Measurement Part 2

This unit covers measurement using rulers, measurement of time (non-standard units, hours, days, weeks, months, seasons), measurement of area and measurement of capacity.

Talking About Clocks

For some of the lessons, you will need an analogue clock with three hands—hours, minutes, and seconds. Referring to the hand that measures seconds as the “second hand” may confuse your students if you do not introduce the second as a unit of time; students might wonder why this hand isn’t called the first or third hand, for example. We suggest calling the second hand the “fast-moving hand” at first. After using the phrase a few times, you can shorten it to “fast hand.” If you do introduce seconds (see the online Extensions for lesson ME1-27), then you can start using the phrase “second hand,” but be aware of the possible confusion.

We will refer to the two slower hands as the hour hand and the long hand. The hour hand moves past one number every hour, and so the term “hour hand” makes sense. However, the minute hand does not pass one number every minute but every five minutes. (Similarly, the second hand goes past one number every five seconds.) Since the minutes are not marked on most of the clocks and watches students will come in contact with, we do not recommend using the term “minute hand.” Furthermore, constantly referring to the minute hand as the long hand will reinforce for students that the hour hand is the short hand.

Scheduling

Some of the lessons using clocks will need to be completed over the course of a day (or two) rather than all at one time. Start these lessons as early in the day as possible. You will find details in the relevant lesson plans.

More Connecting Cubes

Students will need both 2-cm and 1-cm connecting cubes for some lessons. They used the former in Part 1 and will be introduced to the latter in lesson ME1-23. Have large numbers of each on hand.

Containers

You will need a variety of containers for the students to use to measure capacity during this unit. Ask your students to help you to create a collection by bringing empty washed containers (non-breakable bottles, jugs, cans, juice boxes, milk cartons, etc.) You will also need a stack of identical cups to serve as measurement tools and funnels to prevent spilling.

At Home

Check with a parent/guardian which capacity measurement tools are used in the kitchen or at home in general.

Connection - Literature

8 O’Cluck by Jill Creighton

This book introduces time. Mr. Wolf and his neighbours are preparing for dinner.
Goals
Students will learn how to use a ruler.

Prior Knowledge Required
Can measure lengths using non-standard units

Vocabulary
ruler

Materials
small paper clips, strips of construction paper, and paper fasteners (to make rulers—details below)
various classroom objects to measure
BLM Concrete Rulers (p xxx)
BLM Concrete Rulers Without Pictures (p xxx)

Curriculum Expectations
Ontario 1m32, 1m39, 1m40, 1m42 (ME 3, 10, 11, 13)
Western SS1
PSS* (1m2, 1m3)
Comm*

Introduce rulers. Draw a chain of paper clips on the board, and draw the non-writing end of a pencil above it. SAY: The pencil is 2 paper clips long. Who wants to finish drawing the pencil? Then mark the number 2 where the pencil ends.

Explain that we write 2 where the pencil ends because anything that starts where the chain of paper clips starts and ends here is 2 paper clips long. Invite a volunteer to draw a pencil that is 1 paper clip long. Have another volunteer write 1 where the pencil ends. Repeat with pencils that are 3 and 4 paper clips long.

Activity
Prepare small-paper-clip rulers for each student by fastening a chain of 8 small paper clips to a strip of construction paper with paper fasteners. The strips of paper should be longer than the chain of paper clips, and neither end of the chain should line up with the edge of the paper. This will get students used to the way actual rulers work. Have all the chains begin (but not end) with a coloured paper clip so that you can tell your students clearly with which end to start measuring. Have students measure a big paper clip. ASK: About how many small paper clips long is the big paper clip? Where does it end on your ruler? Have students mark “2” where an object that is exactly two paper clips long would end. Repeat with many objects of various sizes, such as an eraser, a pencil, a roll of tape, and a tens block. Students can also measure the length and width of their index fingers. Explain that the width of their index fingers is between no paper clips long and 1 paper clip long and
is likely closer to no paper clips long. ASK: What number should we write to show this? Have students write 0 at the beginning of the coloured paper clip and explain that an object that was exactly 0 paper clips long would end right where it started. EXAMPLE: the thickness of a sheet of paper

**Rulers do the counting for you.** Draw a longer small-paper-clip ruler on the board, one with 10 paper clips and markings from 0 to 10. Draw a pencil lined up with the 0 and 9. ASK: How many paper clips long is the pencil? (9) Students could answer by raising the correct number of fingers. ASK: Did you count the paper clips to find out? Is there another way to find the answer? How is the counting already done for you? Explain that a **ruler** is a tool that does the counting for you. PSS – **Making and investigating conjectures** Then show pencils of different lengths and ASK: How many paper clips long is this pencil? How do you know?

**Using rulers correctly.** Draw a pencil above the small-paper-clip ruler like this:

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 0 1 2 3 4 5 6 7 8 9 10
[10 paper clips]
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SAY: I think this pencil is 7 paper clips long because it ends at the number 7. Am I right? (No; if you count you find only 5 paper clips along the length of the pencil.) SAY: But the ruler is supposed to do the counting for us. Why didn’t the ruler get the same answer our counting did? Explain that the object has to be lined up with the 0. A ruler is a tool that people made so that they don’t have to count every time, but we have to use it properly for it to do what we want it to do.

**Activity**

Give students copies of rulers from BLM Concrete Rulers, but do not use the ruler of small (1-cm) connecting cubes yet. Have students measure various objects using their rulers and record their measurements. Then have them compare their measurements with a partner who measured the same object(s) with the same kind of ruler. Did both students get the same answer? If not, have them work together to determine the correct measurement. Students might also find a partner who measured the same objects with a different kind of ruler. Were their partner’s measurements more or less than their own? Can they explain why? PSS – **Reflecting on the reasonableness of an answer** Repeat with rulers from BLM Concrete Rulers Without Pictures.
Goals
Students will learn the centimetre and the advantage of standard units.

Prior Knowledge Required
Can measure using non-standard units/rulers
Can skip count by 2s, 5s, and 10s

Vocabulary
ruler
centimetre (cm)
standard units

Materials
small (1-cm) and large (2-cm) connecting cubes
BLM Ruler or Counting (p xxx)
BLM Concrete Rulers (p xxx)
rulers
BLM Measure with a Ruler (p xxx)
BLM Practice Measuring with Centimetres (p xxx)

Curriculum Expectations
Ontario 1m30, 1m31, 1m32, 1m39, 1m40, 1m42 (ME 1, 2, 3, 10, 11, 13)
Western SS1
PSS* (1m1, 1m3, 1m6)
Comm*

Introduce small connecting cubes. Remind students that we have big paper clips and small paper clips (show samples). Then show students the big and small connecting cubes. So far they have used only the big cubes. Now they will measure using the small cubes, too.

Measure using small connecting cubes and rulers. Give students small connecting cubes and a copy of BLM Ruler or Counting. Have each student measure the real objects pictured to complete the first column on the BLM. Then give students a small-connecting-cube ruler (from BLM Concrete Rulers) to measure the same objects again and complete the second column. Discuss whether they got the same answer both ways, and if not, why not. Did they forget to line up one end of the object with the 0? Did they count the cubes properly or were there so many that they got lost in the counting? ASK: Which way of measuring was easier? Which way was less work? Why? PSS – Reflecting on what made the problem easy or hard. Explain that because the ruler does the counting for us, it is less work to use the ruler.

Relate the length of small connecting cubes to the spaces on a ruler. Give each student a regular ruler (30 cm long) and 30 small connecting cubes. Have students line up the cubes on the ruler so that they fit in the markings. What do students notice? (The spaces between the markings are the same length as the cubes; the cubes fit exactly between the markings.) Explain that the length of each small cube is called a centimetre and people use centimetres to make rulers. Students can practise measuring with a ruler by completing BLMs Measure with a Ruler and Practice Measuring with Centimetres. Students can measure the pictures directly on the page (they are all a whole number of centimetres) or else measure the real objects whenever available.

Use a ruler to measure longer objects. Have students use rulers to measure objects that are between 20 and 30 centimetres long, such as the length of a sheet of paper. Then give students metre sticks and ask them to measure objects that are more than half a metre long but less than one
metre long. Remind them to line up the 0 mark on the metre stick with the end of the object. Objects they might measure include the width of a doorway, the length of a bookshelf, a width of a window, the length of an arm, and the distance around a garbage can (using string and the metre stick). Emphasize how much easier it is to have the ruler count for them when there are many centimetres to count.

**Centimetre and cm.** Write the word centimetre on the board and tell students that people often just write \( cm \) for centimetre. Have a volunteer find and circle the letters \( c \) and \( m \) in the word.

**Activity**
Have students find objects which are about 1 cm long, wide, or high in the classroom.

**Connection** Real-world

**The need for standard units.** Tell students that a long time ago, people didn’t use paper clips or straws or connecting cubes or even centimetres to measure lengths. They used other things. For example, in ancient Egypt, they used *cubits*. Tell students that a cubit is the length from the tip of your middle finger to your elbow and show this length on yourself. Use the following Activity to illustrate the disadvantages of such a unit of measurement and the need for standard units.

