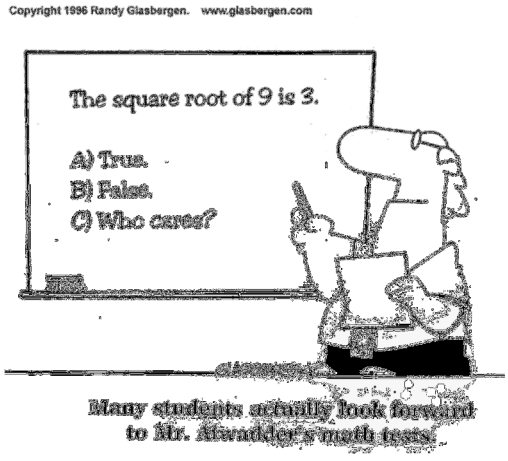
SIXTH GRADE MATHEMATICS

CHAPTER 1

OPERATIONS WITH WHOLE NUMBERS

TOPICS COVERED:

- Whole Number Operations
- Whole Number Estimation
- Exponents/Perfect Squares
- Order of Operations
- Patterns and Sequences



Mathematics is the science of magnitude and number and related topics. It is derived from the Greek "mathema" which means learning.

Arithmetic is the science of numbers and reasoning. It is derived from the Greek "arithmetike tekhne" which means art of counting.

Activity 1-1: **Interest Inventory** Name:

1.	This is the grade I entered Southlake schools:	
2a.	In my house the following adults live…	
2b.	In my house the following kids live… (list ages)	
3.	In my house the following pets live… (name and animal)	
4.	My favorite subject(s)	
5.	My favorite hobbies	
6.	My favorite sports	
7.	The one song, TV show, or book I will always remember from this summer is…	
8.	I like my friends because they are…	
9.	Something special and unique about me is…	
10.	Careers that might interest me are…	
11.	When I have free time I enjoy…	
12.	Books and magazines I enjoy…	
13.	The three people I admire the most are…	
14.	If I were an animal I would be a…	
15.	My greatest talent is…	
16.	If I could live anywhere I would live…	
17.	My favorite cartoon character is…	
18.	A responsibility I handle well is…	
19.	If I were principal of this school the one thing I would change is…	
20.	Subjects I want to learn about	
21.	Things I want to improve	
22.	Major food preferences and favorite restaurant	
23.	My favorite dessert is…	
24.	[Your house is burning down. Your family, you, and all pets are safe.] The two possessions that are special to me that I would rescue from my house are…(things you couldn't just buy again)	

25.	My most memorable event is…	
26.	Places I have traveled include…	
27.	One thing that REALLY gets on my nerves is…	
28.	The happiest day of my life was…	
29.	I was sad when I learned that…	
30.	The best opportunity I ever had was…	
31.	If I were a TV show I would be…	
32.	If you were allowed to stop going to school, would you?	
33.	An experience that embarrassed me was…	
34.	In five minutes you will be stranded on a deserted island. You may only take ONE realistic item with you. That one item will be… (cell phones don't work!)	
35.	Three qualities I like in a teacher are…	
36.	My favorite movie of all-time is….	
37.	If I could visit any country or city outside the US it would be…	
38.	The wildest and craziest thing I have ever done is…	
39.	If I were given $1,000 to help other people I would spent it...	
40.	My fifth grade teachers would describe me as…	
41.	My parents would describe me as….	
42.	My best friend would describe me as…	
43.	What I am most proud of having accomplished in the past year is…	
44.	The luckiest thing that ever happened to me was…	
45.	If I had to eat only ONE food item for the entire next week it would be…	
46.	I get to invite five famous people, dead or alive, to come eat dinner. Who would I choose?	
47.	If I could grow up to be famous and successful, what would I like to be known for?	
48.	If I could appear on any TV show (past or present), what show would I pick?	
49.	In 5th grade, where in school did you feel most important? Why?	

Activity 1-2: **Newspaper Scavenger Hunt** Name:

On your construction paper you must include the following:

1. The **item number** and the **description of the item** included on this page plus the newspaper cutout.
2. Box each item so that it is separate and easy to identify.
3. In the "Found" column, check the items you have included.
4. Your grade is the total points for all correctly identified items on your construction paper.
5. The maximum number of points you may earn is 110.
6. You may only include ONE of each item and one cut-out may not count for more than one item.
7. Staple this page to your completed work.

Place all on same side of construction paper			*Place all on the other side of construction paper*		
	7 points	**FOUND**		**4 points**	**FOUND**
1	A circle graph		20	A pentagon	
2	An item with 2 different prices		21	A baseball batting average	
3	A metric unit of weight		22	A baseball team's winning average (decimal)	
4	A metric unit of length		23	Sale date (beginning and ending)	
5	A percentage using a fraction		24	A bar graph	
6	An octagon		25	A date in numbers	
7	A top 5 or 10 list		26	A restaurant ad with prices	
8	A ratio		27	A number between 100 and 1000	
9	A mixed number		28	A number greater than 10,000	
10	A number written in words		29	A temperature in degrees	
11	A metric unit of volume		30	Time	
12	A hexagon		31	A stock price with the company name or symbol	
13	A temperature in Celsius		32	A coupon	
14	An address and phone number		33	A percent using a whole number	
15	A line graph		34	A decimal NOT as money	
16	A real estate ad with prices		35	A fraction	
17	A percent using a decimal		36	A triangle	
18	A negative number		37	A circle	
19	A decimal as money		38	A rectangle	

TRAFFIC JAM

Process:
Have the participants stand in the boxes of the pattern: half of the group faces right, half of the group faces left. Explain the task: Using only legal rules, people on the left side must end up on the right side and the people on the right must end up on the left.
Legal Moves
A person may move into an empty space in front of them.
A person may move around a person who is facing them into an empty space.
You CANNOT:
Move backwards. Move around someone facing the same way you are. Make any move which involves two people moving at once. After the task is completed, ask the team/group if they can complete it again in half the time. If the team is particularly adept at this exercise and has successfully completed the task, ask them to complete the task while holding their breath. Allow them to appoint a coach who may breathe while assisting the team.

