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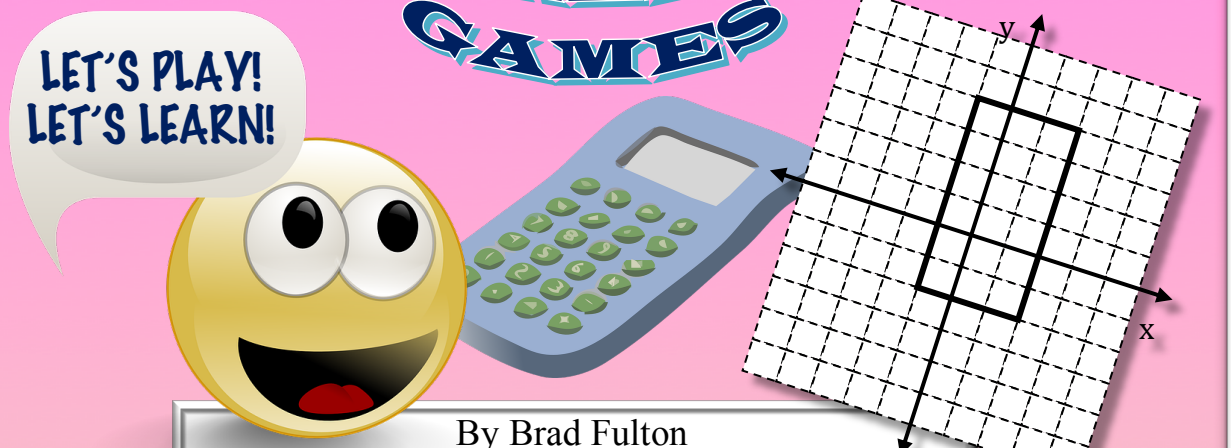
Pins & Posts

GREAT GAMES



By Brad Fulton
Educator of the Year, 2005
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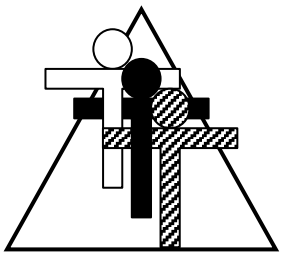

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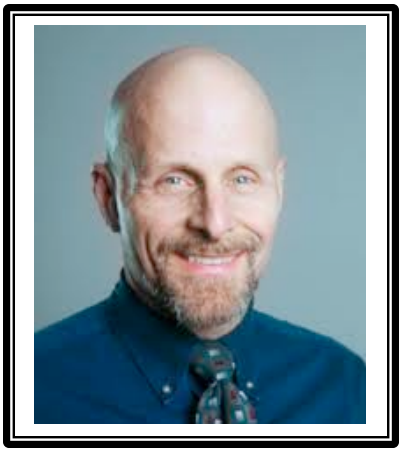

Brad Fulton

Educator of the Year

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

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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

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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 

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Pins and Posts

An empowering game to build geometric vocabulary and skill

Overview:

This is a thought-provoking game that helps students build their understanding of the properties of polygons while promoting geometric vocabulary. Each problem has many solutions, and students will be challenged to improve their score by improving their geometry skills.

Required Materials:

- ☒ Display of the activity master
- ☒ Student copies of the activity master
- ☒ Two differently colored dice or a spinner
- ☒ Polygon key

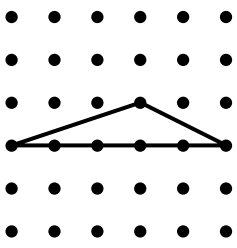
Optional Materials:

- ☐ Geoboards

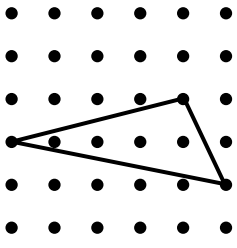
Procedure:

1. Display a transparency of the activity master and give copies to the students. They will also need to see a copy of either of the Polygon Keys. Two are provided, one for younger learners and one for more advanced students. Use the one most appropriate for your class.

