Grade 4/5

Number Sense

Assessment Package

SNAP Assessment

First Steps in Math

Diagnostic Assessments & Learning Activities

Comox Valley Schools
A Community of Learners
INNOVATIVE • INQUISITIVE • INCLUSIVE

Table of Contents

SD71 4-8 Numeracy Assessment

Intermediate/Middle Years

Foundations

Intermediate and Middle Years teachers identify and monitor their learners' strengths and needs to ensure continuous growth in numeracy. This assessment tool is designed for classroom teachers and focuses on critical skills that foster numeracy development. The tool can be used to inform instructional decisions as part of the ongoing instructional cycles throughout the Intermediate and Middle Years and is useful for school data collection to determine school goals and to pass on to future teachers in support of transitions.

Wiliam and Leahy (2015, p.9) state that many in education talk of 'data driven instruction' resulting in large scale assessments that provide information on our learners after the fact – too late to do anything about it! We should instead be focusing on 'decision-driven data collection' answering the questions:

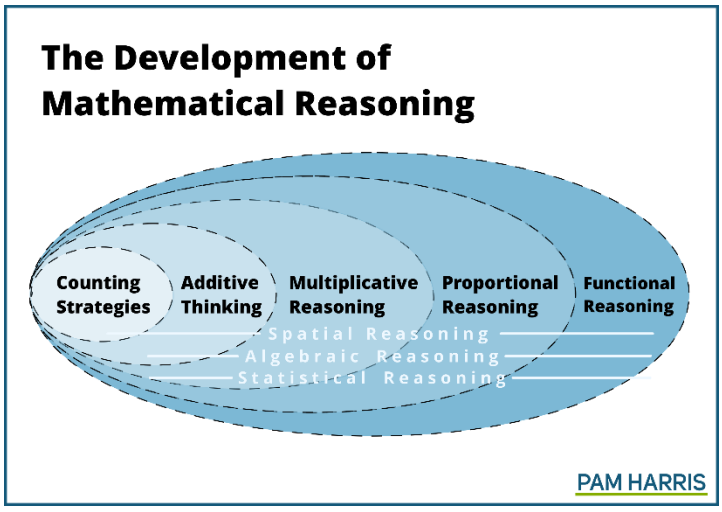
- "What do you want to know about your learners?"
- "When do you want to know it?"

We need 'laser-beam focused' assessments to help us reach all our learners that are quick to implement, interpret and act upon.

NOTE: Please note that these assessment tools focus on some of the key numeracy areas and do not represent a comprehensive numeracy learning program. For more information about our district's holistic approach to numeracy learning, please see the SD71 Numeracy Framework.

Grades 4-7 Numeracy Developmental Stages:

- ✓ Grade 4 students begin to move from the world of additive thinking into multiplicative thinking.
- ✓ Students need to recognize multiplication in repeating equal quantities, rates, ratios, arrays, and as a product of measures.
- ✓ They see division as the inverse of multiplication and as both partitive and quotative.



- ✓ They are continuing to develop their basic facts as they find and use strategies for multiplication and division to 100.
- ✓ The world of fractions looms large on the landscape of learning and students need to think flexibly about fractions of area, measurement, and sets. They will name, order, and compare fractions.
- ✓ *Place Value* expands infinitely now in both directions, and there are special fractions, called 'decimal fractions' that are also part of the place value system.
- ✓ They also learn to operate with fractions (add, subtract, multiply and divide).
- ✓ They will take all these concepts into solving numeracy tasks based on real-world experiences.

What's on the Horizon?

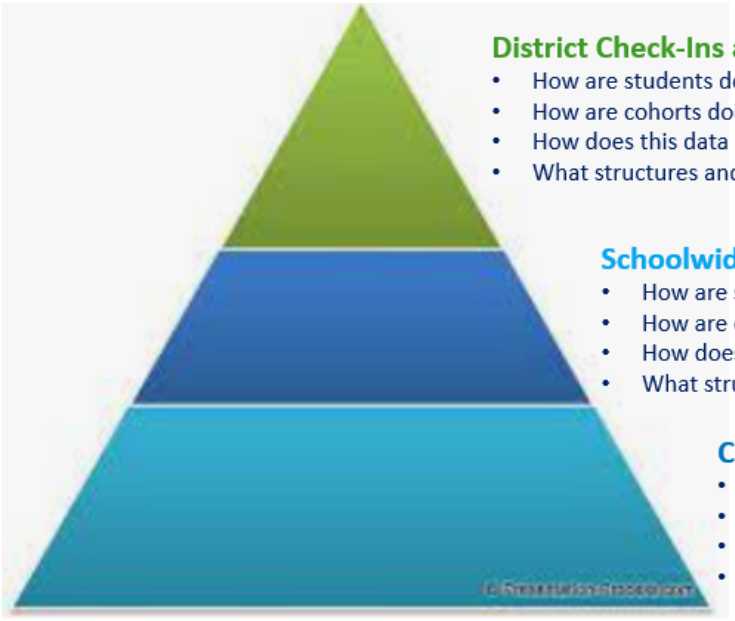
- ✓ In **Grades 8 and 9** students build on their understanding of fractions and decimals, moving flexibly between fractions, decimals, ratios and percents, and operating with them.
- ✓ They will use their developed multiplicative understanding to find perfect squares, cubes, square roots, and cube roots so having *automaticity* with basic facts is crucial.
- ✓ Students also operate with integers and polynomials and begin to work with exponents.

Mathematics is not about numbers, equations, computations, or algorithms: it is about understanding.

William Paul Thurston

Assessment Design for the Frameworks

Grounded in Classroom Assessment System



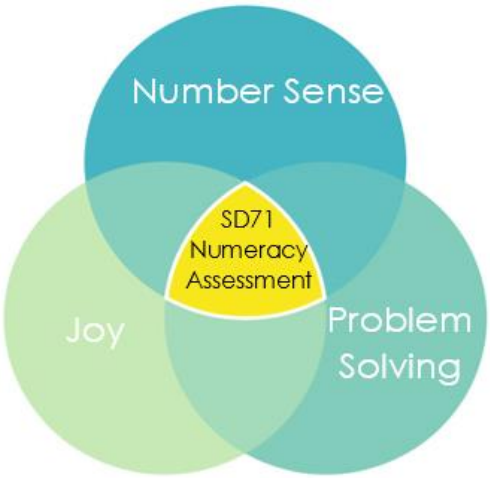
District Check-Ins and Provincial Assessments
- How are students doing across our system?
- How are cohorts doing across time?
- How does this data inform our district's long term goals and plans?
- What structures and strategies are needed for continuous improvement?

Schoolwide Assessment
- How are students doing across the school?
- How are cohorts doing across the grades?
- How does this data inform our school goals and plans?
- What structures and strategies are needed to address needs?

Classroom Assessment
- How is each student doing?
- How is the class doing?
- Who needs supplemental learning?
- Did supplemental learning make a difference?

District Numeracy Check-In Points

With in the SD71 Numeracy Framework, there are district check-in points to monitor how learners in our system are doing across the years and to inform decision making regarding numeracy initiatives, professional learning opportunities, and resources. The district will be extracting the data from both the SNAP and Problem-Solving Assessments that classroom teachers have entered in Grades 3, 5, and 8.



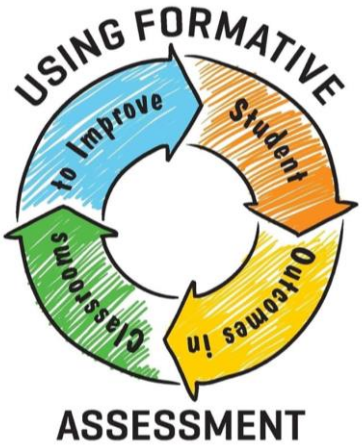
District Check-In Points and Provincial Assessments Timeline:

Number Sense Numeracy Assessments:

1. **Whole class**: SNAP (Student Numeracy Assessment and Practice), every 6-8 weeks. (Fall/Winter/Spring)

2. **Targeted Diagnostic Assessment**: First Steps in Math - Targets misconceptions and gaps, accompanied with learning activities to build key math understandings for the whole class, small groups, and/or one-to-one instruction.

3. **Daily Observations**: Can be recorded in checklists, comments, and reflections.

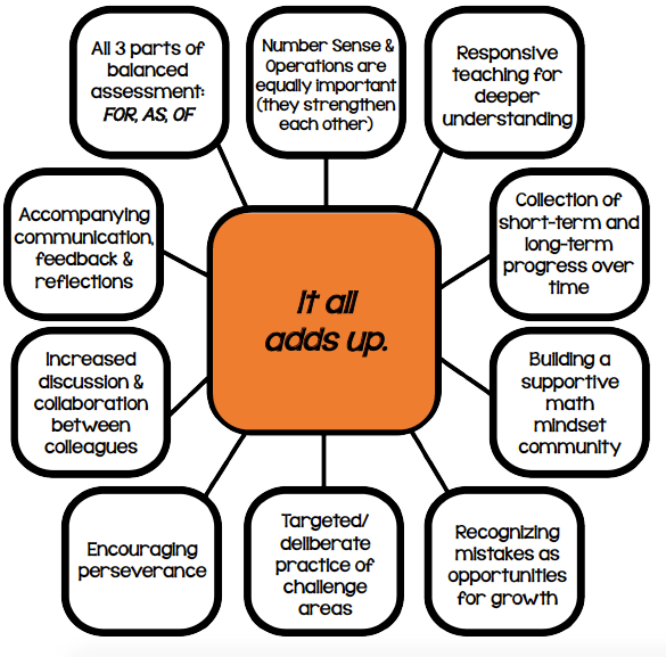


We value what we measure.

Do we measure what we value?

Whole Class Assessment SNAP Grades 4-7:

The Student Numeracy Assessment and Practice (SNAP) is the Chilliwack School District's numeracy assessment for all students in grades K – 7. It was created by a group of Chilliwack educators and has been used in all grades K – 7 classes since September 2016. The SNAP is a unique assessment; not only is it a measurement of achievement, but it is intended to be used as a practice tool throughout the entire year. The data it provides should be used to inform and guide instructional planning.



The SNAP is a two-page assessment that focuses on the foundational skills of mathematics: Number Sense and Operations. It **compliments any balanced math program** and quickly provides teachers the information they need for responsive planning and instruction.

SNAP is fully aligned with the BC Curricular Competencies in math. Each area of the assessment is connected to a particular competency, and the competencies are built right into the rubric.

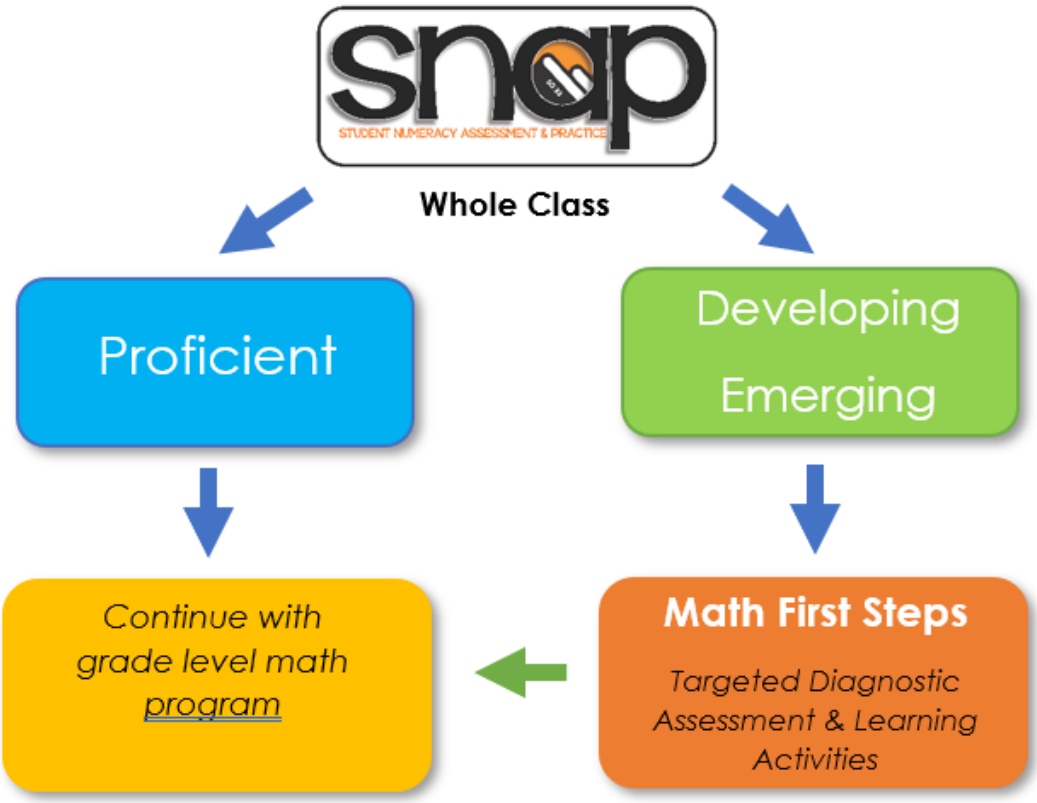
(SNAP Teacher Guide – updated, Chilliwack School District)

NOTE: Please reference the SNAP website for teacher guides, templates, rubrics, and exemplars for your grade.