HA

This exercise asks the participants to pass the word 'ha' around a circle. This activity is generally more effective when used during the later stage of the training program or session. It takes about 7 minutes and is best suited for a group of 20 or less participants.

Ask the participants to form a circle. When they are ready explain that the object of this activity is for the participants, without laughing, to pass the word "ha" around the circle. Designate one participant to be the head of the circle. That participant begins by saying "ha". The person sitting to his or her right must repeat the "ha" and then say another "ha." The third person must say ha ha and then given an additional "ha." In this manner the "ha" continues around the circle. It ends when all of the participants, trying not to laugh (a virtual impossibility), have repeated the "ha's" that preceded them and then added their own "ha."

Variations: Use another word in place of "ha." For example: "yuck," "har," or "tee hee." or ask all of the participants to repeat the "ha's" stopping only to let the person whose turn it is pipe in with his or her own. You can continue the exercise for five minutes regardless of how many times the "ha's" go around the circle.

SNOWBALL

Students write on a piece of paper three things about themselves. Then they crumple the paper up into a 'snowball' and have a one-minute snowball fight. At the end of the minute, everyone grabs the closest snowball and has to try to find the person who wrote it. They then introduce that person to the rest of the group, sharing the three facts.

ALPHABETICAL

After introducing yourself, create some chaos. Tell students they have three minutes to complete their first assignment: "Sort yourselves in alphabetical order by last name." After the initial shock and after they succeed, remind them how capable they are to handle their first day, and every day, by asking questions, getting help from others, working together, trying and evaluating strategies to "just do it"! Whatever "it" might be, they can do it!

PAIRS

Walking toe-to-heal chase your partner (3 spins head start)…tag, switch roles

COWBOY

Everyone starts out as an Egg, best 2 of 3 in Rock/Paper/Scissors, winner moves up a level, Egg, Chicken, Dinosaur, Car Salesman, Cowboy

PAPER DISTRIBUTION

3 or 4 people hold all papers, to get one you must give one of them a genuine compliment

COMFORTABLE

Using the entire room…one end “very comfortable” to the other “very uncomfortable”…people move based on comfort zone questions like “math ability”, “Eating”, “rock climbing”, etc.

MAZE

6 by 9 square…leader holds plan of which squares are okay and which are not…team gets 3 minutes to prepare…no talking once time begins…must make it through the maze…beep everytime step on a wrong square…must walk back out the same way they came in…next person goes…repeat 2 or 3 times, notice improvement…you didn’t make a “mistake” by learning a new square was not part of the maze.

PUSH OR PULL

Stand arms distance apart from partner…you win by either pushing the other person over or by them falling over you (if one foot moves in either direction)

SQUEEZE IT

Set up 2 equal length lines…each lines holds hands and sits faces the front…in back show quarter, nickel, or dime to the last person…if quarter, they squeeze the persons hand and so on all down the line.. The front person grabs an object when they get a squeeze to win.

Activity 1-3: **Lost on the Mangham Moon** Name:

(Taken from Cooperative Group Problem Solving – Frank Schaffer Publications, Inc.)

You are a crew member of the spaceship *DukeRules*! Your mission has been to search for life forms in space and return safely to Earth. The mission has been jeopardized because of problems with the cooling systems in your spaceship. You have been forced to land 175 miles from your space station, which is on the lighted surface of Mangham Moon. Mangham Moon has a circumference of 350 miles. Because of a difficult landing, your crew has been forced to evacuate quickly. Moments after the evacuation, an explosion destroyed most of the contents of your spaceship. All that remains are the 15 items listed below.

Your crew's survival depends on reaching the space station. You must choose the most important items from surviving gear, those which will have the most value in reaching the space station.

Place a number 1 alongside the most important item, number 2 by the second most important, and so on through number 15, the least important.

	You	**Team**	**Expert**	**You/Expert**	**Team/Expert**
A cigarette lighter					
Concentrated food					
60 feet of nylon rope					
Signal flares					
A magnetic compass					
Six 50-pound tanks of oxygen					
A case of dehydrated milk					
Parachute silk					
A solar-powered heating unit					
A 357 magnum pistol					
A map of this moon					
A self-inflating life raft					
5 gallons of water					
First-aid kit					
Solar-powered FM two-way radio					
			TOTAL		

4 door	**Van**
Jeep	**Truck**
Sports Car	**2 door**
4 door	**Van**
Jeep	**Truck**
Sports Car	**2 door**

Activity 1-4: **Place Value: Find Your Partner!** Name:

