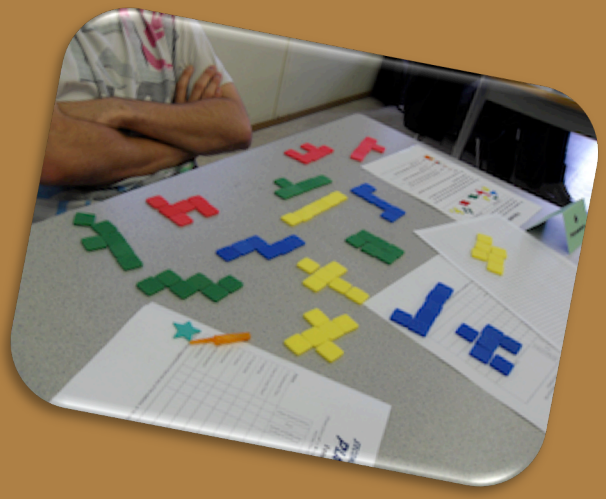
Daily Math Intermediate Investigations

Meaningful Math Routines



Selina Millar
Surrey School District (36)
Adapted from “Daily Math Investigations” – Sandra Ball and Carole Fullerton (2013)

This resource is dedicated to Sandra Ball and Carole Fullerton for inspiring math teachers all over "our" world.

What is the Purpose of Daily Math Investigations?

This resource presents a more active, participatory version of daily math routines – a daily opportunity for students to truly engage with meaningful math concepts, to work with materials, to process, think, and problem-solve. The tasks, questions and problems included in this resource are intended to inspire thoughtful math investigations into number, shape, pattern probability and data. We call these experiences "**Daily Math Investigations**".

Daily Math Investigations allow students to explore math concepts in real and embedded ways. They promote connection-making and meaning-making between concepts. In our literacy practice, we know that balance is important. Likewise, it's important to consider balance in our math programs, including hands-on explorations, independent practice, open-ended tasks, direct instruction and opportunities to share and compare what students are learning.

Re-imagining: Daily Math Investigations
Daily Math investigations are an opportunity for students to think and play with mathematical ideas. Teachers present tasks and pose questions that are intended to promote curiosity about numeracy concepts. In opening up the kinds of questions we ask, we include more students in the learning of math, and help to address the range of learners in our classrooms. A combination of **entry tasks** and **rich routines** allow for balance between whole group, small group and independent learning, a chance for students to explore the math at their level.

Daily Math Investigations

Considerations:

Timing

- How do I afford the time?

Students working with the tasks have the opportunity to engage in communication, reasoning, visualizing, problem solving and mental math i.e. mathematical processes. These routines provide opportunities for students to practice their mathematical processes in an engaging and relative way. Connections to literacy are abundant as students practice their oral, prediction, visualizing and comprehension skills.

Engagement

- Who's doing the talking?
- Who's doing the math?

So often, the students want to interact with one another as ideas come to them. As they exchange their ideas, they become more fluent with the mathematical concepts. Especially when they are able to solve problems together. The engaging part of the task must be the math - the complexity of the question, the curiosity it inspires and the conversations that emerge.

Grouping

- Whole group?
- Small group?
- Independent?

Daily Math Investigations do not need to be done all together, all the time. Consider opportunities for students to work in small groups, pairs or even alone around a particular question or task.

Content

- What important math idea(s) will be explored?
- How does it address the range of learning needs?

Within the curriculum, there are several skills and concepts that require time to master. It makes sense to present these ideas over time and with intention in thought-provoking ways through a Daily Math Investigation! As they develop as thinkers throughout the year, students will engage with the important concepts again and again seeing it through a different, more evolved lens.

Connectedness

- What connections are being highlighted?
- What math-to-math, math-to-self, math-to-world connections can be made?

Students learn best – and remember more – when the learning they are doing is connected. Supporting students to think about how the mathematical idea you're exploring is like another they already know is an important foundational aspect of learning. Connecting to their own experience is likewise critical - embedding the math in something relevant to your students is highly motivating!

Assessment

- What can I learn about my students?
- What can I watch and listen for?

Daily Math Investigations are ideal opportunities for teachers to observe, listen and reflect on what their young learners know and can do. As they wrestle with important math, students' thinking is exposed through their actions and words. Take advantage!

Engaging Tasks for Daily Math Investigations

In our math instruction, thoughtful planning is essential. If we are to take advantage of the rich learning time that presents itself at the beginning of our students' day, we must be mindful and make good instructional decisions about how this valuable time is used.

Daily Math Investigations:

Get them engaged.
Get them thinking.
Get them reasoning.

In order to ensure that we are making the most of these activities and that the intent of these daily experiences remains sound, we have developed criteria for engaging tasks. The entry tasks and rich routines are characterized by the following:

1. **Interactive**
   - All students are doing math
   - Good questions are asked to promote wondering

2. **Oral language opportunities**
   - Mediated conversations exist between teacher and students
   - Frequent opportunities for students to share and describe thinking

3. **Relevant**
   - Connected to classroom context and students' lives

4. **Focused on important mathematics**
   - Connected to PLOs

By keeping the mathematics at the forefront and by focusing on students' active engagement with the math, we maximize the potential of these experiences to promote deep mathematical learning. Daily Math Investigations are designed to get students engaged, thinking and reasoning.

Practicing the "facts" – What to keep and what to let go

It is critical that our students are fluent with their facts. They need to be able to use them with certainty and understanding – fluency. Developing understanding and strategies is key with "mastering the facts". This combination allows students to make meaning and to apply their knowledge resulting in "robust recall".

Facts drill is a "routine" that has students "plugging" in numbers that do not necessarily have meaning. Rote recall (answers without having to make sense) in the drill situation does not enable to a student to be fluent with recall of their various facts when needed to solve problems or more complex situations.

Students need to practice to become fluent. In Grades 1 - 4, students have worked with strategies developing number sense resulting in knowing their facts. Their fluency will increase as we provide engaging repeated practice.

Grades 1 to 5 PLO's ("Math Facts")

GR 1 A10 describe and use mental mathematics strategies (memorization not intended), such as • counting on and counting back • making 10 • doubles • using addition to subtract to determine the basic addition facts to 18 and related subtraction facts	**GR 4** A5 describe and apply mental mathematics strategies, such as • skip counting from a known fact • using doubling or halving • using doubling or halving and adding or subtracting one more group • using patterns in the 9s facts • using repeated doubling to determine basic multiplication facts to 81 and related division facts
GR 2 A10 apply mental mathematics strategies, such as • using doubles • making 10 • one more, one less • two more, two less • building on a known double • addition for subtraction to determine basic addition facts to 18 and related subtraction facts	**GR 5** A3 apply mental mathematics strategies and number properties, such as • skip counting from a known fact • using doubling or halving • using patterns in the 9s facts • using repeated doubling or halving to determine answers for basic multiplication facts to 81 and related division facts
GR 3 A10 apply mental mathematics strategies and number properties, such as • using doubles • making 10 • using the commutative property • using the property of zero • thinking addition for subtraction to recall basic addition facts to 18 and related subtraction facts	A11 demonstrate an understanding of multiplication to 5 x 5 by • representing and explaining multiplication using equal grouping and arrays • creating and solving problems in context that involve multiplication • modelling multiplication using concrete and visual representations, and recording the process symbolically • relating multiplication to repeated addition • relating multiplication to division

Entry Tasks

Entry tasks are exactly that - tasks that are prepared and waiting for students as they enter the classroom at the beginning of the day. Knowing that our students' minds tend to be the most fresh in the morning, presenting these problems and mathematical curiosities to students as they arrive makes sense. Likewise, they will allow teachers to welcome and talk to their students as they settle into the room.

Entry tasks are invitational in nature. They are intended to inspire wonder and to encourage questioning. Students love these interesting questions and eagerly anticipate these morning tasks. These explorations can be very motivating - even for reluctant learners.

Set up

Imagine a single table or counter space set up where students can easily gather and access materials, or multiple tables set up with inviting materials and a clear prompt. Some days the tasks may be to sort information, to vote in a survey, to estimate a collection, to create, extend or correct a pattern, to complete a puzzle, or to contribute to a collaborative solution. The power of an entry task is in its immediate engagement in something thoughtful and mathematical. Examples of what these tasks could look like are described below.

Timing

The timing and content focus of these tasks are flexible and should be responsive to the needs and abilities - of your learners. Feel free to choose tasks from the list below and to adapt them as you see fit. You might consider using one task each day for all students to explore, or you might create 5 stations and allow your students to explore different tasks each day over a week. Don't feel as though you have to present something new every morning. Novelty is important, of course, but students may find these entry tasks engaging enough to explore for more than one day in a row. Learning will still happen!

Choice and learning

Children naturally choose tasks that evoke their curiosity and have learning potential - sometime several days in a row. Given a rich task and an engaging context, exploring the same materials and question over and over can continue to promote thinking for many children. Since these entry tasks are designed as an invitation to think and explore, it makes sense to let students lead the way. Trying to be too prescriptive will ruin the experience - for both you as a teacher and for your students as explorers.

Entry Tasks

Spatial Tasks

- Shape Shifter (Tangram) Puzzles
- Pattern Block Puzzles
- Pentomino Puzzles

Number Sense

- Number Magic
- Number Puzzlers
- Roll and See
- Add Some More
- Sink or Swim

Logic Anyone?

