



This material is copyrighted and protected by U.S. anti-piracy laws.

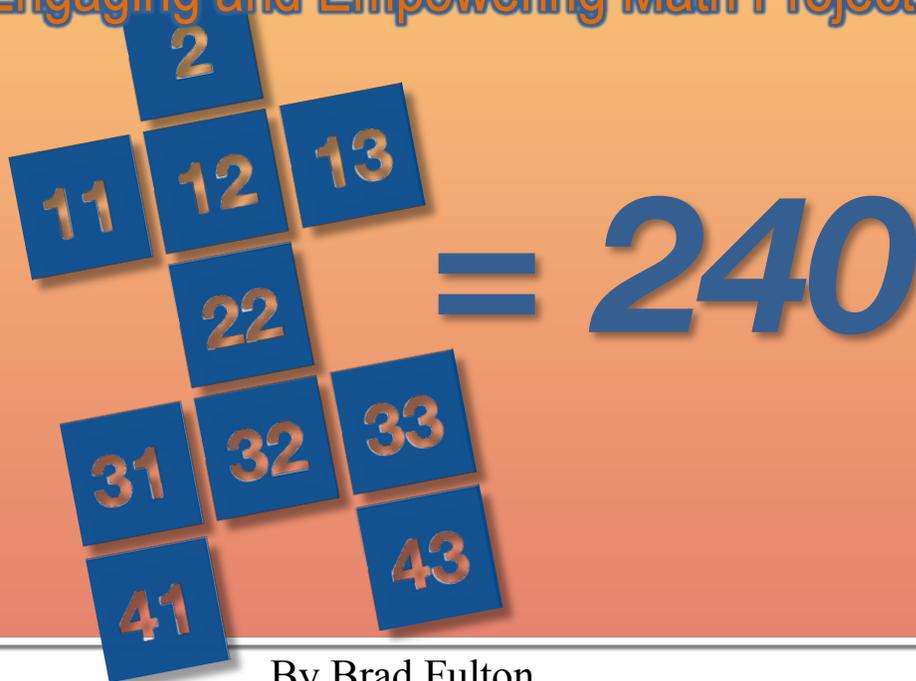
© 2019 by Teacher to Teacher Press. All rights reserved.

As a purchaser of this handout, you have a single-user license. You may duplicate student activity pages for your own classroom use only. Any unauthorized duplication of these materials by physical or electronic means or any public performance and demonstration of these materials without prior written consent of Teacher to Teacher Press are strictly prohibited.

If you should need written permission, you may contact Teacher to Teacher Press at their website, www.tttpress.com.

ALGEBRA MAN

An Engaging and Empowering Math Project



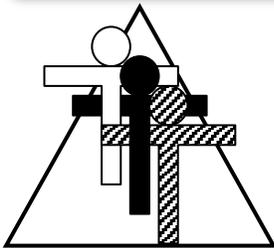
By Brad Fulton

Educator of the Year, 2005

brad@tttpress.com www.tttpress.com

530-547-4687

P.O. Box 233, Millville, CA 96062



Teacher to Teacher Press

Join us!



Facebook: TeacherToTeacherPress



Twitter: @tttpress



/watchtttpress





Brad Fulton Educator of the Year

- ◆ Consultant
- ◆ Educator
- ◆ Author
- ◆ Keynote presenter
- ◆ Teacher trainer
- ◆ Conference speaker

PO Box 233, Millville, CA 96062
(530) 547-4687
brad@tttpress.com

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 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 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

Like my activities? How about giving me a favorable rating on the Teachers Pay Teachers website? Four stars would be much appreciated and would help me sleep better at night.



Like me even more? Then please don't make copies for your colleagues. I know it's tempting when they say, "Wow! Groovy activity! Can I have a copy?" But this is how I make my money, and why are they still saying "groovy" anyway?



If we make copies for our friends, can we honestly tell our students not to copy or take things that don't belong to them? (Ouch!)



Discounted site licensed copies are available on the TPT website. Please encourage them to take advantage of this affordable option. Okay?



Thanks and happy teaching,

Brad 

I want...

- a) Effective staff development
- b) Affordable staff development
- c) Ongoing staff development
- d) **ALL OF THE ABOVE!**

www.tttpress.com
brad@tttpress.com



- ◆ **Effective because** they are classroom-tested and classroom-proven. These popular DVDs of Brad’s trainings have been utilized by teachers throughout the country for years.
- ◆ **Affordable because** they are site-licensed. Buy only one copy for your whole school, print as many copies of the handouts as you need.
- ◆ **Ongoing because** when you hire new staff, simply hit “play” and the training begins. There’s no need to bring back the consultant.