Identifying who may require targeted instruction

Use the SNAP with the **whole class** and sort completed assessments into 2-3 groups – Students who have demonstrated ***mastery/proficiency*** and those who have not. You may want to break the second group down into 'developing' and 'emerging' groupings if appropriate.

SNAP Grade 4: • Number Sense 0 – 10 000 • Operations: Multiplication
SNAP Grade 5: • Number Sense 0 – 1 000 000 • Operations: Division
SNAP Grade 6: • Thousandths to Billions • Decimal division
SNAP Grade 7: • Integers • Fractions/Decimals/Percent



Targeted Diagnostic Assessment- First Steps in Math

It is this second group (emerging/developing) with whom we use the set of rich ***First Steps in Math - Number Sense*** diagnostics to identify learners' misconceptions and gaps and to determine which learning activities can address these and build their understanding. The *First Steps in Math* resource is designed to pinpoint and target student misconceptions and can be used to inform next steps in learning. This package includes the curated diagnostic tasks from the resource.

It is recommended that the teacher focus on **one** diagnostic assessment at a time, followed by an analysis to determine the next step for supplemental learning. "Next step" learning activities that correspond with each diagnostic are also provided to target the misconception or key understanding. All activities on the *Learning Activities* sheet will support the same misconception starting with less complex activities moving toward more complex activities. If the suggested learning activity does not seem to work for learners, try another corresponding activity. Professional judgement and relationship with your students will guide you in determining what works better for them.

Note that both the diagnostic assessments and learning activities can benefit the whole class or can be done during small group and/or one-to-one instruction.

Frequently Asked Questions:

1. ***Can I have my LST or CST assess my students for me?***

The SNAP and First Steps in Math numeracy assessments are designed for classroom teachers to use as part of their teaching, learning and assessment cycle. It is important for teachers to know where their students' strengths and stretches are in key numeracy skills to inform planning and to scaffold learning to meet the needs of their learners.

2. ***Do I have to assess students all at once?***

Teachers assess at a variety of times in a variety of ways, depending on assessment purposes and what works for their students. As described herein, the SNAP can be performed as a whole class, while First Steps in Math resources can help to identify specific misconceptions and gaps as well as provide suggestions for targeted instruction to address them.

3. ***Do I have to use this assessment if I have my own numeracy assessment tools?***

Teacher colleagues in our district have reviewed and discussed many possible strategies and assessments for number sense learning and have selected SNAP and First Steps in Math based on research and what works with students. It is recommended that intermediate and middle years teachers become familiar with the common language and understandings of these district wide assessment tools, as they will be used throughout K-9, and support student numeracy learning across the school years.

4. ***What do I do if my students are not demonstrating proficiency on a skill?***

Teaching, Learning and Assessment Cycle:

i. *Whole class teaching, and repeated experience practicing the skill*
ii. *Assess*
iii. *Targeted classroom instruction according to identified student needs.*
iv. *Assess*
v. *Targeted classroom instruction and/or consult with school-based team about other interventions that may be necessary.*
vi. *Assess*

Frequently Asked Questions:

6. ***How will the information collected from this assessment be used?***

Classroom Teachers *use this information to inform instruction and monitor progress of their students' numeracy skills. Additionally, this information will be helpful to pass on to the next year's teacher.*

The School *can use the data for school growth plans, allocation of resources and to inform school-based team discussions and strategies.*

The District *will collect the SNAP- Number Sense and Operations information in Grades 3, 5, and 8. This data will be used to inform decisions regarding resource allocation and professional learning opportunities, as well as to monitor the numeracy development of student cohorts over time.*

Bibliography

First Steps in Mathematics.(2007-13). Pearson Canada.

SD38 - Chilliwack School District (retrieved 2024). *SNAP: Student Numeracy Assessment and Practice*.

Wiliam, D. and Leahy, S. (2015). *Embedding formative assessment: Practical techniques for K-12 classrooms* Learning Sciences International.

Grade 4/5
SNAP Assessment

Comox Valley Schools
A Community of Learners
INNOVATIVE • INQUISITIVE • INCLUSIVE

TEACHER GUIDE

What is the SNAP?

The Student Numeracy Assessment and Practice (SNAP) is the Chilliwack district numeracy assessment for all students in grades 2 – 7. It was created by a group of Chilliwack educators and has been used in all grades 2 – 7 classes since September 2016.

The SNAP is a unique assessment; not only is it a measurement of achievement, but it is **intended to be used as a practice tool throughout the entire year.** The data it provides should be used to **inform and guide instructional planning**. If only used as a summative assessment, the SNAP will not help in achieving one of our main goals, which is to improve students' proficiency in number sense and operations.

The SNAP is a two-page assessment that focuses on the foundational skills of mathematics: Number Sense and Operations. It compliments any balanced math program and quickly provides teachers the information they need for responsive planning and instruction. **Access the SNAP Number Sense and Operations templates under the SNAP Templates tab on the website.**

SNAP is fully aligned with the BC Curricular Competencies in math. Each area of the assessment is connected to a particular competency, and the competencies are built right into the grading rubric. **Access the grading rubrics under the SNAP Training tab on the website.** The rubrics are the same for all grades. It is a good idea to participate in collaborative marking with colleagues to help establish common expectations.

How to Effectively use the SNAP

SNAP practice does not always need to be on the SNAP templates; in fact, once areas of need are identified, most number sense and operations practice will happen through other strategies, such as daily high yield number sense routines (e.g. number talks, count around the circle) and whole or small-group instruction. **Find resources that support each of the four curricular competencies under the Resources tab on the website.** Explore the Recommended Links for sites that support the teaching and learning of number sense and operations.

Curricular Content and Competency Areas

While the SNAP templates and rubrics are the same for grades 2-7, the curricular content and competency goals (pulled directly from the BC Math Curriculum) change and follow a spiraled approach. The table below outlines the curricular areas that students will be assessed on at the end of May. The goal is that all students be proficient (3 on the rubric) in their grade-level standards by the end of the school year. The examples given in the Operations sections are examples of year-end appropriate operations. **There are no district-prescribed numbers or operations for the year-end assessment, but at the request of teachers, numbers and operations have been suggested below to provide guidance.**

Grade	Operations - Sample operations	Number Sense - Sample numbers	Number Sense – Skip counting sample numbers
2	Addition of two-digit numbers without regrouping 24+33 51+17	Number concepts to 100. Any two-digit number. 42 67	Count forward by: 2, 5, or 10 Count backward by: 2
3	Subtraction of three-digit numbers with regrouping 427-153 754-226	Number concepts to 1000. Any three-digit number. 327 568	Count forward by: 4 or 20 Count backward by: 3 or 5
4	Multiplication of a one-digit number by a three-digit number. 4x326 7x142	Number concepts to 10000. Any four-digit number. 5904 6138	Count forward by: 6s or 300s Count backward by: 4 or 25
5	Division of a three-digit number by a one-digit number with a remainder. 635÷3 291÷4	Number concepts to 1000000. Any six-digit number. 347075 762346	Count forward by: 7 or 250 Count backward by: 6 or 30
6	Division of four-digit decimal number to hundredths. Quotient should not exceed thousandths. 47.35÷5 71.76÷3	Number concepts thousandths to billions. Any decimal number to the thousandths. 45.892 534.21	Count forward by: .12 or 5000 Count backward by: .6 or 14
7	Percentage calculations. Find the percent of a number. Answer should be in the tenths or hundredths. 16% of 85 47% of 42	Integer concepts. Any negative two-digit whole number. -23 -75	Choose numbers that will make students count through 0. Count forward by: 4 or 12 Count backward by: 5 or 20

Remember that the SNAP templates are intended to be used throughout the year for any numbers or operations in your curriculum.

When introducing your students to the SNAP, take your time and explicitly teach and model each component of the assessment. Use content that the students should be confident with from previous years. You can chunk the assessment into smaller pieces. **The Zoom into SNAP templates under the Resources tab on the website chunk the assessment by competency**. You can complete SNAPs as a whole group guided activity and have students work with partners to help build confidence. Have students share their thinking; encourage them to use many different ways to demonstrate their thinking and solutions.

Remember that the SNAP templates are intended to be used throughout the year for any numbers or operations in your curriculum.

The SNAP templates

Access templates under SNAP Templates tab.

NUMBER SENSE:

See Grading Rubrics for specific criteria.

DRAW: The picture must show the value of the number. A written explanation or a legend should be included in the "write to describe your picture" box.

SKIP-COUNTING: Begin at the number and count forwards and backward by numbers chosen by the teacher. *Update – Spring 2024* Teachers have requested guidance on appropriate numbers to use in this section for the May assessment. We have provided sample numbers based on the curriculum at each grade in the table above.

EQUATIONS: Students who are demonstrating full proficiency will be using grade-appropriate operations in their equations. Teachers should be very specific about their expectations in this section to avoid students using equations like 4561+1=4562, for example (which is not a grade-appropriate operation in Gr. 4).

REAL-LIFE EXAMPLE: The examples must be realistic and specific. It is important that students demonstrate an understanding of value in their example. For instance, "Wayne Gretzky's number is 99" does not show an understanding of value; "we have 99 grade three students in our school" does. Literature and sharing out of real-life examples helps students to make connections to the numbers and add to their bank of knowledge. There is an excellent list of math picture books on the Coast Metro Elementary Math Project site.

NUMBER LINE: For grades 2-5, the endpoints to the number line are provided. For grades 6 & 7, the students choose their own endpoints according to the number chosen for the assessment. To demonstrate full proficiency, students will add at least three benchmarks to their number line to help situate the number. Clothesline Math is an excellent routine to help students to become more proficient with number lines.

REFLECTION: Reflections help increase the value of a learning experience. They allow students to link ideas and construct meaning from their experiences. Students should have opportunities to reflect on their learning at the end of every lesson. Explicit teaching about how to reflect effectively will improve the quality of student responses in this section; reflection sentence stems are available in the Connecting and Reflecting Resources page.

OPERATIONS

See Grading Rubrics for specific criteria.

ESTIMATE: Students will learn to value the skill of estimating through discussions about real-life situations where a person would typically estimate rather than calculate. In which situations would one prefer a high estimate? A low estimate? Explicit instruction on estimation strategies will allow students to select and use an appropriate strategy for the given operation.

DRAW: Students will visually represent the operation. The visual may or may not contain the solution to the operation. Consider the use of bar diagrams as an appropriate, proportional model for the operations. Simply replacing the numbers in the operation with a base ten representation does not demonstrate an understanding of the operation.

CALCULATE: Multiple grade-appropriate calculations demonstrate proficient achievement. Students are not required to use the standard algorithm for any operation. Using the reverse operation to "check" their work is also a recommended strategy. Refer to your grade-specific curriculum elaborations for suggested alternate computation strategies.

REAL-LIFE EXAMPLE OR WORD PROBLEM: Students will provide details on a real-life situation where the given operation would be used to find an amount. Look for evidence that communicates their understanding of the use of the operation. For example, if the operation was 316-141 a student could suggest, "there were 316 blueberries on the bush and I picked 141 of them." For the teacher to know if they understand what the difference between 316 and 141 represents in this situation, they should add, "How many blueberries were left on the bush?"

Grade 2 Math Story: Encourage students to draw pictures to "tell" their story if they do not have the written ability to write a short story. A quick follow up conversation will be required to know whether students are able to communicate their understanding.

REFLECTION: Reflections help increase the value of a learning experience. They allow students to link ideas and construct meaning from their experiences. Students should have opportunities to reflect on their learning at the end of every lesson. Explicit teaching about how to reflect effectively will improve the quality of student responses in this section; reflection sentence stems are available in the Connecting and Reflecting Resources page.

Data Entry

Chilliwack teachers will enter data by the end of November and by the end of May. November data entry is based on the previous year's outcomes, and is only to be completed by grades 3-7 teachers. For example, grade 4 teachers will assess their students at the beginning of the year based on the grade 3 target outcomes and using the grade 3 templates. All grades 2-7 teachers will enter data by the end of May based on the current year's outcomes.

Another unique feature of the SNAP is that students are scored by competency. You will not total or average their scores in the four competencies. Students have until the end of the school year to practice and become proficient at their grade-level learning standards, however if during your pre-assessments prior to May you have students fully proficient, you may enter their data and create learning extension opportunities for those students.

Exemplars

The exemplars on the website are intended to represent proficiency in all categories. We will be updating our exemplars on an ongoing basis. Please feel free to send in student samples that you believe clearly show student proficiency. Scan and send to joanne_britton@sd33.bc.ca.

Acknowledgements

We are grateful to the dedicated team of Chilliwack educators who crafted and piloted this assessment: *Christine Blessin, Jonathan Ferris, Kathy Isaac, Anna Lownie, Shannon McCann, Tammy McKinley, Kathleen Mitchell, Justin Moore, Kirk Savage, Paul Wojcik*

Comox Valley Schools
A Community of Learners
INNOVATIVE • INQUISITIVE • INCLUSIVE

SNAP

Number Sense (0 – 10 000)

Name: _____

Date: _____

Draw to represent the value of the number:

Write to describe your picture:

Write the number in expanded form:

Create 3 equations that equal the number:

Write a real life example that shows the value of the number:

Count **forwards** by _____ from the number.