2. Select two numbers randomly using spinners or dice. Two six-sided dice of different colors make this simpler. Use the Polygon Key to determine which polygon will be drawn. For example, if a three is selected first, and a two is selected second, the player must make an obtuse triangle.



3. The player then tries to draw the polygon on the Activity Master using the points as vertices. The opponent must verify that the polygon satisfies the conditions. An example is shown.



4. Scoring is based on the number of "pins" and "posts" in the polygon. A post is defined as a vertex. A pin is any point inside the polygon. To determine the score, the player subtracts the number of posts from the number of pins as shown in the first example.

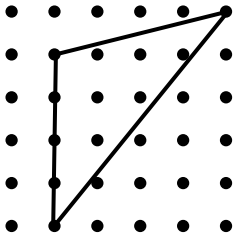
   $$pins - posts = \text{score}$$
   $$0 - 3 = -3$$

   This is obviously not a very good score. Here are two other obtuse triangles that get better scores. The second example gets a score of

   $$4 - 3 = 1$$

   The third triangle is even better. Its score is

   $$6 - 3 = 3$$



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5. After drawing the polygon, the student writes the name of the polygon and the score on the arrow next to the grid on the Activity Master.

6. The second player or team now selects two new numbers and draws the polygon determined by the Polygon Key. Again, the goal is to maximize the score by including the greatest number of pins inside the polygon. However, the number of posts (vertices) is always determined for the student by the Polygon Key. Again the student writes the name and score for the polygon.

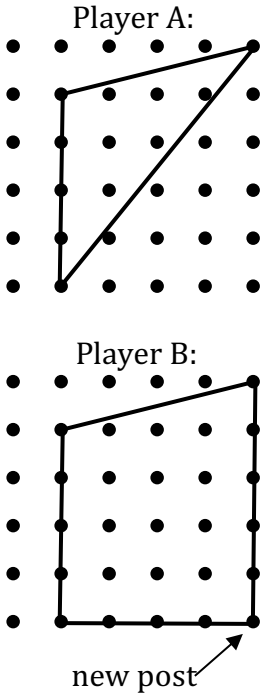
7. Students play the game for ten rounds or as time allows. After ten rounds, the students total their scores and the highest score wins.

Good Tip!

There is a math tool called a "geoboard" that has nails arranged in a grid on a board. Students can use rubber bands to make polygons on the nails. These geoboards offer a paperless version of the game. Check a mathematical supply catalog for these tools.

8. This game can promote so much critical thinking that you may wish to impose a time limit for each round.

9. The game can be customized many ways to adapt to different levels of students.
   - For younger students, any time the number of posts is greater than the number of pins, the score is zero. There are no negative scores.
   - Lowest score wins instead of the highest score.
   - Students aim for a target score such as five. Sometimes they will exceed this score and then try to come back to it in the next round with a negative score.
   - Students must build their polygon by transforming the polygon of the other player. Scoring is based upon the number of new posts (vertices) created. Low score wins. An example is shown in the margin. Here player A has formed an obtuse triangle. Player B has selected numbers 1 and 3 and must transform this shape into a right trapezoid. Player B does this creating only one new post for a score of 1.



10. A blank Polygon Key is provided for you to customize to the needs of your class.

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Journal Prompts:

Rachel has just made a parallelogram. Danielle now has to make a trapezoid. She says that she should not have to make any changes to Rachel's shape because she believes that all trapezoids are parallelograms and she should therefore get the same score. Write a note to her telling her if you agree or disagree and why.

Homework:

Students can play this game at home with a parent or sibling.

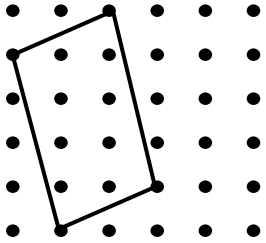
You may also give them a list of six to ten shapes from the Polygon Key. They can then try to get the best score with these shapes at home.