- 2 or 3- digit Scavenger Hunt
- Matrix Puzzles

Data Building & Analysis

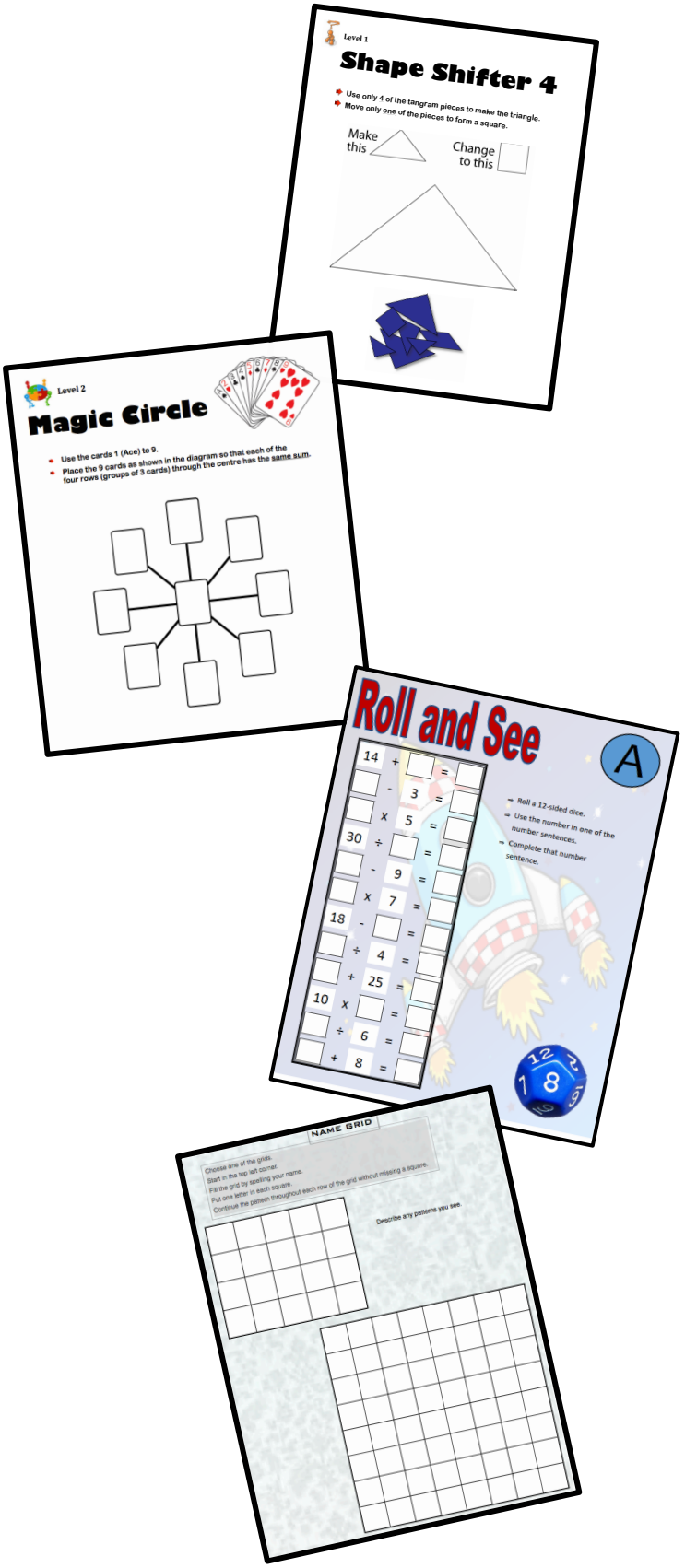
- Dice
- Dice Games
    - Pig

Fluency Builders

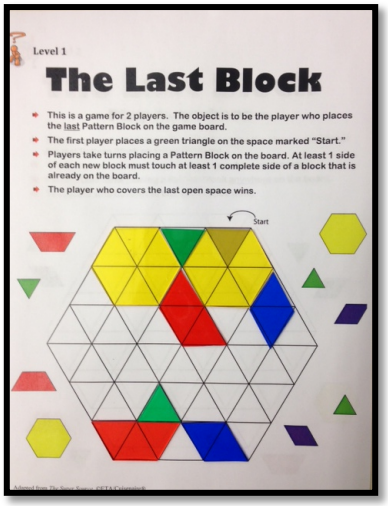
- Addition Facts Games
- Multiplication Facts Games
- Hidden Numbers
    - Sums
    - Fractions

Patterns Galore!

- What's the Rule?
- Calendar Time!
- Name Grid



Spatial tasks



Mathematical thinking depends on being able to visualize and manipulate images. These tasks will promote talk, reasoning and thinking. These tasks allow the students to work in pairs, small groups or independently.

Pattern block puzzles
Use Pattern Blocks and the attached puzzles. Have students complete tasks as described. The tasks encourage them to complete the puzzles in more than one way. Highlight the attributes and relationships between the pieces!

Tangram puzzles
Use a complete set of 7 tangram pieces and the attached puzzles. Have students match pieces to the outlines. Encourage them to complete the puzzles in more than one way! Give students the language of *reflecting* and *rotating* to describe the translations they are using.
Consider reading "Grandfather Tang's Story" as an introduction to these puzzles.

Pentomino puzzles
Use a complete set of 12 pentomino shapes and the attached puzzles. Have students match pieces to the outlines. Encourage them to complete the puzzles in more than one way!
Encourage older students to create puzzles for friends.
Consider reading the novel, "Finding Vermeer" as a read-aloud to solve more puzzles using pentominoes.

Number Sense

These are puzzles – mathematical mysteries – to be solved. Each one promotes reasoning through an important concept. Students can work on these problems alone or with a partner. Afterwards, the mystery is reset to allow the next group of children to solve it. Over time, students might like to create their own puzzles for friends. The following are brief descriptions of possible tasks. Be creative and make or adapt your own tasks.

Number Magic
Using numbers fill in the spaces and the answers "magically" give the same sum or product. Shape doesn't matter!

Number Puzzlers
Using digits, students "figure out" how the equations can be solved.

Roll and See
Using different dice (6 – 10 – 20 sided), randomly select numbers to complete equations that will make sense

Logic Anyone?

The human brain needs to make sense of the world. Reasoning is a key process for information to make sense. Often as adults, we take this "skill" for granted. Being able to reason and to articulate the reasoning is one key process that can be "practiced" in a fun and engaging way.

Logic puzzles are not only popular but allow students to practice their logical thinking in a non-threatening way. Learning is a social activity. Whether the students solve these puzzles / problems together or individually, they are making sense of the information. They are discriminating between relevant from irrelevant data. Connections between information are often made during the reasoning process.

As students "think aloud" in solving the logic problems, they are processing their reasoning in a logical and meaningful way.

2 or 3 -digit Scavenger Hunt
These are number riddles that provide clues that help students figure out the answer i.e. the number. Have students create their own Scavenger Hunts.

Matrix puzzles
Matrices are one of the most common, easy and engaging ways for students to put their logical reasoning into practice. These types of puzzles can easily be solved in partners or individually. Starting simple allow students to apply their logical minds and build confidence. This one way to organize information helps students to identify the clues and sort the information as needed. There is a rich resource available on-line.

Data Building & Analysis
For data to have meaning, students need to collect the information themselves. Surveys are great ways for students to gather data while they become more familiar with one another and build class community. Another source of data is school theme. The data can be organized in a variety of ways such as "How many crazy hair-do's for each class?", "Number of boys vs girls in various grades", "Types of hats" etc. While collecting the data is always engaging, it is the analysis process that provides the opportunity for the students to practice their mental math and operations. By posing meaningful questions, students learn how to anaylyze data and become more critical of data presented.

Pose questions that ask students to compare, such as:

- Which had the most numbers?
- What is the difference between the most and least common _____ ?
- How is this information useful?
- What question could have been asked to make the survey more useful?

Dice – You Got What? / Pair of Dice
The probability of a number on a dice showing up is intriguing for people. The probability aspect keeps one engaged in guessing and hoping. As students try out this activity, begin to realize the likelihood of a number on a die showing up. With frequent experiences of gathering, recording and analyzing first-hand data, students start to realize that it really isn't just luck!

Dice Game - Pig
Students play in pairs. They "race" to 100 by rolling a pair of dice. The rules force the students think about moving ahead or losing their turn or all of their points depending if a one or "snake eyes" showing up. Students use different strategies to record their totals. This is a great way for the students to practice their mental math!

Fluency Builders

Students need and benefit from daily practice in order to develop fluency with the facts. Be aware though, that students need to understand what the *operations mean* and *have strategies* for finding sums, differences, products and quotients before they practice them in isolation. The following tasks promote thinking rather than memorization - a developmentally sound approach to mastery of the facts starting in early primary.

Simple Partner Games

There is a wide array of quality games for practicing and mastering number relationships. Consider those included in this document and those drawn from other core resources. Be sure that students know how to play these games before setting them out. Even a set of dice, a stack of counters and a spinner can be used by students to play games of their own creation.

Patterns Galore

As students move along the curriculum, their patterning abilities extend into numbers. Using the Hundreds Chart and asking students to find patterns is always an interesting way to see what they know. Simple activities such as "skip counting" or moving in a consistent pattern and recording the "landing" are ways for students to "see" patterns in a different way.

What's the Rule?

Identifying patterns on the Hundred Chart can benefit all different types of learners. The kinesthetic learner is able to "move" the counter the various squares while the visual learner is seeing the pattern emerge. This type of representation enables the students to articulate the pattern rule as they "experience" first hand the movement on the chart.

Calendar Time!

Similar to the Hundreds Chart, calendars are rich with patterns! But, are they similar patterns? Have students analyze the possible patterns in a month. Ask them to compare the patterns found on the Hundreds Chart to a month calendar. Pose problems such as:

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	5	25	26
27	28	29	30			

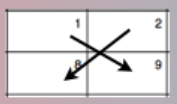
Look to see if you can find any patterns in this month. See if you can figure out the pattern rules for the questions below.

What do you notice when you go down a column? Is it true for all columns?

What do you notice when you move diagonally down to a number? Is it true for every diagonal? Why does this pattern happen?

What do you notice about the sums of the 4 adjacent dates? e.g. 1 + 9 and 2 + 8

What do you notice about the sum of the four numbers?



Grades 6 and 7

What do you notice about the products of the diagonals? 1 x 9 and 2 x 8

What other patterns can you find?

Name Grid

Seeing your name over and over can be interesting, especially if it is arranged in different formations. As the students share and compare their grids, have them find similarities and differences in the attributes of the patterns. An extension to this activity, have students apply different attributes to their letters, such as line thickness, colour or size.

Rich Routines

Rich Routines - What are they?

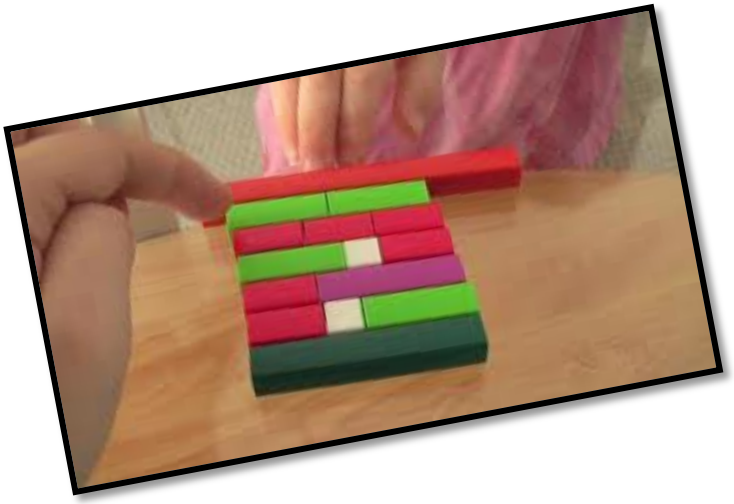
Rich routines are explored in more structured, less fluid ways. These questions - open-ended and interesting - are more often posed during whole class instruction i.e. first thing in the morning. Unlike a traditional "Problem of the Week", rich routines include far more opportunities for talk and modeling. Students engage with them in active ways and in a variety of groupings. These questions may be a springboard to another more involved investigation, but the focus is on connectedness and content. The power in rich routines is in their potential to revisit important content over time.

Routine ≠ Rote

Do not confuse "routine" with "rote" - routinized structures are predictable, but remain engaging owing to their ongoing, increasing complexity. The questions may, over time, be the same, but the intent is to deepen knowledge and understanding as the content becomes more complex. Mastery of an idea comes through multiple experiences and the chance to connect each new experience to prior knowledge. Rich routines provide the structure for making these connections. Examples, prompts and frames are described below. They are loosely separated into content areas - number, measurement, data, etc.

Be Selective!

Consider the suggested tasks on the following pages or choose your own adventure. Taking into consideration the needs and interests of your students, pick carefully from the tasks that follow. You might like to work through 3-4 of them a day, for several weeks, and then swap out one or 2 of the tasks to keep it fresh. Revisiting tasks later in the year is likewise a good idea! Students in the spring of the year are much different thinkers than in the fall!



Rich Routines

All About Number

- Thinking Frames
- Great Estimations
  - Estimating Jar
  - Ducks Everywhere!

