**The Number Strand: Outcome N4.5**

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| **Outcome** | **Indicators** |
| N4.5 Demonstrate an understanding of division of whole numbers(1-digit divisor to 2-digit dividend) by:* using personal strategies for dividing, with and without concrete materials
* estimating quotients
* explaining the results of dividing by 1
* solving problems involving division of whole numbers
* relating division to multiplication.

[C, ME, PS, R, V]*In support of the K-12 Mathematics goals of Number Sense, Spatial Sense, Mathematical Attitude and Logical Thinking.* | 1. Solve a division problem without a remainder using arrays or base ten materials.
2. Solve a division problem with a remainder using arrays or base ten materials.
3. Solve a division problem using a personal strategy and record the process symbolically.
4. Create and solve a word problem involving a 1-digit or 2-digit dividend (the number being divided into).
5. Estimate a quotient using a personal strategy (e.g., 86 4 is close to 80  4 and close to 80  5.
6. Explain the property for determining the answer when dividing numbers by one.
7. Explain, using examples, the relationship between division and multiplication.
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| **Learning Space:** [**Top**](#top) |
| In grade 3, students began to explore and develop an understanding of the meaning and role of division. Division was approached as equal sharing, equal grouping, and repeated subtraction. Linked directly to their study of multiplication, the students focused on division related to the multiplication of whole numbers less than or equal to 5. During this development, the students modeled different division statements related to different contexts using concrete, physical, and pictorial models. These models were then generalized into symbolic notation and the students learned to use the relationship between multiplication and division to make sense of and solve division questions. In this grade four outcome, the students are expanding their understanding and strategies for solving division statements and problems. Emphasis should first be on modelling the larger division questions as well as sharing and discussing the strategies used to find solutions. The three broad contexts of equal sharing, equal grouping, and repeated subtraction should continue to be present in the students’ learning. As the students develop more confidence in their understanding and ability to divide they should be challenged to represent their strategies using symbolic notation. Students’ should be developing their own strategies and ways to reason about division and not memorizing some particular abstract algorithm. Students should be able to generalize and explain a rule for division by one. They should also be able to determine and explain estimates for division situations. Again, there are a variety of possible ways in which the students’ can be engaged in problems related to this mathematics outcome. Equal grouping and equal sharing, even repeated subtraction, are events that can and do occur in all subjects. It is important that when this occurs, the teacher has the students recognize how the particular context is relevant to their mathematical studies and vice versa. Even in the planning and running of school events, grade four students can be involved in determining strategies for equal sharing of equipment, time, or the formation of equal groups of desks, students, or designated objects.  |
| **What Students Should…** [**Top**](#top) |
| **Know*** **“**” is used to designate division.
 | **Understand*** how and why to choose the numbers used in an estimation
* how to determine which of two estimates will be closer to the original value
* why they might select a particular strategy in solving a division question
* the mathematical reasoning behind a particular division strategy.
* when a problem involves division of whole numbers by relating the problems situation to arrays, area, repeated subtraction, groups, or models using base ten materials
* symbolic representations for division are directly related to concrete and pictorial modelling of the division
* why some division questions have a remainder and some do not
* when a context in which division could be involved and create a problem to reflect the situation.
 | **Be Able to Do*** model different ways to represent division of whole numbers
* use personal strategies to determine the quotient (and remainder) in a division question
* provide an estimate for a division question
* create and solve a problem involving division of whole numbers.
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| **Key Questions:** [**Top**](#top) |
| * What does it mean to divide?
* How are multiplication and division related?
* What is the result of dividing by 1, and why is that true?
* When would you find an estimate for a quotient?
* How do you know that you need to divide to solve a problem?
* What does a remainder tell you about a division question?
* What does it mean if there is no remainder?
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| **Suggestions for assessment:** [**Top**](#top) |
| **Big Idea:**Determining quotients involving 1-digit whole number divisors and 1- or 2-digit whole number dividends. **Suggestions for assessment tasks:**1. Assign the students a project in which they are to demonstrate their understanding of division. The format for how the student will present their understandings should be left up to the individual students. They should be allowed use manipulatives, volunteers from the class, music…
2. Prior to class, generate a list of the ideas you feel are most important for the students to focus their project upon. For example, you may wish to find out what the students understand about demonstrating what division means, creating problems in context which require division to be done, demonstrating different strategies for carrying out division calculations, and explaining of what remainders mean. This list will vary depending on the learning experiences the students have had so far and any assessments done prior to this project.
3. Have students brainstorm about what they think someone who understands division would be able to demonstrate about division. Record their ideas so that they can be seen by all students in the class. Remind the students that brainstorming is not about being right or wrong, but to generate ideas.
4. Many of the ideas generated by the students will be specific examples, so have the students group their ideas that show the same characteristic of understanding. You may need to give them an example to begin this process. Then, ask the students how they would describe those ideas that are in each group and record their descriptions. During this time period, students should be allowed and encouraged to challenge or clarify the ideas presented or and to bring forward new ideas.
5. If there were ideas you wanted to focus on that the students have not yet been mentioned, use questioning to probe if the students can come up with those ideas. If they are still unable to generate those ideas, then they likely need more learning experiences with those ideas prior to this assessment. At this point, your ideas can be modified so the project can go ahead, or you can take time to extend their learning before proceeding.
6. As a class, with influence from you, select five or less big ideas that the students should focus their project on. As a class, develop a rubric or rating scale that can be used for scoring the projects.
7. Explain to the students that the purpose of the project is to show you, in a way that is meaningful to each of them individually, what they understand about division.