Count **backwards** by _____ from the number.

Show where the number belongs on the number line.

0 10 000

Reflect:

Find grading rubrics with specific criteria at snap.sd33.bc.ca

Communicating & Representing: *Drawing, description, expanded form*	Understanding & Solving: *3 equations*	Connecting & Reflecting: *Real-life*	Reasoning & Analyzing: *Skip counting & number line*
1 2 3	1 2 3	1 2 3	1 2 3

Comox Valley Schools
A Community of Learners
INNOVATIVE • INQUISITIVE • INCLUSIVE

Operations Multiplication SNAP

Name: _____

Date: _____

Operation: _____

Estimate – justify your thinking:

Represent - with a sketch or drawing:

Explain your sketch:

Calculate:

Write a Real Life Example or Word Problem: _____

_____

Reflect:

Communicating & Representing	Understanding & Solving	Connecting & Reflecting	Reasoning & Analyzing
1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Entire assessment	Draw and Calculate	Real-life & reflection	Estimate

Comox Valley Schools
A Community of Learners
INNOVATIVE • INQUISITIVE • INCLUSIVE

SNAP

Number Sense (0 – 1 000 000)

Name: _____

Date: _____

Draw to represent the value of the number:

Write to describe your picture:

Write the number in expanded form:

Create 3 equations that equal the number:

Write a real life example that shows the value of the number:

Count **forwards** by _____ from the number.

Count **backwards** by _____ from the number.

Show where the number belongs on the number line.

0 1 000 000

Reflect:

Communicating & Representing: *Drawing, description, expanded form*	Understanding & Solving: *3 equations*	Connecting & Reflecting: *Real-life*	Reasoning & Analyzing: *Skip counting & number line*
1 2 3	1 2 3	1 2 3	1 2 3

Chilliwack School District

Operations Division SNAP

Name: _____

Date: _____

Operation: _____

Estimate – justify your thinking:

Represent - with a sketch or drawing:

Explain your sketch:

Calculate:

Write a Real Life Example or Word Problem: _____

_____

Reflect:

Communicating & Representing	Understanding & Solving	Connecting & Reflecting	Reasoning & Analyzing
1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Entire assessment	Draw and Calculate	Real-life & reflection	Estimate

SNAP

Number Sense

Name: _____

Date: _____

Draw to represent the value of the number:

Write to describe your picture:

Count **backwards** by _____ from the number.

Write the number in expanded form:

Create 3 equations that equal the number:

Write a real life example that shows the value of the number:

Count **forwards** by _____ from the number.

Show where the number belongs on the number line.

Reflect:

Operations SNAP

Name: _____

Date: _____

Operation: _____

Estimate – justify your thinking:

Represent - with a sketch or drawing:

Explain your sketch:

Calculate:

Write a Real Life Example or Word Problem: _____

Reflect:

Reasoning & Analyzing

Communicating & Representing

Understanding & Solving

Reasoning & Analyzing

Comox Valley Schools
A Community of Learners
INNOVATIVE • INQUISITIVE • INCLUSIVE

Number Sense Rubric
SNAP (Student Numeracy Assessment & Practice)

Competency	Emerging *The student demonstrates an initial understanding of the concepts and competencies relevant to the expected learning.*	Developing The student demonstrates a partial understanding of the concepts and competencies relevant to the expected learning.	Proficient *The student demonstrates a complete understanding* of the concepts and competencies relevant to the expected learning.	*Teacher notes for demonstration of understanding and applications beyond proficiency*
Communicating and Representing *Picture Box*	• Pictures do not show the value of the number • Inaccurate	• Pictures show some value in representing the number • Partially accurate	• Pictures are clearly communicated and represent the value of the number (e.g. base ten and/or symbols) • Accurate	
Describe Picture	• Description and elaboration of pictorial representation is not evident • Communication is not clear	• Partial accuracy in describing and elaborating on pictorial representation **AND/OR** partially communicated	• Accurately describes and elaborates on pictorial representation (e.g. legend, key, or words) • Clearly communicated	
Expanded Form	• Emergent understanding of the value of digits in their place values	• Partially accurate in demonstrating the value of each digit (40000 +2000+139=42139 OR 40000+100 +30+9=42139)	• Accurately demonstrates the value of each digit (e.g. 500+20+4 or five hundreds, 2 tens, and 4 ones)	
Understanding and Solving *3 Equations*	• Emergent use of operations	• Accurately uses grade appropriate operations in one or two equations	• Accurately uses grade appropriate operations in all three equations (see Exemplars for examples)	
Connecting and Reflecting *Real Life Connection*	• A real-life example is not provided or is not connection to the number	• A partial connection to a real-life example is provided (e.g. "I bought a house for $319")	• Connection to a real-life example is provided • Demonstrates understanding of the number value (e.g. 5347 leaves on a small tree shows understanding; "I live at 5347 Elm St," does not)	
Reflection	• With support, student is not yet able to reflect on their learning	• Can partially identify strengths and stretches (e.g. *"Everything was easy. Nothing was hard.")*	• With sentence frames and structure, can proficiently reflect on their learning (e.g."I feel confident with ___; ___ was challenging; my goal is___")	
Reasoning and Analyzing *Number Line*	• Emergent understanding of the placement of the number on a number line	• Partially correct estimate of placement of number on provided number line; benchmarks may be missing	• Correct estimate of placement of number on provided number line with at least three benchmarks and appropriate endpoints.	
Counting Forwards and Backwards	• Emergent understanding of place value, number sense, and/or skip counting	• Partially complete and accurate	• Complete and accurate; demonstrates understanding but may include a minor recording error	

Comox Valley Schools
A Community of Learners
INNOVATIVE • INQUISITIVE • INCLUSIVE

Operations Rubric
SNAP (Student Numeracy Assessment & Practice)

Competency	Emerging *Student demonstrates an initial understanding of the concepts and competencies relevant to the expected learning*	Developing *Student demonstrates a partial understanding of the concepts and competencies relevant to the expected learning*	Proficient *Student demonstrates a complete understanding of the concepts and competencies relevant to the expected learning*	Extending *Student demonstrates an insightful understanding of the concepts and competencies relevant to the expected learning*
Communicating and Representing *Entire Assessment*	• Communication (written, pictorial or symbolic) of understanding is emerging	• Communicates (written, pictorial or symbolic) partial understanding	• Communicates (written, pictorial or symbolic) clear understanding	• Communicates (written, pictorial or symbolic) insightful understanding in multiple ways
Understanding and Solving *Draw & Calculate Boxes*	• Emergent use of strategies to solve the problem and show understanding	• Strategies chosen do not lead to an accurate solution • Reasoning to solve the problem is absent	• Uses ***grade appropriate*** strategies to correctly solve the problem and show understanding	• Uses multiple strategies and/or insightful reasoning to correctly solve the problem and show understanding
Connecting and Reflecting *Real Life Example/ Word Problem*	• Emerging ability to connect mathematical concepts to real life examples	• Real life example and connections to mathematical concepts are partially developed	• Real life example and connections to mathematical concepts are evident • The example shows a clear connection to the operation	• Real life example and connections to mathematical concepts are insightful
Reflection	• With support, student is not yet able to reflect on their learning	• Can partially identify strengths and stretches "*Everything was easy; nothing was hard'*	• With sentence frames and structure, can proficiently reflect on their learning " *I feel confident with ___; ___ was challenging; my goal is___ "*	• Insightful reflection on mathematical thinking is evident
Reasoning and Analyzing *Estimate & Justify Box*	• Emerging ability to use Estimation/mental math strategies • Estimate is not yet reasonable and justification not provided	• Calculates rather than estimates *"I think it is 366 because 3x122=366"* • Strategy use is not justified *"My guess is 300 because I used mental math"*	• Reasonable estimation provided • Clearly explains strategy *"I think it is about 360 because I did 3x100=300 and 3x20=60 and added 300+60"*	• Reasonable estimation provided and insightfully explains the strategy *"I think it is about 360 because I did 3x100=300 and 3x20=60 and added 300+60 but the solution is greater than that because I rounded down""*

Grade 4/5

First Steps in Math Curated

Diagnostic Assessments & Learning Activities

Comox Valley Schools
A Community of Learners
INNOVATIVE • INQUISITIVE • INCLUSIVE

First Steps in Math

Curated Diagnostic Assessments and Learning Activities for Mathematics

In this section of the SD71 Number Sense Assessment Package can be used to support learning for students who have fallen into the emerging/developing categories from the SNAP assessment. Conversely, you will gain an even deeper understanding of all your students mathematical understanding if they all participate in the First Steps in Math Diagnostic Activities, and all students will benefit from the First Steps in Math Learning Activities.

The First Steps in Math Assessment section is organized into two sections:

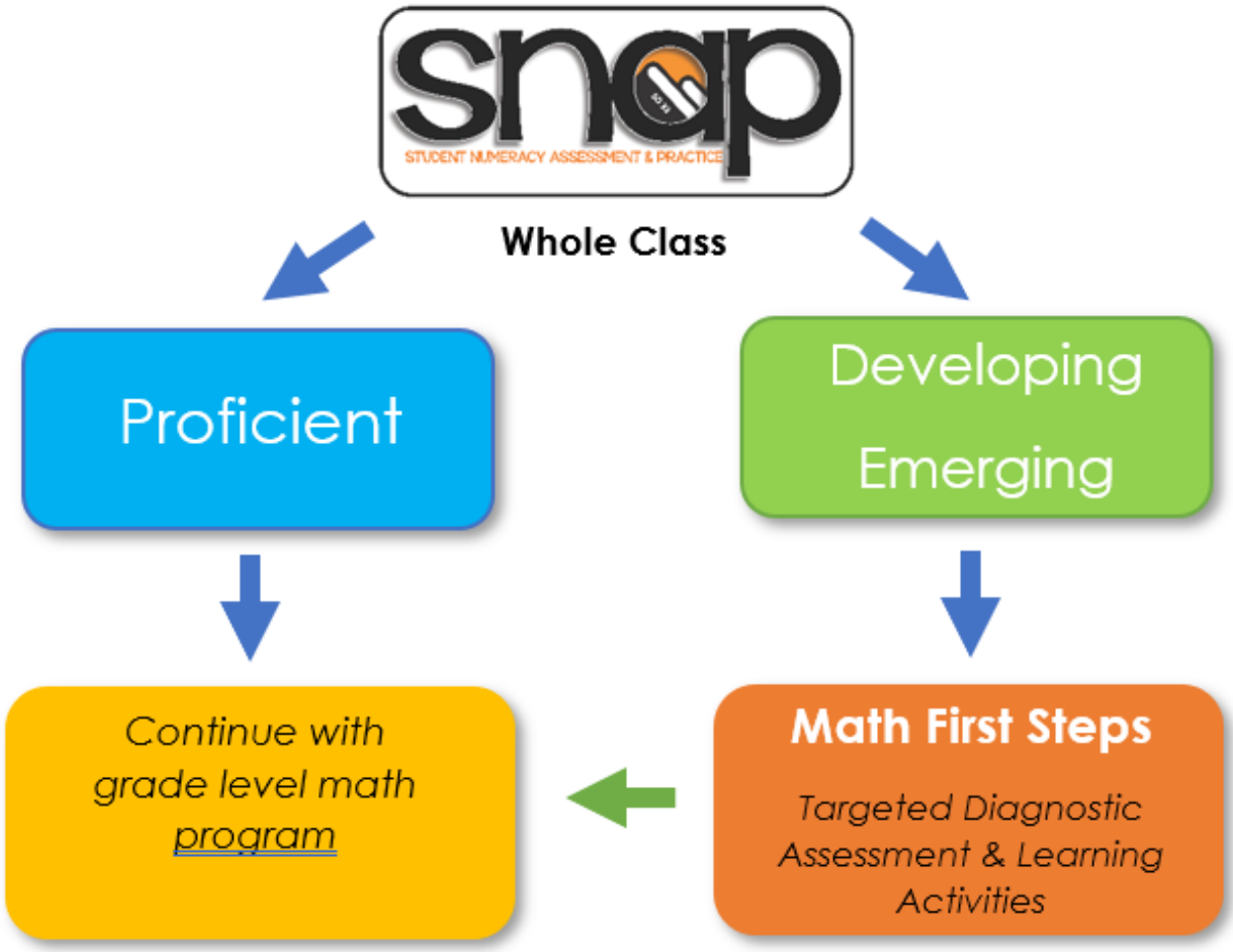
1. Diagnostic Assessments that hone in on Key Understandings of Mathematical development that students might be missing, and:

2. Learning Activities that will support learning in the key understanding areas of mathematics learning to building a strong foundation of Number Sense and relationships.