Taking a Closer Look:

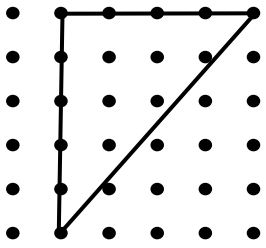
Austrian mathematician, Georg Alexander Pick (1859–1943), discovered a way to find the area of a polygon using the points inside and on the perimeter of the polygon. If you add the number of points on the inside of the polygon and half the number of points on the perimeter and then subtract one, you get the area of the polygon. Why this works is pretty advanced, but it's a very simple formula. We'll call the number of points on the inside *n* and the points on the perimeter *p* in this equation:

$$A = n + \frac{p}{2} - 1$$

Some examples are shown in the margin to illustrate this. This could be a more advanced way of keeping score in the game if you wish.



$$A = 8 + \frac{4}{2} - 1 = 9$$



$$A = 6 + \frac{10}{2} - 1 = 10$$

Assessment:

During play, this game is often self-assessing, as opponents will always check their opponent's move.
If you wish, you can have students turn in their Activity Master so you can check that their shapes match their labels.

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Polygon Key 1

Second number \ First number	1	2	3	4	5	6
1	Isosceles Triangle	Quadrilateral	Scalene Triangle	Hexagon	Trapezoid	Square
2	Rectangle	Rhombus	Obtuse Triangle	Right Triangle	Pentagon	Parallelogram
3	Right Trapezoid	Obtuse Triangle	Irregular Quadrilateral	Right Triangle	Concave Hexagon	Triangle
4	Right Scalene Triangle	Concave Pentagon	Square Area = 4 un^2	Right Isosceles Triangle	Triangle Area = 3.5 un^2	Rectangle Area > 6 un^2
5	Parallelogram Area = 6 un^2	Isosceles Trapezoid	Scalene Triangle Area = 5 un^2	Square Area < 16 un^2	Isosceles Triangle	Concave Quadrilateral
6	Obtuse Scalene Triangle	Acute Triangle	Acute Isosceles Triangle	Octagon	Obtuse Isosceles Triangle	Acute Right Triangle

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Polygon Key 2

Second number

First number

	1	2	3	4	5	6
Even	Square	Octagon	Triangle	Concave Quadrilateral	Parallelogram	Hexagon
Odd	Trapezoid	Right Triangle	Rhombus	Quadrilateral	Rectangle	Pentagon