8,008,800	**eight million, eight thousand, eight hundred**	**80 million, 800 thousand, 800**	**80,800,800**
eighty million, eighty thousand, eight hundred	**80,080,800**	**8,000,000 + 80,000 + 800**	**eight million, 80 thousand, 800**
80 million, 800 thousand, 800	**80,000,000 + 800,000 + 800**	**8 million, 8 thousand, 80**	**8,000,000 + 8,000 + 80**
eighty million, eight thousand, eight hundred	**80,008,800**	**eighty million, eight hundred thousand, eighty**	**80,000,000 + 800,000 + 80**
8,000,000 + 800,000 + 800	**8 million, 800 thousand, 800**	**8,080,080**	**eight million, eighty thousand, eighty**
8,800,080	**eight million, eight hundred thousand, eighty**	**80,000,000 + 8,000 + 80**	**80 million, 8 thousand, 80**
800,008,080	**eight hundred million, eight thousand, eighty**	**800,080,800**	**eight hundred million, eighty thousand, eight hundred**

Activity 1-5: **What is a Whole Number?** Name:

Place the following items into the correct category.

WHOLE NUMBERS	NOT WHOLE NUMBERS

$28 \quad 1{,}000{,}000 \quad 82\% \quad 8 \quad -6.2$

$-10 \quad 157 \quad \frac{27}{3} \quad y \quad x \quad 20\%$

$\frac{7}{8} \quad 0 \quad \frac{7}{2} \quad 5.0 \quad -\frac{3}{2} \quad 1.8$

Bonus	On 2/2/00, the date had all even digits. Which day before this date was the last to have all even digits?	

Materials: Numbers 0-9 cut out separately, a dot on the desk to use as a decimal.

WHOLE NUMBERS

How many digits do you have?

Create an even number using all 10 digits. Ask the place value of the first and last digit. Put your finger on the ten thousands digits. Make sure it is odd.

Where is the units place? What is a unit? What is another name for the units place?

Put your finger on the hundreds place. It must be a factor (or multiple) of 3 (or any number). [Review other whole number place values].

WHOLE NUMBER PLACE VALUE CHALLENGES (one person)

1. Create the
   a. largest
   b. 4-digit number
   c. without consecutive digits next to each other
2. Create the
   a. smallest
   b. 4-digit number
   c. without consecutive digits next to each other
3. Create the
   a. largest
   b. 8-digit
   c. odd number
   d. first three digits are not in descending order
   e. product of the digits is 0
   f. one-fourth of the digits are between 1 and 4
4. Create the
   a. largest
   b. 10-digit number
   c. odd number
   d. multiple of 5
5. Create the
   a. smallest
   b. 10-digit number
   c. without consecutive digits next to each other

WHOLE NUMBER PLACE VALUE CHALLENGES (combine with a partner)

1. Create the
   a. largest
   b. 4-digit number
   c. without the digit 8
   d. which would round to 8000 if rounded to the nearest thousand
2. Create the
   a. smallest
   b. 4-digit number
   c. even number
   d. which would round to 1000 if rounded to the nearest thousand
3. Create the
   a. smallest
   b. odd

c. 9-digit number
d. not a multiple of 5
e. only one-third of the digits are factors of 6
f. contains the largest even digit

4. Create the smallest 5-digit even number
5. Create the largest 6-digit odd number
6. Create the smallest 6-digit multiple of 10
7. Create the largest 7-digit multiple of 5
8. Create the closest number to half a million
9. Create the smallest 9-digit number with more than 50% of its digits odd

DECIMALS

Now use the dot on your desk as a decimal point.

Make a 10 digit number with 5 digits to the right of the decimal point and 5 digits to the left of the decimal point. Place your finger on the tenths and make sure it is a factor of 2. Who at your table has the largest number? Take away the 5 digits to the left of the decimal. Who at your table has the largest decimal? (Go over the symbols <, >, =) [Review other decimal place values].

DECIMAL PLACE VALUE CHALLENGES (one person)

1. Create the a. smallest decimal using any number of digits you choose
2. Create the a. smallest decimal
   b. using only the five odd digits
   c. the hundredths place must contain a 9
3. Create the a. closest number to 400 that you can using all ten digits
4. Create the a. largest
   b. 6 digit decimal
   c. without consecutive digits next to each other
5. Create the a. closest decimal to 0.8
   b. using the numbers 6-9
   c. with 7 in the ten-thousandths place

The following chart demonstrates place value from the billions place down to the hundred-thousandths place.

Whole Number Place Value									
5 ,	8	4	6 ,	3	1	9 ,	2	0	8
Billions	Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thou-sands	Hundreds	Tens	Ones

Decimal Place Value					
1 .	5	3	7	2	8
Ones	Tenths	Hundredths	Thousandths	Ten-thousandths	Hundred-thousandths

How to read a number with a decimal in it:

Read the entire whole number part (without saying "and"). After the ones place, say "and." Then, read the number after the decimal as if it were a whole number. The last words are the place value of the final digit.

Example: 82.0075

"Eighty-two AND seventy five ten-thousandths"

Activity 1-16: **Place Value Game** Name:

The goal: Have a sum which is the closest to 1000 without going over after 10 rolls of the die.

