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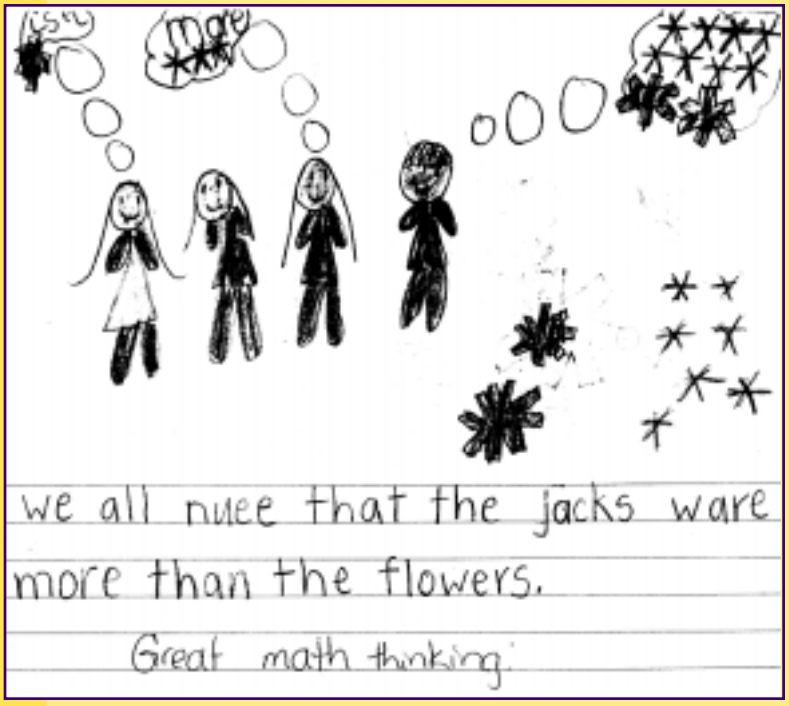
Whole Group Follow-up

BC Early Numeracy Project (K-1)



BRITISH COLUMBIA
Ministry of Education

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Whole Group Follow-Up

These lessons are appropriate for children who struggle with math but would benefit from working as part of a whole class. The lessons offer something of value for all levels of numeracy, and children adept at mathematics can model successful strategies to the others.

The Whole Group Follow-Up materials consist of two sets of structured lessons:

- Sample Number Lessons
- Sample Spatial Lessons

A scale at the top of each lesson shows the relationship of the activities to the Framework for the Development of Number on pages 8 and 9 of *Supporting Early Numeracy*. The scale uses numbers to relate to the stages or levels of the Framework.

1 – Emergent

2 – Early

3 – Developing

4 – Expanding

5 – Established

The lessons are laid out using the following headings (not all headings are present for every lesson):

- What do you need?
- What are you looking for?
- What do you do?
- How might you adapt this activity?
- How might you extend this activity?
- Quick Tasks

Some lessons make reference to the use of "Masters". Masters are located in *Supporting Early Numeracy*, pages 101–151. S*upporting Early Numeracy* is available in print and on the Ministry Website.

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Sample Number Lessons

The Sample Number Lessons are a set of tasks that incorporate number and operations, representation and number sense, and counting and numeral recognition skills. This section provides useful number lessons for all children, regardless of their performance on the Early Numeracy Assessment. The lessons can be adapted to a variety of levels, and so are accessible to all.

The first lesson, Number Operations, has a slightly different format from the others. Because problem solving is such an important skill, extra attention has been given to this lesson and additional information is included.

Number Operations

Math Focus: Problem Solving

Children use a variety of strategies to solve problems. They develop these strategies naturally through their experience with mathematics. You can support children's personal "sense making" by building on their own strategies and procedures rather than teaching them adult strategies.

WHY ARE NUMBER RELATIONSHIPS AND PROBLEM-SOLVING SKILLS IMPORTANT?

We know from research that children progress from direct modeling and counting strategies to storing and using number relationships when they solve problems. In early numeracy, children may use fingers or manipulatives to show each part of a problem and then count all the objects. Gradually, children move on to more efficient counting strategies (counting on, counting down). Once they begin to store and use number relationships, they can use groupings rather than counting by ones (e.g., solving 5+6 by using 5+5 and adding 1).

There are many ways to solve problems. It is important for teachers to understand how students solve problems in order to know whether they truly understand mathematics. Ask students to share their problem-solving strategies. Watch how the children work out the problems and ask them to tell you what specific symbols or pictures mean. Continue asking them questions until you fully understand how they solved a given problem and they can articulate their strategy. Eliciting examples of children's own strategies and highlighting their good thinking provides models for others and allows all children to be successful with strategies that make sense to them.

WHAT DO YOU NEED?

- Base-Ten blocks
- Unifix cubes
- Multilink cubes and various counters
- any manipulatives children may choose to help them solve the problems
- paper or math journals
- a variety of pens and markers

WHAT ARE YOU LOOKING FOR?

Can the children:

- understand the meaning of the problem?
- model the problem to solve it?
- explain their thinking?

WHAT DO YOU DO?