Algebra Man Conquers the Hundreds Chart!

An Engaging and Powerful Math Project

Overview:

Are you a “mathmagician”? How did you do that so quickly and so easily? From the outset, your students will be engaged; they’ll demand to know your trick. It looks so impressive, but the algebra behind it is easy to grasp. Students will have so much fun, they will want to design their own projects, and that is the point!

This project is designed to follow my other handout, “Hundreds Magic: Where Math Comes Alive!” Older students with some familiarity with algebra may not need the previous instruction. However if you wish to have students in a pre-algebra setting try their hand at the project, it is best to walk them through the Hundreds Magic lesson first.

Required Materials:

- Display copy of the hundreds chart
- Practice charts
- Project instructions
- Project templates

Optional Materials:

- Calculators

Procedure

1. Display a copy of the hundreds chart. Here are some ways to do this:
 - You can make a transparency of the master provided if you are using an overhead projector.
 - You can scan the master provided and project it.
 - You can download one from the internet using an image search.
2. Have a student outline ten numbers in the shape of Algebra Man. They need to make sure that the ten numbers are in the correct arrangement. Have them do this while your back is turned.
3. Immediately you turn around and tell the sum of the ten numbers! Have them verify that you are correct by adding with pencil and paper or with calculators.
4. How did you do that so quickly? I tell my middle school students that I am incredibly brilliant. They don’t buy it and insist that I’m using a trick. Some think I just got lucky, so I let them try it again by moving Algebra Man to a new location. They can re-draw Algebra Man if you wish, but here are some easier options.
 - If you are using an overhead projector, simply layer a transparency of Algebra Man on top of the transparency of the

43	44	45
53	54	55
63	64	65
73	74	75
83	84	85

hundreds chart. Then they can slide Algebra Man to any location they wish.

- Since I have an interactive board in my class, I scanned an image of the hundreds chart. Then I outlined Algebra Man in a continuous motion using the pen tool. This allowed me to select the outline using the selection tool and move it to new locations.
5. No matter where they move Algebra Man, you always get the sum correct quickly. How are you doing that?
 6. Now you have a couple of options. You can move on to the instruction phase of the project so that you reveal the secret to *all* the students. Or you can keep repeating the trick. Eventually some students will see a pattern and be able to do the trick as well. This will drive the other students crazy and engage them even more. Typically I do the trick once on Monday as a morning hook. Then I repeat the trick on Tuesday and move on without explaining it. By Wednesday, students are expecting this and are fully engaged. By Thursday, some students are figuring out the trick, and by Friday the others are begging you to teach them. When was the last time your students *begged* to learn math?

How it works:

7. Place Algebra Man at any location on the hundred's chart. Ask the students what number is in his waist? In the first example, his waist contains a 37.

Move him to a new location. Now his waist contains a 53.

Move him to a third location and repeat the question. His waist holds a 22.

5	6	7	8	9
15	16	17	18	19
25	26	27	28	29
35	36	37	38	39
45	46	47	48	49
55	56	57	58	59
65	66	67	68	69

21	22	23	24	25
31	32	33	34	35
41	42	43	44	45
51	52	53	54	55
61	62	63	64	65
71	72	73	74	75
81	82	83	84	85

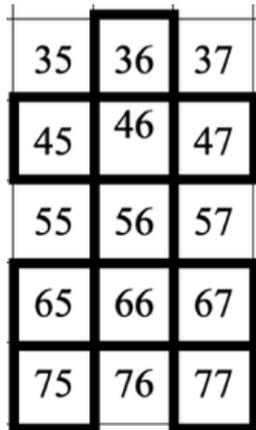
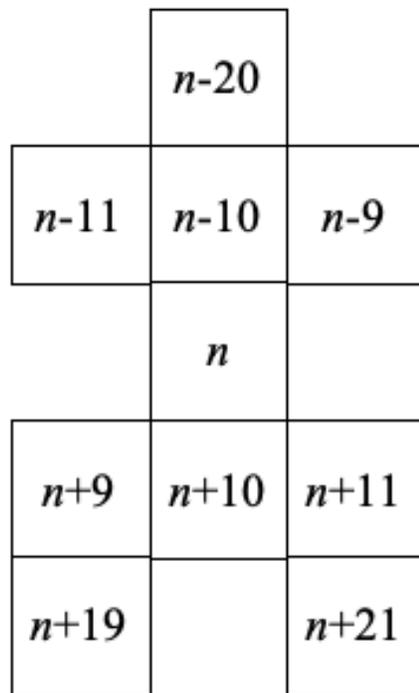
1	2	3	4	5
11	12	13	14	15
21	22	23	24	25
31	32	33	34	35
41	42	43	44	45
51	52	53	54	55
61	62	63	64	65

The object is to show that the numbers can *vary*. Since they vary, we can use a *variable* to represent them.