**Activity**
Tell students that you want to make a table that is 4 cubits high. Have students each make one leg using their own cubit and then get into groups of 4 to make a table. Students can roll old newspapers to make the legs and use bristol board to make the tabletop. (Rolling newspapers diagonally works well; the ends are thinner and easier to cut off.) Then ask students to lay a pencil on their tables. Does the pencil roll off? Why? Why aren’t the legs the same height? Explain to students that the ancient Egyptians recognized the need for everyone to use the same, or a standard, cubit. Who’s arm did they use to determine the length of the standard cubit? The king’s! Discuss: How do you think people recorded and shared the king’s cubit so that everyone would know what it was? (They used a wooden stick with lines scratched in to show the length of the king’s cubit, just like we use rulers.)
Goals
Students will become familiar with the details on a clock face.

Prior Knowledge Required
Can use number lines

Vocabulary
- clock
- hands
- face
- short
- long
- thick
- thin
- fast
- slow

Materials
- an analogue clock with three hands
- masking tape, string, or a hula-hoop
- cards numbered 1 through 12
- BLM Clocks (p xxx)
- BLM Make Your Own Clock (p xxx), paper plate, paper fastener, and scissors for each student

Curriculum Expectations
- Ontario 1m3, 1m5, 1m7, 1m36 (ME7)
- PSS* (1m3, 1m5)
- Comm*

NOTE: Students will need to copy the hands on the clock at different times throughout the day.

Compare clocks to number lines. PSS - Connecting Point out how the clock face has numbers all around, beginning with 1 and ending with 12. Draw a number line on the board and label it from 1 to 15. Discuss how the clock is like a number line that goes in a circle. Ask students what comes before and after various numbers from 1 to 12, first on the number line and then on the clock. (EXAMPLE: What comes before 3 on the number line? On the clock?) Finish with the number 12, and explain how it is special (the next number on a clock is 1; the next number on a number line is 13). Emphasize that clocks are like number lines, except the clock only goes from 1 to 12 and then starts over again at 1.

Add the numbers to a clock face. Tell students to look closely at a clock face and to try to remember where all the numbers go. Then gather the class around a large “clock” on the floor: a circle (made from masking tape, string, or a hula-hoop) with cards numbered 1 to 12 placed face
down in the correct positions. Make sure students have their backs to the actual clock or hide it, if possible. Have volunteers turn over cards of their choice after predicting the number.

ASK: Which numbers were easier to remember? Why do you think they were easier to remember? PSS – Reflecting on what made the problem easy or hard (Most students will likely say 12 and 6; some will say 3 and 9.) Explain that the numbers at the top, bottom, left, and right are usually the easiest to remember. Put the cards for 3, 6, 9, and 12 in position and ask students to place the remaining numbers on the “clock.”

Take away all the cards and ASK: Where does the 12 go? Have a volunteer place it in the correct position. Repeat with 6, 3, and 9. ASK: What numbers come before and after the 3? Have volunteers place those numbers and repeat for 6 and 9. End with 12. Emphasize that the clock face shows only numbers 1 to 12.

PSS – Reflecting on the reasonableness of an answer SAY: We said that 2 comes right before 3 and that 1 comes after 12. That means the 1 comes right before 2. Does that make sense? Does 1 come right before 2 on a number line? Repeat with more numbers on the clock. Explain that when students can solve the same problem in two different ways and get the same answer, then they must have done the problem correctly. If we know that 5 comes right before 6 and right after 4, and both pieces of information make the number go in the same place, the answer must be right.

Connection Physical Education Activity Teach students this dance: point to the right with both arms and your right foot while singing “Here is the 3,” then point down with both arms and hop once on both feet while singing “Here is the 6,” then point left with both arms and your left foot while singing “Here is the 9,” and finally jump up as high as you can with both arms reaching high in the air while singing “Here is the 12.” Have students face the clock while doing this dance several times. VARIATION: “12 is at the top, 6 is at the bottom, 3 is over here, and 9 is over there”

Discuss differences between the hands on a clock. Draw students’ attention to the three hands on a clock. Brainstorm how they are different and record students’ answers. Depending on the clock you have, answers might include:

- Two are thicker, one is thinner
- The thin one is moving (reflect this back as: only the thin hand looks like it’s moving)
- They are different lengths (reflect this back as: one of the thick hands is longer than the other)
- Two are black and the other one (the fast one) is red

All the hands are moving. Explain that all the hands on a clock move, but two move so slowly that they don’t look like they’re moving. Compare this to the motion of the sun. You don’t see the sun moving, but it is in a different place after school than it was when school started. You might have students note where the sun is at the start of the day and then again at the end.

Copy clock hands throughout the day. Give each student a copy of BLM Clocks. Pause throughout the day to have students look at the clock and copy the two thicker hands at various times. Discuss how the hands have moved. EXAMPLE: From 1:15 to 1:50, both hands moved but the short hand didn’t move very much—it is still between the 1 and the 2, but closer to the 2 instead of the 1.
Online Guide: Prompts for studying clock hands.

Activity
Make your own clock face. Students will need a paper plate, a copy of BLM Make Your Own Clock, scissors, a paper fastener, and a pencil. Students use the circle on the BLM to make a hole (with the pencil) in the centre of the paper plate and write the numbers in the correct positions. Attach the hands to the plate with the paper fastener.
ME1-25
What Takes Longer?
pages xxx–xxx

Goals
Students will directly compare two amounts of time.

Prior Knowledge Required
Can sequence two events (Which happened first?)
Can compare lengths directly

Vocabulary
longer and shorter
more and less (with reference to time)

Materials
two windup toy cards
BLM More Time and Less Time (p xxx)
BLM Time and Length (p xxx)
BLM Draw Lines to Match Stories (p xxx)

Curriculum Expectations
Ontario: 1m35 (ME 6)
PSS*(1m5, 1m7)
Comm*

Start at the same time, end later. Wind up two toy cars and let them both go at the same time, then
ASK: Which car ran for more time? How can you tell? Which car stopped first? Which car stopped
second? Explain that the car that stopped second ran for more time than the car that stopped first.

Have students predict if they think the same car will always go for more time. Do several runs,
always making sure that you let the cars go at the same time. This will give students practice
identifying which car runs for more time and which car runs for less time.

Car times are like pencil length. Show two pencils side by side. They should be similar, but not
identical, in length. The pencils start at the same point, but the shorter one ends first. Similarly, the
cars start moving at the same time, but the one that stops first runs for less time than the one that
stops second.

Compare times directly. Ask students to predict which activity will take more time: walking around
the room or doing 10 sit-ups. Explain that you will check the prediction by asking one person to do
one activity and another person to do the other, and seeing who finishes first. Emphasize that this is
not a race! The only reason you need two volunteers is because one person can’t do both things at
the same time. Volunteers should do each activity at a normal pace (demonstrate correct and
incorrect paces, if necessary). Invite volunteers to get into position. Remind students that just as
pencils have to be lined up for you to compare their lengths, the volunteers have to start moving at

Elapsed Time Teacher’s Guide Workbook 1:2
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the same time for you to compare the time each activity takes. ASK: How can we make sure the two volunteers start at the same time? (EXAMPLE: Say “1, 2, 3, GO!”) Invite a third volunteer to tell the others when to start.

When the volunteers are finished, ASK: What took longer, walking around the room or doing 10 sit-ups? How do you know? How is this like comparing the lengths of pencils?

**Introduce longer and shorter with reference to time.** ASK: What’s another way to say “more time” and “less time?” Can we say heavier time and lighter time? Thicker time and thinner time? Longer time and shorter time? Explain to students that we use the words **longer** and **shorter** to describe time because time is so similar to length. More time is longer time and less time is shorter time.

### Activity

Have pairs compare the time it takes to do 5 jumping jacks and say the alphabet. Each pair should:
1. Decide who will do which activity.
2. Start at the same time and not rush.
3. Answer these questions: Who stopped first? Who stopped second? Which activity took a longer time? Which activity took a shorter time?

Students can record their answers on BLM More Time and Less Time.

**Start later, end at the same time.** Have two volunteers clap their hands until you tell them to stop. Ensure that one of them starts before the other but they stop at the same time. ASK: Who clapped for a longer time? (the one who started first) Who clapped for a shorter time? (the one who started second) Repeat with other activities, such as doing jumping jacks or marching on the spot. Relate this to length.

**Start sooner, end later.** Tell two volunteers when to start clapping so that one starts sooner and finishes later. ASK: Who clapped for a longer time? Who clapped for a shorter time? Explain that when one person starts clapping sooner and finishes later, that person is clapping for a longer time. Relate this to length.

**Connect measuring time to measuring length.** Have students cut out the four pictures of pencils on BLM Time and Length. Tell students the following stories, one at a time, and have them choose the picture they think best matches the story.
- Sarah started drawing a snowman and Tom started writing the alphabet at the same time. Tom finished first. (PROMPTS: Did Tom and Sarah start at the same time? Which picture shows pencils starting at the same place? Which pencil represents Tom—the shorter pencil or the longer pencil? How do you know?)
- Sarah started clapping. Then Tom started clapping. Then Tom stopped clapping. Then Sarah stopped clapping.
- Sarah started clapping. Then Tom started clapping. Then Sarah stopped clapping. Then Tom stopped clapping.
- Tom was playing a song on his recorder. Sarah joined him on her guitar partway through. They both stopped playing at the same time. Tom played for longer.

