Which could be the total number of feet of nylon rope Mr. Garza has on these spools?

   A. 50 ft.
   B. 100 ft.
   C. 250 ft.
   D. 500 ft.
   E. 600 ft.

7. Mr. Emerson's truck travels an average of 18 miles per gallon of gas. The gas tank holds 24 gallons. Which is the best estimate of the total number of miles Mr. Emerson's truck can travel on a full tank of gas?

   A. 200 mi.
   B. 250 mi.
   C. 300 mi.
   D. 400 mi.
   E. 600 mi.

8. The temperature outside at Walter's house was 37.3 degrees. At the same time, the temperature around an airplane that was about 1 mile above his house was 11.8 degrees. Which is the best estimate of the difference between the 2 temperatures?

   A. Less than 20 degrees
   B. Between 20 and 30 degrees
   C. Between 30 and 40 degrees
   D. Between 40 and 50 degrees
   E. More than 50 degrees

Activity 1-36: **Why and When Do We Estimate?** Name:

In some situations an **estimate** is all that is needed to solve a problem. At other times an **exact** number is needed.

Think about each situation below. Would you need an exact amount or would an estimate be okay? For each item, write exact or estimate and give an example.

		Estimate or Exact	**Example**
1.	the distance from your home to school	estimate	about 5 miles
2.	the time you get up in the morning		
3.	the amount of medicine you need to take daily		
4.	the amount of soft drinks needed for a party		
5.	the final score of a football game		
6.	the street address for a package delivery		
7.	the cost of a restaurant bill		
8.	the amount of money needed for lunch for a week		
9.	the amount of gas left in the tank of a car		
10.	the amount of gas just purchased to fill a tank		
11.	the weight of gear packed for a vacation		
12.	your height		
13.	the amount of time it would take you to run 100 meters		
14.	the amount of time it took to set the world record for 100 meters		

Do these questions with your parents or another adult. You are to do the writing (all writing on a separate sheet of paper). Have the adult sign for each question they helped you answer.

15.	Ask an adult to describe some situations in which a very close estimate is needed and some situations in which an estimate can just be "in the ballpark." (Do not use the examples above.)
16.	Ask an adult to describe some situations in which an overestimate is needed.
17.	Ask an adult to describe some situations in which an underestimate is needed.
18.	Many sewing machine patterns have a five-eighth inch allowance for sewing the seam. Is this allowance closer to 0, $\frac{1}{2}$, or 1 inch? Explain your reasoning.

Activity 1-37: **Estimation – Moon Walk** Name:

If you could walk to the moon, about how long would it take? Huh?

Here is an investigation that, at first, may seem impossible to do. But if you take it apart, step by step, you'll be surprised at how quickly you'll be off and running. You may use a calculator for this activity.

You really only need two pieces of information: how fast you walk and how far it is to the moon.

1) Find the distance to the moon in miles. You may use any available resources that your teacher provides.

2) How can you determine your walking speed? What tools do you need?
   Mark off a distance of at least 20 meters to walk. Time one person as they walk the given distance. From this information determine how many meters per second he or she can walk.

3) Since the distance to the moon is in miles and your walking speed is in meters per second, you will need to covert the speed to miles per second. To change meters per second to miles per second, divide your answer in #2 by 1603.3.

4) Now that you have the number of miles to the moon and your speed, you can determine how long it will take you to walk to the moon. Your initial answer will be in seconds…a very big number! Convert your answer to minutes, hours, days, and years (assume 365 days in a year).

5) Repeat the process above if you were going to walk to Washington, D.C.

Miles to the moon	
Walking speed (meters/sec)	
Walking speed (miles/sec)	

Time required…	**To the moon**	**To Washington, D.C.**
Seconds		
Minutes		
Hours		
Days		
Years		

Activity 1-38: **Estimation – Submarine Sandwich** Name:

How many submarine sandwiches would be in a line that stretches from our school to the White House in Washington, D.C. Huh?

Here is an investigation that, at first, may seem impossible to do. But if you take it apart, step by step, you'll be surprised at how quickly you'll be off and running. You may use a calculator for this activity. You really only need two pieces of information: how big a sub sandwich is and how far it is to Washington, D.C.

1) Find the distance to Washington, D.C. in miles. You may use any available resources that your teacher provides.

2) You will need to determine the length of a typical submarine sandwich in inches.

3) Since the distance to Washington, D.C. is in miles and your submarine sandwich is measured in inches, you will need to do a conversion to determine how many miles long one submarine sandwich is. One inch is equal to 0.000015783 miles (one mile is equal to 63,360 inches).

4) Now that you have a common set of units, you can determine the number of submarine sandwiches necessary to reach Washington, D.C. After you determine this, complete the rest of the tables below.

5) Repeat the process above if you were going line up submarine sandwiches to the moon.

Miles to Washington, D.C.		**Meat per sub**	
Length of one sub (inches)		**Tomatoes per sub**	
Length of one sub (miles)		**Lettuce per sub**	
		Mayonnaise per sub	
Cheese per sub		**Cost per sub**	

	To Washington, D.C.	**To the moon**
Submarine sandwiches required		
Slices of cheese		
Amount of meat		
Number of tomatoes		
Amount of lettuce		
Amount of mayonnaise		
Total cost		