Blank Polygon Key

Second number

First number

	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						

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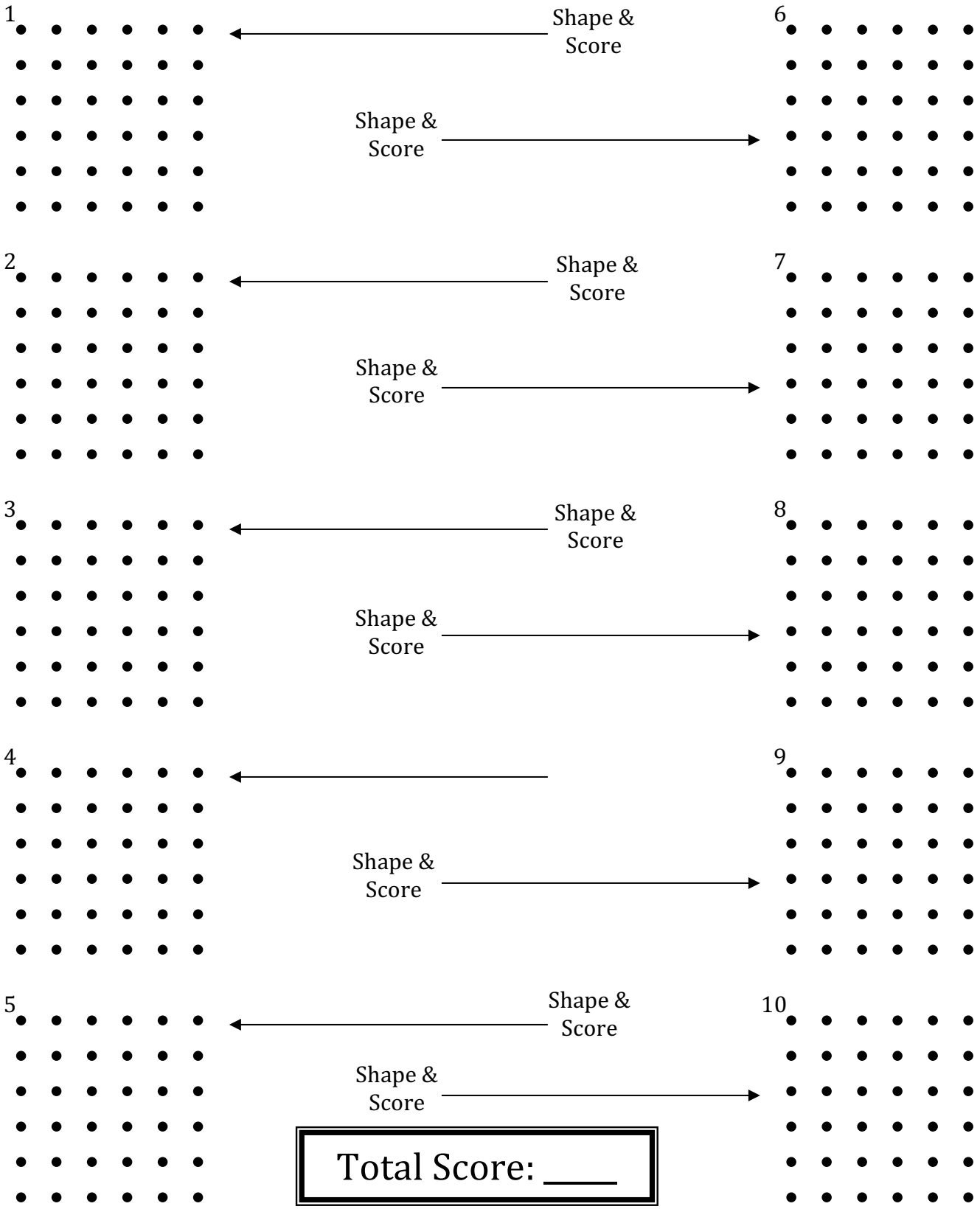
Pins and Posts

Name _____



Total Score: ____

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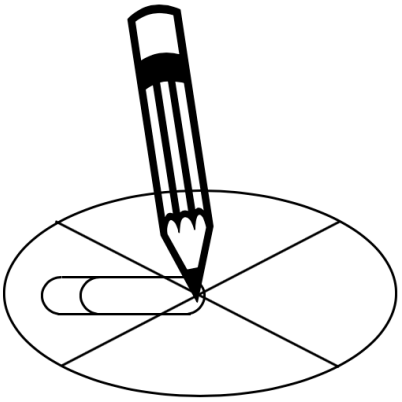