- Provide the children with materials and explain the procedure.
- Read a problem to the children. Reread or use questions to clarify as necessary. (e.g., "There are 10 boys and 7 girls here today. How many children are here?")
- Ask the students to work out their answers (draw a picture, use blocks to model, count in their head, use what they know about adding 10, and use tallies.).

- Have them explain how they arrived at their answers. "Tell me how you figured this out." "Show me how you solved this."
- After each explanation, ask who else used the same strategy and who used a different strategy.
- Find something positive about each child's contribution. (e.g., "Good thinking Donna, you made a picture to work out your answer.")
- Ask the child to tell you what specific symbols or pictures mean.
- If the students show regrouping, ask them what the numbers they record mean (e.g., "I put a 1 up here to show I have a 10 to go in the tens place, because 7+7 gave me 14 or 10 and 4").
- Model how to talk about strategic thinking. (e.g., "So, Bob, you drew a B for each boy and a G for each girl then you counted them all. Did you start from one? Or did you use a faster way to count? How did you know to start with 10?")
- You may want to have the students paste a printout of the actual word problem into their journals to make it clear afterwards what problem was being solved.
- Continue for several examples as appropriate.

HOW MIGHT YOU ADAPT OR EXTEND THIS ACTIVITY?

The lesson can be adapted in several ways to make it appropriate for different age/grade levels:

- Make the quantities smaller or larger.
- Change the names or actions to be simpler or more complex.
- Present the problems in different ways. (e.g., with a younger group, read the problem to the children as they work it out in front of you. For an older group, write the problems on the chalkboard, chart paper or the overhead.)

Mystery Number

Math Focus: Number Concepts

WHAT DO YOU NEED?

- 100 Charts (Master 9)[1]
- markers/beans or crayons

WHAT ARE YOU LOOKING FOR?

Can the children:

- use the information provided to make reasonable guesses?
- use patterns on the 100 Chart to make guesses?
- understand the terms tens, ones, greater than/less than, even and odd?
- use logic to eliminate possibilities? Make logical choices? Keep track of the clues?

WHAT DO YOU DO?

- Show the class a 100 Chart on the overhead projector.
- Say, "I'm thinking of a number" and give a clue. (e.g., "I am more than 20 but less than 80.")
- Call on three students to make guesses and cover incorrect guesses on the 100 Chart.
- Give another clue. (e.g., "I am an even number or I have a 6 in the tens place.")
- Continue giving clues and asking for guesses until someone guesses the number.
- As the students are guessing, cue them to remember what clues and information have already been given. "Who remembers what we already know about the number? Could the number be 54? Why or why not?"

HOW MIGHT YOU ADAPT THIS ACTIVITY?

- Have the students use a 20 board or even a number line to 10 at first.
- It helps to cover sections of numbers that are eliminated with paper so students can see more clearly how the range is narrowed by clues. For example, in the clues above, cover 1-20 and 80-100 with pieces of paper.

HOW MIGHT YOU EXTEND THIS ACTIVITY?

- Have the students play in partners with their own 100 boards and use markers or colour in squares as necessary.
- When students play on their own, it helps to have the student write down his or her number on a piece of paper and fold it up before the other player starts guessing.

[1] Masters are located in *Supporting Early Numeracy*, pages 101 – 151. *Supporting Early Numeracy is available in print and on the Ministry Website.*

Money Mysteries

Math Focus: Money

WHAT DO YOU NEED?

- a "mystery box"
- various coins
- envelopes
- index cards
- coins, stamps or cut outs (Master 15)

WHAT ARE YOU LOOKING FOR?

Can the children:

- identify the coins by value, name, symbol, colour and size?
- ask questions that are logical and that contribute to solving the money mystery?
- count a series of like coins?
- count coin combinations using a range of counting strategies?

WHAT DO YOU DO?

- Announce to the class that you have some coins in the mystery box and their job is to be "money detectives." Ask them to try to figure out the value of the coins and what coins are in the box.
- Start by giving a clue. (e.g., "There are four coins in the box.")
- Have the children ask yes or no questions until they get stumped and then provide them with another clue. "What information do you already know?" "Could the total be 52¢? Why or why not?"
- After 10 questions and clues, have the children make guesses.

HOW MIGHT YOU ADAPT THIS ACTIVITY?

- This is a great beginning activity for students who are learning to identify coins, with clues such as "I am a silver coin and I am worth more than 5¢."
- Use coins of the same denomination (e.g., four nickels) to help children learn beginning skip counting.

HOW MIGHT YOU EXTEND THIS ACTIVITY?

- Once the children are familiar with the activity, do not provide any clues and have them ask questions. Limit the number of questions to 5 or 6.
- Use more complicated coin combinations and add bills.
- Ask the children to create money riddles. Have them write their clues on envelopes. The answer is written on one side of an index card, with pictures of the coins on the other side. The index card is placed inside the envelope. Other students then try to solve the riddles.

QUICK TASKS

- Have the children work with a partner using coins, large cutouts of coins or rubber stamps. The first child says an amount, such as 16¢. The second child shows that amount with the coins and then the first child shows an alternate way to make the same amount.

Smart Money

Math Focus: Money

WHAT DO YOU NEED?

