

Managing the Math Class For Maximum Success

- ☑ Minimizes the teacher's paper work
- ☑ Maximizes the students' work
- ☑ Liberates the teacher to "teach"
- ☑ Limits the students' tendency to make excuses
- ☑ Empowers students to succeed
- ☑ Gives students ownership of their grades and progress
- ☑ Increases homework completion
- ☑ Improves note-taking and test-taking skills



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Brad Fulton

Educator of the Year

- ◆ Consultant
- ◆ Educator
- ◆ Author
- ◆ Seminar leader
- ◆ Teacher trainer
- ◆ Conference speaker

Known throughout the country for motivating and engaging teachers and students, Brad has co-authored over a dozen books that provide easy-to-teach yet mathematically rich activities for busy teachers while teaching full time for over 30 years. In addition, he has co-authored over 40 teacher training manuals full of activities and ideas that help teachers who believe mathematics must be both meaningful and powerful.

Seminar leader and trainer of mathematics teachers

- ◆ 2005 California League of Middle Schools Educator of the Year
- ◆ California Math Council and NCTM national featured presenter
- ◆ Lead trainer for summer teacher training institutes
- ◆ Trainer/consultant for district, county, regional, and national workshops

Author and co-author of mathematics curriculum

- ◆ *Simply Great Math Activities* series: six books covering all major strands
- ◆ *Angle On Geometry Program*: over 400 pages of research-based geometry instruction
- ◆ *Math Discoveries* series: bringing math alive for students in middle schools
- ◆ Teacher training seminar materials handbooks for elementary, middle, and secondary school

Available for workshops, keynote addresses, and conferences

All workshops provide participants with complete, ready-to-use activities that require minimal preparation and give clear and specific directions. Participants also receive journal prompts, homework suggestions, and ideas for extensions and assessment.

Brad's math activities are the best I've seen in 38 years of teaching!

Wayne Dequer, 7th grade math teacher, Arcadia, CA

"I can't begin to tell you how much you have inspired me!"

Sue Bonesteel, Math Dept. Chair, Phoenix, AZ

"Your entire audience was fully involved in math!! When they chatted, they chatted math. Real thinking!"

Brenda McGaffigan, principal, Santa Ana, CA

"Absolutely engaging. I can teach algebra to second graders!"

Lisa Fellers, teacher

References available upon request

Across America, schools are searching for creative ways of meeting new and rigorous mathematics standards. This paper will suggest strategies that I have seen enacted throughout the state of California as well as successful strategies from my own school.

Many districts are trying to increase minutes in math instruction. This is a great way to increase the effectiveness of a mathematics program. But where do we get these minutes? My site, Mistletoe Elementary School in Redding, California came up with a unique idea. Language arts is often presented in a two-period block at many schools. This includes a period of English and a period of literature. At Mistletoe, we have instituted a double math period. While other schools have done this for remediation of struggling students, we have offered this to our more advanced students. In addition to taking a general 8th grade mathematics course in the morning, the top 50% of our students return in the afternoon to take high school algebra or geometry. They do this in lieu of their literature period. By taking algebra on top of their regular mathematics instruction, many advantages arise. First of all, the content of the typical algebra class now spills into two periods allowing students to spend more time on each concept. For example, since integers are a normal component of middle school instruction, they are included for all students in the a.m. class. This is true for other topics such as area formulas, the properties of mathematics, and simple equations. Since these topics do not need to be covered again, the afternoon algebra class can spend more time on the more challenging part of the curriculum. In fact, we have so much time, we are able to spend a good portion of the last semester reviewing for the final that we take in April or May—a month before the students at the high school. This double helping of math for the advanced students serves two other purposes.

Many algebra topics can be addressed in the morning class in a concrete, manipulative, or real-world context. Then the same topic can be revisited in the afternoon at the more abstract level typically seen in a secondary algebra class. The students make a much stronger connection to the subject matter this way. It is similar to the building of a house—first we lay a solid concrete foundation, then we build a greater superstructure upon that. Just as this creates a solid and long lasting building, it also cements the understanding in the student. The result is students that not only can perform algebra, they *get* it.

Secondly, students make more *connections* this way. They see the similarity between the concrete experiences they had in the a.m. and the abstract

presentation in the afternoon. It is in these connections where learning occurs. An example of this is presented in the activity included here called *Hundreds Magic*. Students see how the arithmetic is explained by the algebra and the algebra is embedded within the arithmetic.

Another key factor in maximizing success in mathematics is ongoing instruction in number sense. Often this strand gets neglected in middle and upper grades. We assume that students who have studied number operations have number sense. In fact, we need to be constantly revisiting this. Number sense is not synonymous with proficiency in number operations. Moreover, a lack of number sense will ultimately lead to problems with accuracy. Number sense contains five key components:

1. Estimation
2. Mental mathematics
3. A knowledge of the effects of number operations
4. A fluency with mathematical properties
5. An understanding of number magnitude

Additionally, number sense can be fostered using five strategies:

1. Toying with numbers
2. Solving problems in multiple ways
3. Creative practice
4. Exploring patterns
5. Thinking, talking, and writing about mathematics

In order to be maintained number sense must be taught on an ongoing basis over a period of many years. It cannot be addressed through a single chapter in a textbook. For this reason, we must be willing to set the book aside on occasion to let students become proficient with numbers. Like a plant, number sense must be constantly tended and nurtured. Here is a sample of some creative practice in elementary multiplication that will promote mathematical thinking while providing drill work:

$$7 \times 7 =$$

$$6 \times 8 =$$

$$5 \times 5 =$$

$$4 \times 6 =$$

$$8 \times 8 =$$

$$7 \times 9 =$$

$$10 \times 10 =$$

$$9 \times 11 =$$

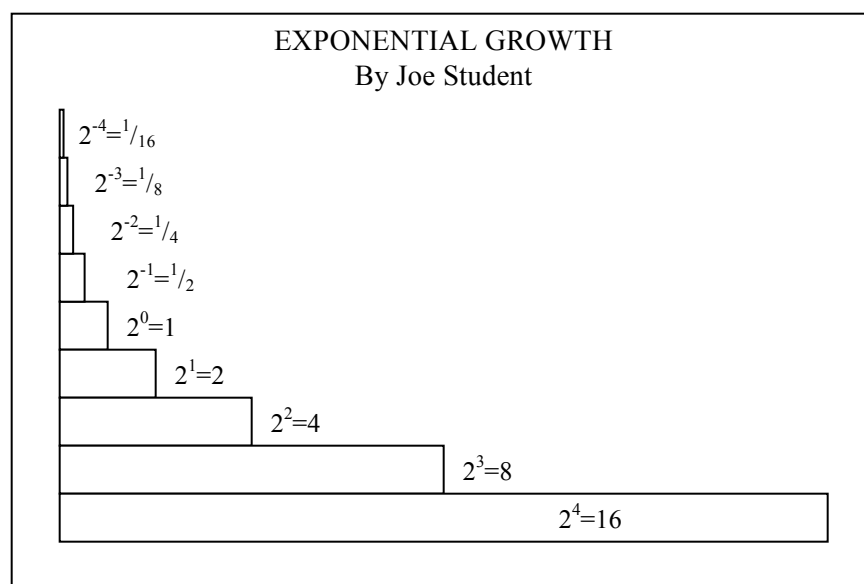
$$4 \times 4 =$$

$$? \times ? =$$

What numbers would replace the question marks in the last problem?

What do you notice about the answers in the second column compared to those in the first? Why does this happen? Will it *always* happen?

Mathematical projects can be a great way of embedding concepts students have learned. The creative format engages all students while immersing them in the mathematics involved. Additionally, this provides a great management tool for the math teacher. Have you ever noticed that language arts teachers can have a free reading day that frees them up to work with students individually or in small groups? Unfortunately, you can't tell your math class, "Find an interesting math book and read it for the next 40 minutes." However, math projects allow us the time to have these necessary connections with smaller groups of students. Here is a math project my students made that allowed them to demonstrate exponential notation, the zero power of a number, and negative exponents while connecting these concepts to bar graphs, linear measurement, and areas of rectangles.



Using 12" by 18" paper, students make rectangles that are 1 inch tall. The middle one has a length of 1 inch and an area of 1 square inch. Below that, each subsequent rectangle doubles in length and in area and is represented by exponential and standard notation. Above the 1 square inch rectangle, each new rectangle is one half the length of the previous one. These are labeled with negative exponents and fractions. The top rectangle is one sixteenth of an inch in length, giving students practice in using the fine gradations of a ruler. The result is a horizontal bar graph of an exponential

curve. The final projects are colored to create a pleasing presentation. And why shouldn't math be anything but beautiful?

Perhaps a math teacher's biggest obstacle is time. It is easy to get so caught up in the paper chase, that we lose valuable time that could be better spent on instruction and planning. For this reason, I have adopted a management system that frees me from much number crunching. Each week my students get a math packet. If complete by Friday, they get 40 out of 40 points.

The assignments allow the student to self assess. Sometimes this is done by including an answer bank. When a student solves a problem, the correct answer is crossed off in the bank. Occasionally I include a few extra false answers in the bank to prevent a student from simply copying the final answer onto the final problem. If the student doesn't find their answer in the bank, they try the problem again to fix their error.

Other times I show the students two ways to solve a problem. On Monday they might solve a system of equations by graphing, and on Tuesday they solve the same equations by elimination or substitution. If they get the same answers both ways, they know they have done the problem correctly.

Of course I also show them how to check and algebra problem, so they can use that strategy to ensure their answers are correct. The students receive full credit if the assignment is completed and turned in on time regardless of the answers. I don't check their answers – that was their job – I simply check that they did every problem and showed their work. If they don't complete the packet or show their work, they get the packet back so they can finish it.

On Tuesday, I ask the students if they had questions about the previous night's homework. I will work a difficult example or two for them if necessary. I repeat this each day of the week, so no one has an excuse to not finish the packet. I discourage students from asking about an example from page one on Thursday, as this shows that they have waited all week to begin their work.

I may also offer extra credit during the week. This is turned in stapled to a completed homework packet. That way a student cannot turn in only extra credit without completing the main work. They understand that extra credit is truly "extra" work done subsequently to the regular work.

I keep these completed and graded packets until the following week when I give them a test. After *clearing their* desks, they are given the test and begin work on the first ten questions. These are worth three points each, are typical test questions on the previous week's material or on review material. As they are working on those questions, I pass back those completed homework papers.

The second ten questions, also worth three points each, are about the homework packet. The student may consult his or her packet to get the answers to these questions. For example, a question may say, "What is the answer to question 6 on page 2 of the packet?" Thus it is in a student's best interest to be diligent when completing the homework. It becomes not only a component of the test, but also a set of notes from which to work. These three categories account for 100 points each week:

Completing the homework on time	40
10 test questions, 3 points each	30
10 homework questions, 3 points each	<u>+ 30</u>
Total:	100

Students who don't have their homework finished are at a loss to answer the last ten questions as they have cleared their desks – their half-finished homework packets are not made available to them. This means that they forfeited the 40 points for the packet and another 30 on the test. On the other hand, if a student diligently worked on the homework and asked for help during or after class, they are ensured that they earned the 40 points for completing their homework and another 30 for doing it correctly.

Feel free to adjust these point totals to suit the needs of your students. One teacher used this method with daily assignments instead of packets. He assigned Monday's homework that the students did on binder paper. On Tuesday, Wednesday, and Thursday he did the same thing. Then on Friday he told the students to get out their homework and put away their textbooks for the test.

The students turned in their work stapled to the back of the test. He did that to check that they had done the homework and had shown their work. This also prevented them from giving their homework papers to their friend coming in to take the test the next period.

I have included a sample test and the accompanying homework packet on the following pages. The assignment “Foursquare Addition 2” is an activity from my book, *Simply Great Math Activities: Number Sense*, which is available on the website. It involves addition of integers, a skill in which my middle school students need constant practice. As you can see from the instructions, the student gets the answer using two approaches – vertical and horizontal addition. Notice that in solving one problem, the student actually adds three times vertically and three times horizontally. If the sums in the triangles agree, the sub-problems are correct.