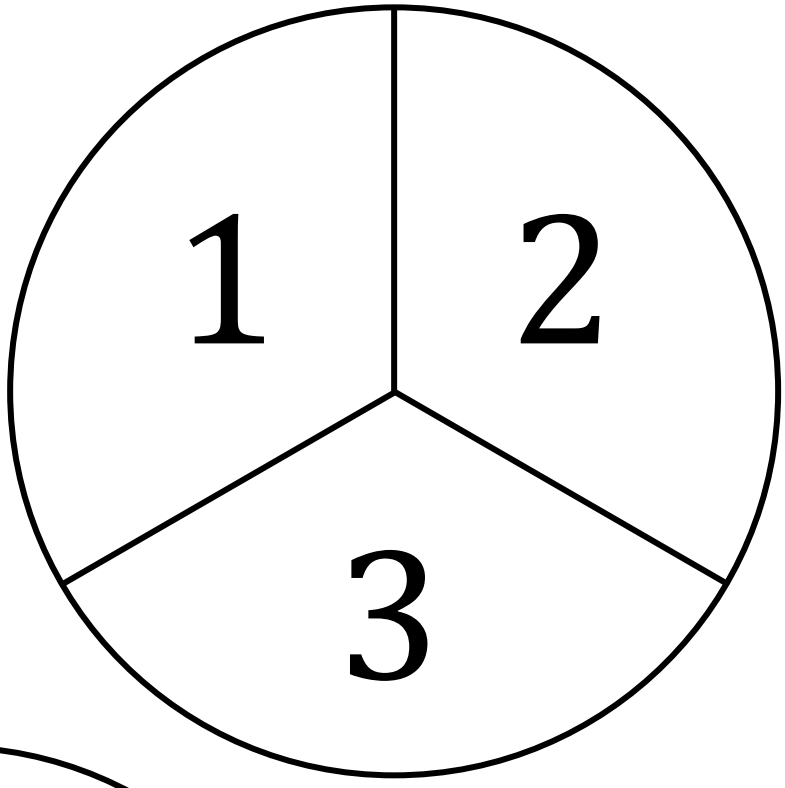

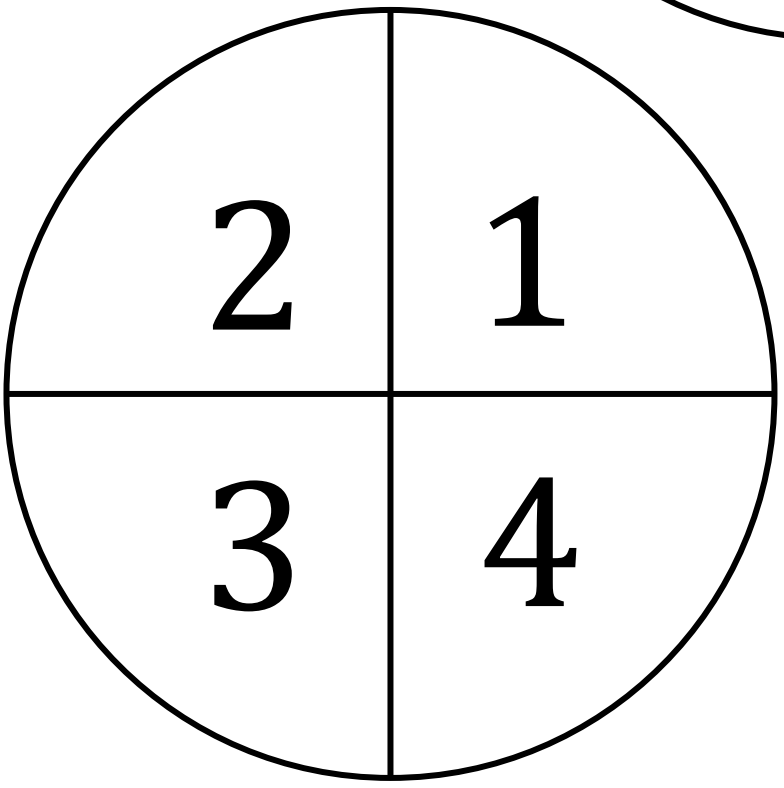