Make up other “time” stories to match the pictures. Then tell stories and have students draw pictures (lines) to match. Start by drawing the lines for student and asking them to identify which line
represents which character; then draw one of the lines and have students add the second. See also BLM Draw Lines to Match Stories.

**Journal** Students can make up similar stories and draw matching pictures in their journals.
Goals
Students will compare elapsed time indirectly.

Prior Knowledge Required
Know the alphabet
Can compare length directly and indirectly

Vocabulary
longer time
shorter time
a lot longer
a little longer

Materials
JUMP Math Workbook Part 1 (not Part 2)
audio recording of a song that is familiar to students (a second recording at a different speed, if possible)

Curriculum Expectations
Ontario 1m35 (ME 6)
PSS*(1m5, 1m7)
Comm*

Which takes longer—saying or writing the alphabet? Ask one volunteer to say the alphabet while another volunteer writes it on the board, so that you can determine which takes a longer time. Again, this is not a race. The student saying the alphabet should whisper. NOTE: Choose volunteers who know and are comfortable writing and saying the alphabet. ASK: Which took longer—saying the alphabet aloud or writing it?

What does it take the same person longer to do? Using your students’ names as appropriate, SAY: It took Nora longer to write the alphabet than it took Tom to say the alphabet. Now I want to know if it would take Nora longer to write the alphabet than for her to say the alphabet. How can I figure this out? Students may suggest asking Nora to do both at the same time. Invite volunteers to try writing and saying the alphabet simultaneously, and then do so yourself. Point out that at least one of the tasks—the saying or the writing—will be slowed down.

Invite students to brainstorm other solutions. Prompt them to think about how they compared lengths, specifically the length of the sides of their desks. PSS – Looking for a similar problem for ideas Remind them that they couldn’t line up one side of their desk with the other, but even before they knew how to measure with connecting cubes there was a way to compare sides. Does anyone remember what that was? (make something the same length as one side and compare it to the other side)
ASK: How can we find out whether it will take Nora longer to say or to write the alphabet? Which do you think will take longer? Can we find something that takes another volunteer more time than it takes Nora to say the alphabet but less time than it takes Nora to write the alphabet? Have students come up with a third task that a different volunteer can do, one that takes longer than saying the alphabet but not as long as writing the alphabet. ASK: How did it help to think about how we solved a similar problem for length?

Use music to compare times. Play or sing a familiar song while Nora does each activity. Tell Nora to start saying the alphabet as soon as the song starts. Stop the song when she is finished. Where did you stop the song? Repeat with Nora writing the alphabet. Explain that since you heard more of the song when Nora wrote the alphabet than when she said it, writing the alphabet took her longer than saying the alphabet.

PSS - Connecting Emphasize that by stopping the song when Nora finished saying the alphabet, we found something that takes the same amount of time. Now we can compare how long it takes to get to the same place in the song with how long it takes Nora to write the alphabet. Did we hear more of the song or less in the time it took Nora to write the alphabet?

Demonstrate trying to compare two tasks with a slow and a fast version of the song. Choose two activities that will take your students approximately the same time to complete. Use two versions of a song, one that is clearly faster than the other, to try and determine which activity takes longer. (If you don’t have two different recordings, sing the song once slowly and once quickly.) ASK: For which activity did we hear more of the song? Does that mean this activity takes more time than the other? How can we check which activity really took longer? (use the same music both times; like using the same size paper clips to measure the length of a pencil)

Have students sing to compare times. Have partners sing for each other to compare the time it takes them each to do two tasks. (POSSIBLE TASKS: solve two different tangram puzzles, sort a deck of cards into suits or numbers, sort a deck of SET cards into different numbers (1, 2, and 3) or by shape, do 20 jumping jacks and 20 sit-ups) Stress the importance of singing the same song at the same speed each time. ASK: Which task took longer? How do you know? Students might wish to do different tasks than their partner so as not to compete. Students might also wish to say the words to a song they know well instead of singing the words. Allow students to choose a song they know well, but stress the importance of using the same song for both tasks and being consistent: if they choose to say the song instead of singing it, they must do so for both tasks. Ask students to articulate why this is important.
Goals
Students will measure time by counting the numbers that the fast-moving (second) hand of a clock passes.

Prior Knowledge Required
Are familiar with clocks

Materials
analogue clock with three hands

Vocabulary
fast-moving hand
clock
clock interval

Curriculum Expectations
Ontario 1m35 (ME 6)
Comm*,
PSS* (1m1, 1m3, 1m5, 1m7)

Introduce the clock as a measuring tool. Ask students to find something in the class that moves in a circle at the same speed all the time. (the fast-moving hand on an analogue clock) Draw students’ attention to this hand and watch it move. Point out how the hand moves at a steady pace, all the way around the clock. PSS – Connecting. Just as connecting cubes are all the same length, the time it takes the fast hand to move from one number to the next is always the same, so we can use these “clock intervals” to measure time.

Use the clock as a measuring tool. Have a volunteer start doing 10 jumping jacks when the fast hand is at the 12 and have the other students tell you where the hand is pointing when the volunteer is done. Repeat with a different activity, such as clapping your hands 10 times. Then ASK: Which activity took more time, or more clock intervals? How do you know? Where was the fast hand when the volunteer started jumping/clapping? Where was it when the volunteer stopped? How many intervals passed? Draw a clock on the board and count the intervals together, if necessary.

Repeat with other tasks that take less than a minute to complete. EXAMPLES: hop on one foot 10 times, count to 20, say the alphabet, walk around the room. ASK: Which task took the longest time, or the most clock intervals? Which took the shortest time? Did any two tasks take about the same amount of time? Did any task take a little longer than another? A lot longer?

Count intervals when the fast hand starts at 12. Draw the clock shown and say: The fast hand was at the 12 when we started and at the 3 when we finished. How many intervals passed? Repeat
with different numbers, but always start at 12. **BONUS:** Do not include the numbers on the clock faces, only the markings.

**The clock counts for us when the clock hand starts at 12.** **PSS – Looking for a pattern** **SAY:** The fast hand was at 12 when we started and at 9 when we finished. Can you tell me how many clock intervals passed without counting? Point out that when the clock hand starts at 12, we don’t have to count the intervals—the clock counts for us! **ASK:** What does this remind you of? What other measuring tool does the counting for us? (a ruler) How do we have to use a ruler to make sure it does the counting for us? (start at zero; make sure the zero is lined up with one end of an object)

**Make and check predictions.** **SAY:** I think hopping on one foot 30 times will take the same amount of time as walking around the room. Invite a volunteer to test your prediction while the class counts clock intervals and you count hops silently. Record the estimate and the measurement. Did the two tasks take close to the same amount of time? How can you tell? Are the numbers close? Repeat with other tasks that students think will take about the same amount of time.

### Activities
1. Have students time each other doing first one task and then another. EXAMPLES: write your first and then your last name; write the first five letters of the alphabet (a to e) and then the last five (z to v); find page 3 of your JUMP Math workbook (Part 1) and then page 43. Students might predict which task they think will take longer (i.e., more clock intervals) before starting. Partners may choose to do the same activities or different activities.

**ASK:** Who took longer to write their first name? Who took longer to write their last name? Why do you think some people needed more time to write their first name and some needed more time to write their last name? **PSS – Reflecting on the reasonableness of an answer** **Discuss why some activities might have taken more time than others.**

2. **Estimate and Measure Elapsed Time.** Have students work in pairs to estimate, measure, and compare the number of clock intervals it takes to trace one hand and then colour the tracing. Students should record their estimates and measurements and complete this sentence: It took - - - - time to trace my hand than to colour my hand.

**You don’t have to wait for the fast hand to get to 12.** Ask a volunteer to start counting to 20 when the fast hand gets to 12 and ask the rest of the class to see where the hand is pointing when the volunteer finishes. **ASK:** If — counts again, but starts when the fast hand is at the 3, where do you predict the fast hand will be when — is finished? Record and check predictions. Repeat with different starting points for the same task.

**Ask students to determine how many time intervals have passed on various clocks** EXAMPLES:
Journal
Complete sentences such as: ______ takes about the same amount of time as ______.

Online Guide: Extensions
Goals
Students will use a 30-second sand-timer (small hourglass) to measure time.

Prior Knowledge Required
Can use the fast hand on an analogue clock to measure elapsed time
Understand the need for reliable measurement tools

Materials
30-second sand-timers (one for each student if possible)
BLM More Than or Less Than (p xxx)

Vocabulary
sand-timer
clock
clock interval

Curriculum Expectations
Ontario: ME 6 (1m35)

Introduce sand-timers. Show students a 30-second sand-timer and ask if anyone knows what it is and how you can use it. Turn it upside down and watch the sand run out. ASK: The sand took some time to finish going down. Do you think it will take the same amount of time for the sand to go down when I turn it around again? How can we check? (Count the number of clock intervals the fast hand passes—it should be 6 both times.)