- the poem "Smart" by Shel Silverstein, from *Where the Sidewalk Ends*.
- a U.S. or old Canadian dollar bill and some coins
- writing paper and pencils

WHAT ARE YOU LOOKING FOR?

Can the children:

- understand that coins have different values?
- explain why more isn't necessarily more?
- count the series of coin amounts that are in the poem?

WHAT DO YOU DO?

- Read the poem together as a class and then ask the children, "Do you think the boy was smart?"
- Have each child write a response to this question, giving some mathematical evidence (e.g., coin drawings and value amounts).
- Ask some of the students to share their responses and discuss them.
- Circulate and check their work. "Show me how you figured that out." "Why did you decide he wasn't smart?" "What would have been a smart trade?"

HOW MIGHT YOU ADAPT THIS ACTIVITY?

- Write out the poem ahead of time on large chart paper and read it once together as a class. Ask the children whether they think the boy is smart or not. Graph their responses (yes/no/maybe).
- Have the students work in partners or small groups and reread the poem, stopping after each stanza to make the appropriate trade with coins.
- Discuss what is happening in the poem as you read.
- At the end, ask the students again whether they think the boy is smart. Compare your results.

HOW MIGHT YOU EXTEND THIS ACTIVITY?

- Have the students write their own money poems or stories with smart or not-so-smart trades.

QUICK TASKS

- During calendar time, use coins and counting money with small pieces of Velcro on the back and a piece of cardboard with strips of Velcro across it. If it is October 23rd, for example, have the children come up with as many different coin combinations for 23 as they can. Place the coins on the Velcro chart. This can also be done with large paper coins in a pocket chart.
- Play race for a quarter or race for a dollar: Students begin with a game board and roll two dice. If they roll a total of 8 they add 8¢ to their board. Children continue rolling and adding coins, trading in each time to make sure there is the fewest amount of coins possible on their board.
- They win when they get to a quarter or a dollar. This game can also be played in reverse (start with a quarter or dollar and subtract).

Build and Change

Math Focus: Counting, Invariance

WHAT DO YOU NEED?

- counters
- ten-frames (Master 5)
- numeral cards for 0-9 (Master 8)

WHAT ARE YOU LOOKING FOR?

Observe how the children work and notice their levels of thinking. Do the children:

- remove all their counters each time?
- add counters or take counters off as needed to make each new number?
- use the "counting on" strategy?

WHAT DO YOU DO?

- Ask the children to sit in a circle.
- Name a number. (e.g., "Show me 4.")
- Ask the children to place that amount of counters on their ten-frame.
- When changing numbers ask, "Do you think we need to take some off or put more on to make the number?" "You counted four, so how many counters are there altogether?"

HOW MIGHT YOU ADAPT THIS ACTIVITY?

- Use a large dot cube: count the dots and ask the children to place as many counters as there are dots onto their mats.
- Use large number cubes 0-5, 1-6, and 4-9. As the students call out the number, have them place the corresponding amount of counters on their mats.

HOW MIGHT YOU EXTEND THIS ACTIVITY?

- Increase the number of dots or the size of numbers.

QUICK TASKS

- During attendance time, count children, boys, girls, and those wearing Velcro shoes, those with short sleeves. Each child sits down when counted. This reinforces one-to-one correspondence. Remember to repeat the phrase, "We counted 6 so how many do we have?"

Exploring Odd and Even

Math Focus: Exploring Number Patterns

WHAT DO YOU NEED?

- numeral cards for 0-9
- linking cubes and number lines

WHAT ARE YOU LOOKING FOR?

Can the children:

- make a general statement about odd and even numbers? (e.g., "even numbers divide in two" or "all the answers in the 2 times table are even")
- count in 2s from 0 or 1 up to 20 or 21 and back again? To 50 or 51 and back again?

WHAT DO YOU DO?

Exploring odd and even numbers provides experience with a basic number property. If children understand that all whole numbers must be either odd or even and that they alternate, this can help with checking calculations and provides a basis for understanding other, number patterns.

- Take a numeral card and the corresponding number of cubes.
- Ask them if they *think* they can make two equal towers with their cubes. Have them check their predictions.
- Try all the numbers from 1 to 10 and make 2 piles according to whether the number "works" or not. "Which numbers made equal towers? Do you know what those numbers are called?" "Which pile do you think 11 would go in? 12? 17? 0?" "Can you put the numbers of each set in order?"
- At the end of the lesson, transfer all the numbers that "worked" onto a number line and talk about the pattern shown there. Tell the children that these are all even numbers. Using a different number line (or a different colour on the same number line), mark the numbers that "did not work." Explain to the students that these are odd numbers. "What do you notice?"

HOW MIGHT YOU ADAPT THIS ACTIVITY?

- If children do not know odd and even, explain that an odd number is one where an *odd* cube is left sticking out when they try to make two equal towers. Even numbers give two towers of equal height which, when put together, have a smooth, *even* top.
- Invent a creature that eats numbers that can be put into pairs and spits out those that cannot.

HOW MIGHT YOU EXTEND THIS ACTIVITY?

- Ask the children to predict what would happen if they used more than 10 cubes? 20? 30? Have them check their predictions.
- Have the children make a class book of odd or even numbers. The children can sign up for a number, then draw and colour pictures using 10-grids.