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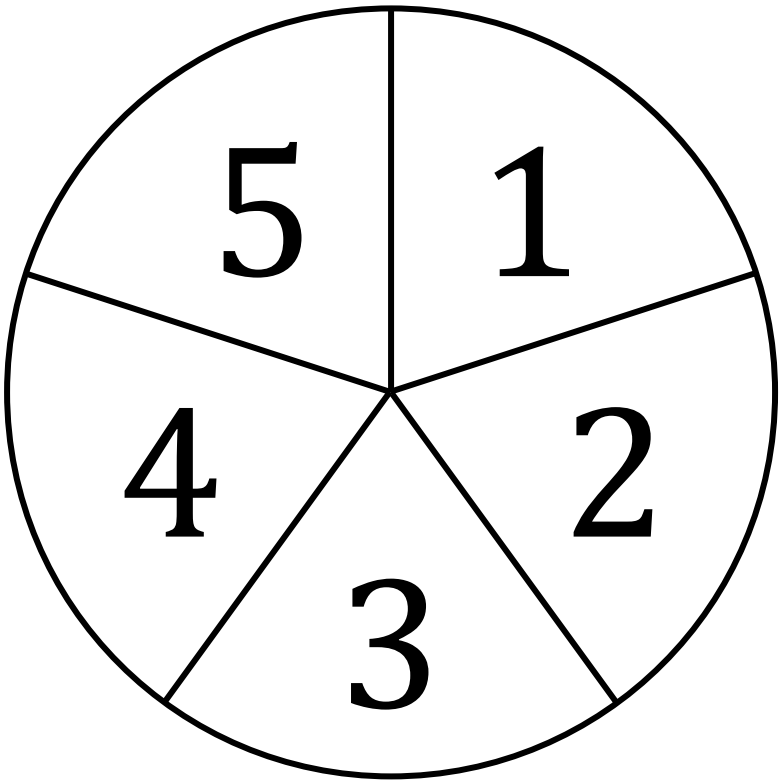