We can use sand-timers and clocks to see improvement. Explain that we can use sand-timers to see if we get better or faster at doing things. Use the Activity below to illustrate. ASK: How can you use the clock to do the same thing? (You can count how many pairs of cards you can find in the time it takes the fast hand to go all the way around the clock or past a certain number of intervals.)

Activity
Memory. Arrange the red numbered cards from a regular deck, 1 (ace) through 10, in 4 rows of 5. How many pairs can you find before the sand-timer runs out? Students should each play at least three games and time themselves each time. Did anyone find more pairs the second or third time?

Online Guide: More activities with sand-timers

What can you do in the time it takes the sand-timer to run out? Ask students to see which of a number of tasks they can complete before the sand-timer runs out. Include tasks that will take less than 30 seconds (one sand-timer unit) and some that will take more than 30 seconds but less than a minute. EXAMPLES: writing the alphabet, doing 5 jumping jacks, tracing your hand, erasing the tracing, sorting SET cards into solid and not solid. Give students a list of the tasks so that they can write "yes" or "no" next to each one as they complete it. NOTE: If students finish a task before the sand-timer runs out, they will have to wait until it does before turning it over and starting the next
task. Demonstrate turning the sand-timer over before it runs out, and point out how the sand is already partway down, giving students less time to do the task.

Now ask students whether they think various tasks will take more than, less than, or about the same time as a sand-timer. EXAMPLES: get dressed, sharpen a pencil, wrap a birthday present, unwrap a birthday present, brush your teeth, read a story, find a red pencil crayon, write your name, line up for recess. Students might show a thumbs up for “more than,” a flat hand for “about the same as,” and a thumbs down for “less than.”

**What can you do in the time it takes the hand to get around?** Ask students if they can do the same tasks in the time it takes the fast hand to move all the way around the clock and record “yes” or “no” again. (Watch students to see if they notice that they don’t have to wait for the fast hand to start at the 12.)

**Compare sand-timers to clocks.** ASK: Were you more able to finish more tasks within the sand-timer unit or in the time it takes the fast hand to move all the way around the clock? Why do you think that happened? (It takes longer for the fast hand to go all the way around the clock than for the sand to run down, so they had more time to work using the clock than they did using the sand-timer.)

**Why clocks are more convenient than sand-timers.** Explain that with sand-timers, you must wait for the sand to run out before you can start again. The clock is more convenient. You can demonstrate this by timing different volunteers doing the same task, one after another. While using the sand-timer, emphasize the waiting time. While using the clock, emphasize that you do not have to wait until the fast hand reaches 12; if the fast hand is at the 3 when one person finishes, the next person can start at the 4 or 5 and you check to see if he or she finishes before the hand gets back around to the 4 or 5.

**Practise estimating and measuring with sand-timers and clocks.** On the first worksheet, students will estimate how many claps and other actions (including one of their choice) they can do before the sand-timer runs out. If you don’t have sand-timers for each student, tell them instead to estimate how many they can do in 6 clock intervals (a sand-timer takes 6 clock intervals to run out, so this is the same thing). If you notice students slowing down or speeding up in order to match their estimates, ask them if they think they would change their estimate next time and whether it would be lower or higher.

**How long does it take?** The second worksheet and BLM More Than or Less Than ask students to demonstrate their developing understanding of how much time common and daily activities take.

**Extension**
Guide students to see the advantages and disadvantages of using sand-timers and clock intervals as measuring tools in different situations.

**Online Guide:** Details for this and other Extensions.
ME1-29
The Hour Hand
pages xxx–xxx

Goals
Students will become familiar with the motion of the hour hand.

Prior Knowledge Required
Are familiar with clock faces and the movement of the fast hand

Vocabulary
clock
hour hand
hour
o’clock

Materials
an analogue wall clock
a toy clock or pre-made clock face with two hands
BLM What Are You Doing? (p xxx)
BLM Clocks (p xxx)
BLM What’s Longer? (p xxx)

Curriculum Expectations
Ontario 1m36 (ME 35)

NOTE: This lesson requires the class to look at and discuss the clock at various times throughout the day. Start the lesson as early in the day as possible or plan to complete it over two days.

The hour hand is short. When the hour hand is pointing directly at the 9, ASK: Where is the short hand pointing? Tell students that the short hand is called the hour hand. Use a pre-made or toy clock to show various times and ask students what number the hour hand is closest to. Students can answer by holding up the corresponding number of fingers.

Introduce hours. Tell students that it always takes the same amount of time for the hour hand to move from one number to the next, just like the fast hand. The amount of time it takes the hour hand to move one clock interval is called an hour. That’s why this hand is called the hour hand: because it moves one clock interval in one hour.

What are students doing when the hour hand points at —? Stop and look at the clock when the hour hand points directly at different numbers throughout the morning (9, 10, 11, and/or 12). ASK: What are you doing? Where will the hour hand be pointing in one hour? Students can record the position of the hour hand and their activities on BLM What Are You Doing? or in their journals.

What are students doing when the hour hand is between two numbers? When the hour hand is halfway between the 1 and the 2, ASK: Where is the hour hand pointing now? Remind students that the hour hand is the short hand. Is it pointing at the 1? (no) At the 2? (no) Between the 1 and the 2? (yes) Explain that the hour hand is pointing halfway (right in the middle) between 1 and 2. Where will the hour hand will be pointing in one hour? (halfway between 2 and 3) Repeat when the hour hand is halfway between 2 and 3, and finally when it is pointing right at the 3. Students can record the position of the hour hand and their activities as above, on the BLM or in their journals.

Where is the hour hand when —? Over the course of a day, ask students to check the position of the hour hand when they begin the routine activities listed on the third worksheet. Students should draw the hour hand pointing at or between the correct numbers on each clock. Verify that students record the position of the short hand, not the long hand. You can also use BLM What Are You
Doing? to tailor this activity to your classroom schedule: have students record the position of the hour hand and illustrate what they are about to do as a class at various times throughout the day (EXAMPLES: go to an assembly, go to the gym, meet with reading buddies).

**Identify the number of elapsed hours.** Draw a clock face on the board and have a student show you where the short hour hand is pointing when school starts. Have another volunteer show where the hour hand is pointing when school finishes. Demonstrate how students can count the number of hours that school lasts by counting the number of intervals the hour hand passes through:

![Clock Diagram]

We say “o’clock” when the hour hand points directly at a number. If the hour hand is pointing directly at the 9, then we say it is 9 o’clock. Show students a pre-made or toy clock with only an hour hand and move the hour hand so that sometimes it points directly at a number and sometimes it is between two numbers. Ask students if the clock says “o’clock” or not. Students might show a thumbs up for “yes” and a thumbs down for “no.” Then show the hour hand pointing directly at various numbers and have students tell you what o’clock it is.

**Practice finding the number of hours between two “o’clocks.”** Draw a clock on the board with a dotted hour hand pointing at the 1 and a solid hour hand pointing at the 3. Tell students that on the weekend you went to see a movie. It started at 1 o’clock and finished at 3 o’clock. ASK: How long did the movie last? Repeat with other events. EXAMPLES: Grandpa visited from 11 o’clock to 2 o’clock, the baby slept from 7 o’clock to 5 o’clock, the party started at 12 o’clock and ended at 5 o’clock. Then, instead of drawing the times for them, have students draw the times and count the hours that passed using BLM Clocks.

**BONUS:** Students can use BLM What’s Longer? to determine which part of the school day (before lunch or after lunch) is longer. Students can use the third worksheet to complete the BLM.

**At Home**
On the weekend, students discuss with their parents what they would be doing at various times if it were a weekday.
Goals
Students will tell the time to the hour using both digital and analogue clocks.

Prior Knowledge Required
Know that the short hand is the hour hand and it takes one hour to move from one number to the next.

Vocabulary
- clock
- hour hand
- hour
- long hand
- in one hour
- one hour ago
- o’clock

Materials
- an analogue wall clock
- a digital clock or watch
- a clock face with two hands for each student (see BLM Make Your Own Clock)
- BLM Matching Analogue to Digital 1 (p xxx)
- BLM In One Hour and One Hour Ago 1 (p xxx)
- BLM Clocks (p xxx)

Curriculum Expectations
Ontario 1m36 (ME 35)

Investigate where the long hand is when the hour hand is at — o’clock. At various times throughout the day, when the hour hand is pointing directly at a number, ask students to describe where the long hand is pointing. Record the answers on the board. EXAMPLE: At 9 o’clock, the long hand is pointing at the 12. After 2 o’clock, ASK: Where do you think the long hand will be pointing when the hour hand is pointing at the 3? PSS – Looking for a pattern

Teach students to write — o’clock a different way. Ask students if they have seen clocks or watches that show the time in a different way. Tell students that some watches don’t have hands but show the time using only numbers; they show 9 o’clock as 9:00. Show students a digital clock to illustrate. Then summarize the three different ways of showing or writing the same time: 9 o’clock, 9:00, and using a clock with the two hands (hour hand at 9, long hand at 12). Show different times to the hour (in sequence) on a toy or pre-made clock and have students tell what time it is. For each hour read, ask volunteers to come to the board or chart and write the name in the two forms introduced above ( __ o’clock and __: 00). Repeat, but in a random order instead of sequentially.