Building Number Concepts

- Cuisenaire investigations:
  - Fractions
  - Relationship of part to whole
  - Starting to establish equivalency

- Exploring the Number Line
  - Number Theory
    - Multiples
    - Factors
    - Primes / Composites

  - Exploring the 100's Chart
    - Number Theory
    - Multiples
    - Factors
    - Primes / Composites

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

Patterns & Relations

- Picture book Ponders
  - "Two of Everything"
  - "Balancing Act
  - "Spaghetti and Meatballs

Data for the Day

- Smarties Galore!
- Smarties for All!

All About Number

Thinking Frames
For this rich routine, select a number within your students' range, and model with the whole group how to complete a set of prompts.

Consider creating the prompts (provided as BLM'S) as a model to post in your class. Model a sample with writing the following sentence frames on the board.

For example:

57 **is more than** 42.
57 **is less than** 78.
57 **is the same as** 50 and 7.

or

5.7 **is more than** 4.2.
5.7 **is less than** 7.8.
5.7 **is the same as** 5.0 and 0.7.

57 **is too many** pencils for me.
57 **is too few** candies for trick or treat .
57 **is just enough** treats for 2 classes.

5.7 km **is too far / big** to crawl.
5.7 m **is too short / little** for a run.
5.7 L **is just enough** juice for the class.

Do a think aloud as you record your numbers to support students in understanding why you picked them. Invite some ideas from your students for a second number and record them. Then have students work collectively – pairs, small groups in whole groups - on numbers at their respective levels. That is, you might create a group of students and have them work on statements for the number 110, and have another group working on the number 20 00.

Consider your students and the number and kind of sentence frames you use each day. Don't use them all at one go!

Line masters for these thinking prompts are included in this resource for your use. Have students place them in dry erase sleeves or laminate them or on their -pads. Students record their own ideas for the number of the day and share them by holding them up or through the network. This is an excellent strategy of engaging multiple learners at once. Each student will get to create and share – his/her thinking with the group.

Over time, these frames could become part of students' Entry Task work. Assign a number for the day or have older students roll a double die and create their own from the digits rolled.

Thinking About Number – Frames

_____ > _____.
_____ < _____.
_____ = _____.
_____ is too many _____.
_____ is too few _____.
_____ is just enough _____.
_____ is about _____.
_____ is close to _____ but far from _
_____ people could _____.
_____ unifix could _____.
_____ paperclips would _____.
_____ drops of water could _
_____.
_____ jellybeans could _____.
_____ seconds could _____.

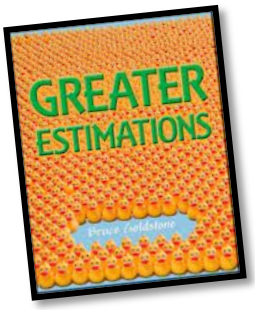
_____ days could _____.
_____ weeks could _____.
_____ years could _____.
_____ is too short for _____.
_____ is too long for _____.
_____ is just right for _____.
$_____ is just enough for _____.
$_____ is not enough for _____.
$_____ is more than _____.
$_____ is less than _____.
$_____ is the same as _____.

Great Estimations!
People of all ages have a difficult time with genuinely understanding the sheer size of large numbers. Usually, a referent or benchmark is most helpful let along necessary! Providing plenty of exposure to using benchmarks and referents, students can become proficient with estimating and understanding the immensity of GREAT quantities and number.

Estimating Jar / Container
Have students bring items that can fill regular sized jars / containers. This activity is helpful to develop students' prior knowledge about capacity and volume. In the primary grades, students are guided to use a referents or benchmarks to help estimate quantities. Instead of students "wildly" guessing the quantities in the jar(s) / container(s), see if students have strategies to "estimate" the quantity in the jar / container. Limit the number of guesses that students may have to arrive at the actual quantity.

Possible prompts to guide student thinking:

- How do you know that your estimate is reasonable?
- What would help us to make a more accurate estimate?
- What do you have to consider to make a more accurate estimate?
- How is estimating different from guessing?
- Why would there be more _____ e.g. jelly beans in the jar than _____ e.g. marshmallows?



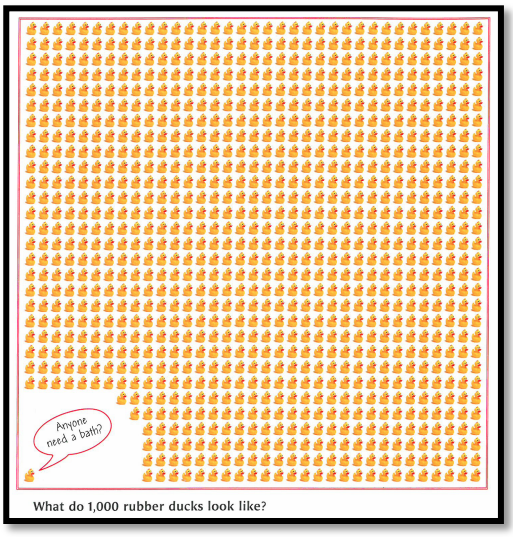
Greater Estimations! (Bruce Goldman)

This book is filled with opportunities for students to try and figure out large quantities! It is also filled with effective strategies that enable students to develop number sense and immensity of quantities. It's prequel, "Great Estimations" is another book rich with more contexts for students to practice their estimating skills. See the following for ways to incorporate this routine into your day.

Ducks Everywhere!
Present this page from "Greater Estimations" without disclosing that there are 1000 ducks.

Ask them:

- How many ducks do you think there are?
- How could you figure it out?
- What would help you to estimate efficiently? i.e. without count each one, even if it's skip counting by 2's or 10's(finding a referent of 100)



Building Number Concepts

Cuisenaire Investigations

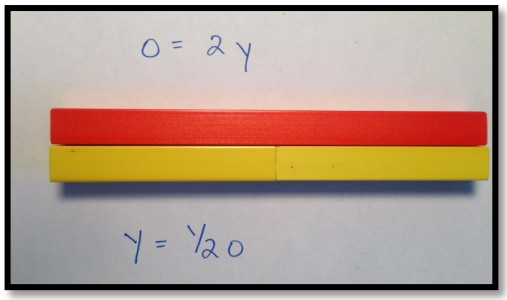
Cuisenaire Rods are a versatile collection of rectangular rods of ten colors, each color corresponding to a different length. Cuisenaire Rods, because of their different, related lengths, provide a continuous model. Thus, they allow you to assign a value to one rod and then assign values to the other rods by using the relationships among the rods. Cuisenaire Rods can be used to develop a wide variety of mathematical ideas at many different levels of complexity.

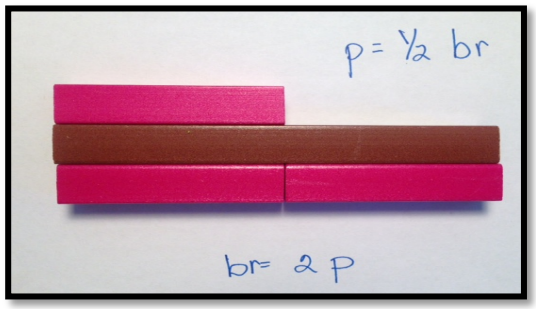
Cuisenaire rods, also provide a linear model for representing number. When using Cuisenaire rods, we line the pieces up end- to-end, creating a longer rod of a certain length. In using an orange Cuisenaire rod as our referent (point of comparison) we help students to visualize length and over time, make connections both to measurement and to a number line.

"Rod Pairs" - modeling relationships based on a unit fraction

Making connections between the relative lengths of the rods, build on a regular basis, using the giant Cuisenaire rods.

Day 1
Post an orange rod on the board. Have the students find the rod that is half the length of the orange rod. Ask students to find other pairs in which one rod is half of the other. Have them record their findings in 2 ways. e.g. br = 2 p or p = ½ br





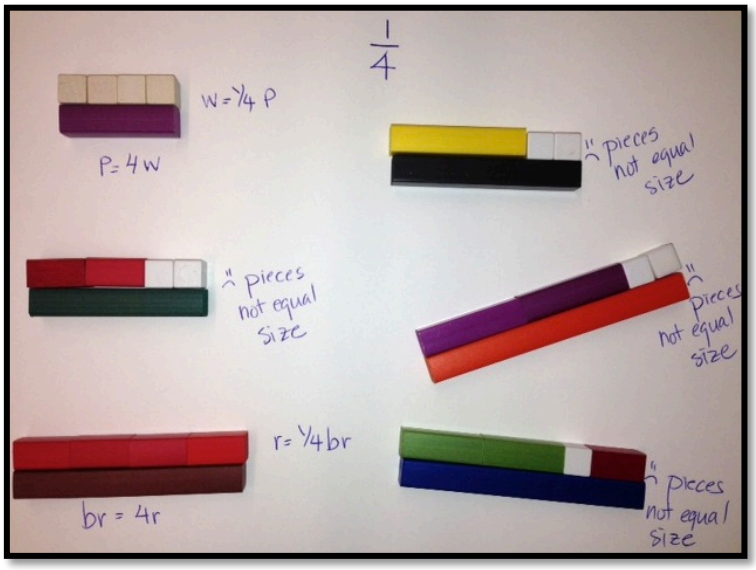
Ask students:

Find as many rod pairs as you can that show 1/3. Record each pair in 2 ways.
Have you found all the different possible ways. Be ready to explain why you think you have found all the possible fractions.

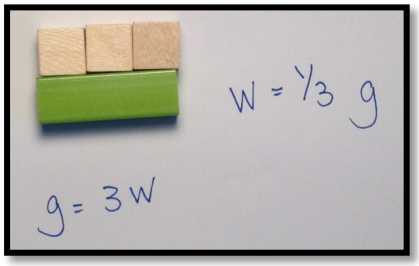
Prompt students' thinking about the relationship of the 2 rods. For example:

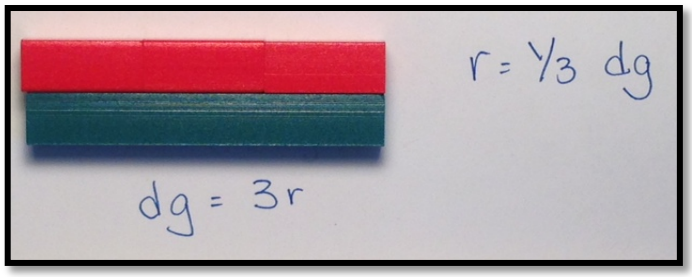
- What patterns do you notice for each fraction? for all the fractions?
- How do you know that the list for 1/2 is complete?
- How can the same rod be used to represent two different fractions?
- Why are some fractions represented by fewer rod pairs than others?

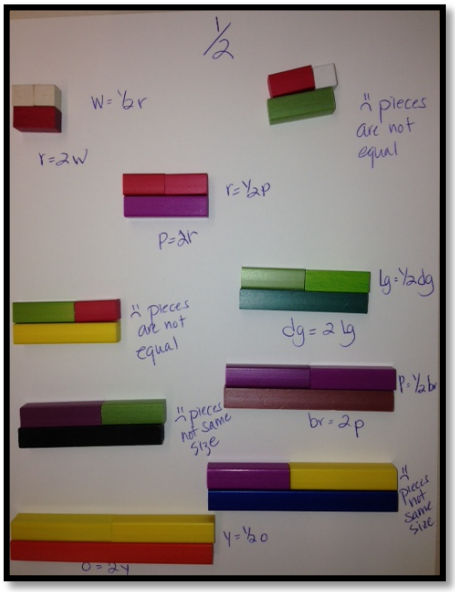
Model solutions to the problem, using the large rods. The following shows all the different possibilities for 1/4.