On Tuesday I would teach subtraction of integers and provide “Foursquare Addition 5” as homework. Because the format is so similar to the previous day’s assignment, even a student who was absent likely could figure out what to do. However, since they are working backwards, the students are practicing subtraction instead of addition.

On Wednesday I would offer further instruction with addition and subtraction of integers using other strategies for students who are struggling with the procedure I previously taught. My DVD, *Integer Strategies*, provides four non-standard strategies for tackling operations with positive and negative numbers.

TEST: Adding and Subtracting Integers

Name _____

Name _____

Answer Column:

Solve:

1. $(-8) + (-19) =$

2. $8 + (-19) =$

3. $(-8) + 19 =$

4. $(-8) - (-19) =$

5. $8 - (-19) =$

6. $(-8) - 19 =$

7. $14 + (-22) + 6 =$

8. $(-9) + 16 + (-17) =$

9. $(-2) - (-7) + 15 =$

10. $(-11) + (-14) - (-8) =$

11. What is the answer to question 4 on page 1 of the packet?

12. What is the answer to question 9 on page 1 of the packet?

13. What is the answer to question 15 on page 1 of the packet?

14. What is the answer to question 3 on page 2 of the packet?

15. What is the answer to question 11 on page 2 of the packet?

16. What is the answer to question 6 on page 3 of the packet?

17. What is the answer to question 12 on page 3 of the packet?

18. What is the answer to question 5 on page 4 of the packet?

19. What is the answer to question 8 on page 4 of the packet?

20. What is the answer to questions 10 on page 4 of the packet?

BONUS:

Mr. Fulton can eat 6 chocolate bars in 9 minutes. At \$.89 per chocolate bars, how much money will he spend in one hour?

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

16. _____

17. _____

18. _____

19. _____

20. _____

BONUS:

Foursquare Addition 2

Name _____

Add across as in the example. Then add downward. Add the sums on the right side and write the answer in the upper triangle. Then add the lower sums and right the sum in the lower triangle. Do your answers match? Congratulations!

-6	3	-3
-8	-12	-20
-14	-9	-23

-8	-11	_____
-5	-10	_____
_____	_____	_____

-8	11	_____
-5	10	_____
_____	_____	_____

-8	-11	_____
5	10	_____
_____	_____	_____

4	-13	_____
-6	-1	_____
_____	_____	_____

14	0	_____
-14	-3	_____
_____	_____	_____

-25	6	_____
12	-14	_____
_____	_____	_____

-15	15	_____
16	-16	_____
_____	_____	_____

22	-11	_____
11	-22	_____
_____	_____	_____

-24	9	_____
19	-16	_____
_____	_____	_____

21	3	_____
-3	-6	_____
_____	_____	_____

24	-15	_____
-4	-5	_____
_____	_____	_____

18	-25	_____
13	-7	_____
_____	_____	_____

-18	25	_____
13	-7	_____
_____	_____	_____

-18	-25	_____
13	7	_____
_____	_____	_____

-18	-25	_____
-13	-7	_____
_____	_____	_____

Foursquare Addition 5

Name _____

Find the missing addends to solve each problem as in the example. You will need to work backwards to be successful.

