

Dial-A-Design

The idea for this came to me years after my retiring from full time teaching. The first students I taught this lesson to were children in third grade. Over the years, I taught this to 4th, 5th, and 6th, graders, to their teachers and to parents at family math day presentations, I discovered the lesson worked as well for children as for adults, delighting them all, equally.

‘Dial-A-Design’ requires a copier printed % circle on 8 1/2 x 11 white paper. The circle (see Basic GTA Grids’) has 20 numerals around its circumference (see below) has intervals in multiples of 5. The students are instructed to first highlight only the points on the circumference that are in multiples of 10%. They do this with colored markers, (If they don’t, mistakes more readily occur. First timers will mistakenly aim their dial at all the numbered intervals. It will double the time it takes to complete a rotation of tracings with the dial. They’ll wind up having “the **unit of repeat**” 20 times instead of 10. Twice as much to color, too time consuming. It’s normal to have at least one student fail to see the significance of counting in 10’s and not in 5s. It is always those who do not highlight the 10s that wind filling in all 20 ‘petals’ of this flower-like design.

The whole point of ‘Dial-A-Design’ is there’s is no way anyone will guess at the outcome till it is completely done. I do not show a sample of how it would turn out. Even after they complete a tracing, a complete rotation 10 dials, it is not till the paper dial is removed that the full impact of it is appreciated. As the lesson goes on, we’ll also add colors that will both delight and amaze.

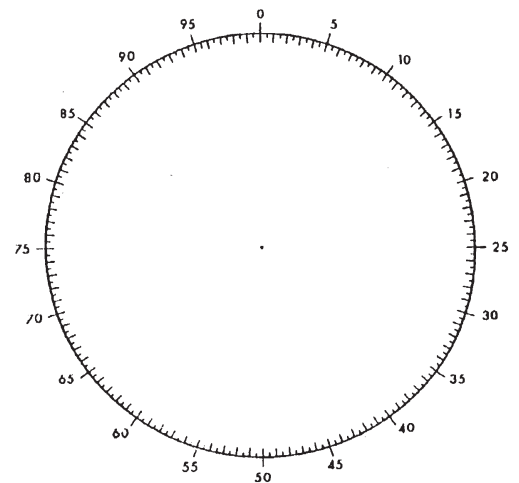
THE 1ST FOUR STEPS are:

1. Marking off of 10 equal intervals around the circle’s circumference.
2. Making of a tag board paper dial,
- 3 Attaching the dial to the paper at the center of the circle, and
4. Tracing the dial 10 times. A ‘rotation’ in 10 positions in the circle.

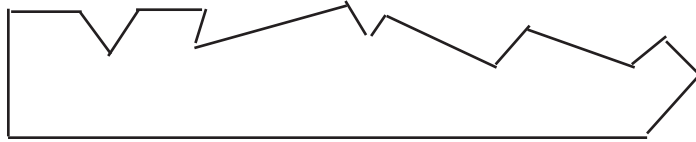
THE NEXT STEPS describe

Visualizing and color mapping sets of congruent shapes, distinguishing as many different ones as each student wants or can identify.

The following are words used to instruct our students:



NOTE: In preparing the ‘dials’ for my students, I cut up 5” X 7” index cards into 5” X 2” strips to make ‘the dials’. I recommend the 7 inch length so it’d be at least an inch or two longer than the radius of the %circle being used. Recommended, but not absolutely, is that the copier made worksheet be on white drawing paper. I use colored markers for the drawing and coloring. The colors are much easier to apply than crayons or crayon pencils. It doesn’t wet and distort the paper as do colors applied with water.)



I demonstrate STEP 2: ‘How To Cut Out The Tag Board Dial.’

Distributed with the % circle worksheets, are 2 tag board paper strips, scissors and a brass fastener . Before demonstrating I tell talk about house keys taking out my own, and each being unique; and how the way were aregoing to make our **dials** will assure that no 2 will be the same. No 2 Dial-A Designs will come out the same. 1. I cut a point for my dial, and ask that everyone do theirs after me. The tip is to touch the ‘**circumference of the circle**’. I refer everyone to the clock on the wall, indicating how the dials ‘**rotate**’ at its ‘**geometric center**’. The ‘**direction**’ it turns is ‘**clockwise**’. We even talk about the different dials on the clock, the second, minute, and hour hands, each varying in speed, and how they are each ‘**units of measure**’. And as I hold the dial I’making up for all to see, I begin cutting into the tag board making straight line‘zigs and zags’. These zigs and zags are ‘**straight geometric lines**’. And just like the keys we use at home or for the car, no two should be cut alike.