8. Now let's put a variable in place of the number in the waist. We'll use n to represent some number.

9. Ask the students, "How does the number *below* Algebra Man's waist compare to the number *in* his waist?" It is *ten more*. This is true *no matter where* Algebra Man chooses to hang out. Thus we can write the number below his waist as $n+10$.
10. How does the number *above* his waist compare to the number *in* his waist? It is ten *less*. Thus we can write it using a variable as $n-10$.
11. What is the sum of the three variable expressions so far? Clearly it is $3n$ since the constants have a sum of zero.
12. Now write an expression for his right hip. It is $n+9$. What expression represents his left arm? It is $n-9$. The sum of the first five expressions is $5n$.
13. Write an expression for his left hip. It is $n+11$, and his right hand is $n-11$. Thus the first seven expressions sum to $7n$.
14. What expression would we write in Algebra Man's head? It would be $n-20$. What should we write in his *left foot*? It would be $n+21$. The sum of the first nine terms would be $9n+1$.
15. Lastly, our expression for Algebra Man's *right foot* would be $n+19$. When we combine like terms for all ten cells of the design we get the expression $10n+20$.
16. Now the math becomes easy. Consider the example shown below.

$$\begin{array}{r}
 n \\
 n+10 \\
 + n-10 \\
 \hline
 3n
 \end{array}$$



The number 56 is in his waist. We substitute this into the expression and solve mentally:

$$\begin{array}{r}
 10(56)+20 \\
 560+20 \\
 580
 \end{array}$$

Ta-da!

17. Some students who figured out the trick may say that they didn't do it that way. They might say that they simply looked two spaces to the right of the waist and put a zero on that number.
18. If that happens, you can show that moving two spaces to the right of the waist can be represented by the expression $n+2$. Putting a zero on the number is actually multiplying it by ten. Thus, their expression is $10(n+2)$ but that is really the factored form of the previous expression!

$$10(n+2) = 10n+20$$

35	36	37	38
45	46	47	48
55	56	57	58
65	66	67	68
75	76	77	78

19. Let students practice by moving Algebra Man to a new location and having them calculate the sum mentally. They can then verify with pencil and paper or with a calculator that they are correct.
20. Students once tricked me by placing Algebra Man upside down on the hundreds chart while my back was turned. When I turned around, I had a momentary panic as I tried to calculate the sum. Then I thought, since he is upside down, maybe the expression is $10n$ minus 20. I tried it, and it worked! Students can verify this by writing algebraic expressions in each cell and combining like terms.

35	36	37
45	46	47
55	56	57
65	66	67
75	76	77

Good Tip:



Do you want a homework or practice assignment to go with this lesson? Ask the students to find the expression for the sum of Algebra Man when he is laying down on his right side.

44	45	46	47	48
54	55	56	57	58
64	65	66	67	68

21. Students are now ready to create their own projects. They should create a design that uses *ten* cells. This is because they can easily multiply by ten in their heads. They may want to make an image such as Algebra Man. Many of my students made a block letter of their name. For example, Eric or Elizabeth could make an “E” using ten cells.
22. They should move draw it in three different locations on the three practice charts.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

23. Then they need to sum of their three examples. This will help them see the formula. In the three examples above, they sum to 327, 457, and 647 respectively. This suggests that the middle number of the left column (shown by the red circle in the second example) is the key number the “mathmagician” will use. By multiplying it by ten and adding seven, the sum is easily calculated.

24. Now the students need to write algebraic expressions for each of the ten cells using the key number as their variable. This is shown here using x as the variable.