QUICK TASKS

- Pick a numeral card, make a stick with that number of linking cubes, and ask the students if it can be broken into pairs of cubes? Have them try it.
- Ask the children to choose any number on the number line and mark it. Have them predict whether, while counting by twos, they will land on the number. Then have them try it.

Target 50

Math Focus: Place Value

WHAT DO YOU NEED?

- Base ten blocks
- Unifix cubes or other base ten materials
- dice

WHAT ARE YOU LOOKING FOR?

Can the children:

- see when they need to exchange ten ones for a ten?
- say how many their materials are worth?
- write the numeral to match their group of materials?

WHAT DO YOU DO?

- Demonstrate this lesson to the whole class first and then have children work in groups of three or four to complete the activity again.
- Have the children take turns tossing a die and then take the corresponding number of ones. At the end of each turn, if they have a set of ten ones, they exchange it for a ten. The children continue taking turns until all the players have reached 50.
- As you circulate, ask the students to record the number their group of materials represents. Ask questions such as:

  "Could you write the number that goes with your materials?"

  "How many more tens do you need to reach 50?"

  "How many more times do you think you will need to roll the dice to get to 50?"

  "How would this game be different if you got to roll two dice each time?"

HOW MIGHT YOU ADAPT THIS ACTIVITY?

- Begin by having the children create different numbers with their materials. For example write 18 on the chalkboard and then say, "Show me 18 with your tens and ones blocks."
- Next roll a die and have the children take that many ones and add them to their other materials.
- Start at 18 again and count on with the new ones, also recording the numerals on the chalkboard, noting when the number changes to 20. Ask the children if there are any trades they could make to have fewer blocks at their spot. Some children will need lots of repetition of this activity.

HOW MIGHT YOU EXTEND THIS ACTIVITY?

- Children could play Target 100 using two dice at a time or choose their own three-digit target number.
- Use two different coloured dice with one being the tens dice and one being the ones dice and have students predict how many rolls it will take to get to 100.

QUICK TASKS

- Use any of the money games (e.g., Race for a Quarter) in the Smart Money activity.

Crazy Equations

Math Focus: Number Concepts

WHAT DO YOU NEED?

- large 100 Chart (Master 9) and small 100 Charts (Master 26)
- blocks, number line
- calendar, calculators, coins
- record of the number of days in school
- board or chart paper
- egg cartons with 10 trays (i.e., last pair of cups cut off)

WHAT ARE YOU LOOKING FOR?

Can the children:

- create equations?
- explain how they came up with that equation?
- use various strategies to create equations (e.g., using ten, using doubles, building on equations created by other students, using patterns)?
- use a variety of tools (100 Chart, blocks, calculator, number line, calendar.) to create equations?

WHAT DO YOU DO?

- Write the date on chart paper or white board.
- Ask the children to count up to that date while you record a tally for that date.
- Have the children make up equations for that date (e.g., if the date is the 10th, an equation might be 5+5=10).
- As the children give their equations, ask: "How did you come up with that equation?" "What tools helped you?" (blocks, 100 Chart, number line, calendar.) "Did anyone else have the same equation?" Record an equation for every student.
- Build the date using cubes and the egg carton tray. Build it different ways and write the equations.

HOW MIGHT YOU ADAPT THIS ACTIVITY?

- Give the children blocks to create addition equations. For example, if the date is the 4th, give them 4 blocks.
- Encourage the students who demonstrate strength in creating equations to help other students in the class.

HOW MIGHT YOU EXTEND THIS ACTIVITY?

- In grades 2/3, the students can create equations for the number of days you have been in school.
- Students who understand the operations can use a calculator to create complex equations.
- As a quick assessment, have each child create as many equations as possible and record them. Have the students record their strategies and reasoning as well.

Counting Games

Math Focus: Counting, One-to-One Correspondence

WHAT DO YOU NEED?

No special equipment is required, but numeral cards or dot cards could be used.

WHAT ARE YOU LOOKING FOR?

Can the children:

- count fluently? To what point?
- count forward and backward?
- tell what number comes next? Before?

WHAT DO YOU DO?

- Ask the children to stand.
- Choose a target number to count to and an action to do when you get there (e.g., 7, jump and clap).
- Count together while stamping feet 1-2-3-4-5-6-7; on 7, jump and clap while saying the number.
- Decide on another action to do, such as a jumping jack.
- Start in a squatting position and gradually move to a standing position with each number said.
- Use a variety of numbers (low, medium and higher) to accommodate more students' needs.

HOW MIGHT YOU ADAPT THIS ACTIVITY?

- Begin with a low number. Those having difficulty will benefit from the repetition.
- Keep the pace of counting to 90 beats per minute or heartbeat speed so that children get the rhythm of counting. Slowing the pace destroys the natural rhythm of counting.
- Have the children march in the gym or in one place. Have them turn each time the target number is reached (e.g., 1 2 3 4 turn). Repeat several times for one number.

HOW MIGHT YOU EXTEND THIS ACTIVITY?

- Count backwards to zero. When you get to the target number, do the action and continue in reverse to 0, keeping the rhythm going. This can also be done starting in a squatting position and gradually getting taller, then back down to squatting.
- Count by 5s, 10s, and 2s.
- Begin at different starting points.
- Have the students make their own pictures for a counting by 2s book (or by 5s or 10s).