‘Some zigs are going to be long, some are going to be short. I advise to make them ‘interesting’, but not too many’ or too ‘teensy weensy.’ As they work on theirs, I say ‘**unique**’, ‘**one-of-a-kind**’ just like my face and your face. Every zig and every zag should vary in one way or another, but not cut too deep into the dial, made ‘at **different angles!**’

I demonstrate how to do the other side of the dial by flipping the tagboard. This time we use ‘**wavy and curvy**’ lines. ‘Nothing is straight’. I walk around and inspect the dials, see if they are cut with one side zig-zags, the opposite with wavy, and a point at the top and at the bottom a cut that shows it is the back of the arrow. *I’ll ask if there are any not satisfied with their dial and want to make another.* It’s OK when everybody in the room is happy and ready to go to the next step. My experience helps me also in determining if a dial is not OK, causing difficulties when the tracing has to be done, (too many fussy details, or the dial being shorter than the radius of the circle, or too skinny and fragile.) The dial has to hold up for being used 10 times.

I demonstrate STEP 3: ‘How To Attach The Tag Board Dial.’

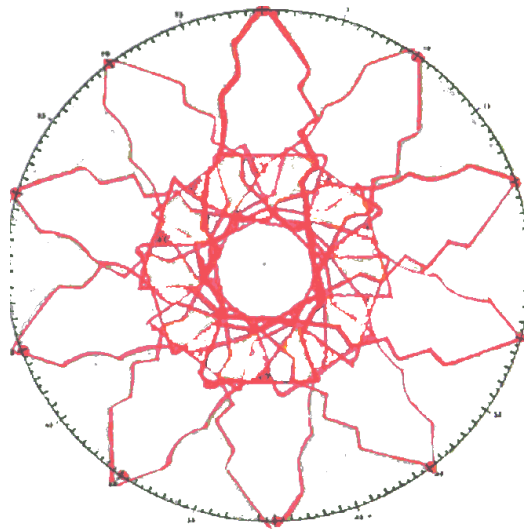
Determining where along the dial to penetrate it with the brass fastener is determined by setting down the dial on the paper and in the circle, the point touching the circumference. The dial should be ‘longer than the ‘**radius**’ and cover the center of the circle’. *I encourage everyone to make an **approximation** as to where the brass fastening will be aimed.and to mark it with a dot.*

I demonstrate STEP 4: ‘How To Trace the shape of the Dial 10 Times.’

I use the blackboard. to draw a ‘**shape**’ with **chalk**. It is important that everyone understands that the interior of a shape is completely enclosed, I draw a loop, a closed loop. All shapes are **closed loops!** Each trac-

ing of our dial must have no gaps or openings. ‘Magellan sailing around the world.’ I demonstrate now with my dial and brass fastener, penetrating the circle worksheet , aiming it at each **interval of 10**, each **‘locus’** on the **circumference** and trace out one unit of repeat outlining slowly, slowly, a whole closed loop of a shape.

New words are coming into play. I write them on the board. I save the ‘pattern’ word for later when we can all see the pattern when it emerges. I use ‘visualize’ later when we come to the step when we do that and start coloring this. We do not mention **‘sets of congruent shapes’**. Not yet. My method is to do and experience first, and then ‘teach’ the new words afterward. I try not to use any words the students do not immediately need. If I must, it is accompanied by my fully demonstrating what I’m tasking about. Actions and hands-on are more eloquent than the words.



I demonstrate STEP 5: **‘How To Color.’**

Coloring is the way to set the stage for teaching **‘Congruence’**. The students will be processing and discovering this new idea. They will perceive **‘sets of 10’**, in this instance, shapes made by them in **‘multiples of 10’**. I will ask them to ‘identify the new shapes that weren’t there when they traced the one shape of this dial. They’ll assign a color for each unique one they identify. We’ll call this process **‘color mapping’**. Every single unique shape has nine brothers and sisters, clones. When all is done, the word **‘congruence’** will be used for this attribute: which is this **‘being identical in both size and shape’**. This kind of lesson I teach is **‘heuristic’**, meaning literally, learning by finding out, providing your students with what are very basic tools and methods in learning how to learn.

Before giving instruction on the how-to’s of coloring, I hold up several students work, emphasizing how all are very **unique** how like snow flakes, flowers, animals and human beings, no two are alike. And that all these come in **sets of 10**. We have a **repeat pattern** and each **unit of repeat** was made in multiples of 10. Coloring will identify them, one from the other.

I ask that each and every child say “CONGRUENCE” in chorus after me. During my lessons, I especially do this with multi-syllabic ‘\$10 dollar words’ like “CIRCUMFERENCE”.