Both the Diagnostic Assessments and Learning Activities can be done one-on-one, in small groups, or whole class. Please note, in the chart on the follow page, curated grade specific diagnostic and learning activities have been hand selected to help you with your planning. If you find that there are other activities from the list that would be a better fit for your learners, please use your professional decision making to make that choice. All of the Learning Activities within a section focus on the same targeted Key Understanding, starting with the least complex to more complex. Again, all students can benefit from these activities, and they can become key components to your math program.

It is recommended that one Diagnostic and corresponding Learning Activities are focused one at a time, working with your students through those foundational key understandings at a manageable pace, revisiting multiple times. These diagnostics and activities can be woven into your existing math program and revisited every 2-3 weeks as you see fit.

All Diagnostics Assessments and Learning Activities have been curated from a larger and more comprehensive Frist Steps in Math resource that is accompanied by a 16-hour workshop to orientate and take a deeper dive into the essence of First Steps in Mathematics. If you are interested in learning more about First Steps in Math, please reach out to your School Districts Lead Teacher for Numeracy, your schools CST, or your principal.



Grade 4/5

First Steps in Math

Diagnostic Assessments

Comox Valley Schools
A Community of Learners
INNOVATIVE • INQUISITIVE • INCLUSIVE

First Steps in Math

Grade 4/5 -Curated Diagnostics & Learning Activities:

NOTE: *all the following assessments and learning activities address gaps from previous grades.*

Diagnostic Assessment	Emerging Activity (EM) Suggestion	PAGE	Developing Activity (DEV) Suggestion	PAGE
Read, Write & Say Numbers (NS-Key Understanding 5)	*"Wipeout"* *"Counting in Hundreds"*	*p. 57* *p. 58*	*"Million Square"* *"Words into Symbols"*	*p. 60* *p. 60*
Fraction Task 23: Circle the Bigger (FR-Key Understanding 5)	*"What Number Am I?"* *"Finding Fractions"*	*p. 75* *p.75*	*"Fraction Cards"* *"Places on a Number Line"*	*p. 77* *p. 78*
Decimals A, B, C & F: (NS-Key Understanding 7)	*"Skip Counting Money* *"Counting by 0.5"* *"Clothesline"*	*p. 61* *p. 61* *p. 62*	*"Number Scrolls"* *"Writing Fractions as Decimals"*	*p. 62* *p. 62*
If successful, then:				
Fraction Task 15: After School (FR-Key Understanding 4)	*"Equivalent Fractions"* *"Chocolate Bars"*	*p. 72* *p. 71*	*"Fractions of a Collection"* *"Fraction Tapes"*	*p. 72* *p. 73*
Decimals A-H (NS-Key Understanding 7)	*"Counting by Decimals"* *"Decimal Number Line"*	*p. 63* *p. 63*	*"Place Invaders"* *"Ordering Measurements"*	*p. 63* *p. 64*

Curated by Jeannie DeBoice 2024
Collated by Serina Allison

Comox Valley Schools
A Community of Learners
INNOVATIVE • INQUISITIVE • INCLUSIVE

Diagnostic Assessment	Emerging Activity (EM) Suggestion	PAGE	Developing Activity (DEV) Suggestion	PAGE
BASIC FACTS: (COMP-Key Understanding 1)				
*Addition and Subtraction fact assessment from grade 3, if needed.	*"Compensating to Ten"* *"Easy Calculations"*	*p. 66* *p. 66*	*"Basic facts to Ten"* *"Addition Table"*	*p. 67* *p. 65*
Multiplication and Division assessment **Find the Solution: Sets A (+/-) and B (x/÷)** (COMP-Key Understanding 1)	*"Multiplication Facts"* *"Doubles and Halves"*	p. 69 p. 69	*"Multiplication Doubles"* *"Constant Calculations"*	p. 70 p. 70

Diagnostic TASK

FOCUS
Understand Numbers
- Key Understanding 5

Read, Write and Say Whole Numbers Years/Grades 3–7

Purpose

To explore the limits of children's writing of large numbers and to expose their personal rules or misconceptions when writing such numbers.

Producing work samples

Whole class or small group observations

Provide each student with copies of the 'Read, Write and Say' worksheet. Call out the following numbers for children to write for questions 1–6.

1. Sixty three
2. One thousand twenty
3. Twenty six thousand fifteen
4. Five hundred six thousand fifteen
5. One million five
6. Five billion, thirty six million, four hundred seven thousand four.

Children complete the rest of the sheet independently.

If needed, interview individuals and ask them to explain how they knew to write the number in the way that they did. The purpose of this is to uncover any invented rules that children may be using.

Read, Write and Say Numbers

Name _____ Year/Grade _____ Date _____

Instructions: Write the numbers the teacher says. Here is an example.
If the teacher says ***nineteen*** you write ***19***.

1. _____ **4.** _____

2. _____ **5.** _____

3. _____ **6.** _____

Write these numbers in words:

504

1,768

250,000

13,648

6,003

13,806,009

Diagnostic TASK

FOCUS
Understand Fractions
- Key Understanding 5

Circle the Bigger

Grades 4–8

Purpose

To find out whether students are able to compare fraction numbers using benchmark fractions - for example, $\frac{4}{9}$ is less than a half, or $\frac{7}{8}$ is close to one.

Interpreting Students' Response

Students' responses may fall into one of the following categories, or students may use a combination of strategies to compare the fractions.

1. Responses where students compare digits within the fraction as though they are whole numbers – for example, when comparing $\frac{3}{5}$ and $\frac{4}{9}$, they say 4 is bigger than 3 and 9 is bigger than 5.

2. Responses where students work out how many more are needed to make each fraction into a one - for example, when comparing $\frac{3}{5}$ and $\frac{4}{9}$,they say for $\frac{3}{5}$ you need two more to make one and for $\frac{4}{9}$ you need five more to make one; therefore, $\frac{3}{5}$ is larger. These students are ignoring the size of the denominator.

3. Responses where students compare digits within the fraction using known fractions such as halves and quarters – for example, when comparing $\frac{3}{5}$ and $\frac{4}{9}$, they say $\frac{1}{2}$ of 5 is $2\frac{1}{5}$, so $\frac{3}{5}$ is more than $\frac{1}{2}$ of 9 is $4\frac{1}{2}$, so $\frac{4}{9}$ is less than $\frac{1}{2}$; therefore $\frac{3}{5}$ is larger. To compare fractions that are close to one, such as $\frac{7}{8}$ and $\frac{5}{6}$, they think about the size of the fraction needed to make up the whole – for example, $\frac{1}{8}$ is smaller than $\frac{1}{6}$ because when you cut something up into eight pieces, they will be smaller than if it is cut up into six. Students who do this are aware of the size of the denominator.

4. Response where students accurately draw diagrams to compare the size of the fractions, including diagrams of the same-sized whole.

Students responses that fit into category 3 or 4 show good fraction understanding, whereas those that fit into either of the first categories indicates that the students need further work on comparing fraction numbers.

Circle the Bigger

Name _____ Year/Grade _____ Date _____

Circle the bigger number $\frac{3}{4}$ or $\frac{4}{8}$

Explain how you decided which is bigger.

Circle the bigger number $\frac{3}{7}$ or $\frac{4}{7}$

Explain how you decided which is bigger.

Circle the bigger number $\frac{3}{5}$ or $\frac{4}{9}$

Explain how you decided which is bigger.

Circle the Bigger *(page 2)*

Name _____ Year/Grade _____ Date _____

Circle the bigger number $\frac{7}{8}$ or $\frac{5}{6}$

Explain how you decided which is bigger.

Circle the bigger number $\frac{5}{9}$ or $\frac{5}{6}$

Explain how you decided which is bigger.

Circle the bigger number $\frac{7}{8}$ or $\frac{8}{7}$

Explain how you decided which is bigger.

Diagnostic
TASK

FOCUS
Understand Fractions
- Key Understanding 4

After School

Grades 4–6

Purpose

This task can be used to find out whether students have an understanding of simple equivalent fractions like $\frac{3}{4} = \frac{6}{8} = \frac{9}{12}$

Interpreting Students' Response

Students are often familiar with portioning geometric shapes to show a particular fractional amount. This understanding of fractions needs to be extended to include comparing different fractional amounts.

The two geometric figures have been included in this task for students to use for their diagrams. This part of the task will show whether students know how to use the same-shaped wholes to explain equivalent fractions. Some students will not consider this and will draw $\frac{3}{4}$ on the square and $\frac{6}{8}$ on the circle to try and demonstrate their equivalence. Ideally, students should choose to draw a model of $\frac{3}{4}$ and $\frac{6}{8}$ on two matching figures – the squares – and $\frac{3}{4}$ and $\frac{9}{12}$ on the other two matching figures – the circles. Their diagrams should show that they have attempted to partition the shapes into equal sized sections.

Students completing this task may show the fractions as equivalent in different ways. Some will partition on the same-shaped wholes to compare $\frac{3}{4}$ to $\frac{6}{8}$ and $\frac{3}{4}$ to $\frac{9}{12}$, while others will only compare $\frac{6}{8}$ to $\frac{9}{12}$. Some students may use a computational method for working out equivalent fractions. It is important to determine whether students have rote knowledge of the procedure or actually understand why this works. An interview may be needed to clarify this.

After School

Name _____ Grade _____ Date _____

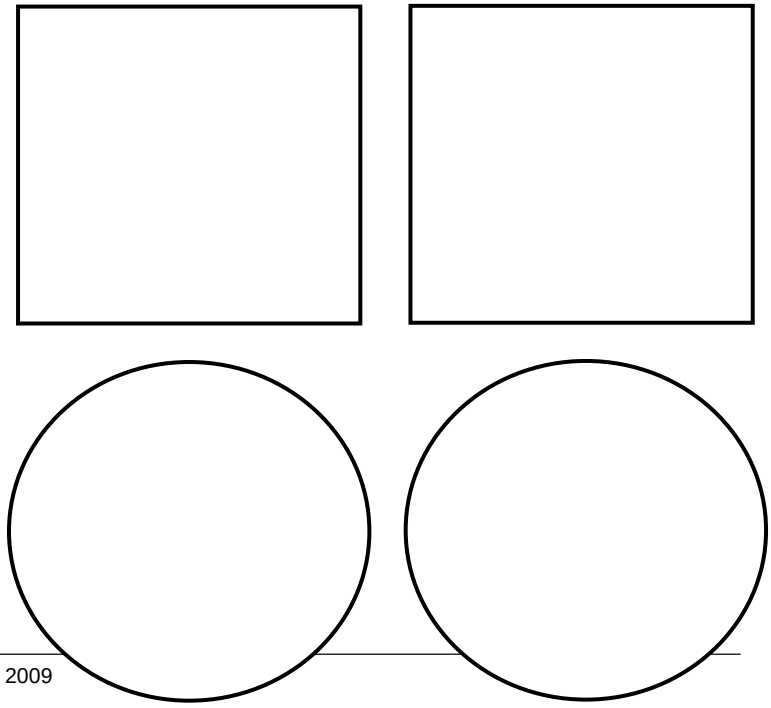
Deon and Lee had been working on fractions at school.

After school they were doing some thinking.

Tick a box to show what you think.

- ☐ Deon is right
- ☐ Lee is right
- ☐ They are both right
- ☐ They are both wrong

Use the shapes opposite to explain your thinking



Diagnostic TASK

FOCUS
Understand Numbers
- Key Understanding 7

Decimals

Grades 5-9

Purpose

To see the extent of students' understanding of decimals and to uncover preconceptions and misconceptions

Materials

- Line Masters: Decimals (Sets A–H)

Instructions

Have students complete the questions individually. You may need to conduct some individual interviews where students' reasoning is not clear from the written explanation.

Note: Students usually find some questions easier than others. Therefore, you may choose to break up the worksheets and present sections one at a time.

Name _____ Grade _____ Date _____

Line Master **Decimals (Sets A–D)**

A Compare and Order

Circle the biggest number in each group of three.

i) 5 436 or 547 or 56

ii) 6.78 or 45.6 or 345

iii) 3.521 or 3.6 or 3.75

iv) 15.4 or 15.56 or 15.327

v) 4.09 or 4.7 or 4.008

Swan, M. (1983)

B Money

i) When James used his calculator to see how much his shopping came to it showed 14.5.
How much is that in dollars and cents?

_____

ii) Rachel purchased 4 balls.
She worked out the price for one ball on the calculator.
The result was 6.125. How much is that in dollars and cents?

_____

C Renaming Decimals as Fractions

Write these numbers as fractions.

i) 0.67 _____

ii) 0.341 _____

iii) 0.2 _____

D Naming Digits after the Decimal Point

i) What does the 3 mean in 0.236?

_____

ii) What does the 2 mean in 0.236?

_____

iii) What does the 6 mean in 0.236?

_____

Name _____ Grade _____ Date _____

Line Master **Decimals (Sets E–F)**

E Ordering

Sonya said, "When we put books on the library shelf we put 65.6 before 65.125 because 6 is less than 125," but Tao didn't agree.

Who is right? _____

Why do you think that?

Write your explanation in this box.