QUICK TASKS

- Spot the mistake: say the numbers in order but include a deliberate mistake. Children enjoy finding your mistakes or missing numbers.
- Adapt any finger plays or number rhymes by changing the numbers to those that need more practice.

Pop the Balloon

Math Focus: Counting, One-to-One Correspondence

WHAT DO YOU NEED?

- the gym or other large area

WHAT ARE YOU LOOKING FOR?

Can the children:

- recite the number sequence correctly? (How far does the chain extend?)

WHAT DO YOU DO?

- Have the children stand on the circle that is painted on the gym floor, hands at sides.
- Decide on the number to count to. As the children count, have them take a step back for each number.
- When the desired number is reached, all clap and say POP!
- The children run back to their place on the circle.
- You might stop part way and ask, "What number comes next?"
- When counting backwards, ask, "What number comes next?"
- You may need to practice one step for one number. Many students walk backwards with no attention paid to one step/one number!

HOW MIGHT YOU ADAPT THIS ACTIVITY?

- Start low, at 5 and increase the number gradually depending on students' abilities.

HOW MIGHT YOU EXTEND THIS ACTIVITY?

- Count by 10s, 5s, 2s, forward and backward.
- Count forward from different starting points.
- Count backward from different start points.
- After reading a counting book, have the students make one. Try "In Our Classroom We Have..." (1 teacher's desk, 2 doors, 3 computers.). Encourage the children to contribute ideas for each number; check by counting. Assign students a number and have them paint pictures to go with the number. Mount on the wall for a wall story that the class can read.

QUICK TASKS

- Ask children to put things away (or meet at the circle) by the time you've counted to 10 (or start at 20 and go to 30, or count by tens to 100).
- In gym class or in the playground, ask: "Can you count while you are bouncing that ball? While skipping? While hopping?"
- The Circle time area number line or 100 Chart for the "Days in School" can be used for many counting activities.

Listen and Count

Math Focus: Counting, One-to-One Correspondence

WHAT DO YOU NEED?

- 10 bean counters or pennies
- a cup

WHAT ARE YOU LOOKING FOR?

Can the children:

- raise 1 finger to 1 bean dropped?
- do they know the order of numerals to 10? To 20?

WHAT DO YOU DO?

Have the students close their eyes or place their heads on their desks.

- Drop beans one at a time into a cup.
- The children cannot see the beans but can hear them being dropped.
- Ask the children to show with their fingers how many beans were dropped. "Can you show a finger each time you hear the bean drop?" "How many altogether?"

HOW MIGHT YOU ADAPT THIS ACTIVITY?

- Begin this activity with students watching.
- Other oral counting activities using bodies will reinforce one to one counting—clapping, jumping, snapping. Jump and count 1 2 3 4 5.

HOW MIGHT YOU EXTEND THIS ACTIVITY?

- Drop beans into a cup. Ask the children to show with one hand the number they hear.
- Do again into a second cup and ask them to show with the other hand. Pause, and have students tell how many altogether. Recheck using the beans in the cup.
- This could also be used as a "counting on" activity. Show a numeral card as the starting point, put more beans in the cup and ask, "what number now?"

QUICK TASKS

- Have the children use body actions (jumping jacks, jumps, hops, claps, snaps.) while counting for breaks, gym warm-ups, waiting, or focusing attention.
- Choose a number and action and have the children count while doing the action.
- Ask the helper of the day to choose a numeral card and an action.
- Have the children do the above activities beginning at different starting points (e.g., 12, 45, 164, 1256).
- Roll a large die and have one student hit a drum to correspond with the number rolled.

Sample Spatial Lessons

The sample spatial lessons involve the use of spatial imagery and the development of spatial sense. They are organized roughly by difficulty, but can be adapted for most primary classrooms. As you use them, note which children are highly engaged and seem to work comfortably and ably with the tasks.

Spatial activities involving hands-on experiences provide the sensory input that helps to develop mental imagery. Imagery is increasingly being recognized as important in children's sense-making activity in mathematics. High imagery levels are related to higher levels of understanding of numerical relationships.

These lessons are useful for all children, regardless of assessment results. They are included as examples of inclusive tasks that allow children to be successful at a variety of levels.

Copy Cat

Math Focus: Exploring 2- and 3-D Shapes

WHAT DO YOU NEED?

Sets of building materials:

- Multilink blocks
- pattern blocks
- building blocks

WHAT ARE YOU LOOKING FOR?

Can the children:

- copy the models accurately?
- use appropriate language to describe the constructions, shapes, and positions? What terms do they use?
- record their constructions accurately?

WHAT DO YOU DO?

- Have the students work in pairs with one kind of material.
- Ask each student make a construction and then build an exact copy of their partner's construction.
- Next, have one student make a construction but keep it hidden. Ask the other children to build it from the student's description of it.
- Have the students make a 2-D record of their constructions for others to build. Ask:

  "How can you check that both constructions are the same?"

  "How can you describe what you have made?"

  "How can you record what you have made?"

HOW MIGHT YOU ADAPT THIS ACTIVITY?