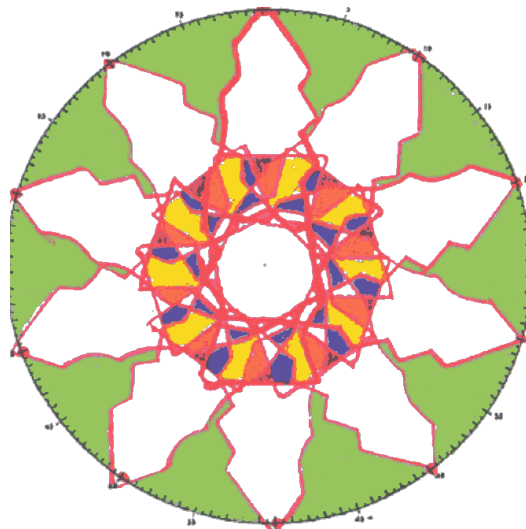
There are a few **rules for coloring**:

1. We color inside the shape, right up to the color that outlines it. We stay inside, and do not color over the line.

2. Shapes that share the same borderline, (‘**Adjacent**’ shapes) are rendered in different colors. Different countries that border one another, look at any map are made in 2 distinctly contrasting colors.. The states of North and South Dakota are mapped in different colors.

3. ‘Congruent’ shapes (shapes that are the same in shape and size) will be assigned the same color.

Then, I stop ‘teaching’ and facilitate the doing of work I’ve assigned.



There’s a geometric theory about color mapping a surface. They claim it can be done completely in 4 colors. But this lesson is not about that. The students will use as many colors as there are different shapes to identify. Dial-A-Design’ is a lesson providing a series of accumulative stages in the making of visual work of displayable art. For those participating, it culminates dramatically. A variety of ‘learning-by-finding-out’ experiences by the uninitiated encountering geometry is an esthetic experience. They’ve followed procedures such as they’ve had no familiarity or experience with, and obtained the ‘**memes**’ (the word refers to mind and attitude altering ideas,) -that establishes needed, basic and important methods of processing information.

This approach grabs student’s attention. motivates them to direct their interest in learning the new vocabulary: center, radius, circumference, perimeter, etc. The % circle worksheet provides units of measure, a finite and measurable set of regular intervals, a grid for designing patterns that are rotational. This is different from what the class has seen prior to his lesson or used in this manner. The teacher’s role is to highlight these considerations, raise the consciousness of the students. It is the teacher who directs that notice be taken of these matters. Just as it is to move around the room as the students work, to assist where needed, to take note of those who lack the ability to ‘visualise,’ or adhere to the problem that is to be addressed. In grades K-4th, it is very helpful that

new words are said aloud, in chorus. New words should be both seen, heard, and written. Notebooks are open and notes are written down! The teacher at the blackboard models how to do it. Doing it for every subject, every single day, builds the habit of recording and of writing. Every notebook should contain a glossary of terms, ones in which the student defines the word the best way they can. As important as is the teaching of vocabulary, there is “looking for patterns”, “making connections”.

In this lesson I connect rotating a dial in a circle and its units of repeat to the units of measure that are on the clock on the wall. It is very fruitful to revisit the dials, their relative speeds, fruitful at a later time, to ask not only about units of seconds in a minute, unit of minutes in an hour, but also “What Is Time?” “Is Time Real?” “Are we the only animals on Earth who are aware of time? Make clocks and keep calendars?” “Do other animals respond to time of day and night, follow some biological clock? Do plants have calendars, biological clocks?” Just as we connect art with math and geometry, we should look for patterns and connections in other subject areas. Why does the clock have “12” numbers?” “Why do we count dozen eggs? Why are rulers made with 12 inches?” Is there a history to this? How long ago does this story take us? Where did all originate?” “Where do we go to find out about it if we want to find out on our own?” Different things have different units of measure. Take money, for example. The currency is not the same in everywhere. -Depends in which country we are. The lesson should occasion myriads of teaching opportunities, make myriads of connections, -arouse wonder and curiosity, raise your student’s consciousness of what they’ve learned and have yet to find out..

“Do circles exist in nature? Is it just an abstract idea, - ‘man-made’?” Can anyone think of an example of a perfect circle in nature? (How about ripples made by raindrops on still pools of water?) Why is the unit of measure in degrees with a total of 360 as its maximum?) This was an art lesson’ about geometry, but much more. It taught in a way that was interdisciplinary, there being no limit as to its connectivity to several other subject areas in the curriculum.

If there are students who ‘don’t get it’, we cannot ignore that, to do so would be to irretrievably leaving them behind. They’ll never likely ever want to find out on their own as to what they missed. The lesson, their day in school is just one more brick in the edifice we built for the ‘Left-Backs’, Those who teachers who simply didn’t check to see who got it and didn’t, had no time to look into its diagnosis, had taken no effort to address it with the child, his parents, or someone with special tools to deal with what might be a disability. Whether this student gets a social promotion or not -is less important than discovering and attaining a love for learning.