Activity
Play Memory with the cards on BLM Matching Analogue to Digital 1.

Draw time to the hour. On pre-made clock faces, ask each student to show 12 o’clock, then 1 o’clock, and continue sequentially until you reach 12 o’clock again. Then repeat in random order.
Ensure that students show the hour hand pointing directly at the number of the hour and the minute hand pointing directly at the 12. Then give various times orally and have students draw them on BLM Clocks. Students can compare their answers with a partner.

**Find the time “in one hour.”** Show various times to the hour and ask students to draw (on BLM Clocks) or show (on a pre-made clock face) what time it will be in one hour. Explain that “in one hour” or “one hour from now” tells them to move the hour hand to the next number.

**Find the time “one hour ago.”** Show various times to the hour and ask students to draw or show what time it was one hour ago. Emphasize the different directions they need to move the clock hand when finding the time “in one hour” and “one hour ago.” “In one hour” tells them to move the hour hand to the next number; “one hour ago” tells them to move the hour hand to the number before. Students can complete BLM In One Hour and One Hour Ago 1 for practice.

**Solve word problems.** Write simple word problems on the board and read and solve them together as a class. **EXAMPLES:**
- Gym class starts at 10:00 and lasts for one hour. What time does it end?
- Ron started swimming lessons at 9:00. The lesson lasts for one hour. What time does it end?
- Keri’s mom told her to play the piano for one hour. Keri started playing at 7:00. What time can she stop?

Write similar word problems on the board for students to solve independently. Underline important phrases such as “for one hour” or “takes one hour” and also start times. **BONUS:** Give problems where the activity lasts for more than one hour. **EXAMPLE:** A movie starts at 3:00 and lasts for two hours. What time does the movie end?

**Extension**

**Which clock is right?** PSS – Using logical reasoning Draw two clocks on the board or have several pre-drawn clocks ready to stick to the board. Start with one clock showing the short hand pointing at the 6 and the long hand at the 12, and the other clock showing the short hand pointing at the 12 and the long hand at the 6. Tell students that only one clock is possible—can they figure out which one? Have students work in pairs to solve the puzzle. Then discuss the solution: When the hour hand is pointing directly at the 12, it is 12 o’clock. **ASK:** Where should the long hand be pointing? (at the 12, too) Repeat with other similar pairs of clocks (**EXAMPLE:** 7:00 and a clock showing its “reverse”). Then show one clock with both hands pointing at the 12 and another with both hands pointing at the 6 and repeat the exercise. Explain that when the hour hand is pointing directly at the 6, the long hand cannot be pointing at the 6—it must be pointing at the 12.

**Connection**

**Literature—** *Bats Around the Clock* by Kathi Appelt
A 12-hour dance-a-thon with lively critters and rhyme. A fun introduction to time on the hour.
ME1-31
Time to the Half Hour
pages xxx–xxx

Goals
Students will tell the time to the half hour using both digital and analogue clocks.

Prior Knowledge Required
Can tell time to the hour

Vocabulary
clock
hour hand
hour
long hand
half an hour
half past the hour
o’clock

Materials
an analogue wall clock
a toy clock or pre-made clock face with two hands
BLM Matching Analogue to Digital 1 and 2 (p xxx–xxx)
BLM Clocks (p xxx)
BLM In One Hour and One Hour Ago 2 (p xxx)

Curriculum Expectations
Ontario 1m36 (ME 35)

Where is the long hand pointing when the hour hand is halfway between two numbers? Ask students to describe where the long hand is pointing at various “half past” times throughout the day (EXAMPLES: 9:30, 11:30). Encourage students to notice that the long hand is always pointing at the 6 when the hour hand is pointing exactly halfway between two numbers.

The long hand moves halfway around the clock when the hour hand moves halfway from one number to the next. On a pre-made clock, move the hour hand between the 2 and the 3. Explain that while the hour hand is moving between the 2 and the 3, the long hand is moving all the way around the clock, from the 12 back to the 12. Move the long hand all the way around the clock. Then point the hour hand back at the 2 and tell students you want to move it halfway to the 3. Start moving the hour hand and have the class stop you when you get there or have a volunteer move the hour hand instead. Then tell students that you will move the long hand and you want them to stop you when it gets halfway around the clock. ASK: Where is the long hand pointing now? (at the 6) Draw a clock face with a shaded half, and show the movement of the long hand from the 12 to the 6.
Explain that when the hour hand is pointing halfway between two numbers, the long hand is always pointing at the 6. It takes half an hour for the hour hand to move halfway from the 2 to the 3. It also takes half an hour for the long hand to move halfway around the clock.

**Write “half past” the hour in two ways (half past ____ and ____:30).** Explain that when the hour hand is halfway from one number to the next, we say it is “half past” the hour. Remind students that some watches show time only with numbers. Have students guess how half past 3 would be shown on a digital clock. If students guess 3:6 or 3:06, explain to them that if the long hand counted intervals in the same way the hour hand does, then 3:6 or 3:06 would be correct. But instead of counting intervals from one number to the next, the long hand counts the very small intervals between the numbers. Draw your students’ attention to the very small intervals on the clock and have students count with you the number of small intervals the long hand passes between 12 and 6. You might stress every fifth number as you count since there are five small intervals in every “big” interval. (This might lead students to notice that they can just count by 5s.) Then explain that half past 3 is written as 3:30 because the long hand passes 30 small intervals.

**Activity**
Play Memory with BLMs Matching Analogue to Digital 1 and 2.

**Show time to the half hour on an analogue clock.** On a clock face or BLM Clocks, ask students to show half past 12, then half past 1, and continue sequentially until you reach half past 12 again. Repeat with times in random order. Ensure that students show the hour hand pointing halfway between two numbers and the minute hand pointing straight at the 6. Repeat with a mix of times (“half past” and “o’clock”).

**Find the time “in one hour” and “one hour ago.”** Show various times on the half hour and have students show or draw the time “in one hour” or “one hour ago.” Students can complete BLM In One Hour and One Hour Ago 2 for further practise.

**Solve word problems (as in ME1-30).** Include problems where students have to decide if the activity will be done by a given time. **EXAMPLE:** Ron started playing piano at 1:30 and played for 1 hour. Did he finish by 3:00?

**Extra practice.** BLM Extra Practice: Time.

**Activity**
Small groups can create a collage of pictures of clocks, watches, timers, and other timepieces and write the times shown beneath each one.

**Extensions**
1. Repeat Extension 2 from ME1-30 with clocks that have one hand pointing halfway between two numbers and the other pointing at the 6. **PSS – Using logical reasoning**
2. What time will it be in half an hour? First teach students to draw where the minute hand will be in half an hour, then where the hour hand will be in half an hour, and then the two together. Use pre-made clocks and/or BLM In Half an Hour. Students can then complete BLM Time Word Problems.

**Online Guide:** Where will the long hand be when the hour hand is at various other positions?
Prior Knowledge Required
Can sequence and order

Goals
Students will order the days, months and seasons, associate different seasons with different activities, and read the date on a calendar.

Vocabulary
week
day
weekend
month
year
season
calendar
tomorrow
yesterday
the days, months, and seasons

Materials
the days of the week, months, and seasons written on cards
letters of the alphabet (lowercase and capital) written on cards
class calendar

Curriculum Expectations
Ontario 1m37, 1m38 (ME 8,9)
PSS* (1m1, 1m5, 1m7)
Comm*

Order the days of the week. Display the cards with the days of the week in order. Ask students what the words on the cards are. Have students recite all seven days in order. Then take away one of the cards and repeat. Continue taking away cards, one at a time, and having students recite the days. Repeat several times, removing cards in a different sequence each time. Mix the cards up and ask if anyone can put all seven in order. (If this is too difficult, start with three cards, then move to four, five, and so on.)

Have seven volunteers each take a card and stand in a row facing the class, and ask another volunteer to come and place the “days” (students holding cards) in order. Have another volunteer sort the row of students/days into two categories, weekend and weekday.

Online Guide: Songs for the days of the week and the months.
Look for patterns in the words for the days of the week. PSS – Looking for a pattern ASK: What do all these words have in common? Suggest that students look at the end of the words. (They all end with the word day.) ASK: Why do you think that happened? (because they are all days)

Unscramble the days of the week. PSS – Splitting into simpler problems, working backwards Have cards with letters on them. Put the 6 cards for the letters in “Friday” on the board in the following order: Fdiayr (F is capital, other letters are lowercase). Tell students that someone mixed up the letters for a day of the week. Can they guess which day? Tell them you want to rearrange the letters to check the guess. ASK: What letters are in every day of the week, no matter which day it is? (d, a, y) Where should those letters go? (at the end) Explain that it is easier to start with those letters because we know where they go. Demonstrate moving those cards to the end and then have a volunteer rearrange the remaining cards at the beginning. Repeat for various days of the week, this time having volunteers move the letters d, a, y to the end and completing the problem themselves. EXAMPLES: Sdayatru, oMdany, Sayndu.