1

18	26	<u>44</u>
9	12	<u>21</u>
<u>27</u>	<u>38</u>	<u>65</u>

2

	8	<u>-1</u>
12		<u>32</u>
<u> </u>	<u> </u>	<u> </u>

3

		<u> </u>
19		<u>64</u>
<u> </u>	<u> </u>	<u> </u>

4

	35	<u> </u>
		<u>39</u>
<u>36</u>	<u> </u>	<u>32</u>

5

	-1	<u>99</u>
34		<u> </u>
<u> </u>	<u>62</u>	<u> </u>

6

-1		<u> </u>
		<u>45</u>
<u> </u>	<u>87</u>	<u>101</u>

7

	-19	<u>73</u>
		<u>24</u>
<u> </u>	<u>48</u>	<u> </u>

8

		<u> </u>
	17	<u>41</u>
<u> </u>	<u>28</u>	<u>-11</u>

9

		<u> </u>
29		<u>38</u>
<u>-29</u>	<u>19</u>	<u> </u>

10

		<u>26</u>
17		<u>0</u>
<u> </u>	<u>19</u>	<u> </u>

11

23		<u>55</u>
	16	<u> </u>
<u>1</u>	<u> </u>	<u> </u>

12

	17	<u> </u>
		<u>0</u>
<u>70</u>	<u> </u>	<u>59</u>

13

	-46	<u> </u>
46		<u> </u>
<u>72</u>	<u> </u>	<u>0</u>

14

-11		<u>-44</u>
		<u> </u>
<u> </u>	<u>-38</u>	<u>-65</u>

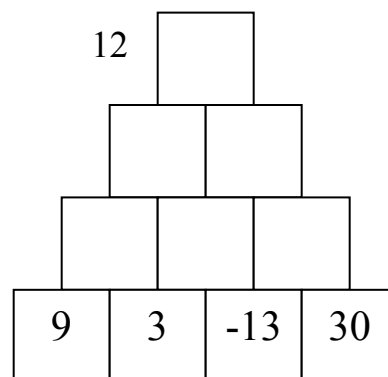
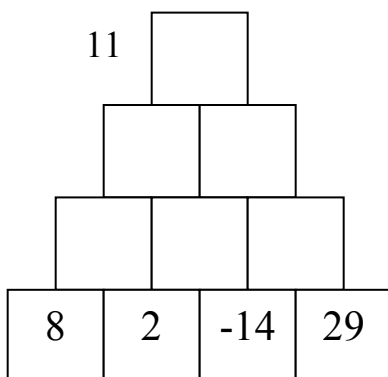
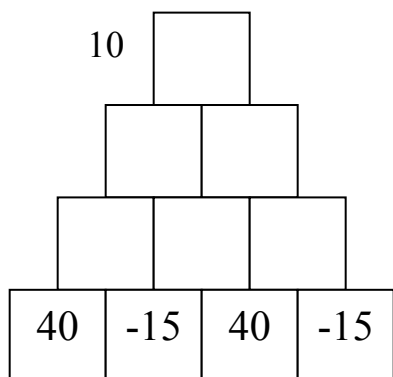
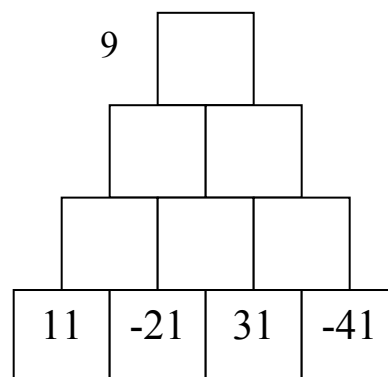
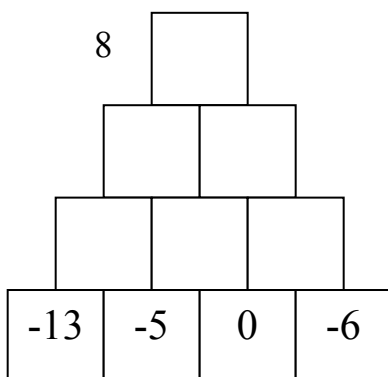
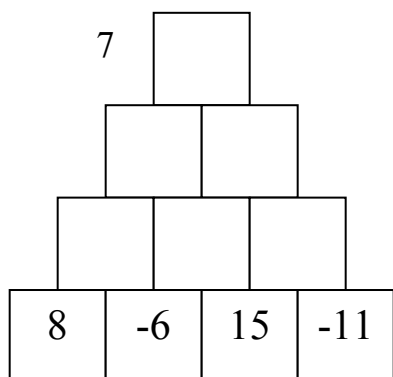
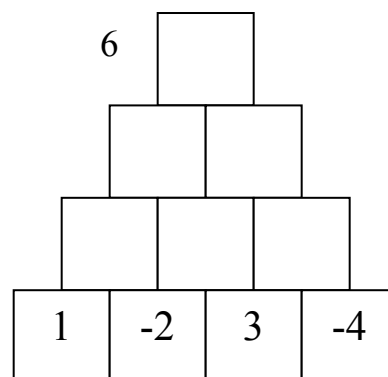
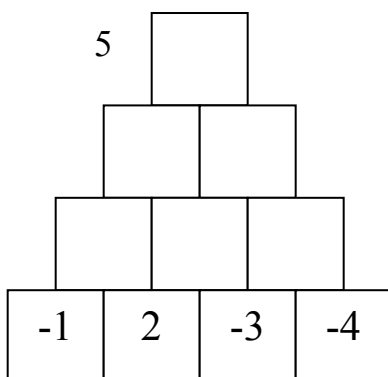
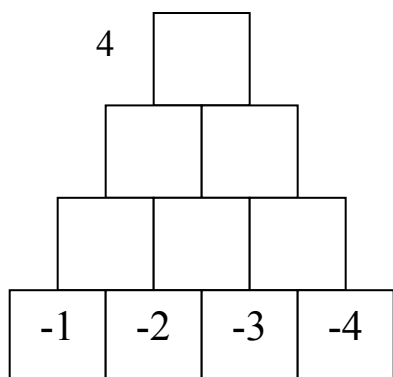
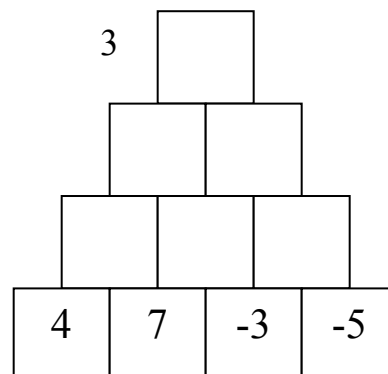
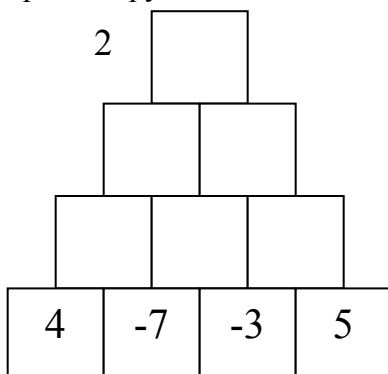
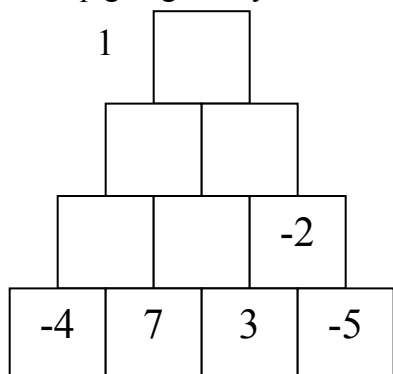
15