- Keep the materials simple, such as pattern blocks and tracers, and crayons to match colours.

HOW MIGHT YOU EXTEND THIS ACTIVITY?

- Use more pieces or different construction materials.
- Ask the children to draw a sequence of how they built their construction.
- Have each child draw a plan of their construction and see if their friend can build it from the plan.

Triangle Jigsaws

Math Focus: Spatial Thinking

WHAT DO YOU NEED?

- demonstration set of tangrams
- individual sets of tangrams
- pencils and paper
- format sheet of several large triangle shapes, one sheet per pair (Master 51)

WHAT ARE YOU LOOKING FOR?

Can the children:

- see alternative arrangements and possibilities?
- use two triangles to make a larger triangle (joining at the right angle)?
- see immediately which pieces go where?
- persevere when a pattern is challenging?
- work cooperatively with their partners?
- trace shapes accurately and cut out easily?

WHAT DO YOU DO?

- Using the overhead or large, demonstration tangrams, trace a large triangle shape onto the chart.
- Ask the children how to cover the triangle shape with just one tangram piece (all should get this since you just traced it!).
- Ask how to cover it with two pieces, then three pieces. Trace the three-piece pattern onto the chart to show how they make a record of their pattern.
- Discuss the difference between arrangements, in terms of pieces used and number of pieces used.
- Ask the children if they think they could cover it with more than three pieces. Ask if they think they could use four or more. Explain that their task is to see how many different ways they can cover the triangle using the parts from two sets of tangrams.
- Distribute two sets of tangrams for each pair (or per child) and one format sheet.
- Have the students cut out their triangles and sort or match them, looking for patterns, similarities and differences.

  "Which of your triangle jigsaws uses four pieces?"

  "Is there any other way these pieces could be arranged to fit? Why or why not?"

  "Do all 4-piece triangle jigsaws use the same shaped pieces?"

  "Which of your triangle jigsaws use the same four pieces but in different arrangements?"

  "Which jigsaws use three different sized triangles? Only triangles?"

  "What is the least number of pieces needed? Using only two sets, what is the greatest number you can use to fill the triangle jigsaw?"

  "If you had lots of sets, what would be the greatest number? Why?"

  "What could you do to cover any shape with the greatest number of pieces?"

Triangle Jigsaws continued

HOW MIGHT YOU ADAPT THIS ACTIVITY?

- By having the children work in pairs, you can provide help with cutting or representing (or whatever is needed for support).
- Once some jigsaw patterns are created and recorded, have the children match shapes to the patterns.

HOW MIGHT YOU EXTEND THIS ACTIVITY?

- Ask the children to create their own designs as the starting shape, then use the same process to generate different arrangements.
- Have the children create job cards describing which pieces to use and giving the starting shape. The others try to find how to fit the pieces.

Four Square Challenge

Math Focus: 2-D Shapes, Thinking Logically

WHAT DO YOU NEED?

- square tiles
- squared paper to record (Master 52)
- scissors
- crayons or felts

WHAT ARE YOU LOOKING FOR?

Can the children:

- generate all possibilities?
- identify repetitions?
- make a permanent record of their shapes?
- use slides, flips and turns to compare shapes?

WHAT DO YOU DO?

- Using large squares on the overhead, demonstrate how a domino is made of two squares joined by one side. Ask if there is any other way two squares could be put together to make a different shape. Demonstrate how the sides must join and how to flip, rotate or slide any example to show that it is the same as the original shape (since there is only one possibility).
- Take three squares and go through the same procedure. Generate the two possible shapes. Prove how any other shapes are simply versions of the basic two shapes and discuss why that is the limit. (Sides must match exactly and each square must share at least one side.)
- Ask children how many different shapes they think they will be able to make with four squares. Record predictions. Provide each student with four square tiles and a piece of grid paper, ideally with the same sized squares, for students to record findings. Have the students work with a partner to find all the possible different combinations for arranging four squares into a shape. Have the students make a grid paper record of their findings. It is best to have them cut out the shapes to make sure they are not duplicating.

  "Can you think of any other ways to arrange the squares?"

  "Are you sure these are all different? How can you check?"

  "If we flip this shape over, will it be the same as one of your other ones?"

  "If we turn this shape, will it be the same as one of your other ones?"

  "I see two that are the same. Can you find them? Show me why they are the same."

HOW MIGHT YOU ADAPT THIS ACTIVITY?

- Provide square tiles so the children can leave their examples in place as they build new ones.
- Ensure that the grid paper squares are the same size as the tiles.
- Have the children build shapes to match the paper models once some models are recorded.

HOW MIGHT YOU EXTEND THIS ACTIVITY?

- Repeat the process using five squares. Compare to a set of pentominoes.
- Have the students make shapes with their models trace the outline, and then ask others to fit the shapes inside the outline. This can be quite challenging as more squares are involved.

Triangle Challenge

Math Focus: Exploring 2-D Shapes

WHAT DO YOU NEED?

- triangle shapes (e.g., green pattern blocks)
- paper triangle shapes or triangle stickers (optional)
- triangle paper to record
- triangle tracer to record (optional)
- scissors
- crayons or felts

WHAT ARE YOU LOOKING FOR?