HUNDREDS	TENS	ONES
SUM:		

HUNDREDS	TENS	ONES
SUM:		

Activity 1-8: **Writing Whole Numbers** Name:

	Planet/ Object	Distance from Earth (miles)	Distance from Earth in words (miles) in June 2001
1.	Sun		Ninety-four million, four hundred eight thousand, twenty
2.	Mercury	58,241,250	
3.	Venus		One hundred sixteen million, seventy thousand, six hundred ninety-six
4.	Moon	238,857	
5.	Mars		Two hundred thirty-five million, seven hundred sixty-two thousand, four hundred forty
6.	Jupiter		Five hundred sixty-five million, seven hundred thirty thousand, one hundred sixty
7.	Saturn		Nine hundred thirty-five million, seven hundred seventy-six thousand, three hundred twenty-three
8.	Uranus	1,826,710,650	
9.	Neptune		Two billion, seven hundred forty million, two hundred fifty-three thousand, seven hundred forty-two
10.	Pluto		Two billion, seven hundred forty-five million, two hundred sixty-nine thousand, four hundred eighteen

Determine which object is further away. Below each object write its distance from Earth. Then fill in the square with <, >, or = to make each sentence true.

11. Moon _____ ☐ Sun _____

12. Mars _____ ☐ Venus _____

13. Neptune _____ ☐ Pluto _____

14. Saturn _____ ☐ Jupiter _____

15.	Which planet is closest to Earth?	
16.	Which planet is farthest from Earth?	
17.	Which planets are more than one billion miles away from Earth?	
18.	Which planet is about half a billion miles from Earth?	

Activity 1-9: **Whole Number Addition and Subtraction** Name:

Variable	Value	Variable	Value	Variable	Value
A	7,234	*F*	19,054	*L*	4,188
B	6,902	*G*	708	*M*	7,298
C	13,488	*H*	9,326	*N*	9,612
D	11,194	*J*	10,586	*P*	13,656
E	19,886	*K*	16,106		

Add.

		Sum
1.	$A+G$	
2.	$B+D$	
3.	$L+G$	
4.	$P+H$	
5.	$F+N$	
6.	$C+M$	
7.	$K+J$	
8.	$A+F$	
9.	$B+H$	

Subtract.

		Difference
10.	$E-A$	
11.	$D-B$	
12.	$L-G$	
13.	$P-H$	
14.	$F-N$	
15.	$C-M$	
16.	$K-J$	
17.	$M-L$	
18.	$K-D$	

19.	Which number in the table is the smallest?	
20.	Which number in the table is closest to 8,000?	

Activity 1-10: **Whole Number Multiplication** Name:

Below are some distances between cities in the United States.

Starting at…	**Arriving at…**	**Total distance (miles)**
Boston, Massachusetts	Providence, Rhode Island	49
Providence, Rhode Island	Hartford, Connecticut	86
Hartford, Connecticut	Trenton, New Jersey	176
Trenton, New Jersey	Dover, Delaware	111
Dover, Delaware	Annapolis, Maryland	67
Annapolis, Maryland	Richmond, Virginia	137
Richmond, Virginia	Charleston, West Virginia	314
Charleston, West Virginia	Frankfort, Kentucky	197
Frankfort, Kentucky	Nashville, Tennessee	208
Nashville, Tennessee	Raleigh, North Carolina	543
TOTAL ROUND TRIP USA DISTANCE (Austin to Austin)		14,165

Complete the road race table below using the information above.

	Name of the Race	**Number of cars entered**	**Total distance driven by all cars (assuming they all finish)**
1.	Dover-Annapolis Battle of the Buicks	8	
2.	Hartford-Trenton Chase of the Chevys	3	
3.	Nashville-Raleigh Pursuit of the Porshes	11	
4.	Boston-Providence Contest of the Corollas	74	
5.	Frankfort-Nashville Event of the Eclipses	30	
6.	Richmond-Charleston Fight of the Ferraris	6	
7.	Providence-Hartford Clash of the Camrys	5	
8.	Trenton-Dover Brawl of the Beetles	20	
9.	Austin-Austin War of the Winnebagos	12	
10.	Annapolis-Richmond Drive of the Durangos	25	
11.	Charleston-Frankfort Match of the Mustangs	10	
12.	Dover-Annapolis Race of the Rams	16	
13.	Hartford-Trenton Battle of the Buses	7	
14.	Austin-Austin Lap of the Limousines	55	
15.	In the total round trip (Austin-Austin) the number **4** represents what place value?		
16.	The shortest race is between which two cities?		
17.	A race from Annapolis to Charleston via Richmond is exactly how many miles?		
18.	Rounded to the nearest ten, how far is it from Hartford to Trenton?		
19.	Rounded to the nearest thousand, how far is the Austin-Austin round trip?		

Activity 1-11: **Whole Number Division** Name:

Mr. Mangham kept track on his gas mileage as he drove a wide variety of rental cars across the United States.

Complete the table by dividing. Write your answer as a whole number and a remainder (ex. 10 r6).

THIS SUMMER					
	Starting at…	**Arriving at…**	**Total distance (miles)**	**Average miles per gallon**	**Gallons of gas used***
1.	Austin, Texas	Santa Fe, New Mexico	745	22	
2.	Cheyenne, Wyoming	Salt Lake City, Utah	439	8	
3.	Salt Lake City, Utah	Phoenix, Arizona	708	34	
4.	Carson City, Nevada	Helena, Montana	1911	9	
5.	Denver, Colorado	Bismarck, North Dakota	4551	23	
6.	Phoenix, Arizona	Pierre, South Dakota	3513	10	
7.	Sacramento, California	Boise, Idaho	1230	5	
8.	Austin, Texas	Austin, Texas	14,165	20	

Complete the table by dividing. Write your answer as a whole number and a remainder (ex. 10 r6).