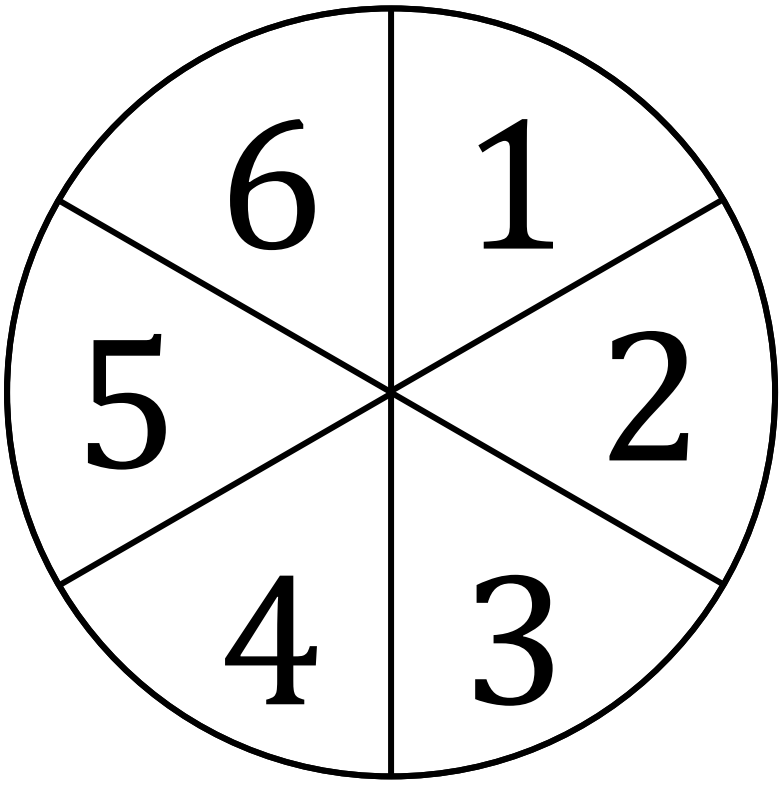

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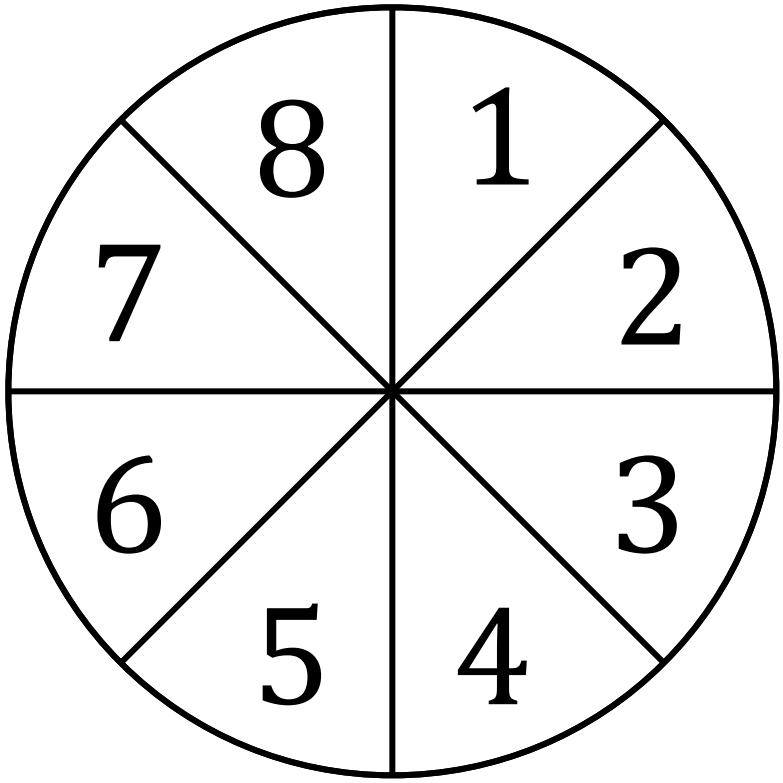