F Counting On and Back by Decimal Numbers

Write down the next 2 numbers in each sequence.

a) 0.2, 0.4, 0.6, _____, _____
(add 0.2 each time)

b) 0.3, 0.6, 0.9, _____, _____
(add 0.3 each time)

c) 0.92, 0.94, 0.96, 0.98,
_____, _____
(add 0.02 each time)

d) 1.13, 1.12, 1.11,
_____, _____
(take away 0.01 each time)

Name _____ Grade _____ Date _____

Line Master **Decimals (Sets G–H)**

G Quantity

Paper clips come in boxes of 1000. Abi counted the loose paper clips in a tray and said there were 1260. Jeremy said, “That's 1. 26 boxes of paper clips.”
Could they both be right?

Yes ☐ No ☐

Why do you think that?

H Number Sequence

How would you use a calculator to generate this number sequence?

2.0, 0.2, 0.02, 0.002

Diagnostic TASK

FOCUS
Understand Computations
- Key Understanding 1-6

Find the Solutions

Sets A and B suitable for Grades 3-4
Sets B and C suitable for grades 5-7

Purpose

To see what strategies students use to solve problems requiring addition, subtraction, multiplication, or division

Materials

- Line Master: Find the Solutions (Set A)
- Line Master: Find the Solutions (Set B)
- Line Master: Find the Solutions (Set C)

Instructions

1. Provide each student with the appropriate line master(s). Read the questions with them to make sure they understand what they need to find out.

2. Explain to the students that they need only work on the problems that they think they can do. It is important to end the interview when the child indicates the questions are getting too hard. You may wish to copy only the left-hand set of questions for the students you believe might feel inadequate for not progressing to the end.

Individual Interview: Sit with a student as she/he works out each question. When she/he has an answer, ask about the strategy the student used. The focus is on revealing some of the repertoire the student has developed; commenting on whether the answer is right or wrong is inappropriate in this situation. It is important to end the interview when the student indicates that the questions are getting too hard. Record the numbers the students uses as she/he partitions, re-arranges, orders, and operates on a separate copy.

Whole-Class Task: Provide each student in the class with a copy of the questions. Ask them to read the question, and work out the answer in their head. Interview a few students of different abilities to find out how they thought of the numbers and how they worked each question out. Record the numbers they use as they partition, re-arrange, order, and operate on a separate copy.

Name _____ Grade _____ Date _____

Line Master **Find the Solutions (Set A)**

1. On the bus there are 25 children from Mr. Foster's class and 30 children from Mr. Singh's class. How many children are on the bus?	2. There were 100 paper clips in the box. We have used 37 of them. How many are left?
3. Your mother made 24 pancakes in the first batch and 18 in the second batch. How many pancakes did she make?	4. Sean's family is on the way to town. They have already travelled 15 km and the town is 65 km from their home. How far do they still need to travel to reach town?
5. There are 18 slices of bread in a loaf. How many slices will there be in 5 loaves?	6 There was $120 in $10 bills. How many bills should there be?

Name _____ Grade _____ Date _____

Line Master **Find the Solutions (Set B)**

1. In Joe's school each class has 25 children in it. The school has 16 classes. How many children are in the school?	2. Crystal has 375 newspapers to deliver. She has delivered 127. How many does she still have to deliver?
3. Every week Ted earns $235. Does he earn more or less than $900 every 4 weeks? How do you know?	4. Jeremy has to deliver 226 newspapers. How many more does he need to deliver until all of the 537 newspapers in his paper route are delivered?
5. Abi has two short paper routes. She delivers 374 in one route and 227 in the other. How many newspapers does she deliver altogether?	6. There were 1035 newspapers to deliver and 10 delivery people. How many papers did they each deliver?

Name _____ Grade _____ Date _____

Line Master **Find the Solutions (Set C)**

25 + 30	25 x 16
24 + 18	375 – 124
18 x 5	226 + ___= 537
100 – 3	374 + 227
15 + ___ = 65	1035 split into groups of 10
120 split into groups of 10	27 x 16
235 x 4 Estimate. Will the answer be more or less than 900? Why?	

Grade 4/5

First Steps in Math

Learning Activities

Comox Valley Schools
A Community of Learners
INNOVATIVE • INQUISITIVE • INCLUSIVE

First Steps in Math

Grade 4/5 - Learning Activities & Materials:

NOTE: *all the following assessments and learning activities address gaps from previous grades.*

Emerging Activity (EM) Suggestion	PAGE	Materials	Developing Activity (DEV) Suggestion	PAGE	Materials
"Wipeout" *"Counting in Hundreds"*	p. 57 p. 58	• Calculators	*"Million Square"* *"Words into Symbols"*	p. 60 p. 60	• *cm paper coloured* • *See Appendix -Line Masters 2* • *Scissors* • *Glue* • *Newspapers/magazines*
"What Number Am I?" *"Finding Fractions"*	p. 75 p. 75	• Paper strips	*"Fraction Cards"* *"Places on a Number Line"*	p. 77 p. 78	• *Fraction cards* • *String* • *Clothes pegs*
"Skip Counting Money *"Counting by 0.5"* *"Clothesline"*	p. 61 p. 61 p. 62	• Coins & paper money • Calculators • String/line • Clothes pegs • Numbered cards	*"Number Scrolls"* *"Writing Fractions as Decimals"*	p. 62 p. 62	• *Paper strips /cash register tape* • *Calculators*
"Equivalent Fractions" *"Chocolate Bars"*	p. 72 p. 71	• Fraction strips/pattern blocks • Paper chocolate bar pictures	*"Fractions of a Collection"* *"Fraction Tapes"*	p. 72 p. 73	• *Egg cartons* • *Various coloured paper* • *Scissors* • *Felt markers*

Curated by Jeannie DeBoice 2024
Collated by Serina Allison

Comox Valley Schools
A Community of Learners
INNOVATIVE • INQUISITIVE • INCLUSIVE

"Counting by Decimals" *"Decimal Number Line"*	p. 63 p. 63	• Calculators • String/line • Clothes pegs • Numbered cards	*"Place Invaders"* *"Ordering Measurements"*	p. 63 p. 64	
"Compensating to Ten" *"Easy Calculations"*	p. 66 p. 66	• Ten frames Appendix -Line Masters 6 • Calculators	*"Basic facts to Ten"* *"Addition Table"*	p. 67 p. 65	• Basic Fact Cards
"Multiplication Facts" *"Doubles and Halves"*	p. 69 p. 69		*"Multiplication Doubles"* *"Constant Calculations"*	p. 70 p. 70	• Calculators

first steps

First Steps in Mathematics

Number Sense

Whole and Decimal Numbers, and Fractions

Improving the mathematics outcomes of students

PEARSON

Department of Education and Training

FSMN000 | First Steps in Mathematics: Number Sense

First Steps in Mathematics: Number
Number Sense: Whole and Decimal Numbers, and Fractions

Published in Canada by Pearson Canada Inc.
26 Prince Andrew Place Don Mills, ON
M3C 2T8

Text by Sue Willis with Wendy Devlin, Lorraine Jacob, Beth Powell, Dianne Tomazos, and Kaye Treacy for Steps Professional Development on behalf of the Department of Education and Training, Western Australia

Photos: Ray Boudreau, p. 1, 3, 4, 14, 15, 20
Illustrations: Neil Curtis, Vesna Krstanovich and David Cheung

ISBN-13: 978-0-13-201885-2
ISBN-10: 0-13-201885-3

Director, Pearson Professional Learning: Theresa (Terry) Nikkel Professional Learning
Manager: Marina Pyo
Canadian Edition Consultant: Lynda Colgan
Canadian Edition Advisors: Maggie Martin Connell, Craig Featherstone, Bill Nimigon, Barry Onslow, Verna Schmidt
Project Manager: Keltie Thomas Production Coordinator:
Zane Kaneps
Art Direction: Jennifer Stimson and Zena Denchik Design: Jennifer
Stimson and David Cheung
Page Layout: David Cheung

Sample Learning Activities

K-Grade 3: ★ ★ ★ Major Focus

Jack-in-the-Box

Have students play games that involve chanting numbers. Initially, ask students to count into the teens. Then, have students choose a number between 10 and 20. In unison, the class counts up to the chosen number and one student, playing the role of "Jack", jumps up in the air. Similarly, have students count down from a selected number to one, then the class calls out "Blast off!"

Numbers and Objects

Display collections of 13 to 19 objects that are found in the classroom, such as pencils, and their matching number. Arrange the objects in ways that highlight the way the number is said. For example, 14 pencils can be arranged as:

Numbers and Actions

Ask students to count aloud matching the count to the rhythm of actions. For example, skips with a rope, hops with a hoop, or catches of a ball.

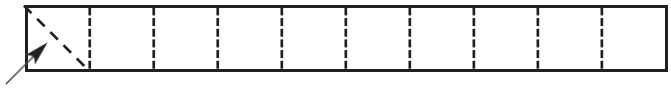
Number Line

Invite students to make a number line around the room in chunks of numbers, such as 0 to 10. Begin with the range 0 to 10, then add 11, 12, 13 to 19, 20, 21 to 29, and so on. Ask: What sounds the same about the new numbers? How does each new number sound different from the others? Before counting from 1, focus students' attention on when the number pattern sounds different, such as from 12 to 13 and from 19 to 20. Ask: What comes after 13 (14, 15)? What parts of the twenties sound the same as the thirties?

FSIM006 | First Steps in Mathematics: Number Sense

Number Scrolls

Invite students to generate decade and hundred number sequences by using the constant function on a calculator and to record the sequences on cash register tape. Have students fold strips of cash register tape into equal-sized squares as shown below and record one number per square. Then ask students to read, say, predict and verify the numbers from the calculator display.



Counting Sequences

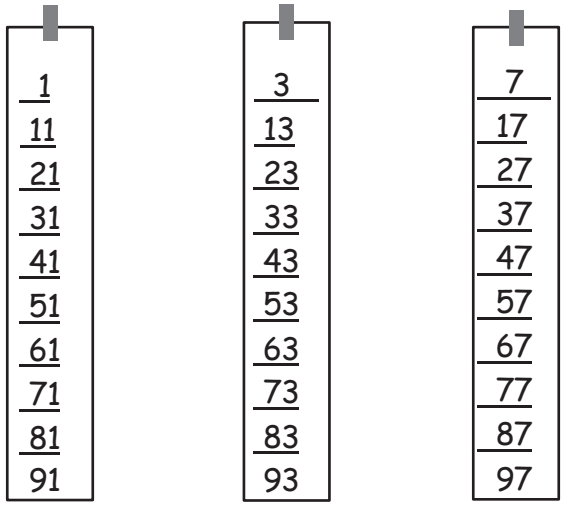
Ask the class to form a line. Beginning at 1, have students say in turn the next number in the counting sequence, going down the line and then back again. Over time, begin the count at, say 8, 18, 25, 30, 48, 95 to extend the count into the larger numbers.

Biggest Number

Select students to write the biggest number they know at the top of a display board. Ask each student: What is one more? Write the new number beneath the first. Then, have students add to the sequence each day and say the new number. Ask: Can this number sequence come to an end?

Partner Number Scrolls

Invite students to make number scrolls from cash register tape as in *Number Scrolls*, above, and use the constant function on their calculators to fill them in. Have students start from any number between 1 and 9 and constantly add 10. Then, organize students into pairs. One student reads aloud the numbers in the chart vertically by tens while his or her partner keys in the agreed starting number, such as 3, and constantly adds 10. Encourage the student with the chart to call stop at any time, then ask: What number will be next? Have students check the calculator display against the chart.



FSIM006 | First Steps in Mathematics: Number Sense

Sample Learning Activities

Grades 3-5: ★ ★ ★ **Major Focus**

Patterns in Numbers

Ask students to make their own 100-chart, arranging the numbers in whatever number of rows and columns they like. Have students use their chart to look for patterns in the numbers. Then, ask students to quickly find a number, such as 67 or 42. Show students a 10 x 10 100-chart (See Appendix: Line Master 5) and ask: What changes from one row to the next? Why? What changes in the other charts? Why? In which chart is it easier to find particular numbers? Why? Have all students make a chart for their personal use. Encourage students to extend their chart over time.

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

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21			

Number Cube Rolls

Ask pairs of students to take turns to throw a number cube and record results in a row on squared paper, which is 5 squares wide. Have students choose which square to enter each digit in order to make the largest possible number. When both students have made a five-digit number, the player with the largest number chooses a different rule, such as *Make the lowest number or the number closest to 50 000*.

Wipeout

Play with the whole class. Enter a number, such as 256, into a calculator. Ask: How can we make the 5 a 0? (*Subtract 50.*) Why did you do that? What number have we got now? Eliminate the 2. Try larger numbers when students are ready. Later, have students play Wipeout in pairs, taking turns to give each other instructions. Encourage students to try larger numbers, such as 946 256.

FSIM006 | First Steps in Mathematics: Number Sense

10 Times as Great

Organize students into pairs. Invite students to use their calculators to find out what numbers are 10 times as great as the given numbers, such as 30, 172, 109, 200, 210, 4550. Say: Can you see a pattern? Try to explain to your partner why that happens. What will 10 times 7568 be? Test it and see.

Counting in Hundreds

Ask students to use constant addition on a calculator to count in hundreds. Have them predict which number will come next, then press = to verify. Ask: How many hundreds did you put in to make 900? How many hundreds are in 1000 (2000)?