	33	<u>-35</u>
41		<u> </u>
<u> </u>	<u>-51</u>	<u> </u>

Pyramid Math 3

Name _____

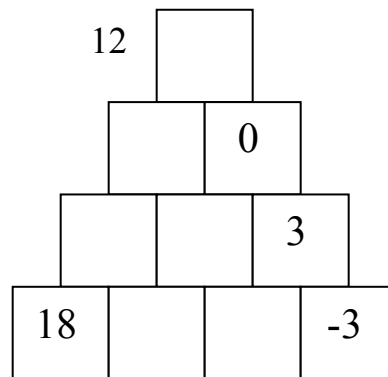
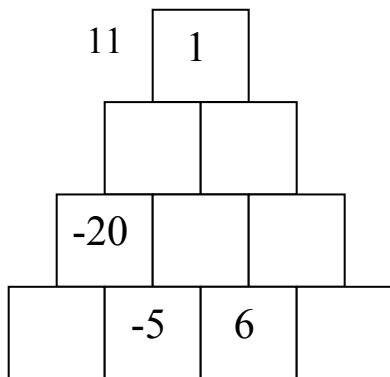
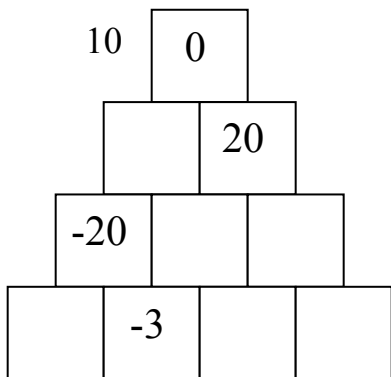
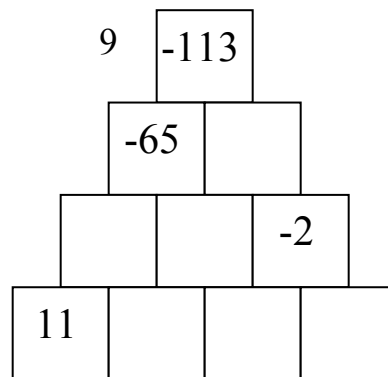
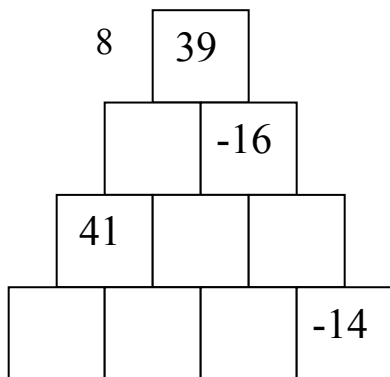
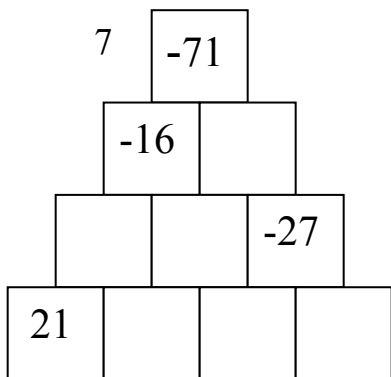
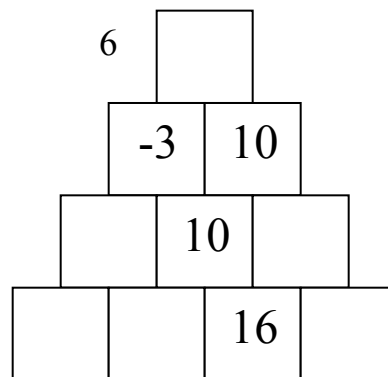
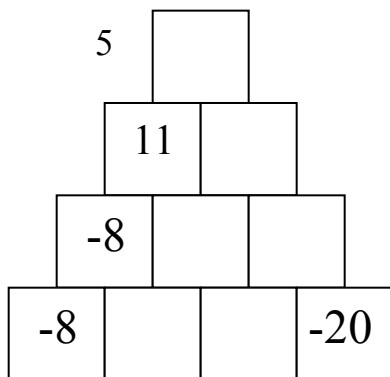
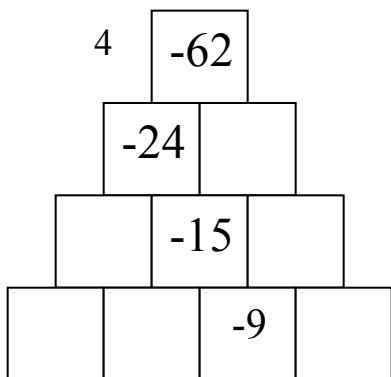
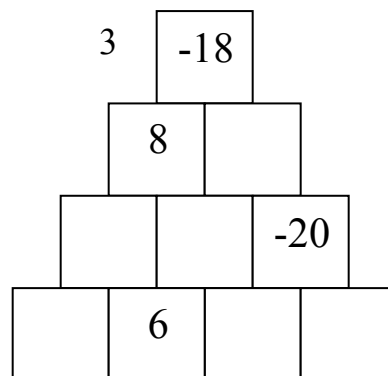
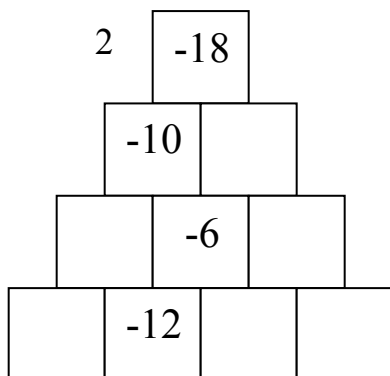
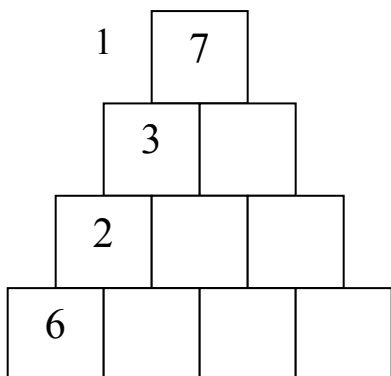
Add pairs of adjacent numbers and write their sums in the box above them as in the first example. Keep going until you reach the top of the pyramid.



Pyramid Math 8

Name _____

Each number is the sum of the two numbers below it. Work backward to fill in the bottom row.



Materials:

- Activity Master
- Transparency Master
- Calculators

Overview:

Many students don't realize how one missing assignment impacts their grade. This activity will show them that exponential growth is the problem they must overcome to catch up.

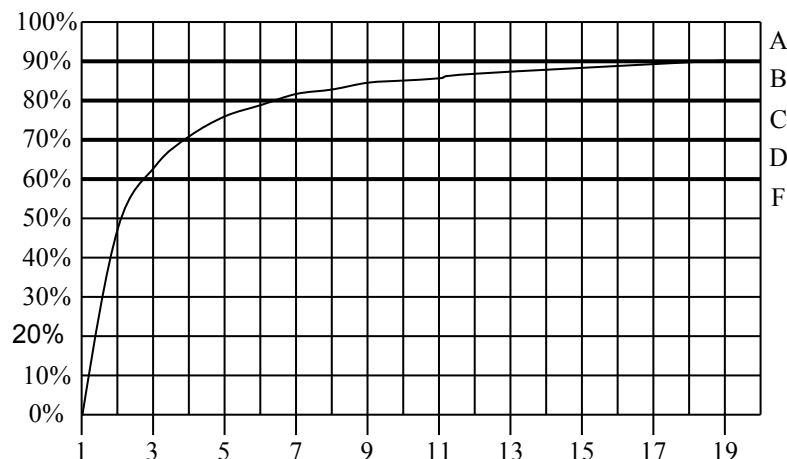
Vocabulary: percent, exponential growth, asymptote