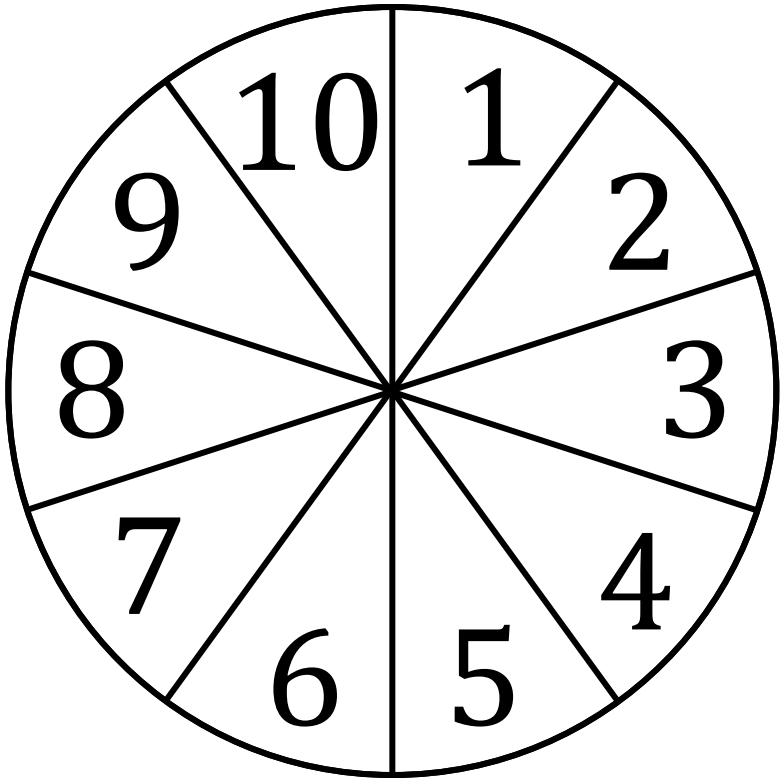

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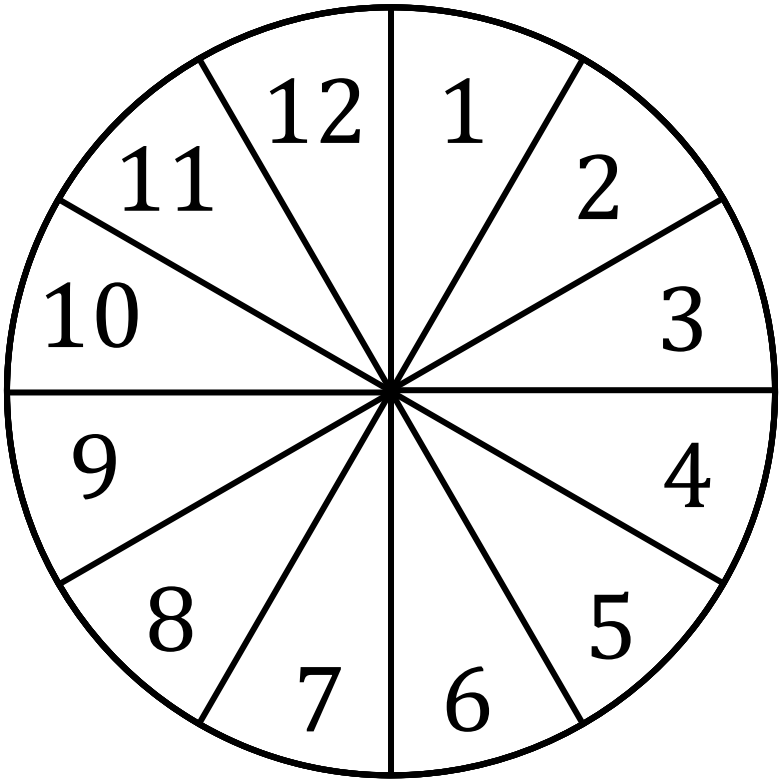

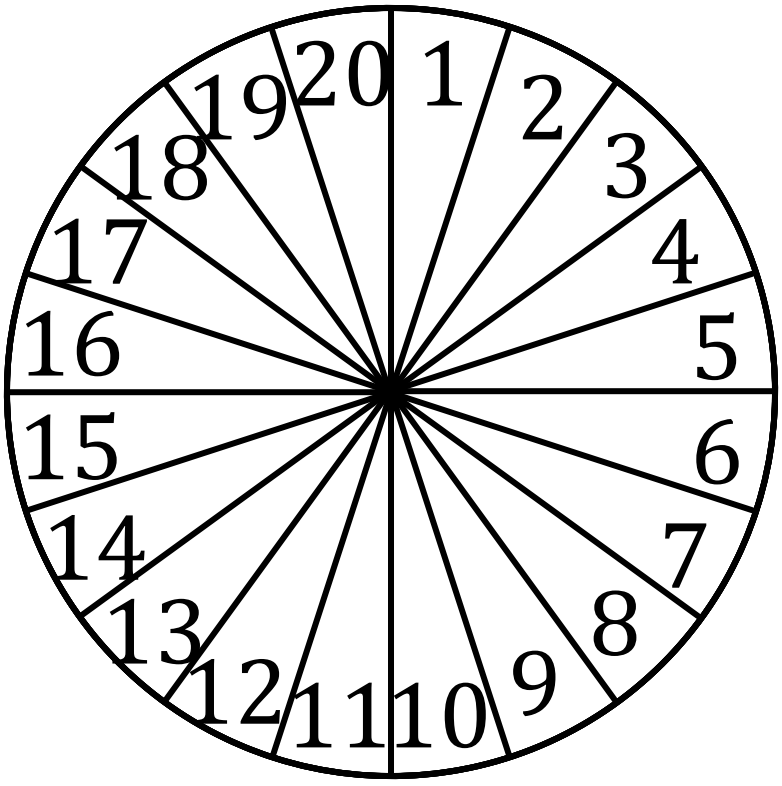

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Feel free to contact me if you have questions or comments or would like to discuss a staff development training or keynote address at your site.

Happy teaching,
Brad

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