PROPOSAL WITH NEW CAR AND BETTER GAS MILEAGE					
	Starting at…	**Arriving at…**	**Total distance (miles)**	**Average miles per gallon**	**Gallons of gas used***
9.	Austin, Texas	Santa Fe, New Mexico	745	32	
10.	Cheyenne, Wyoming	Salt Lake City, Utah	439	18	
11.	Salt Lake City, Utah	Phoenix, Arizona	708	42	
12.	Carson City, Nevada	Helena, Montana	1911	20	
13.	Denver, Colorado	Bismarck, North Dakota	4551	30	
14.	Phoenix, Arizona	Pierre, South Dakota	3513	26	
15.	Sacramento, California	Boise, Idaho	1230	15	
16.	Austin, Texas	Austin, Texas	14,165	35	

For the concluding exercise, use only the ***whole numbers*** from your answers above (forget about the remainder!)

17.	How many gallons could have been saved on the Austin-Santa Fe route?	
18.	How many gallons could have been saved on the Carson City-Helena route?	
19.	How many gallons could have been saved on the entire Austin-Austin route?	
20.	Rounded to the nearest hundred, how far is it from Denver to Bismarck?	
21.	Is the Austin-Santa Fe trip or the Salt Lake City-Phoenix trip longer in distance?	

Using centimeter cubes create the following squares. Then count the number of cubes necessary to create each square.

Square	Number of cubes
1 by 1	
2 by 2	
3 by 3	
4 by 4	
5 by 5	
6 by 6	
7 by 7	
8 by 8	
9 by 9	
10 by 10	
11 by 11	
12 by 12	
x by x	

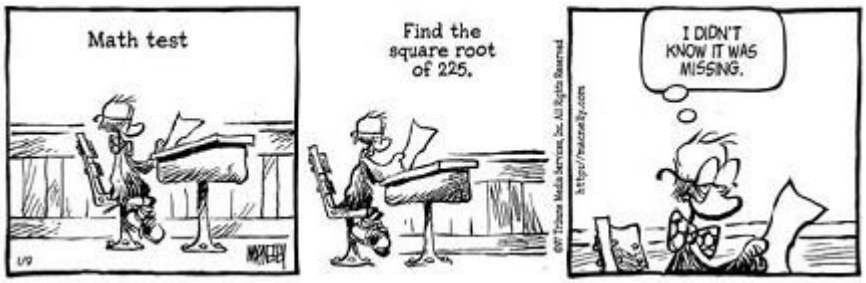
$3 \text{ by } 3 = 3 \times 3 = 3 \bullet 3 = 3^2 = 9$

exponent

Three squared equals 9.

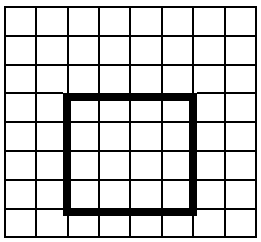
$\sqrt{9} = 3$

This is a radical sign. It represents a square root. Square root is the opposite operation of square. What number times what same number equals nine? Three. Thus, the square root of 9 is 3.

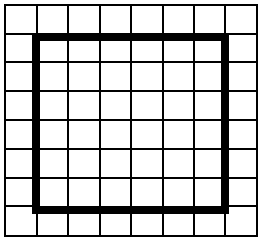


Activity 1-13: **Squares and Square Roots** Name:

You are finding the **square** of a number when you multiply a number by itself.



$4 \bullet 4 = 4^2 = 16$



$6 \bullet 6 = 6^2 = 36$

If $a^2 = b$, then a is the **square root** of b. The symbol, $\sqrt{\ }$ called a **radical sign**, is used to represent a square root. Read $\sqrt{16}$ as "the square root of 16." Both the squared sign and the square root sign are exponents. The number 16 is a "square number" because you square the number 4 to get 16.

Examples

a. Find $\sqrt{9}$ Since $3^2 = 9$, $\sqrt{9} = 3$.

b. Find $\sqrt{64}$ Since $8^2 = 64$, $\sqrt{64} = 8$.

In the space below make a drawing to demonstrate each problem.

1. 3^2	2. 7^2	3. $\sqrt{25}$
4. A side length of $\sqrt{9}$	5. A square with an area of 36 sq. units	6. 9^2
7. Arrange 16 marbles to demonstrate 4^2	8. $\sqrt{1}$	9. 2^3

Activity 1-14: **Squares and Square Roots** Name: _____

Find each square or square root.

1.	9^2		2.	30^2		3.	24^2		4.	10^2	
5.	15^2		6.	40^2		7.	22^2		8.	11^2	
9.	100^2		10.	$\sqrt{4}$		11.	$\sqrt{169}$		12.	$\sqrt{196}$	
13.	$\sqrt{225}$		14.	$\sqrt{576}$		15.	$\sqrt{2500}$		16.	$\sqrt{121}$	
17.	$\sqrt{3600}$		18.	$\sqrt{144}$		19.	31^2		20.	$\sqrt{1225}$	
21.	$\sqrt{900}$		22.	17^2		23.	45^2		24.	$\sqrt{729}$	

25.	Which of the following could represent $\sqrt{225}$? A. 5 rows of 45 squares C. 25 rows of 9 squares B. 15 rows of 15 squares D. 3 rows of 75 squares	
26.	I am larger than 15^2 and smaller than 16^2. I am odd and divisible by 3. The product of my digits is 24. Who am I?	
27.	When, if ever, can $x^2 = 2x$?	