Day 2 (etc.)
Have the students find other relationships, 1/3, 1/4, 1/5, 1/6, 1/7, 1/8, 1/9 and 1/10:







Prompt students' thinking about the relationship of the 2 rods. For example:

- What patterns do you notice for each fraction? / for all the fractions?
- How do you know that the list for 1/2 is complete?
- How can the same rod be used to represent two different fractions?
- Why are some fractions represented by fewer rod pairs than others?

Adapted from "Cuisenaire Rods, 3-5, Supersource", ETA, Cuisenaire

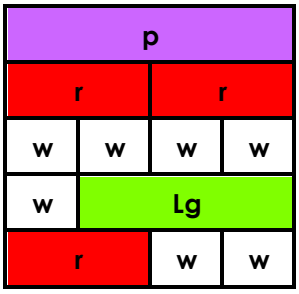
Finding the Trains – comparing and modelling equivalency

Cuisenaire Rods can Deepen students' understanding of the meaning of fractions. This activity allows the students to analyze the part-to-whole relationships. Students will also begin to understand the reasoning behind the fraction names.

Day 1

Model **and record** one colour "trains" that are the same length as the purple.

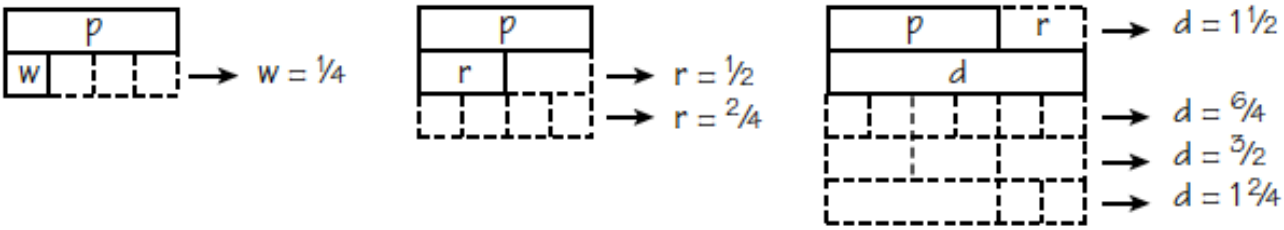
Ask, "What is the fractional name of the light green, if the purple is the whole?" (3/4 since the light green = 3 whites)



p = 1 then,

w = 1/4, r = 1/2, Lg = 3/4

Ask the students to build and record for all the different possibilities the purple rod. The names of the other rods may be fractions, mixed numbers or whole numbers. Here is something they might come up with.



Day 2

Have students complete the investigation with the other coloured rods. Be sure to have them build and record, keeping track of their models to ensure that they have actually build them all for each of the colours.

Prompt their thinking:

- What is a good answer to this question: "How big is 1⁄2?"
- How can you explain calling different rods by the same fractional names?
- How can you explain calling the same rod by so many different fractional names?
- What do you notice about names of rods shorter than 1? longer than 1?
- How can you explain that one fractional name can be represented by different rods?
- When you studied all your results, what did you notice?

Adapted from "Mathematics with Manipulatives" (2002) – Marilyn Burns

Exploring the Number Line

A number line is often dismissed at the intermediate grades. While it is usually referred to when working with integers, it is an effective tool for looking at number theory, too.

It helps with our skip counting as it allows the students to see the "jump" yet recognizes that there are regular intervals of "1 counts" in between.

Students will begin to develop these linear referents to the Hundreds' Chart activities as the work with the following Number Theory concepts.

The Number Line created is a large model that can wrap around the perimeter of your classroom wall. You can print one of your own or save the time and purchase one @ a teacher store such as Collins. These number lines typically start at 1 and reach as high as 144. It isn't necessary to go to 144 to develop understanding the number theory concepts. Working with numbers up to 72 can attain the same understandings.

Number Theory

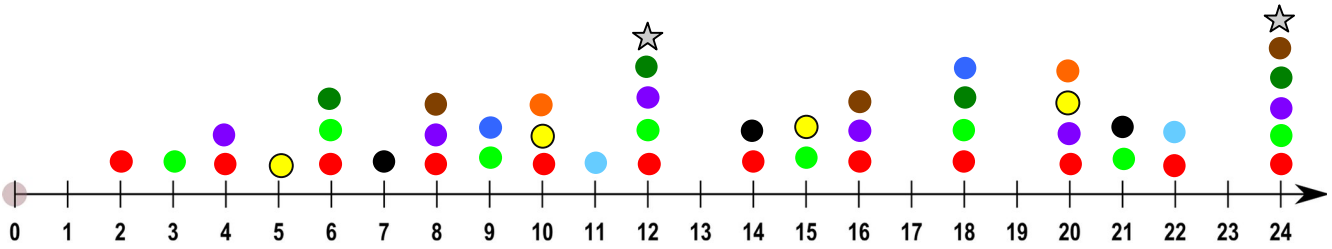
Multiples
Using a coloured sticker / maker for each of the following multiples:

KEY / LEGEND

2 – red	5 – yellow	8 – brown	11 – light blue
3 – light green	6 – dark green	9 – blue	12 - star
4 - purple	7 - black	10 - orange	

Day(s) 1 - 3
For each day or two, work on applying the coloured "dot" to the multiples as indicated by the above "KEY".

Have different students to apply the stickers onto the class number line.



Have the students record the multiples in colours on their number lines.

Day 4 (etc.)
Grades 6 and 7 students

Prompt student thinking about composite numbers and prime numbers by asking:

- What do you notice about the number of stickers on each of the numbers?
- What similarities do you notice amongst these numbers?
- What differences you notice amongst the numbers?

Help students identify characteristics of LCM and GCF by asking:

- What do you notice when looking at the multiples of 2 **and** 3? 2 **and** 4? 3 **and** 4?

Exploring the 100's Chart
Students in benefit from seeing how a hundreds chart can do more than provide counting referents. It gives them time to learn and visualize patterns as they work with the numbers on the chart. Consider the following tasks to make sense of this powerful tool.

Multiples and Factors
Day 1 (if Grade 4 or 5, break this session up to 2 – 3 days)

Use a 100 chart, laminated so that you can write in the squares as well as providing paper copies for students to write on. Consider also a digital version, using a document camera or a SmartBoard. There are commercially available pocket charts for this purpose as well.

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

Using transparent colour counters, place one particular colour on multiples of 2.

Ask:
- "What patterns do you notice?"

Have students record on their paper copy of the hundreds chart
Define the terms **factor** and **multiple.**

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

Repeat with multiples of 3 using a different colour.

Have students repeat with multiples of 4, 5, 6, 7, 8, 9, 10, 11 and 12.
Prompt students to look for patterns and connections with other layouts of the various factors.

Common Multiples

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

Have students repeat yesterday's activity laying out counters on the hundreds chart focusing on multiples of 2 **and** 3.

Prompt students' thinking:

- What do you notice about the counters?
- What can you tell about the counters that are multiples of 2 **and** 3?
- How does this laying out the counters help to understand common multiples / common factors ?

Prime Time (Grades 6 and 7)

Place counters on each number on the Hundreds Chart. Have students do the following:

Take the counter off number 1.

Leave counter on number 2, but remove all multiples of 2.

Leave counter on number 3, but remove all multiples of 3.

Counter on number 4 will have been removed, but need to remove all multiples of 4. (*illustrates that multiples of 4 are also multiples of 2*)

Leave counter on number 5, but remove all multiples of 5.

Counter on number 6 will have been removed, but need to remove all multiples of 6. (*illustrates that multiples of 2 AND 3 are multiples of 6*)

Leave counter on number 7, but remove all multiples of 7.

Prompt students' thinking:

- What do you notice about the counters that are left?
- Explain why the counters are left on these numbers?

Patterns and Relations

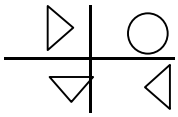
Building and seeing patterns are critical in developing mathematical skills. Working with patterns enables students to make connections within and beyond mathematics. (BC IPR – 2007) While recognizing patterns is essential it is equally important for students to know when the pattern is **not** consistent. By making predictions and justifying their reasoning on a regular and consistent basis, students practice making logical decisions.

Finding relations means figuring out and explaining how the information connects. We use the math to explain those relationships, whether it be about numbers, sets, shapes and concepts. These relationships can be drawn, written with words or symbols or spoken.

Regular routines of patterning and expressing relations enable students to get to the essence of the mathematics.

One of These Belong To Another!

There are lots of activities that ask students to create and extend patterns. There aren't many that ask them to look for "what's wrong". Kids love looking for "mistakes". Have students find the one element that does not belong with the others. Remember to ask students to justify their response.



p	r
t	a

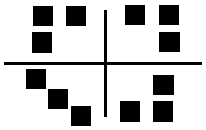
21	7
40	36

a	i
e	m

8	3
1	5

13	2
6	8

16	15
35	20



What could the pattern be?

Write the following on the board: **Ann, Brad, Carol …**

Ask the students to complete the pattern in as many ways as they can. While they complete the pattern ask them to explain how the pattern exists. i.e. pattern rule

As they provide their explanations, help students identify and define the terms elements, terms and attributes.

"Two of Everything" (Lily Toy Hong) – (functions, tables, exponents)

Day 1

Begin by telling students that you have recently read a story about a magic pot that changes numbers in a special way (Don't tell them that the pot doubles whatever goes in). Draw a chart with two columns, one labelled **IN** and the other **OUT**. Challenge students to figure out what is magic about the pot as you begin to fill in the chart. As students suggest numbers and write them in the IN column, you fill in the number that would match it in the OUT column. (e.g. when 10 goes in, 20 comes out). Record several numbers until students begin to catch on to the pattern. Discuss. "It doubles" will likely be the common answer. At this point, relate the term "function" to the predictable pattern they have discovered.

Day 2

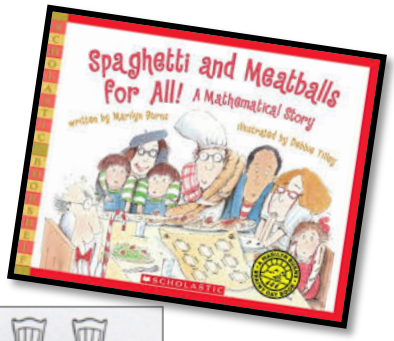
Now, read "Two of Everything" by Lily Toy Hong (1993), a Chinese folktale about a couple that dig up a large, old brass pot and discover that it is magic (it also doubles everything that is put into it!) This literature link is perfect for reinforcing your earlier story. Challenge students to think of functions for their own magic pot. Using charts, students create their own patterns and work with a partner to discover each other's functions. Now hold a discussion to determine what makes a function easy or hard to guess.

Day 3

1. Suppose you are given the choice between receiving a lump sum of 100 coins OR receiving only 5 coins with a Magic Doubling Pot that doubles everything that is put into it and that can be used exactly 10 times. Which option would get you the most coins? Explain how you determined your choice.