Months of the year. Display the months of the year in order. Repeat the exercises for ordering days with the months. Then have a volunteer sort the months (or students holding cards) into school months and summer vacation months.

Seasons of the year. Display the seasons in order. Ask students what the words on the cards are. ASK: What season is it when the new year starts? Have a volunteer put the seasons in order. Ask students to consider why it would be difficult to go skiing in the fall and swimming outdoors in the winter. Brainstorm some ideas of what occurs during each season and the activities that can be done outdoors.

How to read a calendar. Look at the current month on the class calendar. (If you do not have one, draw the current month on chart paper and post it.) ASK: What is a day? Have a volunteer come to the calendar and show a day. Ask what a week is, and review the days of the week, as well as how many days are in a week. Have a volunteer identify where a week starts and ends on the calendar. Emphasize that a row represents a week. Discuss how many days there are in a month and why the month does not always start on the first Sunday and end on the last Saturday. (The start date depends on what day the previous month ended.) Ask students how many days there are in the month that is displayed. Explain the words today and tomorrow. Ask questions such as: What day will it be tomorrow? What day was it yesterday?

The day vs. the date. Explain that the day is the day of the week, and the date is the month and the ordinal number that shows how far into the month we are. The numbers are written on the calendar in order so we don’t have to count every time. If today is Wednesday, March 7th, the day is Wednesday and the date is March 7th. ASK: What day will it be tomorrow? What will be the date? What day was it yesterday? What was the date yesterday? Repeat for random dates on the calendar. ASK: If today is Wednesday, December 1st, what day will it be tomorrow? What was the date on the day before Sunday, December 19th?
**Connection** Visual Art

**Activity**
Create an illustrated class calendar. Assign pairs or small groups one month of the year. Students identify important dates in their month (holidays, birthdays, field trips, and so on) and illustrate one event or activity. Have existing calendars on hand as models.

**Extension**
Have students write/illustrate what they do on each day of the week and then sequence the events.

**Journal**
My favourite day (or month or season) is ___________________ because ___________
_______________________________________________________________________.
Comparing Areas

Prior Knowledge Required
Know the concepts of longer and shorter

Goals
Students will compare areas by covering surfaces.

Vocabulary
area
bigger
smaller

Materials
paper rectangles and triangles of various sizes and colours (details below)
scrapers for each student
BLM Trace, Cut, and Compare (p xxx)

Curriculum Expectations
Ontario 1m33 (ME 4)
Western SS1
PSS* (1m1)
Comm*

Are they the same size? Cut coloured sheets of paper (8 1/2 by 11) into quarters to make rectangles of the same size. Give each student two rectangles and ASK: Are your rectangles the same size? How can you tell? Have students compare their rectangles with those of one partner and then a different partner. Are the rectangles the same size? PSS – Using logical reasoning SAY (using your students’ names): Joy and Leyla both compared their rectangles with Achmad’s and said their rectangles are the same size as Achmad’s. Do you think Leyla’s rectangles will be the same size as Joy’s? Why? (Have Joy and Leyla verify with each other.) Then SAY: Leyla compared one of her rectangles with Le’s and said they are the same size. Can Joy and Le’s rectangles be different? How do you know? Explain that you made sure everyone’s rectangles were the same size.

Introduce area. Tell students to fold one of their rectangles in half and then cut along the fold; now they have two smaller rectangles. Ask students to rearrange the pieces to make a different rectangle than the one they started with. They should paste the new rectangle onto white paper. Tape one of the rectangles onto the board. ASK: Does anyone have a new rectangle that looks like this one? Does anyone’s rectangle look different? Have a volunteer tape a different one on the board. Then put up a copy of the original rectangle so that students can see all three shapes. ASK: Which shape is bigger? How is it bigger? Did one shape use more paper than the other? Did they use the same amount of paper? Explain that the amount of paper you need to make the shape is the shape’s area. ASK: When you cut the rectangle in two and rearranged the pieces, did you change the amount of paper you were using? Does your shape have the same shape as the rectangle I gave you? (no) Does it have the same area? (yes) How do you know? (because I used the same amount of paper to make it)

Compare areas directly. For each student, cut out these paper shapes: 2 blue rectangles (12 cm by 24 cm), 2 red squares (18 cm by 18 cm), 1 yellow square (10 cm by 10 cm), and 1 white square (20
cm by 20 cm). Give students one of each colour. ASK: Which piece of paper is smaller, the blue or the yellow? How do you know? Demonstrate how the yellow paper fits onto the blue paper completely. The yellow paper has a “smaller area” and the blue paper has a “bigger area.” Compare the red and white pieces in the same way.

**Compare areas by cutting out the extra parts and then comparing them.** Now compare the blue and red pieces. Explain that the blue piece doesn’t fit on the red piece and the red piece doesn’t fit on the blue piece. ASK: Why does that happen? (The blue piece is longer one way and the red piece is longer the other way.) Ask students to remember how we compare pencil lengths when the pencil crayons are lined up so that there is extra blue at one end and extra red at the other. ASK: How can we compare the lengths of the pencils without lining them up end to end? (Check to see if there’s more extra red at one end or extra blue at the other.) Challenge students to think about how we can use this idea to compare the areas of these two pieces. **PSS – Looking for a similar problem for ideas**

Give each student a pair of scissors and have them cut out the parts of each paper that are the same, i.e., the parts that overlap. **PSS – Splitting into simpler problems, changing into a known problem** Explain that because we know these parts are the same, we can just compare the leftover parts to see which is bigger. ASK: Does the extra red part fit onto the extra blue part or does the extra blue part fit onto the extra red part? (The extra blue part fits onto the extra red part. Because there was more extra red than extra blue, the red piece must have been bigger.)

**Compare areas by colouring the extra parts and then comparing them.** Tell students that you would have liked to compare the pieces without cutting them up. We know which piece was bigger, but it’s not bigger any more because we cut it! Give students the second blue and red shapes and have students colour the extra parts instead of cutting them out. Then have students compare the coloured parts by placing them one on top of the other. Which piece has more “extra”—the red or the blue? (the red) Have students use this method to compare various pairs of shapes. **EXAMPLES:**

- 10 cm by 10 cm (same area)
- 10 cm by 20 cm (same area)
- 10 cm by 12 cm (same area)
- 10 cm by 14 cm (rectangle at left is bigger)

**When one extra part doesn’t fit on the other.** Give students an 8-by-8 square and a 6-by-12 rectangle. ASK: Does one of these shapes fit completely over the other? (no) Have students colour the extra parts and then ASK: Does one of the extra parts fit completely over the other extra part? (no) ASK: How can we compare the extra parts when one doesn’t fit completely over the other? **PSS – Changing into a known problem** Do we know how to compare areas when one shape doesn’t completely fit over the other? (yes, colour the extra parts) Suggest to students that they compare the
extra parts of the extra parts by colouring them a different colour. Which of these parts is bigger?
What’s bigger—the original square or the original rectangle? (the rectangle) Have students compare
similar pairs of shapes. EXAMPLES:
i) A 10 cm by 12 cm rectangle and a 8 cm by 16 cm rectangle.
ii) A 10 cm by 14 cm rectangle and a 6 cm by 30 cm rectangle.]

**BONUS:** Which is bigger, a 6-by-11 rectangle or an 8-by-8 rectangle? (This problem will require
three steps.)

**Trace, cut, and compare.** Demonstrate how to place a sheet of paper inside the workbook so that it
will not move while students trace the shapes on the worksheet (you can use tape or paper clips,
too). Tracing is a good exercise to improve motor skills, and all students should attempt it. Use BLM
Trace, Cut, and Compare for more practice tracing, comparing, and ordering.

**Online Guide:** Extension: Compare area and perimeter.
Prior Knowledge Required
Know the concepts longer and shorter
Can count
Can measure using non-standard units

Goals
Students will estimate, measure, and describe area through investigation using non-standard units.

Vocabulary
area
bigger
smaller

Materials
paper triangles and rectangles (details below)
playing cards
BLM Cake (p xxx)
BLM How to Measure (p xxx)
BLM Estimate and Measure (p xxx)

Curriculum Expectations
Ontario: ME 4 (1m33)
Western: SS 1
PSS* (1m1, 1m3)
Comm*

Introduce units of measurement for area. Have several pre-made right triangles with base 10 cm and height 10 cm. Give each student 4 triangles. Have students make as many shapes as they can, using 2, 3, or 4 triangles. The triangles must be joined only along lines of the same length. Students should trace their shapes onto paper and label them with the number of triangles used to make them. When students have made several such shapes, stop them and ASK: Show me two shapes you made that have the same area but a different shape. Show me two shapes you made where one of them is bigger—how do you know it is bigger? Did it use more paper? How do you know? Show me a shape you made with 3 triangles. Now show me a smaller shape. How do you know it is smaller? Show me a bigger shape. How do you know it is bigger? Explain that by counting the number of triangles they used to make the shape, they can know which shape used more paper and so has a bigger area.