Multiplying by 10

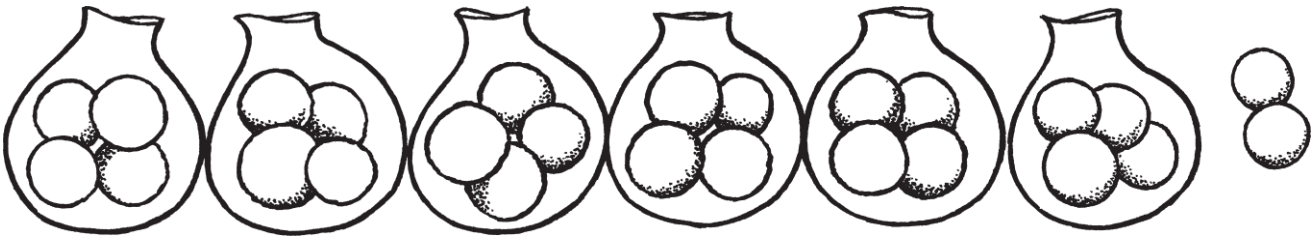
Have students predict the effect of multiplying a number by 10. Use the overhead projector calculator and begin with any single digit. Ask: If we multiply this number by 10, what will the number be? If we multiply by 10 again, what will the number be? How many tens in 100 (1000)?

Three-Digit Numbers

Ask students to use grid paper to draw a diagram that shows the size of each of the digits in a three-digit number, such as 888. Ask: How do you know you have the size right for each of the digits? How many times as big is the second 8 than the first? Later, have students represent the size of the digits in other three-digit numbers, such as 256, without using grid paper.

Marbles

Have students explain the meaning of the digits in a numeral using materials that are deliberately not grouped in standard ways—that is, not in tens—such as 26 marbles. For example, students put out 6 bags of 4 marbles and 2 more marbles. Ask: How many marbles? Have students write down how many. Record the correct answer on the board. Point to one digit and ask students to show their partner the number of marbles it refers to. Point to another digit and repeat. Repeat this activity with other collections that are not grouped in tens, for example, 3 bundles of 10 Popsicle sticks and 13 singles.



FSIM006 | First Steps in Mathematics: Number Sense

Sample Learning Activities

Grades 5-8: ★ ★ ★ Major Focus

800 Game

Have students investigate the multiplicative relationship between places. Organize students into pairs. Then, give each student a card labelled "8" andup to five cards labelled "0". Ask each student to make a different number with the digit cards. For example, the first student could make 8; the secondstudent could make 800. Ask: What number sentence would you key into yourcalculator to change your number so that it is the same as your partner's?Have students share their number sentences, then ask: Who used addition and subtraction? Who used multiplication and division? Refer to a chart that showsthe cyclical pattern of the number system (See Appendix: Line Master 7) to emphasize how multiplication and division match the relationship between the places. For example, say: To make 8 into 800, you can key 8 x 10 x 10 or 8 x 100 into your calculator. To make 800 into 8, you can key 800 ÷ 10 ÷ 10 or800 ÷ 100 into your calculator. Have students repeat the activity making adifferent number with their cards and then use the chart to explain why the number sentence they chose actually works. Later, extend the activity to includea decimal point and more zeros.

Counting Crowds

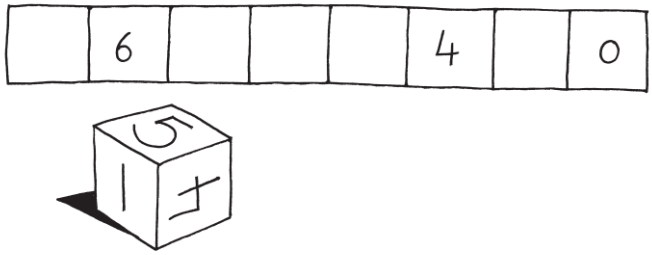
Have students solve problems such as: The number counter at the entrance tothe fair reads 9999 (10 999, 99 999) after the person in front of you goes in. What will the counter read after you go in?

One-tenth As Much

Ask students to use their calculators to find out what is one-tenth of each of these numbers: 30, 172, 109, 200, 210, 4550. Have them record their answers,then ask: What did you do? Did you need to do the same for each number?Repeat the activity with decimal numbers such as: 3, 2.1, 1.72, 1.09, 45.5.

Number Cube Rolls

Have students make either the largest or the smallest number possible from afixed number of number cube rolls. They can use up to eight squares in a rowto record a digit from each roll of the cube. Each student has a "free zero", whichhe or she can place anywhere in the row. After a few rounds, ask: What do youneed to do to make the largest (smallest) number possible? Why?



Million Square

Help students to create an area of one million square millimetres. Drawout the relationships between the powers of ten and successive places.Use 1-mm grid paper (See Appendix: Line Master 2) and draw around 1 squaremillimetre, then 10, 100, 1000, 10 000 square millimetres and label them. Combine cut-outs of 10 to 1000 square millimetres to create a million square.Ask: How much space do you think we'll need on the bulletin board for this? (See Case Study 4, page 94.)

Changing Places

Ask students to use materials, such as Base Ten Blocks, to model the relationshipbetween places. To begin, show students the smallest Base Ten cube. Ask: What number is this? (*1*) Then, show the next largest Base Ten cube, and ask:What number is this? (*1000*) How many times as big is this than the first cube?(*1000 times as big*) What do you think the next-sized cube will look like? Do youhave enough large blocks in the school to build the next-sized cube? Do you have enough to build just the frame of the cube? Have students write thenumbers for each cube. Say: Imagine what the fourth cube looks like. How doyou say it?

Words into Symbols

Have students rewrite large numbers written as words into symbols. Ask students to show all of the places. A good source for large numbers is newspapers. Forexample, "The budget deficit is 8 billion."

Sample Learning Activities

K-Grade 3: ★ Introduction, Consolidation or Extension

Half

During fraction activities, ask students to divide 1 by 2 on their calculatorsto see 0.5 as another way of representing a half.

Counting by 0.5

Have students count by 0.5 on their calculators and then record the sequenceas a number line.

Dollars and Cents

Ask students to focus on the decimal point as the separator between the dollarsand cents. For example, students sit in a circle with money they have broughtto school or use play money. Help each student say how much money he orshe has and write that amount on the board. Select students to identify eachpart of the written amount. Ask: Where did you put the decimal point? Why isit there? What part of your number means the dollars (parts of a dollar)?

Price Tags

Invite students to write price labels for the class "store", including prices thatrequire 5 cents, 50 cents and 55 cents, such as $4.05, $4.50, $4.55. Ask: Is5 cents written the way you would expect it to be? Which one of your price tagsdid you have to think about the most? What does the 5 mean in each of thetags? Which of these prices is the most expensive?

Skip Counting Money

Ask students to skip count, forwards and backwards, by 5 cents (10 cents), upto and over 1 dollar. Then, ask them to skip count by 1 dollar (5, 10 dollars),up to and over 100.

Age Groups

Have students enter their ages on their calculators, then organize themselvesinto groups according to the number shown on their calculators. Ask: Whatdoes your 5 (6, 7, 8) mean? Who is exactly 5 (6, 7, 8) years old? Who is more than 6 years old, but not 7 years old? Can you show this on the calculator? Lookfor a response that can be developed into writing their ages as, for example, 6.5 or 6.75. Encourage language, such as: *I'm six and a bit*. Write students' exact agesin order on the board. Have students regroup into those age groups.

Sample Learning Activities

Grades 3-5: ★ ★ Important Focus

Clothesline

Hang a clothesline and pin two cards: one labelled "0" on the left and onelabelled "4" on the right. Invite students to say where cards labelled "1", "2"and "3" should go on this number line. Then, show 2.5 and ask: Where shouldthis number be placed? Pin it on the line when students answer correctly. Ask:What does 2.5 mean? Are there other numbers like this that we could put up onthe line? Have students write the numbers (*0.5, 1.5, 3.5*) and add them to theline. Encourage students to explain why they have placed their number on a particular part of the line.

Tenths

Have students estimate, then place fraction cards on a Clothesline number lineto show $\frac{0}{10}$through to $\frac{10}{10}$. Help them to rename the fractions as decimals.

Larger Decimals

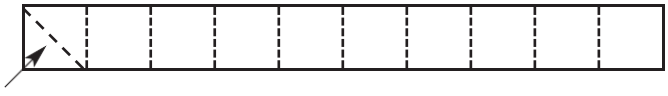
Extend the Clothesline activity above to include larger numbers. For example,35, 35.2, 35.4, 36.1, 36.2, and so on, through to 41.9.

Writing Fractions as Decimals

Ask students to make a metre stick with every 10 centimetres marked. Then, havethem use this metre stick to measure lengths to the nearest 10 centimetres. Invitestudents to record these lengths in metres and fractions of a metre. Show themhow to write tenths as a decimal (*0.1*). Ask: What is another name for 0.1 (1.1)?What does the zero mean when we write 0.3?

Number Scrolls

Invite students to make number scrolls by folding cash register tape into equal-sized squares as shown below. Have students use constant addition on their calculators to count by a decimal, such as 0.2, and record the numbers on thescroll as they go. When they reach 0.8, ask: What comes next? Invite studentsto push = to verify, then ask: Is the answer what you expected? Discuss any conflicts. Then, ask students to continue, first predicting, then checking answers. Students could then count by fifths to make the link between decimals and fractions.



Counting by Decimals

Ask students to use the constant function on a calculator to count by 0.5 andthen 0.25. Students could then represent both sequences on one number lineand say why some numbers are in both sequences.

Sample Learning Activities

Grades 5-8: ★ ★ ★ **Major Focus**

Counting by Decimals

Have students use the constant function on their calculators to count by 0.2. Ask them to read and list each number as it appears on the display. Stop students at 1.8 and invite them to predict what the next number will be. Have students check to verify their predictions. Ask: Why can't the next number after 1.8 be 1.10? Then, ask students to continue the count to 2.8. Repeat the predict-and-check cycle through 3.8, 4.8, and so on. Select students to say the number sequence forwards and backwards.

Decimal Number Line

Hang a clothesline across the classroom. Set it up as a decimal number line, with a card labelled "2" on the extreme left of the line and a card labelled "3" on the extreme right. Write "2.5" on another card and ask where it should go. When students answer correctly, pin the number card in position on the line. Ask students to write another number to add to the line and to explain why they have placed their card in that position. Later, extend the activity to thousandths and decimals with different numbers of places.

Place Invaders

Extend *Wipeout*, on page 68, so that numbers can only be wiped out from the ones place. Discuss with the students how they may need to multiply by 10s (if tenths are present) or 100s (if two decimal places) to remove the decimal first. For example, for the number 256.37, multiply the number by 100 to make 25637 and then subtract 7. Ask: How do you know what to multiply or divide by to get the digit into the ones place?

Number Cycles

Ask students to use an extended place-value chart that includes decimal places.

hundreds	tens	ones	hundreds	tens	ones		tenths	hundredths	thousandths
thousands			ones			•	fractions		
3	4	6	4	2	7	•	1	2	5

How Many?

Recount a story about an office that uses an average of 1.23 cartons of paperclips each month. Given that each carton has 10 boxes of 100 paper clips,have students decide how many paper clips the office uses on average. Ask: Does this seem reasonable? Point to the individual digits in 1.23and ask how many paper clips each digit represents.

Recording Measurements

Ask students to decide what the decimal point shows when using it to record measures, such as their height, or how high and how long they can jump. Havestudents record each measurement in centimetres (132 cm), metres and centimetres (1 m, 32 cm), and metres (1.32 m). Ask: What does the 1 in
1.32 mean? What does the decimal point do? What does the .32 mean? Emphasize that the decimal point distinguishes metres from parts of a metre.

Decimal Fractions

Use decimetre squares of 1-mm grid paper (See Appendix: Line Master 2) as units to show how successive division by 10 relates to the places. Cut the grid paperinto ten pieces, take one-tenth and write 0.1; cut that piece into ten pieces andtake one-tenth, then write 0.01, and so on. Cut a square into two pieces,keeping to grid lines, and calculate the decimal fraction of each piece. Ask: If you are using a calculator to add the two numbers together, why must the result be 1?

Ordering Measurements

Invite students to order a series of measurements in metres (litres, kilograms)and say what the digits to the right of the decimal point mean. Perhaps thesefigures could be taken from the jumps and throws recorded at a recent track andfield meet. Then, ask questions, such as: Which is longer 2.34 or 2.5? Why?How many centimetres is 2.5 metres?

Lengths as Decimals

Ask students to record lengths as decimals on a metre stick. Ask: If we need tobe more accurate than measuring to the nearest 10 centimetres, how could we make smaller measures on our metre stick? Focus attention on splitting a tenth into tenths and renaming these as hundredths. Ask students what fractional part of the metre each place represents. For example, ask: What does the first place after the decimal point represent? What does the second (third) place represent?

Sample Learning Activities

K-Grade 3: ★ ★ ★ Major Focus

How Many

Have students use materials, such as pinecones or bottletops, to model an addition story involving change and then compare their answers. For example: Four butterflies are in you garden. If three more fly into your garden, how many will there be?
Ask: Are the answers all the same? What if we counted them another way? Suppose the butterflies flew around? Ask students to count the total in different ways. Record in a picture and symbols.