Write each expression using exponents.

28.	$4 \bullet 4$		29.	$5 \bullet 5 \bullet 5 \bullet 5 \bullet 5 \bullet 5$	
30.	$2 \bullet 2 \bullet 2 \bullet 2 \bullet 2 \bullet 2 \bullet 2 \bullet 2$		31.	$6 \bullet 6 \bullet 6 \bullet 6 \bullet 6$	
32.	$3 \bullet 3 \bullet 3 \bullet 3 \bullet 3$		33.	7 cubed	
34.	8 to the 5^{th} power		35.	13 squared	

Solve.

36.	6^3		37.	2^6	
38.	5^4		39.	1^8	
40.	9 cubed		41.	4 to the 4^{th} power	

Mathematical operations follow a logical order. This order is not always from left to right, but instead is based on giving importance to certain operations. The following displays the correct order of operations:

P parentheses
E exponents
MD multiplication/division – whichever comes first
AS addition/subtraction – whichever comes first

PEMDAS is frequently remembered using the phrase, "Please excuse my dear aunt Sally."

The order of operations can be used to solve problems one-step at a time by creating a funnel.

$\underline{(8 + 9)} \bullet 4 + 12 - 8^2$

$17 \bullet 4 + 12 - \underline{8^2}$

$\underline{17 \bullet 4} + 12 - 64$

$\underline{68 + 12} - 64$

$\underline{80 - 64}$

16

$\underline{(12 + 15)} \div 3 - 4 + 5^2$

$27 \div 3 - 4 + \underline{5^2}$

$\underline{27 \div 3} - 4 + 25$

$\underline{9 - 4} + 25$

$\underline{5 + 25}$

30

Activity 1-16: **Order of Operations** Name: _____

P	Parenthesis (and other grouping symbols) ex. ( ), [ ], { } also $\frac{a}{b}$ groups *a* together, then *b* together, then you divide (via the fraction bar) last.
E	Exponents ex. x^2 or $\sqrt{x}$
MD	Multiplication and Division from left to right
AS	Addition and Subtraction from left to right

Fill in the blanks.

1.	According to the order of operations, all operations that appear within _____ should be performed first.
2.	According to the order of operations, all _____ should be solved second.
3.	Third, divide and _____ from left to right.
4.	Fourth, add and _____ from left to right.
5.	In an expression that involves a division operation and an addition operation, the _____ operation should be performed first.
6.	In an expression that involves a subtraction operation and a multiplication operation, the _____ operation should be performed first.

True or false.

7.	Always add before you subtract.		9.	Always multiply before you divide.	
8.	Always start with parentheses.		10.	Always go left to right.	

Circle the operation that should be performed first in each expression.

11.	$(9+3)\bullet 7$	12.	$98-5\bullet 7$
13.	$\left(\frac{15}{3}\right)+(4+5)$	14.	$\frac{8^2-2\bullet 10}{30-8}$
15.	$5+4\bullet 7$	16.	13 x (6 + 3)
17.	(4 – 2) + 6	18.	(6 • 8) ÷ 4
19.	$5\bullet(\sqrt{9}-1)$	20.	$5\bullet(5-3)\bullet 2$
21.	32 ÷ 4 • 2	22.	9 x (4 + 2) ÷ 3

Activity 1-17: **Order of Operations** Name:

Solve. Use the tornado method and show all work and answers on a separate sheet of paper.

1.	$8 \bullet 7 + 8 \bullet 3$	2.	$(12-3) \div 3^2$	3.	$8-6+3$
4.	$18 \div 3 \bullet 6$	5.	$(34+46) \div 20 + 20$	6.	$9 \bullet 3 + 8 \div 4$
7.	$10^2 \bullet 3 + 1$	8.	$23 - 45 \div 9 + 5$	9.	$(12-9) \bullet (6+1)$

Solve. Use the tornado method and show all work and answers on a separate sheet of paper.

10.	$15 - 18 \div 9 + 3$	11.	$30 \div (12 - 6) + 4$	12.	$(72 - 12) \div 2$
13.	$2(16 - 9) - (5 + 1)$	14.	$(43 - 23) - 2 \bullet 5$	15.	$90 - 45 - 24 \div 2$
16.	$81 \div (13 - 4)$	17.	$7 \bullet 8 - 2 \bullet 8$	18.	$10^2 \bullet 3^2 + 1$
19.	$5 + 42 \div 3 - 3^2$	20.	$8 \bullet 3 + 2^2 - 1$	21.	$8 \bullet 3^2 + 7^2 - 2$
22.	$10 + 9^2 \div 3 - 4$	23.	$(12 - 3) \div 3^2$	24.	$(34 + 46) \div 20 + 20$
25.	$18 \div 3 \bullet 6$	26.	$5^2 - 12 + 84 \div 3$	27.	$1 + 3 \bullet 4 + 5 - 3^2$

Compare. Use, <, >, or = to make each statement true.

28.	$5 - 3 \bullet 1$	$(5 - 3) \bullet 1$	29.	$(4 + 8) \bullet 3$	$4 + 8 \bullet 3$
30.	$3 \bullet (8 - 2)$	$3 \bullet 8 - 2$	31.	$(7 + 2) \bullet 4$	$7 + 2 \bullet 4$
32.	$4 + (20 \div 4)$	$(4 + 20) \div 4$	33.	$42 - (35 + 4)$	$42 - 35 + 4$
34.	$(9 - 2) \bullet 3$	$9 - 2 + 3$	35.	$55 + 10 - 7$	$55 + (10 - 7)$

Solve.