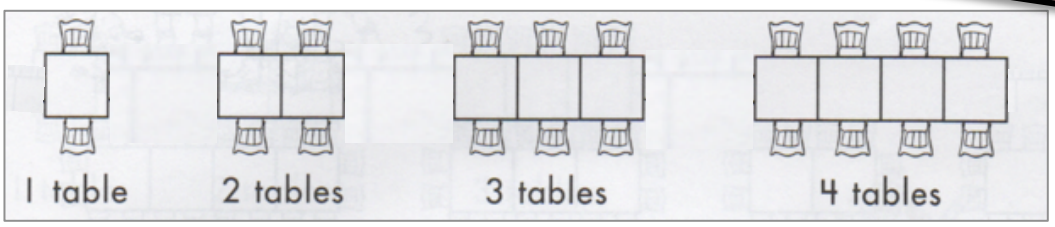
2. Explain in words, using mathematical language, exactly what the Magic Doubling Pot is doing each time it is used. Express this "function" in three different ways.

"Spaghetti and Meatballs" (Grades 4 and 5)



After reading "Spaghetti and Meatballs", pose the following seating plan to the students.

The school is planning on a parent spaghetti dinner. One person can sit at on either side of the table but not on the ends. The tables are grouped in rectangles. It starts by looking like this:



If the pattern continues in the same way, how many guests would there be at 10 tables?

Have students "re-enact" the situation using colour tiles. Model the recording of the manipulatives onto grid paper. Record the tables and the number of people alongside the diagram.

Have students transfer the information onto a table like the one below.

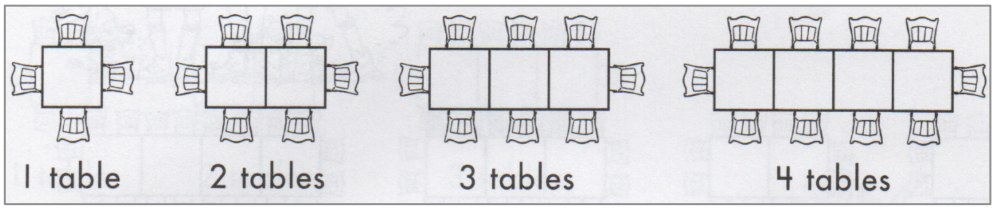
Number of tables	1	2	3	4	5	6	7	8	9	10
Number of guests	2	4	6	8						

Grade 6

Ask students to write the pattern rule for the above table.

Grade 7
This problem is slightly different:

The school is planning on a parent breakfast. One person can sit at each open edge of a table. The tables are grouped in rectangles. It starts by looking like this:



Number of tables	1	2	3	4	5	6	7	8	9	10
Number of guests	4	6	8	10						

Have students use colour tiles to re-enact the problem.

Ask:

What do you notice about the number of people each time you add a table?

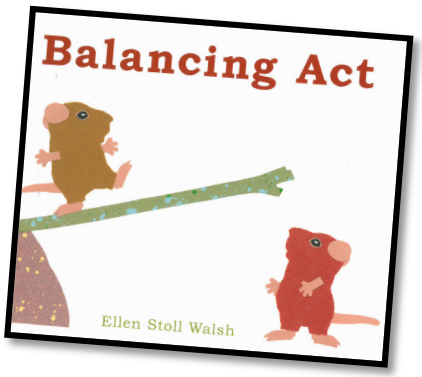
Model the recording of their pictorial representations identifying the number of tables and the number of guests. Ask them to predict the number of people would be sitting at 10 tables. Ask how they would figure it out.

Ask the students to explain the pattern rule in words. (e.g. there are 2 people at each table and the 1 person at each end of the table; 2 people at each table plus the 2 that are on either end)

Model these explanations using symbols i.e. (2 x n) + 2

"Balancing Act" (Ellen Stoll Walsh) (variables, preservation of equality, unknown quantity)

When introducing the concept of an unknown quantity, we typically have students find the "unknown" when the solution is obvious. Merely drawing a "box" to represent the "unknown" when the solution is apparent . (i.e. ☐ + 3 = 8) just confuses the students about the concept of the "unknown".



Providing rich tasks can allow the students not only to make sense of the unknown but also create situations to solve for the unknown quantity.

The following pages from "Balancing Act" can provide that opportunity.

Task 1
If the values of the different animals were:


mouse = 1


salamander = 2

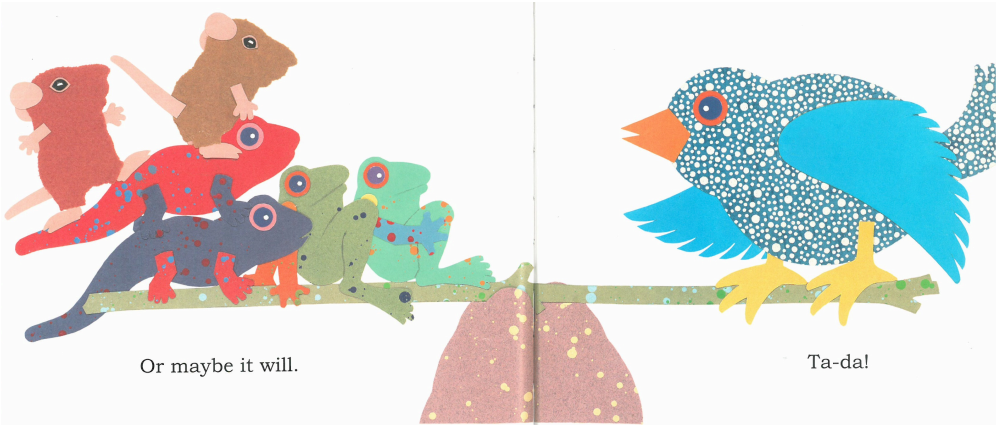

frog = 3


bird = 12

Show the different ways you can make the animals balance on the teeter-totter.

Task 2
Provide the image below and pose the following task:

If the bird has the value of 100 (other possible values; 10.0, 55, etc.) what might be the value of the other animals?



Data for the Day

We need to know whether the data is reliable. From creating, reading, and analyzing graphs, students learn to eventually make predictions based on patterns of certainty or uncertainty. Regular and relevant experiences will enable our students to acquire and use these critical life skills.

How many Smarties?
Have students predict then organize and analyze the data of their individual box of Smarties. Then collect the data of the whole class. Have students compare their data to the class data.

Then have them relook at the posed questions using the class data.

Ask what trends they might notice.

RESOURCES

"Data Management", S & S.

"Math Playgrounds", Surrey School District (36).

"Supersource", Cuisenaire ETA.

"Problem Solving with Math Grades 4-5 – Selecting Successful Strategies", Chris Nitert, (World Teacher Press)

Line Masters and Companion Resources

On the following pages, you'll find a selection of line masters for the tasks presented in this resource.

More tasks and ideas can be found at:
http://mindfull.wordpress.cm

For additional professional development opportunities, contact:
Carole Fullerton at mindfull.consulting@gmail.com
Selina Millar at millar_s@surreyschools.ca

Thinking About Number

_____ > _____ .

_____ < _____ .

_____ = _____ .

_____ is too many _____ .

_____ is too few _____ .

_____ is just enough _____ .

_____ is about _____ .

_____ is close to _____ , but is far from _____ .

_____ people could _____ .

_____ paper clips could _____.

_____ drops of water would _____.

_____ jelly beans would _____ .

_____ seconds is about the same as _____ .

_____ seconds is too short for _____ .

_____ seconds is too long for _____ .

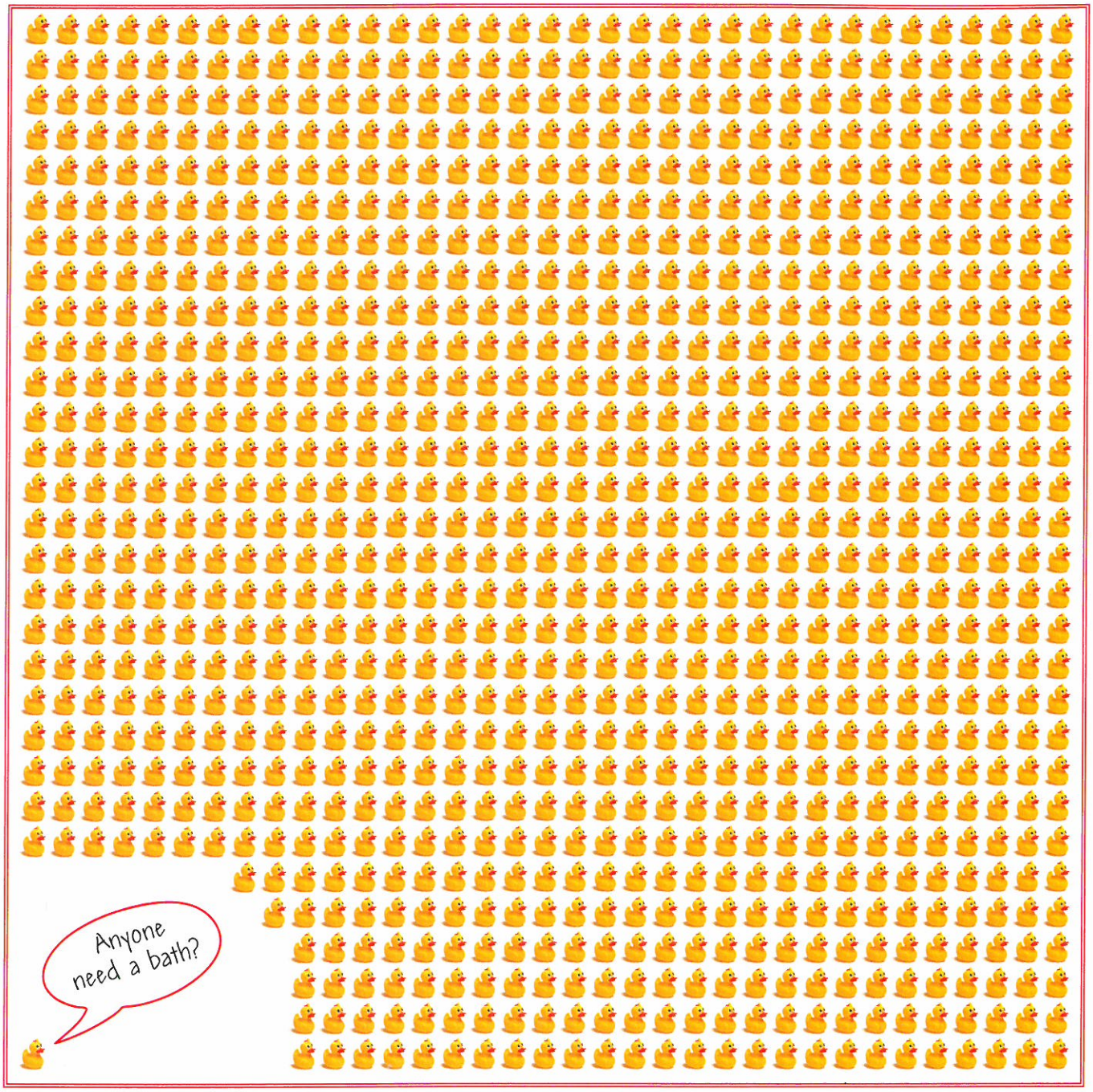
$ _____ is enough for _____ .

$ _____ is not enough for _____ .

$ _____ is more than _____ .