Using quantity to measure area. Now tell students that you made a chocolate cake over the weekend for a birthday party. The cake had candies covering the whole top. Draw a cake with two corner pieces shaded. Challenge students to figure out which corner piece is bigger without cutting out any piece. Guide students to count the number of candies in each piece (as they counted the number of triangles, above) to see which has more candies and is, therefore, bigger. PSS – Looking for a similar problem for ideas.
To measure area, the units should cover the whole area. PSS – Reflecting on what makes the problem easy or hard. Draw the same cake but with smaller candies, as shown. SAY: What if this is how the cake was made—can we still say that the piece with more candies is the bigger piece? (no, now the smaller piece has more candies) How are the candies in the first cake different from the candies in this cake? (they are organized in rows and completely fill the top of the cake) Why can’t we tell by the number of candies which piece is bigger in the second cake? (the candies are not spread out evenly and they don’t cover the whole top of the cake. Explain that, in the first cake, the candies cover the whole cake, so we can find out which piece is bigger just by looking at the number of candies the piece has.

Draw two pieces of cake on the board. Ask students to predict which piece is bigger and then check their prediction by counting as a class. Repeat for various examples. Students can complete BLM Cake for more practice.

To measure area, the units should not overlap. Draw various shapes on the board that are a whole number of units in area, where a unit is, say, a regular sheet of paper. Have students predict which shape is larger and then have volunteers come to the board and tape the units onto the shape such that they cover the shape completely, with no overlapping and no extra space. Which shape needed more units to cover it? Demonstrate an incorrect method that includes overlapping on a smaller shape, so that you need more units for the smaller shape than for a larger shape. Ask students to explain what you did wrong.

Which units work better? Give pairs of students a square, 15 cm by 15 cm. Ask them to determine which pattern blocks work better as units by covering the square with one type of pattern block at a time. Discuss why it was easier to use some blocks than others.

Connection Number Sense
Watch to see how students are counting the pattern blocks. Discuss strategies. (EXAMPLES: making tallies, grouping into 5s or 10s, grouping by the number in each row and doing repeated addition.) PSS – Reflecting on other ways to solve the problem

Approximate areas. Explain that sometimes the units will not fit perfectly on the object whose area you are trying to measure. Have students estimate and then check how many playing cards they can fit onto a sheet of paper. ASK: Do more cards fit onto the paper when they are placed across or up and down? What is the better estimate for the area of the paper—8 playing cards or 9 playing cards? (9)

BONUS: Place 10 playing cards on the sheet so that there is no overlap. Do you think you could fit another playing card on if you were allowed to cut it up? (Students might check by tracing a playing card, cutting their tracing out, and then cutting it into pieces as necessary.)

Practice estimating and measuring. Give students a square (10 cm by 10 cm) and a rectangle (10 cm by 7 cm). Have students estimate and then measure the number of 2-cm connecting cubes required to measure the area of each shape. Students should revise their estimates as they place more cubes onto the shapes. PSS – Guessing, checking and revising Discuss whether the measurements are exact or not, and why. Students can estimate and measure more items (2 of their choice) on the third worksheet.

Extra Practice: BLM How to Measure and BLM Estimate and Measure.
ME1-35
What Holds More?
Pages xxx–xxx

Goals
Students will compare capacities directly.

Prior Knowledge Required
understands the comparatives larger/largest and smaller/smallest

Vocabulary
capacity
container

Materials
empty containers of various sizes, including 500 mL water bottles and 1 L milk cartons
a cup, bottle of water, pitcher, and funnel
large bowls or tubs
dry beans, dry peas, rice, and/or sand

Curriculum expectations
Ontario: ME5 (1m34)
Western: SS1

Connection Literature
Introduce the term “capacity.” Read a version of *Goldilocks and the Three Bears* with students. Focus on the sizes of the bowls. Who had the largest bowl? Who had the smallest bowl? What does it mean that one bowl was the largest? Was it the tallest? The widest? Explain to students that *capacity* generally means the amount of something (porridge, water, cubes, beans, juice, etc.) a container can hold.

Journal: Ask students to draw three bowls of different sizes as in the story, from largest to smallest.

Compare capacities directly—more/less. Hold up an empty cup and a bottle of water. ASK: Which holds more: the bottle or the cup? How could we check? Invite a volunteer to pour water from the bottle into the cup. (Work over a large bowl or plastic tub in case of spillage.) Does the water fit into the cup? Which holds more: the cup or the bottle? What holds less? Refill the bottle and repeat with a container that has a larger capacity than the bottle, such as a large pitcher. Which holds more water? How do we know that the pitcher holds more? (There is room for more water in the pitcher.)

Empty the bottle and fill the pitcher with water. SAY: When I pour the water from the bottle into the pitcher, there is room left in the pitcher. What will happen if I pour the water from the pitcher into the bottle? (The bottle will fill and water will overflow into the bowl or remain in the pitcher.) Check the predictions by pouring the water into the bottle using a funnel (you might wish to discuss why a funnel is necessary).

Which holds the most/least? Order by capacity. Ask students to say which of the three containers (the cup, the bottle, or the pitcher) holds the most water and which holds the least water. Rephrase the answers using the terms largest capacity and smallest capacity. Then invite a volunteer to order the containers from
largest (holds the most) to smallest (holds the least). Repeat with another set of three containers, such as a mug, a pop can, and an empty milk carton.

**Activity**
Create stations at which students can compare capacities directly. Each station will need a large bowl or tub, three or four empty containers of different shapes and sizes, and enough dry goods (beans, peas, or rice) to fill the largest container. At each station, students should:
- Choose two containers, predict which one has the larger capacity, and check. To check, students fill the container they think is larger with beans, then pour the beans into the other container. PROMPTS: If the first container has a larger capacity, will the beans fit into the second container or will there be beans left over?
- Choose a third container and order the three containers from smallest to largest. PROMPTS: How can you order the containers from smallest capacity to largest capacity using the beans? How can you use what you know about the other two containers to do this?
- Determine the capacity of the fourth container (if there is one) relative to the other three. PROMPTS: Fill your smallest container with beans and then pour the beans into the fourth container. Are there any beans left over? What does that tell you about the fourth container? Repeat with the other containers.
Bonus: Add a fifth container.

**Can two containers of different shapes have the same capacity?** PSS – Making and investigating conjectures. Show students two containers that have the same capacity but a different shape, such as a 500 mL water bottle and an empty milk carton cut so that it can contain exactly 500 mL. (To determine where to cut the milk carton, pour water into the bottle, empty the water into the milk container, and mark the height the water reaches; cut the milk carton at that height.) ASK: How are these two containers different? (Have students describe the shape of the containers.) Which one can hold more? Can these two containers have the same capacity? Have students compare the capacities directly using water, beans, sand, or rice. (Different groups of students can use different materials.) Students can then compare and discuss their findings. Did everybody get the same result? Why or why not? PSS – Justifying the solution.

**Connection Sorting**
Sort by capacity. Show students a 1 L milk carton and various containers of different shapes and sizes (EXAMPLES: juice box, pan, glass, cup, jug, pitcher, pot). To sort the containers into two groups, hold them up one at a time and ASK: Will this hold more than the milk carton or less? Students can show thumbs up for more, thumbs down for less, and thumbs sideways if they think the container holds the same amount as the benchmark milk carton (leave this last group of containers outside both sorting circles).

**Check the sorting by direct measurement.** Give small groups of students one of the containers from the collection you sorted, a 1 L milk carton, and beans, and ask them compare the capacity of their container with the capacity of the milk carton. Was the container placed in the correct sorting group?

**Online Guide:** Extensions: Compare capacity by directly comparing containers; capacity is relative.
Capacity
Pages xxx–xxx (1 page)

Goals
Students will compare capacities indirectly.

Prior Knowledge Required
understands the comparatives larger/largest and smaller/smallest
knows the concepts of length, width, and height
can compare linear measurements

Vocabulary
capacity
container
measure

Materials
containers of various sizes
two different containers full of juice
dry beans, rice, and water
large bowls or tubs
markers or masking tape

Curriculum expectations
Ontario: ME5 (1m34)
Western: SS1
PSS* – 1m1, 1m3

Compare capacities indirectly. Show students two containers of different shapes full of juice. ASK: Which container holds more? How can we check? (Students should suggest comparing the capacities directly, as in the last lesson.)