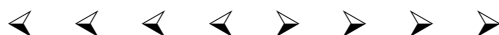
PROCEDURE

- Skills:
- Modeling exponential growth
- Graphing functions
- Using t-charts
- Studying asymptotes
- Converting decimals to percents
- Learning the importance of completing work

1. Pose this question to the class: A student usually scores 95% on his assignments. However, he doesn't complete the first assignment and receives zero points. How many 95% grades will the student need to achieve an average of 90% overall? You may wish to allow students to discuss this in groups or write about the solution in their journals.
2. Pass out the graph paper, or use the activity master to model the activity. The class will see that on assignment one, the student received zero points and has an average grade of zero percent. Have the class put a dot on the graph at week one to show the student has zero percent. Ask them what grade this would be.
3. On line two, the students should enter 95 points and calculate the average of 95 and zero. The new average of 48% (rounded from 47.5%) should be marked on the graph at week two. Ask the students what grade this represents. They can see from the graph that a grade below 60% is an F. Ask them how long they think it will take to catch up to the A grade. Some may say it will take two weeks, believing this to be a linear pattern.
4. Have the students complete the line for assignment three on the t-chart. They will now have a total of 190 points and an average of 63%. This would be a D grade. Upon graphing this, the students will see that the function is not linear. They may want to revise their predictions.
5. Have the students continue working on the problem until they reach a 90% average. This will happen on the nineteenth assignment as shown in this graph and t-chart.

Assign.	Total	Avg.	Grade
1	0	0%	F
2	95	47.5%	F
3	190	63.3%	D
4	285	71.3%	C
5	380	76%	C
6	475	79.2%	C
7	570	81.4%	B
8	665	83.1%	B
9	760	84.4%	B
10	855	85.5%	B
11	950	86.4%	B
12	1045	87.1%	B
13	1140	87.7%	B
14	1235	88.2%	B
15	1330	88.7%	B
16	1425	89.1%	B
17	1520	89.4%	B
18	1615	89.7%	B
19	1710	90%	A





Journal Prompts:



Why does it take so long for the student to catch up to an A?
If the second assignment raised the average over 45%, why didn't the next assignment do the same?

Homework:



You can assign the homework master at the end of this section.
Students will make t-charts and graphs for related problems.
You can have students explore the following problem or others like it.
Assume that the student usually gets 85% on assignments. Use a t-chart and graph to show how long it takes to get back into the B range. Would the student have a D after three assignments as in the previous example? How high would the grade be after 25 assignments? Could the student get an A at this rate?

Taking a Closer Look:



You may wish to have students explore the following extensions. What will be the student's average after 25 assignments? ...after 50 assignments? ...after 100 assignments? When will they reach an average of 95%? These questions lead students toward an understanding of asymptotes. The student can never complete enough 95% assignments to achieve a 95% average due to the effect of the initial zero. However, the student can get increasingly close to a 95% average. Thus the asymptote for this problem is at 95%.

Have students explore each of these options. Some of them are included in the homework master.

- How many assignments would it take to reach the 90% level if the student only averaged 94% on each assignment?
- How many assignments would it take to reach the 90% level if the student averaged 96% on each assignment?
- How many assignments would it take to reach the 90% level if the student averaged 100% on each assignment?
- How many assignments would it take to reach the 90% level if the student only averaged 91% on each assignment?
- How many assignments would it take to reach the 90% level if the student averaged 105% on each assignment through the use of extra credit?
- How many assignments would it take to reach the 90% level if the student averaged 95% on each assignment, but the first assignment was a 50% instead of a zero? (This should help students to see that getting an F on an assignment is better than not doing it at all.)

Algebra students can use a formula to solve these problems. If x represents the total number of assignments, then the number on which the student scored 95% would be $x - 1$. These assignments

Good Tip!



Divide the class into groups and have each explore one of the options shown on the left. Then they can present their solutions and conclusions to the class.

have a value of .95 each. However, we would need to divide by x to get an average of .90. Thus the equation yielding the number of assignments would be:

$$\frac{.95(x-1)}{x} = .90$$

The solution of the equation would be:

$$\begin{aligned} \frac{.95(x-1)}{x}(x) &= .90(x) \\ .95(x-1) &= .90x \\ .95x - .95 &= .90x \\ .95x - .95 + .95 &= .90x + .95 \\ .95x &= .90x + .95 \\ .95x - .90x &= .90x + .95 - .90x \\ .05x &= .95 \\ \frac{.05x}{.05} &= \frac{.95}{.05} \\ x &= 19 \end{aligned}$$

If the students are exploring option f above, the formula would be:

$$\begin{aligned} \frac{.95(x-1) + .50}{x} &= .90 \\ \frac{.95(x-1) + .50}{x}(x) &= .90(x) \\ .95(x-1) + .50 &= .90x \\ .95x - .95 + .50 &= .90x \\ .95x - .45 &= .90x \\ .95x - .45 + .45 &= .90x + .45 \\ .95x &= .90x + .45 \\ .95x - .90x &= .90x + .45 - .90x \\ .05x &= .45 \\ \frac{.05x}{.05} &= \frac{.45}{.05} \\ x &= 9 \end{aligned}$$

Assessment:



While students work on the problem, walk about the room and check their graphs. Since the graph is based on the t-chart it provides a visual key for quick assessment.

By having students work on problems as a group and then presenting their results to the class, you will not need to correct a large amount of papers.

Lastly, by using the formula provided, you will be able to check the accuracy of their work quickly.