$ _____ is less than _____ .

$ _____ is the same as _____ .



What do 1,000 rubber ducks look like?

Hints

You can train your eyes to look for tens or hundreds, even when you're looking at larger numbers. About how much space do 10 ducks take up in this group of 1,000? What about 100 ducks?

"Greater Estimations" (Bruce Goldstone 2006)

Hundred 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

0 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

My Multiple Book

This book belongs to:

____

Color in
multiples of 3

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

Color in
multiples of 12

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

Color in
multiples of 2

Notes:

____

____

____

____

____

____

____

____

____

____

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

Color in
multiples of 7

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

Color in
multiples of 8

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

Color in
multiples of 11

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

Color in
multiples of 4

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

Color in multiples of 10

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

Color in multiples of 5

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

Color in multiples of 9

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

Color in multiples of 6

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


Or maybe it will.
Ta-da!

SMARTIES GALORE !!!!

Predict how many Smarties are in your box. ____

Open the box. Count them. _____

Arrange them in rows according to colour.

List how many of each colour you have in the following table.

Colour	Number

Compare your results with a partner. Add your partner's results to your own. With your partner and using your ***combined*** results, predict the following:

- how many of each colour are in the classroom
- which colour is the most common
- which colour is the least common

SMARTIES FOR ALL

Record the class actual results in the table below

Colour	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	Total

Compare the class results to you and your partner's original findings.

1. What similarities did you notice?

   _____

2. What differences did you notice? _____
3. What is the most common colour in the class? _____
4. What is the least common colour in the class? _____
5. Do you think your results represent a random survey of numbers and colours in Smarties boxes? Why or why not?

   _____

   _____

6. If you bought another package of Smarties what is the probability of having the same number of candies?

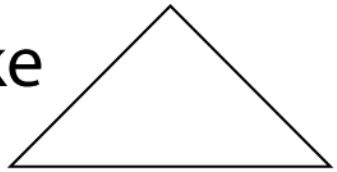
   _____

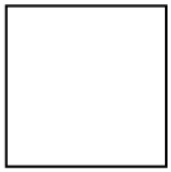
7. Which colour are you most likely to pull out blindly, based on the class data?

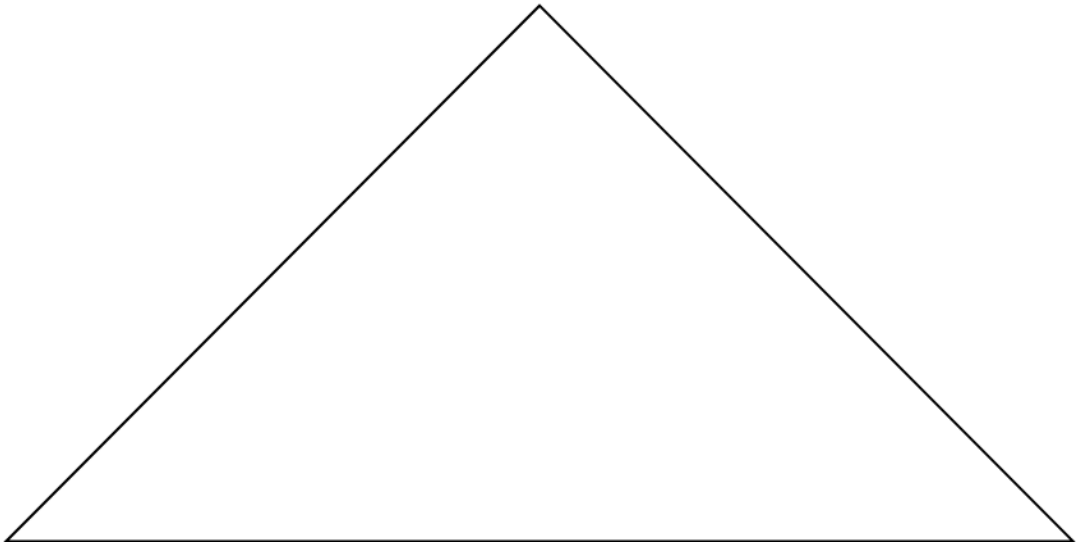
Level 1

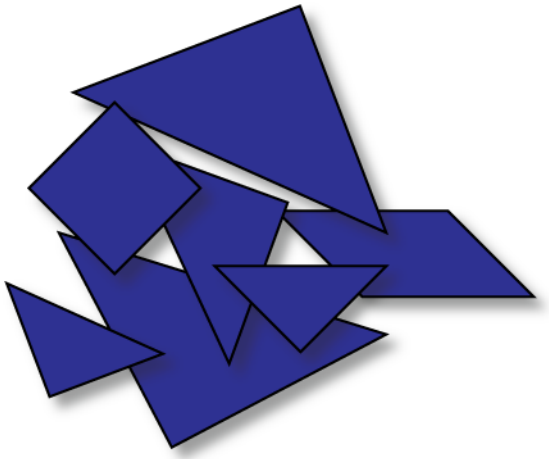
Shape Shifter 4

- Use only 4 of the tangram pieces to make the triangle.
- Move only one of the pieces to form a square.

Make this 

Change to this 



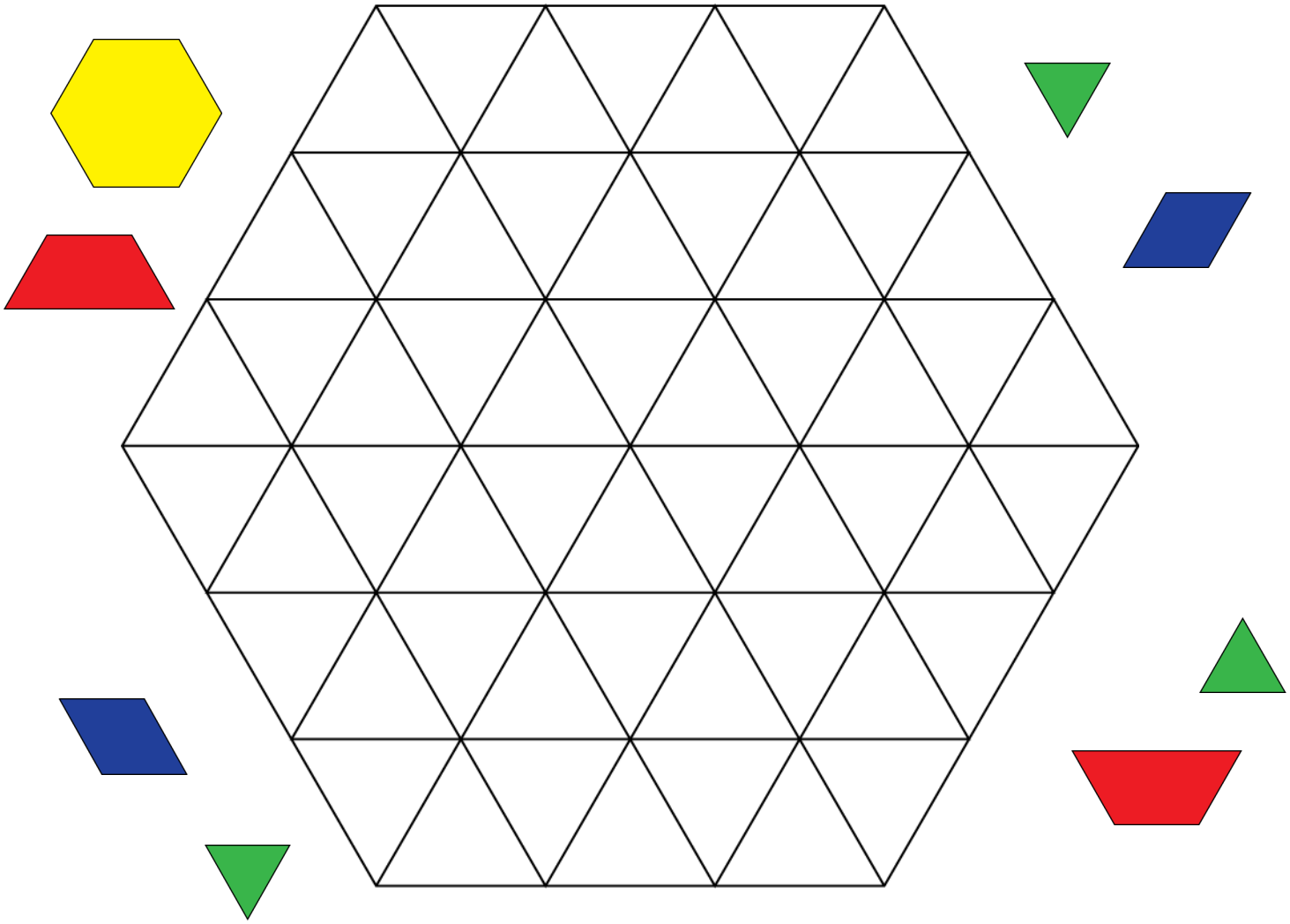


Level 3

The Last Block

~ Choose Your 12 ~

- This is a game for 2 players. The object is to be the player who places the last Pattern Block on the game board.
- Each player chooses 12 Pattern Blocks, of any type
- The first player places a Pattern Block anywhere on the board.
- Players take turns placing a Pattern Block anywhere on the board.
- The player who covers the last open space wins.