Can the children:

- generate all possibilities?
- identify repetitions?
- make a permanent record of their shapes?
- use slides, flips and turns to compare shapes?

WHAT DO YOU DO?

- Using large triangles on the overhead, demonstrate one way two triangles can be joined by one side. Ask if there is any other way two triangles could be put together to make a different shape. Demonstrate how the sides must join and how to flip, rotate or slide any example to show that it is the same as the original shape (since there is only one possibility).
- Take three triangles and go through the same procedure. With the children, generate the possible shape/s. The sides must match exactly and each triangle must share at least one side.
- Ask the children how many different shapes they think they will be able to make with four triangles. Record their predictions. Provide each student with four triangle tiles and a piece of triangle paper (ideally with the same sized triangles as the ones the students are using)for students to record their findings. Have the children work with a partner to find all the possible combinations for arranging four triangles into a shape. Ask them to make a grid paper record of their findings. It is best to have them cut out the shapes to make sure they are not duplicating. Ask:

  "Can you think of any other ways to arrange the triangles?"

  "Are you sure these are all different? How can you check?"

  "If we flip this shape over, will it be the same as one of your other ones?"

  "If we turn this shape, will it be the same as one of your other ones?"

  "I see two that are the same. Can you find them? Show me why they are the same."

HOW MIGHT YOU ADAPT THIS ACTIVITY?

- Provide lots of triangle tiles so the children can leave their examples in place as they build new ones.
- Ensure that the triangle patterns on the paper are the same size as the triangles.
- Once some models are recorded, the children can build shapes to match the paper models.

How might you extend this activity?

- Repeat the process using five triangles.
- Have the students trace the outline of their models, then ask others to fit the shapes inside the outline. This can be quite challenging as more triangles are involved.
- Create a wall display of findings. Compare the triangle findings to the work with squares.

WHAT DO YOU NEED?

- a wide range of small objects, two of each kind
- blocks, pattern blocks, Lego pieces
- pencils, pens, erasers
- a bag or bags to hold half the objects (or a box under the table so that the objects are out of view)

WHAT ARE YOU LOOKING FOR?

Can the children:

- use everyday or mathematical language to describe what they feel?
- match the objects to their partner objects?
- describe how the objects are alike and different?
- draw what they feel?

Feelie Shapes

Math Focus: Exploring 3-D Shapes

WHAT DO YOU DO?

- Place half the objects in full view on the table.
- Place the matching objects out of view but available for touching.
- Have the students feel a hidden object and try to match it to one of the objects in full view.
- Or, have the students describe what they are feeling and see if someone else can find it in the set of objects in full view. (This works well when the students are in a circle and the objects are in the centre. Pass a feelie bag around for each student to take a turn.) Ask:

  "Can you describe the object you are feeling?"

  "Can you spot the object Jon is describing?"

  "You say your object is round and smooth – which of these objects might it be? Which can't it be? Why?"

  "Choose two hidden objects. How are they alike and how are they different?"
- Once you have introduced this lesson to the whole class, make it available for centre activity.

HOW MIGHT YOU ADAPT THIS ACTIVITY?

- Start off with everyday objects like tape, erasers, pencils, and board brushes.
- Use objects that are very different.
- Use fewer objects at a time.
- Try matching objects to pictures.

HOW MIGHT YOU EXTEND THIS ACTIVITY?

- Encourage the children to try to draw what they feel, then to draw it again when the object is in full view.
- Use simple constructions as the hidden objects and ask the children to try to duplicate them.

Mailing Shapes

Math Focus: Relating 3-D Objects to 2-D Shapes

WHAT DO YOU NEED?

- 3-D shapes
- interlinking blocks
- paper for practice
- card stock for final mail slots
- scissors
- pencils
- overhead projector

WHAT ARE YOU LOOKING FOR?

Can the children:

- recognize, name and/or describe the faces of the solids?
- recognize that different views result?
- connect the faces with the mail slot shapes?
- use a sensible technique to get a hole of the right size and shape?

WHAT DO YOU DO?

- Using the overhead projector, demonstrate how different 3-D solids have different sizes depending on how they are placed on the overhead.
- Connect that idea to mailing a letter. Ask: "Why are mail slots long and thin? What can and can't go into those mail slots?"
- Show the children how to first draw a shape, cut it out, and then try to determine the smallest hole needed to "mail" their object. (They may need adult help with this.)
- Have the students draw a slot for their object from card stock for, then challenge a partner to find the object that matches the card and show how it can fit. Encourage the students to try to find the smallest hole possible. Ask:

  "If you turn the shape can you still mail it through the hole?"

  "Will any of your friend's shapes fit through the hole you made?"

  "How many different holes can you make to fit your shape through?"

  "Can you make a smaller hole that will fit your shape?"

HOW MIGHT YOU ADAPT THIS ACTIVITY?

- Provide paper and pencil for students to trace the different ways they could mail their object.
- Use a helper to trace and cut for the student following the student's directions.

HOW MIGHT YOU EXTEND THIS ACTIVITY?

- Ask: "Is there any shape that can only be mailed in one way?"
- Have the children draw silhouettes of objects and see if others can identify the object.
- Make as many different mail slots as possible for any one object.