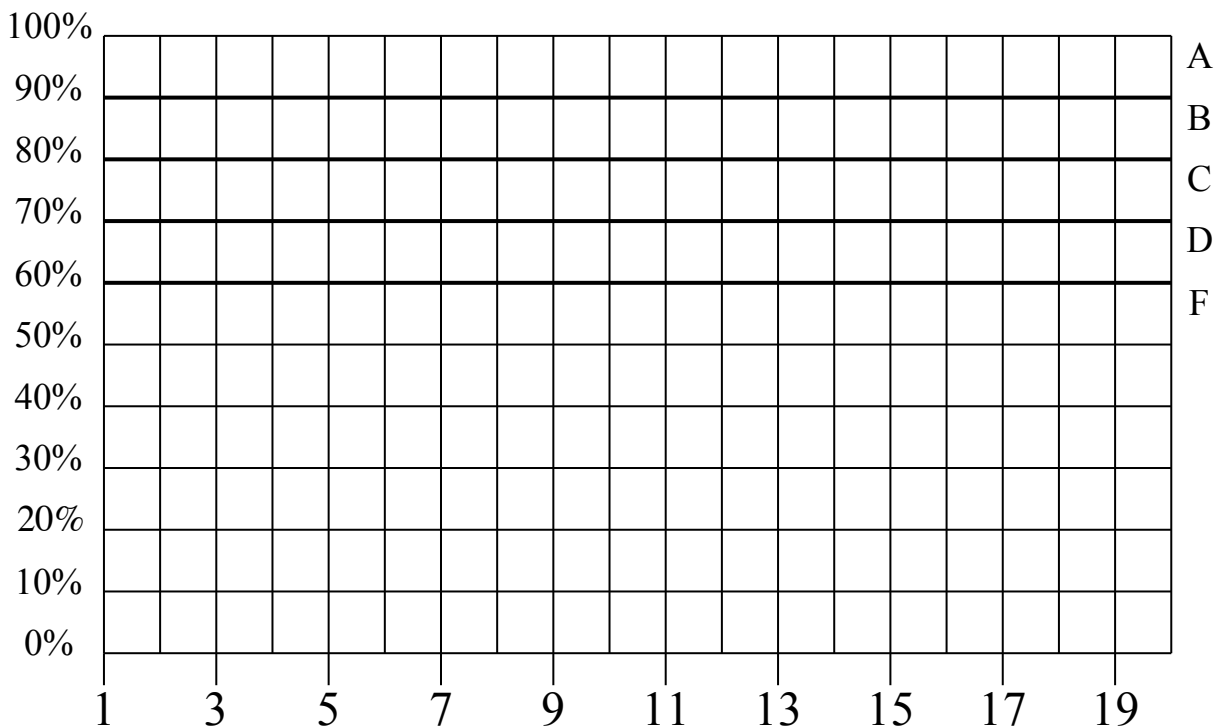
Playing Catch Up

Assign: Total Percent Grade

1	0		
2			
3			
4			
5			
6			
7			
8			
9			
10			

Assign: Total Percent Grade

11			
12			
13			
14			
15			
16			
17			
18			
19			
20			



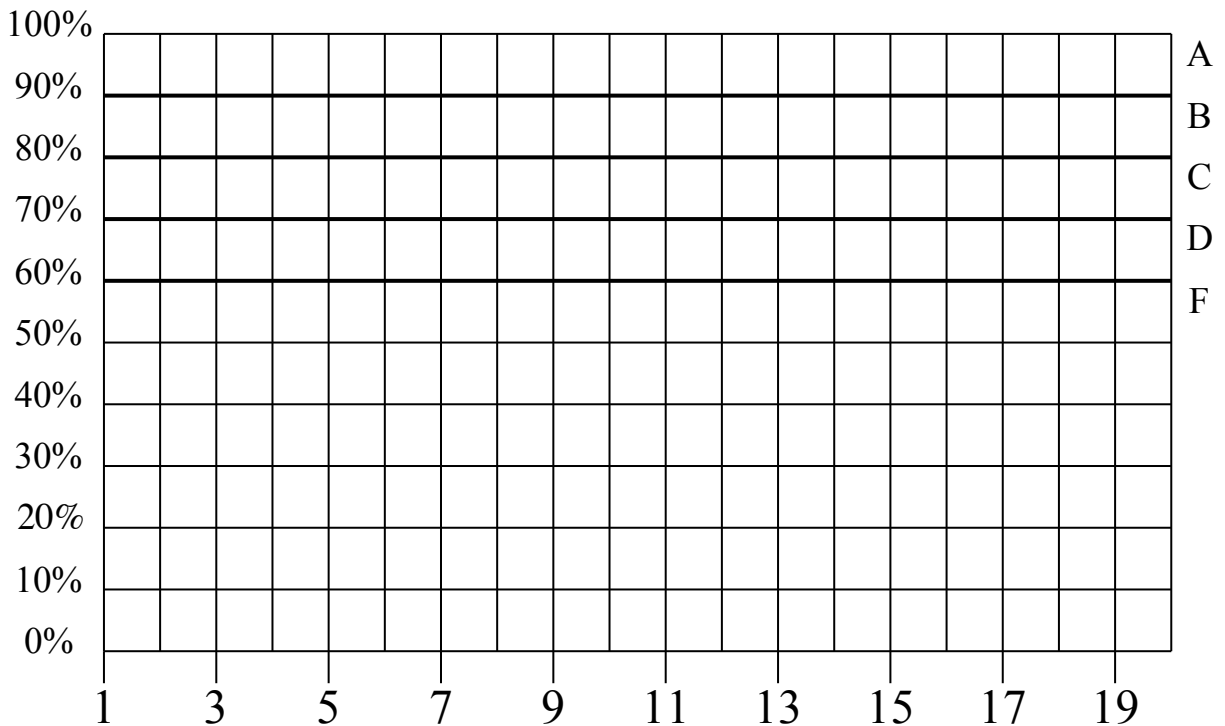
Playing Catch Up

Assign: Total Percent Grade

1	50		
2			
3			
4			
5			
6			
7			
8			
9			
10			

Assign: Total Percent Grade

11			
12			
13			
14			
15			
16			
17			
18			
19			
20			



5. Who got his or her desired grade the fastest? _____

6. Who was the slowest at reaching his or her goal? _____

7. How did the time it took Brenda to reach her goal compare to Andy's time? Why is that?

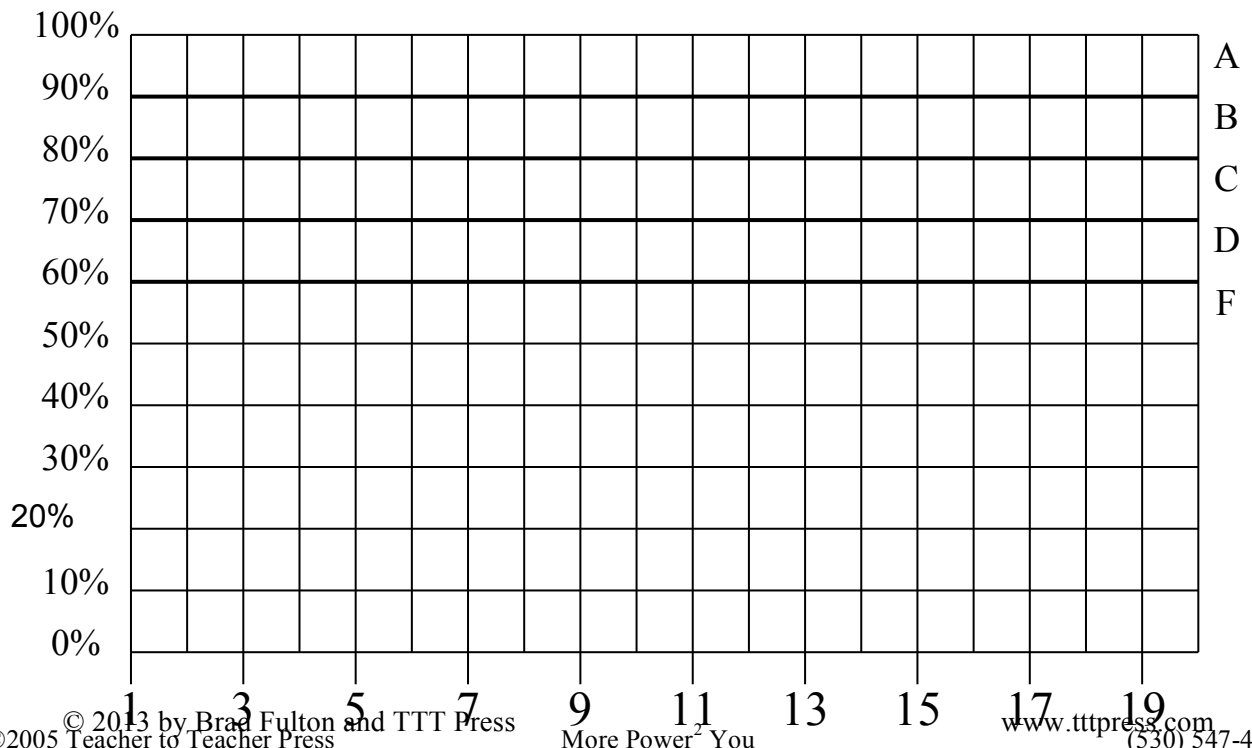
8. Which student can never earn an A at the current rate? _____

Why is that? _____

9. What might a student be able to do to accelerate their progress toward their goal?

10. How is this assignment similar to or different from the grading system in your own class?

11. What surprised you the most about this assignment?



Backwards and Upside Down

An Article for the California League of Schools newsletter, February 2005

By Brad Fulton, brad@tttpress.com

It's just like coaching high jump—teaching mathematics that is. Like math students, high jumpers try to reach new heights and clear the bar. The posts that support the bar are called the standards. If you want to raise the bar, you raise the standards. Good jumping requires an optimistic mindset as well as physical skill. *The worst thing a coach can do to a struggling jumper is raise the bar.* Yet that is just what has happened here in California and much of the rest of the nation. Experience has convinced me that we can reach new heights however, but we need to take a lesson from jumping coaches.

In the 1968 Olympics in Mexico City, the high jumpers approached the bar at an angle from the left side. Prior to their vault, the jumper would swing up the right leg and go over the bar sideways facing down in what was known as the “Western Roll.” One young college kid from the University of Oregon approached the bar in a semi-circle from the right side. On his last step, he kicked his left knee up and across his chest, turning his body in midair. This made him go over the bar upside down and backwards. On that day, Dick Fosberry took home the gold medal and the Fosberry Flop that every modern jumper now uses was born. *If we are going to succeed where others have failed, we need a new approach too.* Let me offer three proven strategies to help coach our students to these new heights