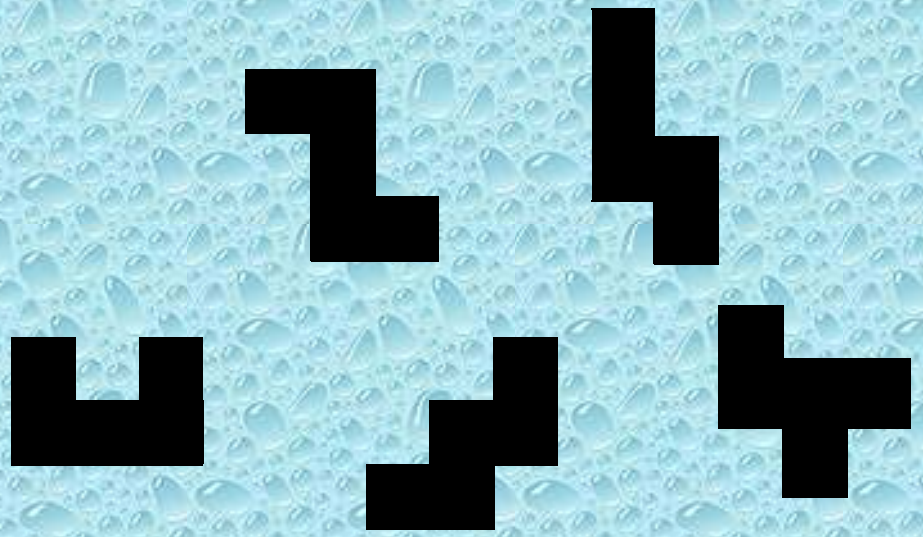


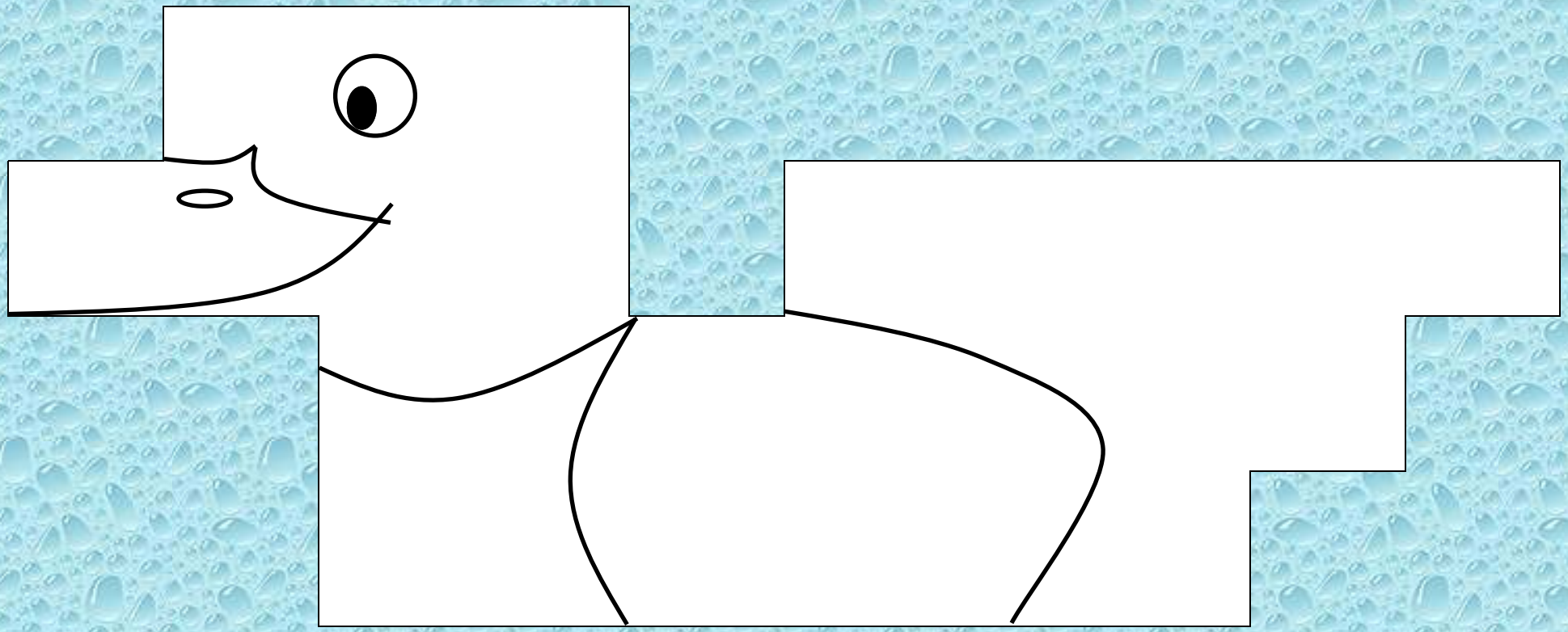
Make the Duck

Use your pentomino pieces.

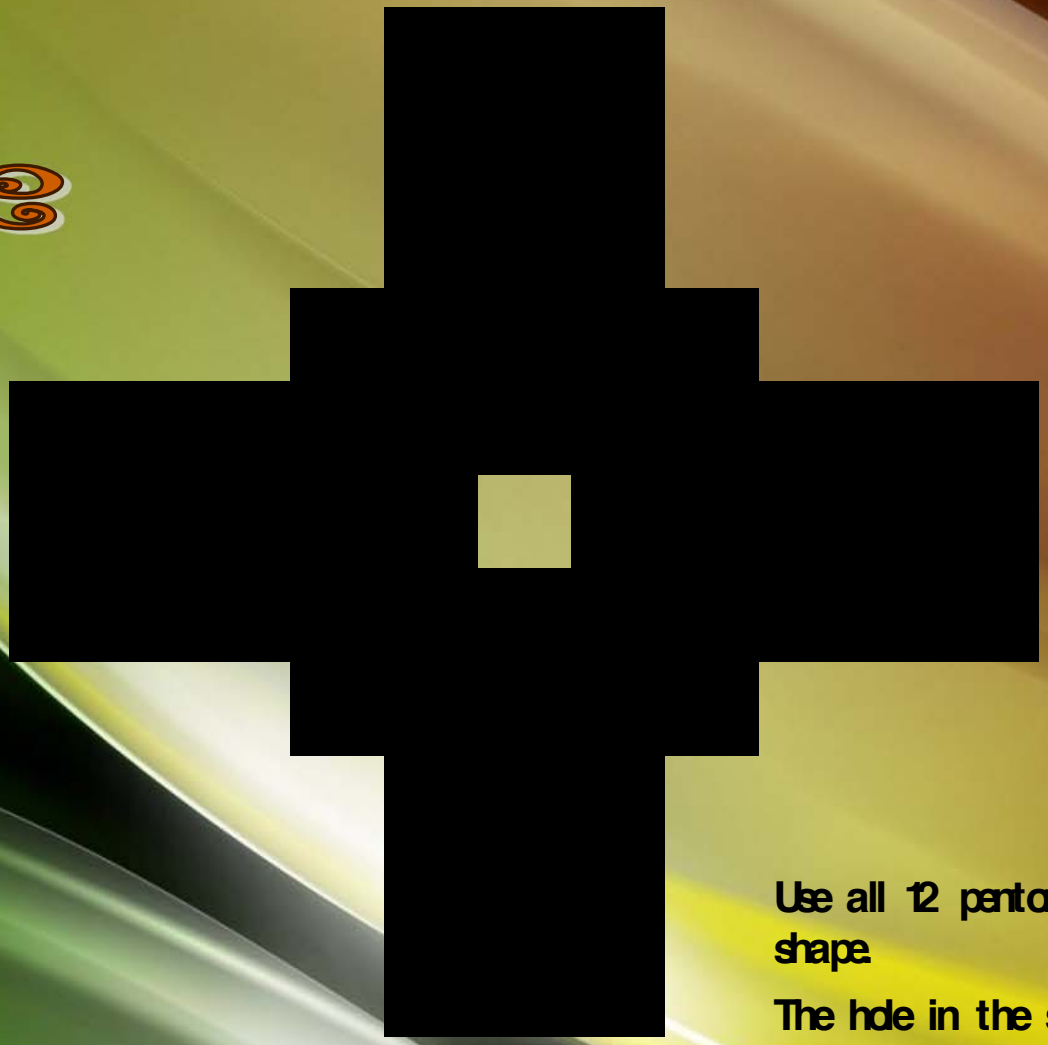
Make the Duck using the pieces shown.

Trace around each shape on another sheet of paper.



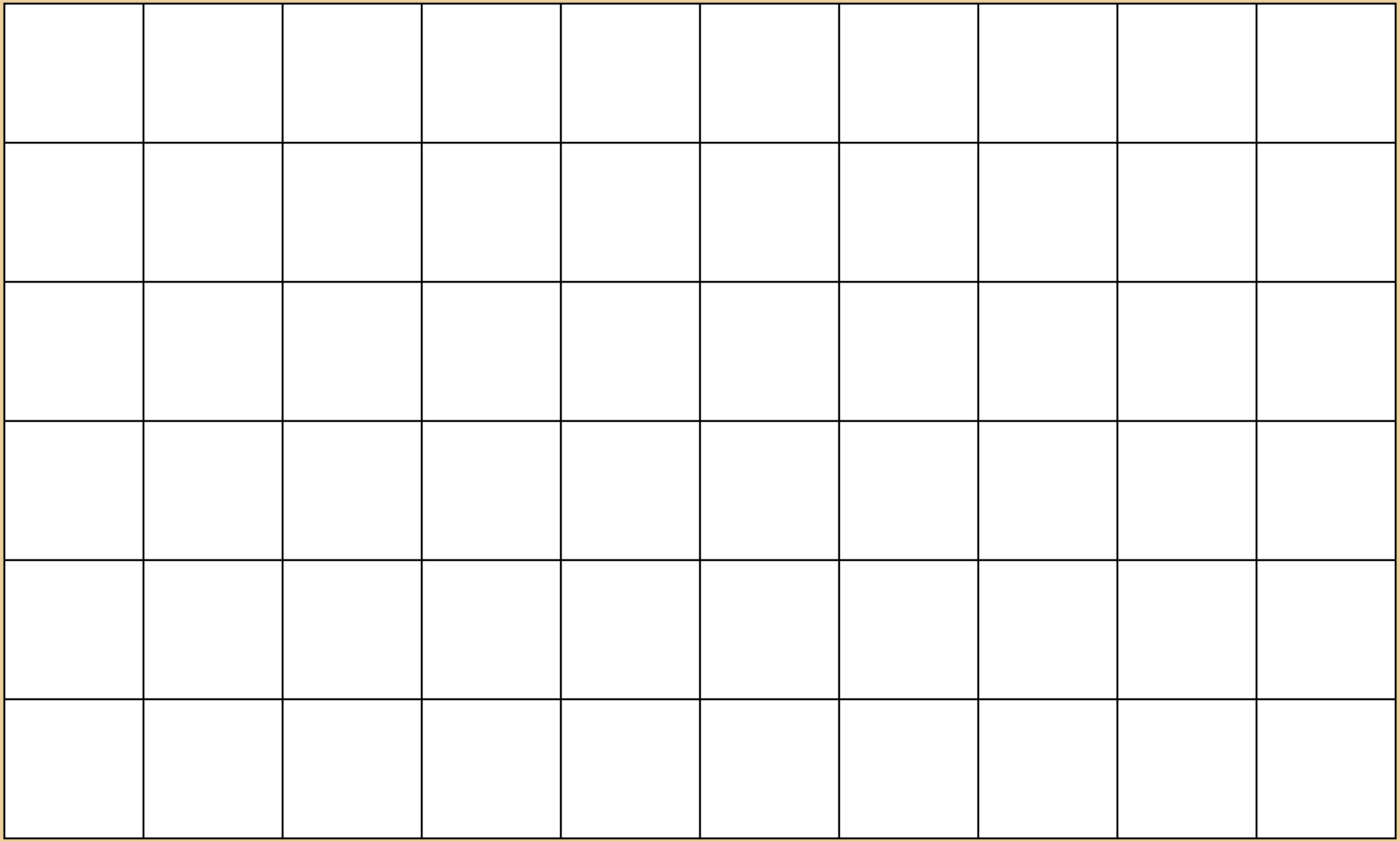


Make the Shape



Use all 12 pentomino pieces to make the shape.

The hole in the shape does not need to be covered.



Pentomino Challenge

How to Play

1. Place the12 pentomino pieces on the table.
2. The first player chooses one piece and fits it on the gameboard.
3. Players take turns placing pieces on the gameboard.
4. The last player who is able to to fit a piece onto the gameboard.
5. Players should have a 5 - 10 game tournament. Keep track of wins to decide who is the Pentomino Challenge Champ.