36.	13^2	37.	26^2	38.	$\sqrt{961}$	39.	$\sqrt{529}$

40. Using parentheses and any operations you wish (+, - , ÷, •), make equations that equal 0 through 11.

8 4 2 1 = 0	8 4 2 1 = 1	8 4 2 1 = 2
8 4 2 1 = 3	8 4 2 1 = 4	8 4 2 1 = 5
8 4 2 1 = 6	8 4 2 1 = 7	8 4 2 1 = 8
8 4 2 1 = 9	8 4 2 1 = 10	8 4 2 1 = 11

Activity 1-19: **Order of Operations** Name:

For each PEMDAS story below, write the correct mathematical expression. Include parentheses as needed in order to follow the order of operations.

1. Mr. Mangham's IQ – **What is Mr. Mangham's IQ now?** One day Mr. Mangham found out that his IQ was only 20. That made him feel sad. He went to the library and studied for a few hours and raised his IQ by 12 points. As he was walking out of the library, aliens abducted him and stole half of his brain and then they put him back on Earth (so he only knew half the stuff he knew before). Then he babysat for his little niece and learned a lot from the baby lowering his IQ by 6 points. Next he went to a math convention where 3 speakers each raised his IQ by 3 points.	2. Mr. Monkey's Teeth – **How many monkeys were in the room?** One day Monkey Mel went to the dentist. There were 35 more monkeys in the waiting room that needed to get their teeth cleaned. The dentist split the monkeys into two even groups. In Mel's group, three groups of three monkeys got their teeth cleaned and left. The dentist found that Mel had a big cavity so he called 72 more monkeys to help out. One of the monkeys got scared from the size of cavity that she ran away. If you happen to see Monkey Mel call 1-800-ISAWMEL.
3. The Toilet Weepers – **How many total people are at Dairy Queen?** Thirty people worked at the plumber service. Twelve of them were laid off so there were eighteen employees left. They got a phone call from 1980 Maple Street were the toilet had flooded. In the office, their boss said to split up into two equal groups – one to go to the house while the other group could go to Dairy Queen. In the Dairy Queen group, two employees left because they were mad. When the rest of the group arrived at Dairy Queen, they saw five tables each with five people sitting at them.	4. Ants at the Picnic – **How many ants are left at the picnic?** Shelby and Emily were at a picnic. All of a sudden, they saw a hundred ants. They got so scared that they stepped on twenty of the ants. The ants then got so scared that they scattered into five equal groups of which only one stayed at the picnic. Then their friend Kristen ran up to us and accidentally stepped on seven of the ants. Since ants have a good sense of smell, three groups of three ants each then came to join the ones that were left at the picnic.
5. Sour Chocolate Camp – **How many licorice bags did they have when they woke up?** There were eight M&M people at Chocolate Camp. There were nine Sour Skittle people at Sour Camp. The two camps joined together and called the camp Sour Chocolate Camp. Each person had four bags of Black Licorice. The camp counselor had twelve extra bags of Black Licorice. Eight lollipop people came to Sour Chocolate Camp while everyone was sleeping and stole eight bags each. When all of the people woke up they were very mad so they turned into pink Leprechauns and swam into the rainbow until next summer.	6. Fruit Football Players – **How many players are on the Seeds?** There were nine grapefruits that went grocery shopping. They decided to get nineteen bananas. When they got home, they found out there were twenty-eight fruits in all. They split into two even teams to play football, the Seeds and the Peels. On the Seeds one banana got split and died so he was off the team. Two kiwis came over and got cloned by the angry Seeds who were now losing the game. Since there were now four kiwis they decided to join the Seeds football team. In the end the Seeds won and they were all very happy.
7. Apples – **How many apples were left?** There were nine apples and Hillbilly Bob ate eight of them. There was only one apple left. Bob ran into a apple tree and knocked off tons of apples. In fact, Bob realized he now had forty times as many apples. Bob's son, Bob Jr., then ran into the same tree and seventeen more apples fell. Next, six more of Bob's relatives arrived and they each ate six apples.	8. SpongeBob – **How many cooked patties are there?** SpongeBob made forty patties and twelve of them were eaten. He then divided the remaining patties into two groups and cooked one of the groups. With the cooked patties, SpongeBob gave six to Patrick. Then six friends came by and each of them brought six cooked patties.