$x-20$	$x-19$	$x-18$
$x-10$		
x	$x+1$	
$x+10$		
$x+20$	$x+21$	$x+22$

25. Next we combine like terms and see that our predicted formula was correct!
26. All that remains is to display this on the final project. The project needs to include these components:
 - a) Their shape on the hundreds chart with the key cell highlighted
 - b) The algebraic expressions written neatly in an enlarged version
 - c) The list of terms added correctly
 - d) The example from the hundreds chart substituted into their formula
 - e) Their name and title

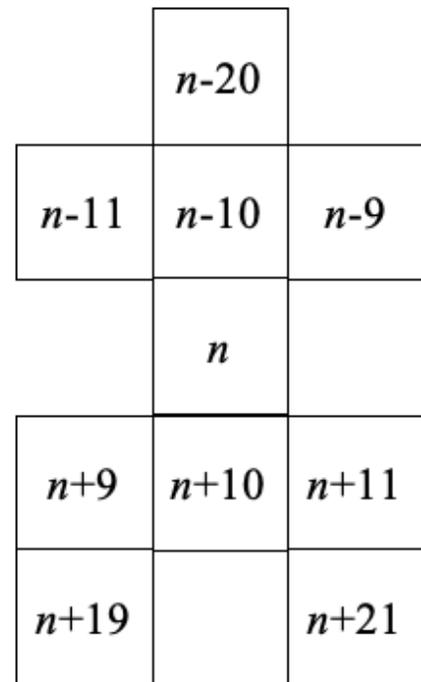
$$\begin{array}{r}
 x-20 \\
 x-19 \\
 x-18 \\
 x-10 \\
 x \\
 x+ 1 \\
 x+ 10 \\
 x+ 20 \\
 x+ 21 \\
 + \underline{x+ 22} \\
 \hline
 10x+ 7
 \end{array}$$

27. An example showing all five components is on the following page.
28. Masters for the project are on the pages following the example. Copy pages 11 and 12 for the students. Provide copies of pages 13, 14, and 15 as well. Assessment instructions follow that. Copies of actual student projects are at the end.

Your Title

Your Name

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100



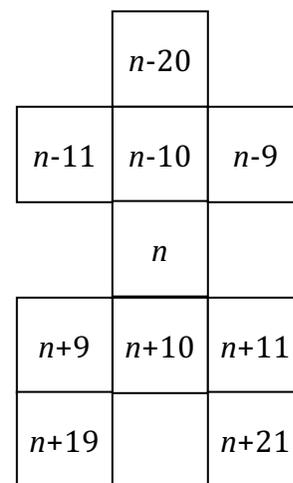
$$\begin{array}{r}
 n \\
 n+10 \\
 n-10 \\
 n+11 \\
 n-11 \\
 n+9 \\
 n-9 \\
 n+21 \\
 n-20 \\
 \hline
 + n+19 \\
 \hline
 10n+20
 \end{array}$$

$$10(44) + 20 = 460$$

Algebra Man Project Instructions

Planning your project:

1. Design a shape of ten cells on the hundreds chart.
2. Place your pattern on the chart and find the sum of the ten cells.
3. Do this two more times. What pattern do you notice? This will give you a clue as to the formula and will show you what cell to use for your *key*.
4. Now write a variable such as x or n in your key cell.
5. Write the expressions for the other nine cells of your shape as shown in the top figure.
6. Combine like terms to find the total as shown in the second figure. You are now ready to begin your final project.



Designing your project:

7. Neatly glue a hundreds chart onto your final paper.
8. Outline your design on the chart.
9. Highlight your key cell.
10. Show the sum of your ten cells arithmetically (with numbers) and algebraically (with expressions).
11. Center your title at the top of the paper.
12. Your project should then look like the samples.

$$\begin{array}{r}
 n \\
 n+10 \\
 n-10 \\
 n+11 \\
 n-11 \\
 n+9 \\
 n-9 \\
 n+21 \\
 n-20 \\
 \hline
 + n+19 \\
 10n+20 \\
 10(n+2)
 \end{array}$$

Grade Sheet (cut out and tape to the back of your project)

Mathematics..... ____/20
 addition, expressions, combining like terms, formula

Measurement..... ____/10
 centered title, alignment of terms, parallel and perpendicular edges

Presentation..... ____/10
 spelling, creativity, coloring, neatness

Other _____

Total..... ____/40

Practice charts

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Project chart

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Algebraic terms chart

Assessment:

This project takes my students two to three class periods to finish. We do all our work in class; I wouldn't expect parents to understand how to help their children on a task such as this. However, it only takes me a minute or so to assess it.

When they submit it for grading, they should tape the grade sheet to the back.

I assess them on three areas: math, measurement, and presentation. Some students may wonder why presentation counts in a math grade. I explain that my tie doesn't help me do math, but it helped me get the job. If they want an A, they need to put a tie on their project. They love making math beautiful.

Math accounts for 50% of the grade, and measurement and aesthetics are worth 25% each. The project is worth 40 points in my grading system. You can of course adjust the points I've assigned to suit your own grading scale.