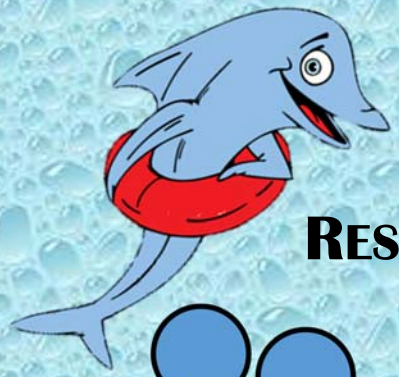
Roll and See

A

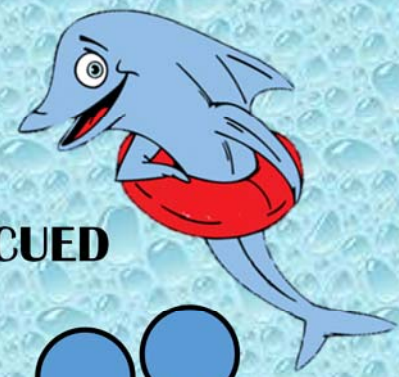
14	+		=	
	-	3	=	
	x	5	=	
30	÷		=	
	-	9	=	
	x	7	=	
18	-		=	
	÷	4	=	
	+	25	=	
10	x		=	
	÷	6	=	
	+	8	=	

- ⇒ Roll a 12-sided dice.
- ⇒ Use the number in one of the number sentences.
- ⇒ Complete that number sentence.

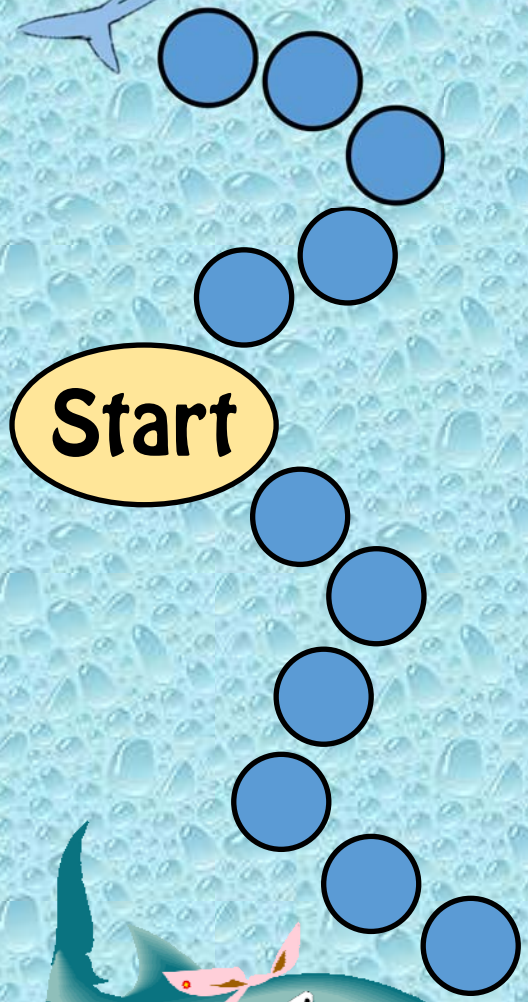
SINK OR SWIM

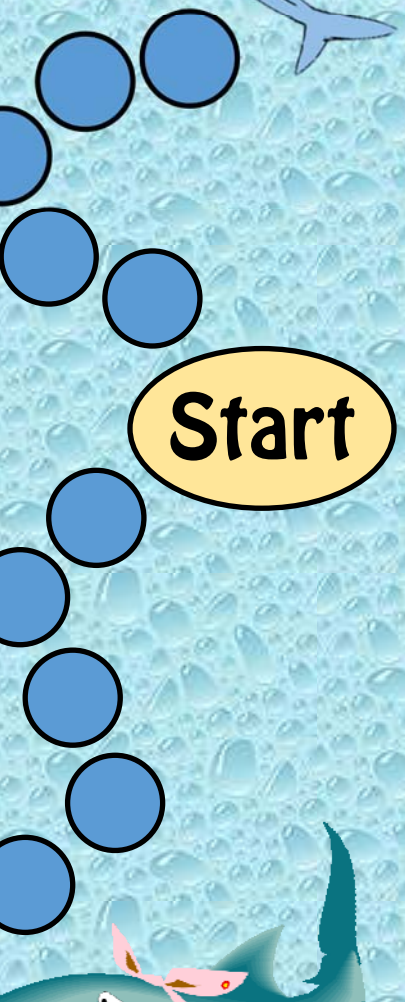


RESCUED



RESCUED



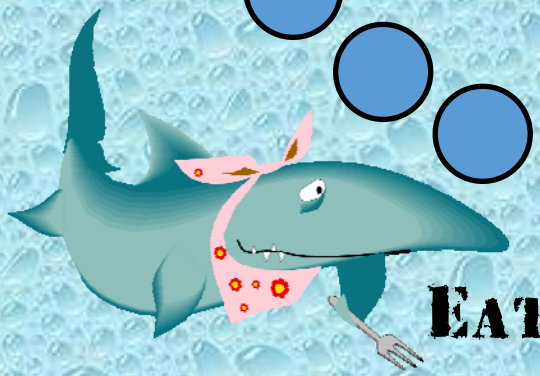


THE GAME

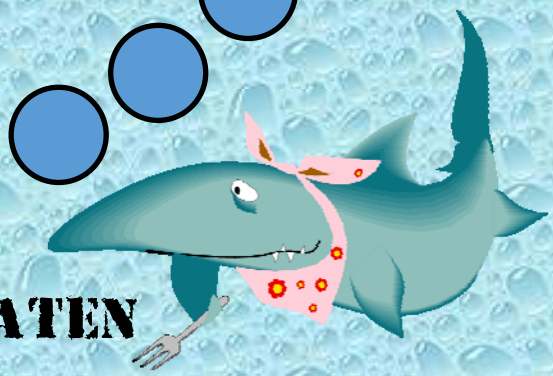
Two divers are diving for buried treasure. Their tanks begin to run low on air. See which diver is the first to either sink and be eaten or swim and be rescued.

HOW TO PLAY

1. Each player puts his/her marker on a START circle.
2. Player A rolls the dice and either **adds**, *subtracts* or ***multiplies*** the two numbers.
3. If the answer equals an odd number, move one space toward the shark.
4. If the answer equals an even number, move one space toward the life raft.
5. Player B takes his/her turn.
6. Alternate turns until one player reaches either the life raft or the shark. Then points are scored:
   ~ A player reaching the life raft first earns 5 points.
   ~ A player reaching the shark first earns 3 points.
7. Play as many games as you can in 10 minutes. The player with the greatest number of points is the winner.



EATEN



EATEN

TWO-DIGIT SCAVENGER HUNT

It's a two-digit number.

The second digit is three times the first digit.

Both digits are even numbers.

The number is __ __ .

THREE-DIGIT SCAVENGER HUNT

It's a three-digit number.

All the digits are odd.

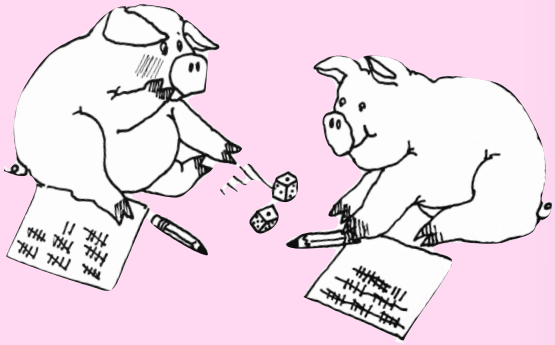
The second digit is 2 more than the first digit.

The third digit is 4 more than the second digit.

The number is < 300.

The number is __ __ __ .

GREEDY PIG



Work in a group of 2 or more.

- ★ Goal is to be the first to reach 100 or more.
- ★ First player rolls two dice as many times as she/he likes, keeping a running total of the sum.
- ★ The player's turn ends when:
  - the player decides to stop and records their current total
  - or a one comes up on one of the dice (player loses that turn's points)
  - or two ones are rolled. (player loses all points).
- ★ Next player rolls and follows the same rules.
- ★ On each turn, the player adds that turn's total (if any) to their previous score.

Can you think of any winning strategies?

Cross over for 2 players

you need:
~ 2—1-6 dice
~ 2 small play people

First of all
Put your people on 18 and 20

When it's your turn
Roll both dice and choose one of the numbers.
Add that to, or take away from, the number you are on and say the answer.

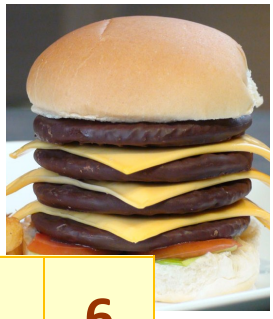
If one of the next-door spaces shows that answer, move your play person there.

If you don't want to move, you don't have to.

The end of the game
Keep playing like this. The first player to cross the board and reach the opposite grey space wins the game.

Adapted from BEAM
www.beam.co.uk

Double or Double-Double



Pick a factor from the **Factor Box**.

Double it (multiply by 2) or double-double it (multiply by 4).

Find the product below and cover it in your colour.

Four in a row wins!

Factor Box

1	2	3	4	5	6
7	8	9	10	12	14

24	8	6	20	12	4
16	28	14	32	18	24
10	2	6	36	28	40
12	14	18	4	16	20
10	8	24	32	36	2
40	28	18	16	4	6

Adapted from BEAM
www.beam.co.uk

HIDDEN SUMS OF 30

- Loop 3, 4, or 5 numbers that equal 30.
- The numbers must be next to each other.
- You can use a number more than once.

Challenge - Use every number at least once.

11	5	3	27	1	9	6	15
4	22	7	18	29	24	14	1
13	3	4	20	9	3	30	17
8	12	2	16	17	4	0	23
10	7	20	28	19	26	11	16
1	7	18	2	6	25	12	5
14	5	1	9	15	2	0	13
10	19	8	21	10	15	6	11

HIDDEN SUMS OF 100

- Loop 2, 3, or 4 numbers that equal 100.
- The numbers must be next to each other.
- You can use a number more than once.

Challenge - Use every number at least once.

20	80	70	10	15	85	30	50
35	65	80	20	60	45	40	5
90	45	90	65	85	15	10	95
40	10	55	35	25	75	25	75
15	20	85	90	75	55	35	15
60	25	50	5	40	30	35	30
70	80	5	10	45	55	30	65
75	20	60	50	25	70	5	95

Hidden Equivalent Fractions

$\frac{5}{10}$	$\frac{1}{2}$	$\frac{1}{6}$	$\frac{2}{12}$	$\frac{4}{16}$	$\frac{1}{4}$
$\frac{2}{3}$	$\frac{8}{12}$	$\frac{4}{8}$	$\frac{1}{3}$	$\frac{3}{9}$	$\frac{2}{8}$
$\frac{4}{6}$	$\frac{6}{9}$	$\frac{1}{5}$	$\frac{1}{2}$	$\frac{6}{12}$	$\frac{6}{15}$
$\frac{3}{4}$	$\frac{9}{12}$	$\frac{10}{20}$	$\frac{2}{10}$	$\frac{8}{20}$	$\frac{2}{5}$
$\frac{6}{8}$	$\frac{2}{6}$	$\frac{3}{8}$	$\frac{6}{16}$	$\frac{2}{4}$	$\frac{4}{10}$
$\frac{1}{3}$	$\frac{4}{12}$	$\frac{5}{6}$	$\frac{10}{12}$	$\frac{3}{6}$	$\frac{1}{2}$

- Loop equivalent fractions that are next to each other.
- A number can be looped more than once.
- Each number has a partner.

NAME GRID

Choose one of the grids.
Start in the top left corner.
Fill the grid by spelling your name.
Put one letter in each square.
Continue the pattern throughout each row of the grid without missing a square.

Describe the patterns you see.