First we need to teach math to students, not to mathematicians. We have decades of research that confirms that students learn differently. In the early 1970's, I was one of ten males in my pre-calculus class. We were the mathematical thinkers. But what of the students who learned kinesthetically, spatially, linguistically, or by any other learning style? They had been sifted out of the mix. The mathematics class of today must invite *all* students. This will require change not on the part of the student but of the mathematics educator. We must take advantage of the diverse instructional strategies available to us.

High jump coaches often use a device called a springboard to help their athletes practice. We must also be willing to use the textbooks offered to us as springboards instead of crutches. A textbook is a reference work. In science it supplements a curriculum that includes hands-on labs. In English class, it supplements rich discussions about great literature. Yet in math, we have been taken captive to the thinking that we shouldn't stray too far from the page. The truth is that our books don't teach students; we do. If we are to offer a more successful curriculum, it must come from us with the help of texts and other materials. This will require districts to provide more training so their staff can develop greater expertise with the subject.

Lastly, we need to know that elementary students do not reason as abstractly as older students. *I am convinced that higher mathematical content is not out of the reach of younger minds if we present it concretely.* This belief is based on my experiences with younger students and upon the testimonies of countless teachers I have met. I have seen fourth graders who can look at a linear function and talk about its slope and y-intercept. I

have seen fifth graders solve systems of equations algebraically and graphically. Students in special education can solve equations with understanding. In each case, the material was presented concretely allowing the students to have access to the content.

While an article of this length is not sufficient to provide detailed math lessons, it can help us to see our need to change how we coach our students. It can also encourage us to see that we *can* reach new heights. Awareness of learning styles, a more open approach to materials, and concrete instruction will help more students to clear the bar—even those who approach mathematics a little upside-down and backwards