Counting Chickens

Ask students to model stories. For example: Mother Hen gathered four of her chickens. If three more came back, how many will there be? Continue with different examples using the same numbers until students confidently claim it will always be seven. Ask those who claim this to justify to others. When students are convinced, ask them to say it in their own words and record as a number sentence: 4 + 3 = 7.

Imagining

Have students mentally add or take away two from a small collection of objects, such as five plastic animals. Ask students to imagine that they have taken away two animals. Ask: How many animals will be left? Repeat by adding three, four, five animals. Focus students on working it out by counting on; thinking of four as two and two and counting on by twos; and thinking of five as three and two.

Addition Table

Encourage students to build up their own table pf addition facts, first to 5 + 5. Over time, build up the addition table to 6 + 6, then 7+ 7, and so on.

Number Cube Games

Play games such as this number cube game. Organize students into pairs. Give each pair three number cubes. Have students take turns to throw the cubes, add the number together and keep a running total on a calculator. During the game, ask: Which two numbers did you add together first? Why? At the end of the game (when one student reaches a total of, say, 50mor more), ask students to use number sentences to show their addition for at least one turn.

Doubles

Help students develop their repertoire of known facts by building on from "doubles". For example: Have students use 6 + 6 = 12 to work out 6 + 7, 5 + 6 and so on.

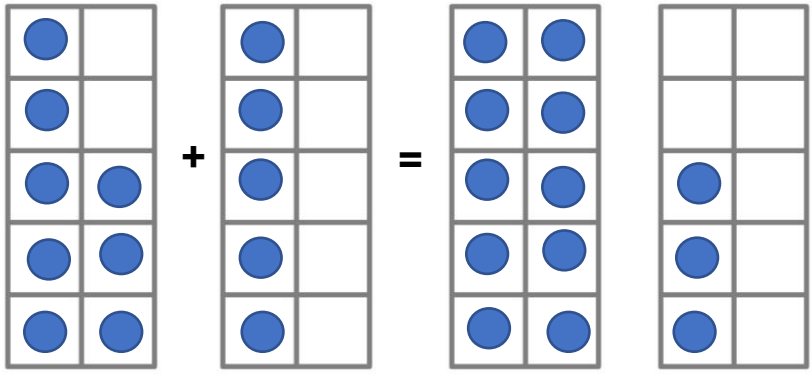
FSIM006 | First Steps in Mathematics: Number Sense

Number Line

Extend the number of *Cube Games* activity on page 37. As students play the game, have them use a number line to check their mental counting on and counting back always give the same results as counting, starting the count from the same one every time.

Compensating to Ten

Ask students to use two ten-frames to find ways of breaking up numbers to calculate. For example, to add 8 + 5, students move two form the five into the frame with eight to make ten and then ass the remaining three. Extend so students can visualize the above movements.



8 + 5 = 13

Easy Calculations

Help students find an easy way of working out calculations, such as 7 + 4 or 5 + 7, using known combinations to ten. Ask them to share their strategies with the class. Extend later to include calculations with larger numbers by adding or subtracting from one of the numbers to make the other into a multiple of ten.

Double Calculations

Have students doubling collections of materials, such as beans and counters, to make "twice as many" or "two times", and tell others the results. Begin with numbers form one up to four and ask students to extend the numbers themselves. Use a diagram to show the results and describe what the groupings mean, such as two sixes and six plus six. Use double and double again for students to work out four times a given collection.

Number Combinations

Ask students to recall number combinations from contexts where they made different partitions of the same number. For example: Think about when we made necklaces. We made one with eight beads. When five were red, how many were blue? Ask them to recall the situation and "see" in their mind's eye the parts of the collection.

FSIM006 | First Steps in Mathematics: Number Sense

Basic Facts to Ten

Help students to Memorize basic facts to ten. Give each one a set of number facts cards. Ask students to work in pairs and take turns to put out three combinations of cards, such as 6 + 3, 9 + 0, and 3 + , two of which are combinations of the same number. If the partner can identify the odd card and say why, they can take the three cards. To vary the game, one student can set out two cards with equivalent totals for the partner to find another card to match the total.

Sample Learning Activities

Grades 3-5: ★ ★ ★ Major Focus

Animal Patterns

Have students create an animal using Pattern Blocks, and then say how manyblocks were used. For example: *My cow was made with eight triangles*. Ask: How many triangles would you need for five cows? Ask students who did not usematerials to solve this and share with the class how they worked it out.

Same Numbers

Ask students to use their own strategies to solve and record solutions to multiplication problems involving the same numbers. For example: Jeremy canonly carry seven plastic milk containers at a time to the recycling bin. Howmany does he take in four trips? Ask students to share the number sentences they used, say why they are the same and why the answers are the same.

Multiplication Facts

Help students to build up sets of related multiplication facts. For example: Askstudents to draw one tricycle and say how many wheels then two tricycles andhow many wheels, and so on. Encourage students to look for the pattern andsay why five tricycles must have 15 wheels. Have students record the numbersentences as the pictures are drawn to list the first five or six multiples ofthree.

Today's Number

Write a number on the board. Ask students to suggest calculations with that number as an answer. Record their calculations on the board. Ask: Are there any number sentences that belong together? Why? As students mention the four operations, build different groups. Ask: Can we rearrange the number sentences so they are in order? How can each set be extended?

Forgotten Facts

Ask students to explain to a partner how they could work out a fact they do notknow or have forgotten. For example: *To find 6 x 5, I know it's 5 x 5 and another five.*

Doubles and Halves

Have students use doubles and halves to multiply and divide. For example:4 x 7 is double double seven, which is double 14, or 28; 24 ÷ 4 is half of half of 24, which is half of 12, or six.

Multiplication Doubles

Have students relate known multiplication "doubles" to the harder multiplication facts. For example: As a way of remembering 6 x 8, students could make a 6 x6 grid and build on until they make 6 x 8. They work out tables they couldput together to help work out the original, such as 6 x 6 and 2 x 6. Ask: Couldyou use addition instead of the 2 x 6? Which is easier?

Extending Doubles and Halves

Extend students' use of doubles and halves to find answers to multiplication, such as 8 x 12. For example: Halve eight and double 12 gives 4 x 24; halve fourand double 24 gives 2 x 48; halve two and double 48 gives 1 x 96.

Concentration

Have students use addition and multiplication examples to construct cardsto play games such as Concentration. Pairs of cards are made by putting together different representations of the same number. For example: 3 x 2 and 2 + 2 +2 would be a matching pair.

Constant Calculations

Have students use the constant function on the calculator to find multiples. Forexample: When learning the four times table, press 0 + 4 then = = = to find the multiples of four. Ask students to predict what will be next andthen to verify their prediction. Ask: Why can't a number with seven in the ones column be a multiple of four?

Grid Patterns

Have students make a multiplication grid by placing numbers along the top and down the side and the answers within the grid. (See right.) Look for patternswithin the grid. Ask: Why are the numbers above the diagonal the same as below? How can this help findanswers to tables you don't know?

Looking for Patterns

Have students investigate patterns in the answers of times tables. For example: In the nine times table, the digits of each answer add to nine, the numbers in the ones column go up by one and the numbers in the tens column go down by one.

x	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

Sample Learning Activities

Grades 3-5: ★ ★ Important Focus

Representing Fractions

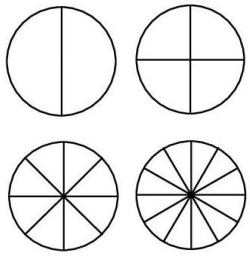
Organize students into pairs. Ask them to use identical paper shapes to makea chart that shows some of the ways any given fractional amount could berepresented. Be sure to increase the level of difficulty to match students' current level of understanding. Introduce the idea of equivalence so that students can record their practical representations using fractional language. Forexample: *I folded my square into eight and coloured four squares. Four-eighths is the same amount as one-half.*

Equivalent Fractions

Invite students to use materials, such as strips of paper, fraction circles and Pattern Blocks, to find as many different fractions as they can that are equivalentto one-half. Repeat this activity with one-third and one-quarter, then two- thirds and three-quarters. Ask students to discuss and justify their results.

Fraction Circles

Ask students to compare fractions using four paper circles that are equal in size. Have them fold, mark and then cut one circle into halves, one into quarters,one into eighths, and one into sixteenths. Have students explore equivalent fractions by matching sections of the circles. Later, extend this activity usingsuitable models, such as paper rectangles and strips of paper, to find equivalentfractions for thirds, fifths, sixths, ninths and tenths.



Equivalence

Pose this situation to the class: Andrew said, "Three-quarters equals six-eighths!" Angela said, "Not always, it depends!" Ask students to explore the equivalenceand to explain how both students can be right. Have them find a way to illustrate an equal and an unequal representation using materials of their choice. Draw out the idea that for three-quarters to be equivalent to six- eighths, the wholes must be the same.

Chocolate Bars

Ask students to use grid paper representations of chocolate bars to investigate questions, such as: Jackie has two-thirds of a chocolate bar and Martin haseight-twelfths of the same size chocolate bar. Who has more chocolate, or dothey both have the same amount? Explore if this is still true for different-sizedand shaped chocolate bars when the wholes are the same and when the wholesare different.

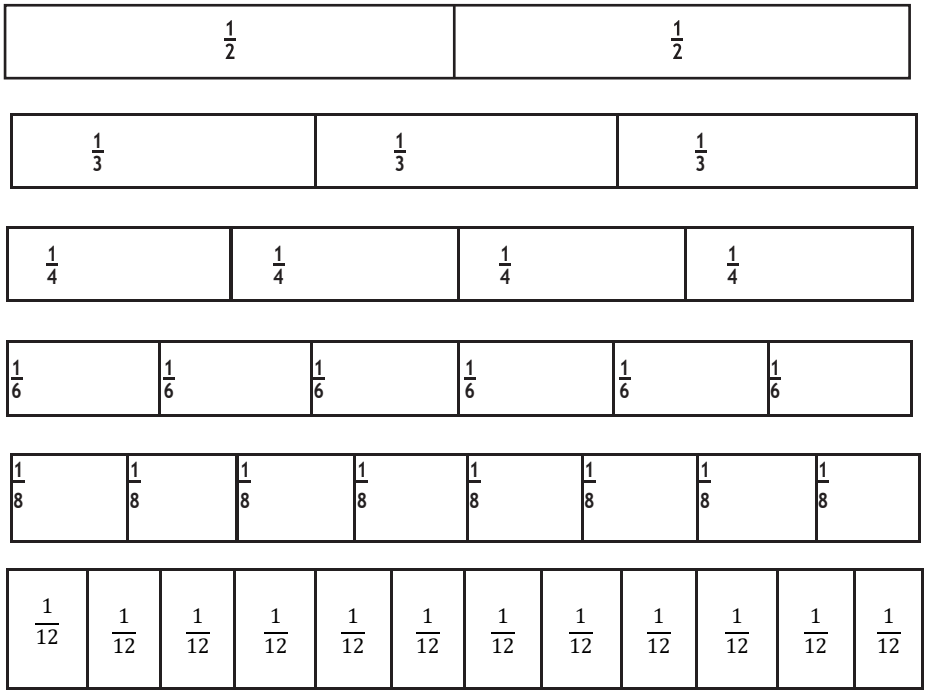
Grades 3-5: ★ ★ Important Focus

Marbles

Have students find equivalent fractions of collections, such as half a bag of marbles compared to two-quarters of the same bag of marbles. Ask:How can you have the same amount of marbles both times? Ask students to investigate other equivalent fractions for a particular sized bag of marbles. Ask: What is the same about half, two-quarters and three-sixths? What isdifferent?

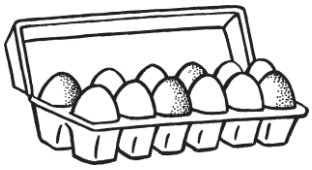
Equivalent Fractions

Ask students to fold equal lengths of cash register tape into halves, thirds,quarters, sixths, eighths and twelfths, then label the sections. Have students lineup the strips to find equivalent fractions. Discuss how accuracy is important ifthe strips are to give useful information.



Fractions of a Collection

Invite students to find different fractions of a collection and to say whichresult in the same amount and which do not. For example, say: Find a third, thentwo-sixths, then a quarter, then four-twelfths of a dozen eggs. How many eggsdo you have for each fraction? Why did some of the different fractions result inthe same number of eggs? Explain why this happened.