**What to look for:**For ideas that might be included in the project rubric, see [*Finding Quotients* Rubric](file:///C%3A%5CUsers%5Cru593%5CAppData%5CLocal%5CTemp%5CFinding%20Quotients%20Rubric.doc).**Big Idea:**Estimating quotients involving 1-digit whole number divisors and 1- or 2-digit whole number dividends. **Suggestions for assessment tasks:**1. Give the students two different estimates for a division question, one bigger than the actual quotient and one smaller. Ask the students to give a context for each estimate, explaining why it is an appropriate context.
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  sois about 8.1. Give the students a division statement and ask them to explain how they would determine an estimate of its quotient and how they would know whether that estimate is larger or smaller than the exact value.
2. Give the students a division statement with the quotient and remainder given. Ask the students to use estimation to determine and explain if the given quotient and remainder seems reasonable.
3. Ask the students how estimation of quotients is related to multiplication.

**What to look for:*** See [*Estimating Quotients Rubric*](file:///C%3A%5CUsers%5Cru593%5CAppData%5CLocal%5CTemp%5CEstimating%20Quotient%20Rubric.doc)*.*

In general, students can be assessed on a project that integrates their learnings in mathematics. Such a project could include all types of calculations including both exact values and estimates. It may also bring in learnings about time, area, 3-D objects, solving equations, equality and many-to-one relationships.Have groups of students investigate possible community or school improvement projects, such as planning the layout for a flower bed at the seniors’ complex or planning the inventory and layout for the school canteen during a tournament. In their plans, students should be expected to show evidence of their understanding of multiplication, division, and any other related mathematical ideas. The project can be assessed on appropriateness of the plan, completeness of the plan, correct inclusion of mathematical operations and other concepts, accuracy of computations (including the use of estimation), and participation in the project. As a class, a scoring rubric for the project should be designed, including a template for evaluating self and group participation.  |

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| **Suggestions for instruction:** [**Top**](#top) |
| **Big Idea:**Determining quotients involving 1-digit whole number divisors and 1- or 2-digit whole number dividends. **Suggestions for instructional activities:**1. Begin the students’ exploration of division using division contexts that will divide evenly. Have the students share and discuss different meanings for these division contexts (equal sharing, equal groupings, partitioning) in terms of different contexts and represent them using different manipulatives or pictures. Be sure to emphasize proper language use. Avoid the phrase “goes into”, but instead use the ideas of “divided into groups of,” “partitioned into sets of,” or “shared equally among”. It is very important to keep these initial encounters free of symbolic notation. Symbolic notation should be introduced when the students are showing that they understand what division means, and then the symbolic notation should be directly linked to the contexts and representations that they have been creating. Introduce horizontal symbolic notation first () and later the vertical form (). Again, be sure to use and listen for the correct language when working with the symbolic notation. For example, if the students are considering  or they should be orally reading these as “forty-five divided by nine” or “nine divided into 45”. Many students pick up the habit of saying “nine divided by forty-five” which can later lead to more confusion. Students must understand what divided means, and sometimes the introduction of symbolic notation too early interferes with that understanding.
2. Using the division contexts from above, have the students explore the relationship between multiplication and division. Using an area or array model for representing a multiplication statement, have the students describe the two related division statements and write them symbolically.
3. Expand the students’ exploration of division to contexts where there may be remainders. Let the students play with representations of different types and discuss the leftovers or missing parts that they find. In developing an understanding of division with remainders, it is important to let the students find remainders in their own terms. For example, a student might say that if there are 35 pennies, there is one penny short of having 12 pennies for each of three people (35 = 3 x 12 – 1) while another student might say that each of the three people should get 11 pennies with two pennies left over and going to no one. Also let the students be creative in what they would do to make things work out evenly. For example, they might ask a parent for a penny, or they might put the two extra pennies into a donation tin at a store. These experiences are also important when students begin estimating quotients because it engages the students in exploring the impact of remainders on the context of the quotient, and ultimately helps them decide if they should be rounding up or rounding down.

 1. Students should experience division problems that involve division by one within their explorations of division. As they become confident in dividing, the students’ attention should be drawn back to those experiences with division by one and the students should be challenged to generalize a rule about dividing by one. As well, they should be expected to explain the pattern that they identify. Division by one is not a complex idea, but its role in future mathematical understandings is important. Just as addition and subtraction of zero can be treated as a special case of addition and subtraction, so too can division, and for that matter multiplication, by one. Whether the students use concrete or visual representations, or if they use mathematical logic and reasoning, they should be able to justify their conclusions. Such an understanding requires that the students explore, hypothesize about, verify the hypothesis, and generalize their results.

**Big Idea:**Estimating quotients involving 1-digit whole number divisors and 1- or 2-digit whole number dividends**Suggestions for instructional activities:**1. Estimation of quotients becomes a natural focus as the students begin to explore division problems with remainders. Estimation should be integrated within the students’ learning experiences related to finding exact values for answers. Questions like “how did you know what the quotient would be close to?” should be interjected regularly into class explorations.
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