I quickly check spelling, creativity, coloring, and neatness visually. If I find an error, such as a spelling mistake, I simply circle "spelling" on the grade sheet and subtract some points. I don't mark the error. I want them to find it, plus I don't want to mark up their project. Typically they will find the error themselves. If they need help, they can ask me. They often ask if they can fix the error and get more points. I encourage them to do this.

Next I give a visual check to the measurement component. They think I check their centering of their title and the perpendicularity of their lines with a ruler and protractor. Actually, I just glance at it. Your eye can easily tell when lines are not parallel or a as little as little as one degree of discrepancy in a 90° angle.

Lastly, I check the math. Often they have caught any math errors as they worked on the project as the formula should have matched the results of their addition. I simply add the constants of their terms. There is no need to add the variables as all the designs incorporate ten cells. As I said, the entire process takes about a minute. Learning occurs in the doing, not in the grading, so my projects maximize their rigor while simplifying my work.

Grade Sheet (cut out and tape to the back of your project)

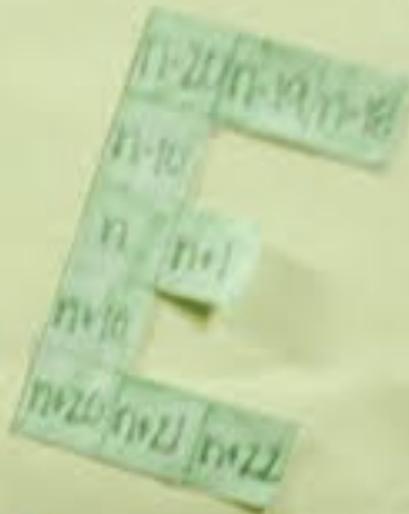
Mathematics.....	____/20
addition, expressions, combining like terms, formula	
Measurement.....	____/10
centered title, alignment of terms, parallel and perpendicular edges	
Presentation.....	____/10
spelling, creativity, coloring, neatness	
Other _____	
Total.....	____/40

ALGEBRA "E"

$n-20$
 $n-19$
 $n-18$
 $n-10$
 $+n$

$n+1$
 $n+10$
 $n+20$
 $n+21$
 $n+22$

$$\underline{10n+7}$$



$$10(43)+7=$$

$$430+7=$$

437

By: Emily Hoke

ALGEBRA "C"

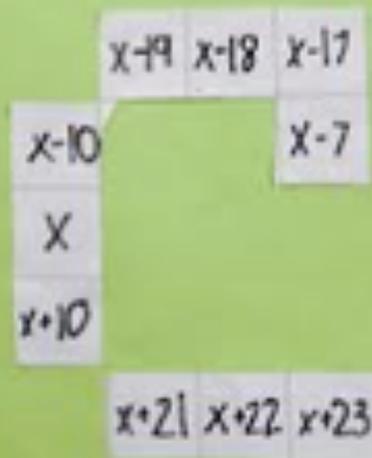


$$\begin{array}{r}
 x \\
 x-10 \\
 x-19 \\
 x-18 \\
 x-17 \\
 x-7 \\
 x+10 \\
 x+21 \\
 x+22 \\
 x+23 \\
 \hline
 10x+5
 \end{array}$$

$$10x+5 =$$

$$10(53) + 5$$

$$530 + 5 = \textcircled{535}$$



Casey Norrington

If you liked this activity, you might also like some of the other lessons available in my TeachersPayTeachers store. Simply search for "Teacher to Teacher Press".

You can also find many free and inexpensive resources on my personal website, www.tttpress.com. **Be sure to subscribe to receive monthly newsletters, blogs, and FREE activities.**

Similar *S.T.E.M. ON A SHOESTRING* activities include:

- *3-D Name Project* - My students' favorite project involves writing their name in three dimensions and calculating the volume and surface area.
- *Getting to Know You* - Fractions, decimals, percent, data, and geometry come alive in this fun project.
- *Developing Proportional Reasoning* - Students use proportions to illustrate a typical day in their life.
- *Super Tangram* - Geometry integrates with fractions, decimals, percent, and algebra!
- *Function Fun 5: the King's Pathway* - Student's create beautiful linear functions as they learn about slope, y-intercept, and more!
- *Exponential Growth Project* - Students can see how exponential growth looks in this great project. They'll even understand why $n^0 = 1$!

Feel free to contact me if you have questions or comments or would like to discuss a staff development training or keynote address at your site.

Happy teaching,

Brad