Cube Constructions

Math Focus: Connecting 2- and 3-D Shapes

WHAT DO YOU NEED?

- plasticene
- toothpicks
- paper
- scissors
- tape
- interlocking cubes

WHAT ARE YOU LOOKING FOR?

Can the children:

- describe the properties of cubes?
- distinguish between cubes and non-cubes and explain how they are different?
- build cubes?
- recognize which nets will fold up into cubes?

WHAT DO YOU DO?

- Give each student one cube and discuss the features of cubes (faces/sides, edges, corners/points, how many.).
- Show the children the difference between:
  - a solid cube, built with one cube or many interlocking cubes;
  - a shell of a cube built from a net (using a paper net and folding it up) – this is surface area only; and,
  - a skeleton of a cube where only the edges and corners are represented as in toothpicks and plasticene blobs or marshmallows.
  - Demonstrate the use of the different materials and divide the class up into groups.
- Give each group the challenge of building as many different cubes as they can. Ask:

  "How many sides/corners/edges does a cube have?"

  "Is it the same for every cube?"

  "How can you keep track of which sides/corners/edges you have counted?"

  "How many toothpicks did you need to build a cube? What does that tell you?"

  "Can cubes stack? Why or why not?"

  "Can cubes roll? Why or why not?"

  "How can we tell if a solid is a cube or not? What does it have to have?"

  "Is this a cube? Why or why not?" (show different prisms)

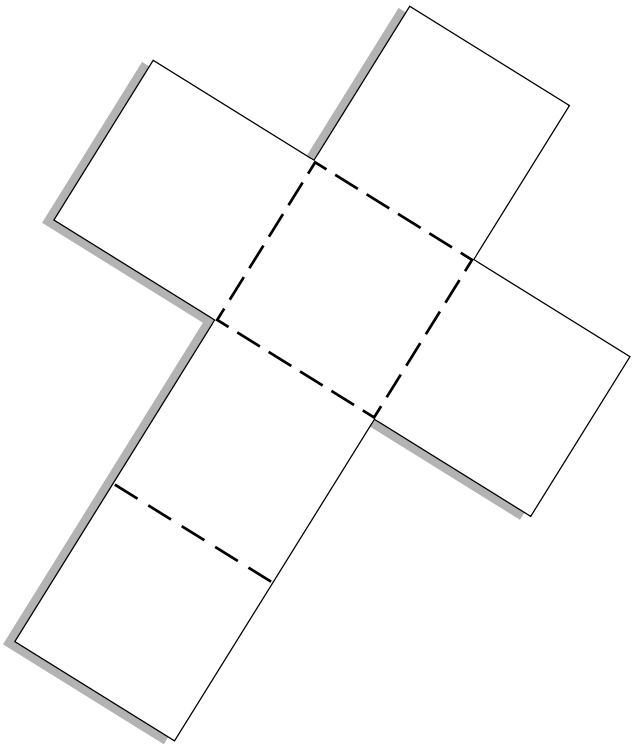
  "Is a cube a rectangular prism?" (yes, a special one, just like a square is a special rectangle)

HOW MIGHT YOU ADAPT THIS ACTIVITY?

- Provide nets for folding into cubes to see if it will work or not.
- Use plasticene to try to shape a cube.

HOW MIGHT YOU EXTEND THIS ACTIVITY?

- Trace nets from cubes.
- Explore all the ways six squares can be joined. Ask: "Which of these shapes can fold up into a cube?" (Use pentominoes to determine which can fold up into an open cube or box.)
- Have the children try to draw cubes showing the three dimensions.
- Use isometric dot grid paper to learn to draw cubes.



Cut Ups

Math Focus: Exploring Symmetry

WHAT DO YOU NEED?

- newsprint or scrap paper for cutting
- scissors

WHAT ARE YOU LOOKING FOR?

Can the children:

- describe their work?
- predict their outcomes?
- explain how different outcomes are made?
- name the shapes they make?

WHAT DO YOU DO?

- Show the children how to fold paper and make a cut on the fold.
- Ask them to predict what their cut will look like before opening the paper.
- Now have them try two folds so that there is a right angle.
- Have the students draw their predictions on the chalkboard or paper, then check by asking:

  "What shape do you think you will get? Now open it. Is it that shape?"

  "How can you cut this folded paper to get a square?"

  "How do you know the hole will be square?"

  "Are there any other ways to make a square?"

- This is a true exploration. Encourage the children to post their examples, first drawing the fold lines to show how they folded. Encourage variety and creativity.

HOW MIGHT YOU ADAPT THIS ACTIVITY?

- Use only one fold and focus on symmetry.
- Have the children draw their predictions, then open and compare.
- Use geoboards. Position an elastic to show the mid flip line. Have the students build a pattern on one side, then give it to a friend to build the flip on the other side.
- Use pattern blocks the same way: Build a pattern along a line, then try to build the symmetrical match. (MIRAs are useful for this.)

HOW MIGHT YOU EXTEND THIS ACTIVITY?

- Show a shape and ask how to cut a fold to get that shape.
- Have the students make a set of shape cards for others to try.
- Ask the children to write a description of how to cut a certain shape.