Sample Learning Activities

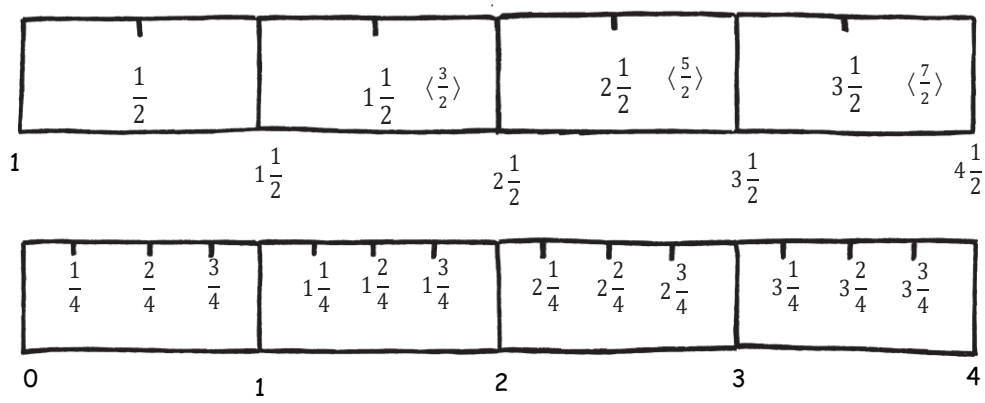
Grades 5-8: ★ ★ ★ Major Focus

Bags of Marbles

Invite students to explore fraction representations using bags of marbles. Havethem begin with a bag of 12 marbles and establish what fraction of the bag onemarble would be, then write two, three, four, up to 12 marbles as fractions ofthe bag. Next, challenge students to find all the fraction equivalents possiblewith denominators between 1 and 12. Later, have students repeat the processwith a bag of 24 marbles. Then, ask them to do the same with 36 marbles.Have them compare the lists of equivalent fractions from the three bags. Ask:Which fraction equivalents are the same in each? How can you explain thiswhen there are different numbers of marbles in the bags?

Fraction Tapes

Have students make paper fraction tapes to explore equivalent fractions. Ask them to join four equal lengths of paper and label them in halves, from 0 to 4. Encourage students to use both mixed numbers and improper fraction notation for each part; for example: $1\frac{1}{2}$ and $\frac{3}{2}$. Then, ask them to make tapes, which are equal length, for thirds, quarters, sixths, and eighths. Have students use the tapes to compare and combine fractions equivalent to $2\frac{1}{2}$? Which fraction tape would show the result of adding a third of a strip to one and a half trips? If I took a half strip away from two and two-thirds strips, how much is left? What new tape would I need to make to add three-quarters of a strip to one-third of a strip? Encourage students to justify their responses.



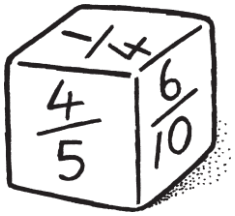
Equivalent Fractions

Ask students to partition a whole into increasingly smaller parts to generate equivalent fractions. Have them devise and discuss rules for generating sequences of equivalent fractions. Draw out the idea that there can be an infinite number of equivalent fractions.

Chocolate Bars

Build on *Chocolate Bars*, on page 157. After students have formulated a general rule for finding divisions, such as $3 \div 4$, ask them the result of a simple example, such as $2 \div 3$. Emphasize that this means "two things shared between three". Then, ask students to predict what they would get if they shared four things between six people. Some students might use their new rule and give an answer of $\frac{4}{6}$. Other students might say that it is the same answer as two shared between three. Have students use diagrams to explore the idea. Draw out the idea that this shows $\frac{4}{6} = \frac{2}{3}$.

Rolling Number Cubes



Label each face of a number cube with one of these fractions $\frac{1}{4}, \frac{2}{6}, \frac{4}{5}, \frac{1}{6}, \frac{2}{3}, \frac{6}{10}$.

Then, label each face of a second cube with one of these fractions: $\frac{1}{3}, \frac{2}{12}, \frac{3}{5}, \frac{8}{10}, \frac{4}{6}, \frac{2}{8}$.

Each student takes a turn to roll the cubes then decide whether the fractions shown are equivalent or not. Ask students to give reasons for their decisions.

Relay Race

Have students work out how many runners are needed for a relay race if each person runs an eighth of one kilometre and the race is three-quarters of a kilometre long. Ask students to draw a diagram Ask: How many runners are needed for one-quarter of a kilometre? How does knowing this help you to solve the problem?

Fraction Problem

Pose the following problem to students: Two students were discussing fractions. Saeed said, "Two-fourteenths is double one-seventh." Wendy said, "No, it isn't. They are the same size." Who do you think is right? Have students draw a diagram to justify their answer, then share their results with a partner.

Pizza Fractions

Ask students to make models of one-half and one-third of the same size pizza. Then, have students place the two sections together. Ask: What fraction of a whole pizza are these pieces put together? Have students draw partitions onto a series of other whole pizzas, dividing the pizzas into fifths, sixths, up to twelfths then place the fraction sections onto these to decide which partitions are most helpful. Draw out the idea that the pizza partitioned into sixths is the most helpful for adding halves and thirds.

Sample Learning Activities

Grades 3-5: ★ ★ Important Focus

What Number Am I?

Pose the following problem to students: I am less than one but more thanzero. I am bigger than one-half. Have students guess the number and thendiscuss the strategies they used to work out the answer. Later, ask them to make up their own fraction clues to give to the class.

The Frog and the Flea

Pose the following problem to students: A frog and a flea had a jumping contest.Each of the frog's jumps was one-third of a unit long. Each of the flea's jumpswas one-quarter of a unit long. The winner was the one who reached four unitsin the fewest jumps. Predict which creature won and explain why. Encouragestudents to represent the jumps on a number line to check their predictions.Then, ask: What if the race was longer?

Fraction Tapes

Help students to see how fractions fit with whole numbers. First, have them foldidentical lengths of cash register tape into various fractional parts. Then, askstudents to label the folds in sequence; for example, from $\frac{1}{4}$ to $\frac{3}{4}$, then label the start $\frac{"0"}{4}$ and the end $\frac{"4"}{4}$. Ask: How is the half marked on this tape different from, say, half an apple? Draw out the idea that the fractions on the tape showa position on the tape. (See also Case Study 3, page 149.)

Allowance

Pose this problem to students: Mary and John each spent a quarter of their allowance. Is it possible for Mary to have spent more money than John? Whatif they had spent half of their allowance? Have students justify their responsesin terms of the size of the whole.

Estimating Fractions

Ask students to estimate the size of fractions of things in their environment. For example, say: Show me a third of the bulletin board (your desk, the wall).Ask: How did you decide where a third is?

Finding Fractions

After activities such as *Estimating Fractions*, above, ask students to fold a paper strip to find a given fraction. Give students different-sized strips ofpaper. Then, ask students to find someone else in the room with the samesized strip and compare fractions. Ask: How do you know that the fractions show the right amount? How can you be sure?

Grades 3-5: ★ ★ Important Focus

Estimating Positions

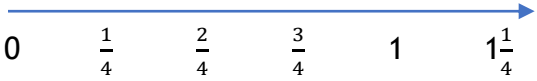
Extend *Finding Fractions*, on the previous page, by giving students several stripsof paper the same size. Ask them to estimate without folding, the position ofa half, a third, a quarter, three-quarters and two-thirds, each on a different strip. Then, have students place their strips together and review their decisions,making changes to the position of the fractions where appropriate.

Cheesecake

Have students think about the size of fractions to solve word problems. For example, say: Dad told Louise and Matthew that there were two pieces of cheesecake left in the fridge. One piece was $\frac{1}{3}$ of the cheesecake. The other piece was $\frac{1}{4}$ of the cheesecake. Dad said the older child should get the biggerpiece. He gave Louise $\frac{1}{4}$ of the cheesecake and Matthew $\frac{1}{3}$ of the cheesecake. Who do you think is older: Matthew or Louise? Have students draw diagrams to explain their answers.

Fraction Number Line

Draw a number line on the ground or on a large sheet of paper with units andhalf units marked. Have students jump in units, half units and/or quarter units,counting as they go, such as *one-quarter, two-quarters, three-quarters, one, oneand one-quarter*.

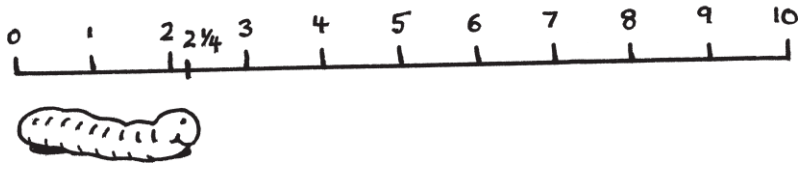


Sharing Chocolate

Pose this problem to students: Last night, I was offered the choice of half,a quarter or a third of a chocolate bar. Which one would have been given methe most chocolate? Have students use a number line to justify their responses.

Comparing Lengths

Give each student a number line marked in units from 0 to 10. Then, askstudents to draw a worm $2\frac{1}{4}$ units long. Repeat this activity with a number ofdifferent lengths. Have students mark their worms' positions on the number line and talk about how they determined where the worm would begin and end.



Sample Learning Activities

Grades 5-8: ★ ★ ★ Major Focus

Less Than 100

Ask: What is the biggest number you can think of that is less than 100? Usea long strip of 1-mm grid paper (See Appendix: Line Master 2) to represent a number line segment between 99 and 100. Have students begin by marking $99\frac{1}{3}$ on the strip and then ask them to add numbers larger than this, such as $99\frac{3}{4}$. Ask students to indicate and justify the position of their numbers on the line.

Ordering and Comparing Fractions

Ask students to use a half, a third, a quarter and three-quarters as referencepoints to determine the size of a fraction, or to order and compare fraction numbers. For example, ask: Is $\frac{5}{8}$ smaller or bigger than a half? Does knowing that $\frac{4}{8}$ is a half help? Use what you know to say whether $\frac{8}{14}$ is more or less than $\frac{5}{8}$.

Have students use these strategies to order sets of fractions with unlike numerators and unlike denominators; for example: $\frac{2}{3}$, $\frac{4}{5}$, $\frac{5}{6}$, $\frac{9}{10}$

Fraction Cards

Have students order sets of fraction cards with:

- like denominators; for example: $\frac{3}{4}$, $\frac{1}{4}$, $\frac{2}{4}$; or
- like numerators; for example $\frac{2}{3}$, c, $\frac{2}{7}$.

Ask them to justify their reasons for ordering the cards as they did.

Number Lines

Organize students into groups. Provide students with equal lengths of cashregister tape and ask them to fold or mark the strips into fractional parts.Have groups tape their fraction strips together to make separate number linesfor halves, thirds, quarters, and so on. Then, ask them to add labels, for example: $\frac{0}{5}$, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{3}{5}$, $\frac{4}{5}$, $\frac{5}{5}$ (or 1), then $1\frac{1}{5}$, and so on. Have students use their number lines to count in fractions. For example, say: Begin at one-third, then count on bytwo-thirds. Encourage students to compare strips to make other counts.

Say:Begin at one and a quarter and count in halves.

Grades 5-8: ★ ★ ★ Major Focus

Places on a Number Line

33 String up a clothesline across the classroom. Add a card labelled "0" at one endand a card labelled "1" at the other end. Ask students to determine where fraction cards would be positioned on the line and justify their suggestions. Draw out the idea that there is a much greater difference between and, for example, than there is between $\frac{32}{}$ and $\frac{33}{}$ in order to help them understand that must be closer to 1 than

Spending Money

Pose this problem to students: Felicity and Cameron both got money as birthdaygifts. Felicity said she spent $\frac{1}{4}$ of her money. Cameron said he spent $\frac{1}{5}$ of his. "You spent more than me!" Felicity added. Cameron replied, "I couldn't have, a fifthis less than a quarter." Ask: Could Cameron be right? How could that happen?

Counting Fractions

Pose this problem to help students count in fractional amounts: I need $1\frac{1}{10}$ m ofribbon to make a bow for a present, but I only have a $\frac{1}{10}$ m ruler. How would I count to measure the ribbon I need? Have students record the count on anumber line.

Comparing Fractions

Ask students to compare two fractions, such as $\frac{2}{3}$ and $\frac{4}{5}$. Ask: Which number is larger? How do you know? Use a number line to prove that your answer is correct.

Fraction Problems

Pose this problem to students: Each day, a baker uses $\frac{3}{8}$ of a bag of flour to make bread, and $\frac{1}{4}$ of the same bag of flour to make cakes. Is more flour used to make bread or cakes? Have students use diagrams to show a partner which quantity is bigger.

Sorting Fractions

Have students explore the relative size of fractions by sorting fraction cards intogiven categories. For example: less than one or more than one; nearer to zeroor nearer to one; nearer to zero, nearer to half or nearer to one. Encourage students to use materials or diagrams to justify how they have sorted theirfraction cards.

Fractions on a Number Line

Ask students to use a number line, marked from 0 to 50, to indicate the position of fractions as numbers as well as fractions of numbers. For example, say: Show the number $\frac{7}{8}$. Show the number that is $\frac{7}{8}$ of 16. Have students compare the ,language used when referring to fractions as numbers and fractions as operators. Discuss the identity of the whole in each context.

Estimating

Have students use equal lengths of cash register tape to estimate (withoutfolding to check) the position of a different fraction on each strip. For example,one-third on the first strip, one-sixth on the second, five-sixths, three-ninths,seven-eighths, and so on. Then, ask students to place their strips of paper onenext to the other and review their decisions, making changes to their estimatesif necessary. Encourage them to check and try other fractions to improve theirestimates.