9. The Skydiving Massacre – **How many skydivers were there in the end?** There were two planes. One plane had 10 people. The other plane has 12 people. The groups of skydivers jumped out of the planes and formed one big group. They formed a circle by holding hands. One of the people's hands slipped and as a result one-half of the skydivers went flying away from the group. Birds starting pecking at the remaining skydivers and eight more people went flying away from the group. Soon four more groups of 4 skydivers joined the remaining few to make one big group.	10. Dem Bones – **How many bones did the puppies have?** Four puppies were playing hide and go seek. Nine more puppies came to play with them. Each puppy was carrying four delicious bones. Some of the puppies were goofing off when they found twenty more bones that were hidden in the ground. The puppies were now very happy. Then three mean dogs came by and took three bones each. That didn't bother the puppies too much though and then spent the rest of the day playing with their bones.
11. The Hiccup Birthday Party – **How many kids are at the movies without the hiccups?** Once there was a little boy named Mr. Mangham. He and eleven little friends were celebrating Mr. Mangham's birthday! Then fifteen more little friends showed up for the party. The kids were split into three cars Mr. Mangham's group drove to the movies while the others went home. In Mr. Mangham's car, four of the kids got the hiccups. When his car got to the movies there were five groups of five kids waiting to celebrate with him.	12. The Race – **How many horses are in Race #1?** There are seven horses in the race. Fourteen more horses came to join the race. Since there were so many, the horses divided into three equal groups to run three races. In race #1, a horse named Dodger hurt his leg so he was not able to participate in the race. At the last moment, two owners entered two horses each in race #1.
13. Mr. Mangham's Cats – **How many cats are at Daisy's bowl of food?** Mr. Mangham had eleven cats. He decided to adopt thirteen more cats because he loved them so much. His favorite cat in the whole wide world was Daisy. With six bowls of cat food, the cats divided up evenly to eat dinner. At Daisy's bowl one of the cats ran away and Mr. Mangham was so sad. Mr. Mangham looked everywhere for the missing cat and while he was looking seven groups of seven cats each all tried to join in at Daisy's bowl of food.	14. The Baked Cookies – **How many cookies were left in the end?** Mallory baked two cookies. Then she cooked three more cookies. She decided she needed more so she ended up with ten times her original total of cookies. Mallory's friend, Jennifer, then brought over 25 more cookies. Mallory and Jennifer invited over six friends and each friend ate six of the cookies.
15. The High and the Odd – **How many animals are in group A?** There once was a group of 32 flying cows. They soon met 16 flying pigs. Then the group of 48 odd flying animals divided into 12 equal groups for a flying obstacle course. Now there are 4 animals in a group. In group A, sadly one of the flying cows got airsick. Surprisingly, four groups of four flying monkeys came to join team A so that they could increase their total of very odd flying animals.	16. The Mudball Team – **How many mudballs were left?** Five small pigs were going to play Mudball. Twelve other pigs saw them playing and joined in. Now there were 17 pigs. Each pig had 5 mudballs. Mrs. Pig showed up and brought eleven more mudballs. Then, mean Mr. Pig and his seven friends showed up and each took away eight mudballs. With the remaining mudballs, the pigs jumped in the mud and played until dark.

Activity 1-21: **Writing a PEMDAS Story** Name:

Work either individually or in pairs

1. The expression below has been created using the following elements:
    - Addition
    - Subtraction
    - Multiplication
    - Division
    - A set of parenthesis
    - An exponent

_____

2. Simplify your expression on a separate sheet of paper. Show in order all of the steps that you used to simplify.

3. Write your PEMDAS story. Your story MUST follow the order of operations as it applies to your expression. You will translate each operation into a real-world situation. Make your story as creative and fun as possible while following all mathematical rules.

SAMPLE PEMDAS STORY

$(4 + 2) \bullet 2 \div 4$

Four friends were playing ball in the park. They were having a great day because it was the weekend. Later, 2 more of their friends from their neighborhood joined them. Now there were 6 friends playing in the park. Another group of 6 kids saw the group of 6 playing and asked if they could join to make 2 teams. Everyone agreed and now there were twice as many people playing; this made the game more competitive. Everyone was out to win. The group stayed in the park long after the game was over, just talking about their favorite topic.

As it was getting later, everyone was getting tire and hungry. When they were ready to go home, the large group of 12 friends divided into 4 groups. Each group had the same number of people. This way, 4 groups of 3 kids walked each other home.

Type your finished story on the computer. Copy your original problem below your story and solve using the order of operations (tornado method).

Activity 1-22: **Patterns and Sequences** Name:

Identify a pattern to the first few terms of each sequence. Then find the next three terms in the sequence.

		Pattern that you notice	Next three terms
1.	13, 18, 23, 28,…		
2.	27, 25, 23, 21,…		
3.	16, 15, 14, 13,…		
4.	3, 6, 12, 24,…		
5.	512, 256, 128, 64,…		
6.	1, 2, 4, 7,…		
7.	7, 17, 27, 37,…		
8.	1, 4, 16, 64,…		
9.	20, 18, 15, 13, 10,…		
10.	17, 34, 51, 68,…		
11.	216, 36, 6, 1,…		
12.	8, 12, 18, 27,…		
13.	2, 4, 6, 8,…		
14.	17, 23, 29, 35,…		
15.	2, 5, 8, 11, 14…		
16.	1, 3, 9, 27…		
17.	1, 2, 4, 7, 11, 16,..		
18.	96, 48, 24, 12,…		
19.	5 ,11, 17, 23,…		
20.	11, 15, 19, 23,…		
21.	1, 4, 9, 16, 25,…		
22.	4, 8, 16, 32,…		
23.	34, 26, 18, 10,…		
24.	100, 93, 86, 79,…		
25.	20, 25, 35, 50, 70,…		
26.	28, 29, 29, 30, 30,…		
27.	8, 13, 18, 23,….		

Frosted Fudge Cakes:

_____

Cosmic Brownies:

_____

Zebra Cakes:

_____

Swiss Cake Rolls:

_____

Donut Sticks:

_____

Oatmeal Creme Pies:

_____

Star Crunch:

_____

Devil Squares: _____

Nutty Bars:_____

Honey Buns:_____

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