Tell students that you do not want to throw out any of the juice in order to pour juice from one container into the other. As a prompt, place two identical see-through jars where students can easily see them. SAY: In mathematics, we often use a problem that we have already solved to help us solve new problems. Explain that you think comparing capacity is a bit like comparing lengths. Discuss how you compared the lengths of pencils in the very beginning of the unit (by lining them up) and the capacities of containers in the last lesson (by pouring from one into the other). ASK: Both these containers are full. Can we pour from one to the other? (no) When we compared lengths, was there a time when we could not line up the lengths? How did we solve that problem? (For example, to compare the lengths of the sides of a book, we used a third object; we compared the sides of both books to the third object.) Can we use the same idea here? PSS – Looking for a simpler problem for ideas. Can we compare to a third object? Invite volunteers to pour the juice from each container into one of the identical jars and compare the juice level. Where is there more juice? Which container of juice holds more?
Tell your students to pretend that you need to take your desk out of the room, but you are not sure if it will fit through the door. How could you check? Show your students a piece of string and use it to measure the short side of the desk and the width of the door, marking each length on the string with a piece of tape. Point out that the string is longer than both objects you measured. Now show your students a cup, a can, and a larger plastic bottle. SAY: I would like to check which has greater capacity, the cap or the can. Can I use only the bottle to measure capacity the same way as I used the string? PSS – Looking for a simpler problem for ideas. Give students time to think through a solution with a partner. Discuss how to do it (and model the steps for students after the discussion: fill one container, pour the contents into the bottle, and mark the level; empty the bottle; fill the second container, pour the contents into the bottle, and compare this level with the mark). Discuss how this way of comparing capacities is different from the way you compared capacities in the beginning of the lesson. (We have only one container instead of two identical ones to use as a benchmark.)

Activity
Every student should have an opportunity to compare capacities directly. Students can do so independently or in pairs at their desks. Each student or pair will need three containers, the largest of them see-through; beans, rice, or water; a large bowl or tub to work over; and markers or masking tape. Each pair should have the same two smaller containers as at least one other pair, so that they can compare their findings. Pairs with the same smaller containers can have different large containers and should use different materials (beans, rice, or water). If you choose to do this activity at stations, create three stations with the same smaller containers, different large see-through containers, and different materials, and have individuals or pairs work at the stations simultaneously and then can compare their findings.

Students have to compare the capacities of the two smaller containers using the third, see-through container as a benchmark (the way you used the string above). Ask students to predict which of the smaller containers has larger capacity. (Scaffold for students who need it: Have the students fill one of the containers, then empty it into the benchmark container and mark the level the beans reach with the marker or a piece of tape. Then empty the benchmark container and repeat with the other container. This time, leave the beans/rice/water in the benchmark container and compare the level they reach with the mark made for the first container. What does it mean if the mark is higher than the level? What if it's lower? Which container holds more?)

Have students with the same containers pair up and discuss their findings. Did they identify the same container as being larger? (If the answer is no, discuss what students might have done wrong and repeat the experiment. Possible reasons for different answers: filing the container(s) incompletely; holding the container at an angle while marking the level; spilling water, rice, or beans while pouring from the container(s) into the benchmark container. Discuss how else students could check the results. Lead students to the idea of returning to direct comparison.) Did people with the same smaller containers but different benchmark containers get the marks at the same level? (most likely not) Did people who used water and people who used beans get the same level marks? Why not? (Explain that there is some space between the beans, so the level of beans should be higher than the level of liquid.)
Goals
Students will measure capacity in non-standard units.

Prior Knowledge Required
understands the comparatives larger/largest and smaller/smallest
understands the concept of measurement
can compare and order measurements

Vocabulary
capacity
container
measure

Materials
containers of various sizes, including identical containers with wide mouths
marbles and masking tape
plastic cups, water, and large bowls or tubs

Curriculum expectations
Ontario: ME5 (1m34)
Western: SS1
PSS* – 1m1

Compare capacities by counting how many marbles fill the containers. Provide three containers, the largest of them see-through, and invite volunteers to fill the two smaller containers with marbles. Then pour the marbles from one of the containers into the largest container, mark the level of the marbles, and empty the container. Repeat with the second container. Ask your students if it was easy to mark the level of the marbles. Why not? (Marbles do not form a level surface as water does. PSS – Reflecting on what made the problem easy or hard) ASK: What can you do with marbles that you cannot do with water? Hint: You can do it with beans. (count the marbles)

Measuring capacity in marbles. Review what it means to measure something. Ask students to think about what they have measured in the course of the year. (length, width, height, area, weight) ASK: Which units did you use? SAY: People measure length in order to tell which of two or more objects is longer. If we say that one container can hold 7 marbles and the other can hold 12 marbles, does this help us tell which container has larger capacity?

Activity
Give each student a container with a wide mouth (EXAMPLES: milk cartons and juice boxes with tops cut off) such that many students have identical containers. Students should measure the capacity of their containers in marbles. Did people with the same containers get the same results? The answer is likely to be no; discuss why not. The answer might depend on the way the marbles are packed. ASK: Are marbles a convenient unit to measure capacity? (not really)
Comparing different mediums used to measure capacity. Discuss marbles as units for measuring capacity: they are all the same size, we have plenty of them, and we can count them, but there is free space around them and it is hard to mark a level with them. Compare marbles with beans. How are beans more convenient than marbles and how are they less convenient? (It is harder to count beans because there are more of them. However, marbles are too big to be used with some containers. As a prompt, hold up a bottle with a narrow neck [one that is too narrow for a marble to pass through] and ASK: Can you use marbles to measure the capacity of this bottle? Why not? Can you use beans?) Hold up a small cup and ASK: The capacity of this cup is 10 marbles. Do you think I will need more than 10 beans to measure it or less than 10 beans? (more) Why?

Compare beans and marbles to water. Point out that water does not leave free space and it is easy to mark levels when you use it. If we found a way to “count” water, it would be a good measuring medium. “Counting” water means measuring it.

Cups as measuring tools. Discuss with students when and why people use capacity to measure water and other liquids, or dry goods like rice. If no one mentions recipes, show students a recipe and point out the different measuring tools (EXAMPLES: cups, teaspoons). Show students a pack of plastic cups and discuss whether they would be good measuring tools.

Online Guide: Activity: A recipe for playdough

The need to fill cups completely. Take three cups and fill them completely with water. Take another four cups and fill them only halfway. SAY: I have three cups of water here and four cups of water there. I think that I have more water there, because 4 is more than 3. What do you think? How could we check? Emphasize the need to fill all the cups the same way. Every cup of water must be the same. Remind students that connecting cubes and paper clips are good measuring tools because they are all the same length and mass. Have students practise filling cups the right way (to the top, or, if the cups have a natural line inside, to that line).

Estimate and measure capacity by filling a row of cups from the container. Show your students a large see-through container, such as a 2 L jar, and have them guess how many cups of water this container can hold. Write their estimates on the board. Fill the jar with water and fill two cups from the jar. Show students how much water is left in the jar. Let students adjust their estimates. Continue filling the caps, stopping occasionally to let students adjust their estimates, until you have measured the capacity of the container.

Online Guide: Packing matters when you measure capacity
Goals
Students will measure capacity in non-standard units using a self-created measuring tool.

Prior Knowledge Required
understands the concept of measurement
can compare and order measurements
can measure approximate length

Vocabulary
capacity
container
measure
measuring cup

Materials
containers of various sizes
scoops
rice or beans
plastic cups, 1.5 L bottles, funnels, markers, water, and large bowls or tubs
BLM Estimate and Measure Capacity (p XXX)

Curriculum expectations
Ontario: ME5 (1m34)
Western: SS1
PSS* – 1m5

Capacity and “almost.” Take a container that has a capacity of almost two cups. Fill it with water and then pour the water into cups. Show your students how one of the cups is not full, but nearly full. Explain that the container can hold almost two cups. Repeat with a container that holds a little more than two cups. Point out that in both cases we can say that the capacity of the container is about 2 cups.

Estimate and measure capacity by filling a container cup by cup and counting the cups as you go. ASK: How could you measure the capacity of a container if you had only one cup? (by filling the cup, pouring the water into the container, and repeating, keeping track of the number of cups used)

Introduce scoops as measuring tool. Show your students a scoop. Explain that we can use scoops to measure rice or beans the same way we use cups. Show two scoops full of beans that are not level (and thus have different amounts in them) and ASK: Is filling the scoop this way a good way to measure? How could we make sure we fill the scoop the same way each time? Demonstrate making the beans level. ASK: Why is it better to use the levelled scoop? (because every scoop must be the same) Measure the capacity of a container with scoops of beans or rice.

Activity
Have students predict the capacities of various containers, then measure the capacities by filling the containers with water or beans using a plastic cup. They should count the number of cups needed to fill each container. Discuss what students should write if there is some space left in the container when they are measuring, but it is less than a cup. They can record their findings on BLM Estimate and Measure Capacity.

**Make your own measuring bottle.** Tell your students that they already had a similar problem (only one unit to measure an object that was several units long) when measuring something else. Remind them how they used hands and index cards to measure length: They moved the index card marking the end of each previous placement. PSS – Connecting What other tools did they use to measure length? (a ruler) ASK: How could we make a “ruler” to measure capacity?

**Activity**

Students can create their own measuring bottles. Review the need for filling cups properly—to the top—when you measure. Then give each student a plastic cup, a funnel, a marker, and a 1.5 L plastic bottle. Students will also need a large bowl or tub to work over, to prevent spills. Model pouring a cup of water into the bottle, letting the water settle, and marking the level the water reached. Repeat until the bottle is full. Have students do the same. Ask them to mark the number of cups poured beside each mark, as on a ruler.

**Measuring capacity using a measuring bottle.** Explain to students that they have created a “ruler” for capacity, and this “ruler” is called a measuring cup (or, in this case, a measuring bottle). Show them a smaller container (about 1 L) full of water and ask how they could use their measuring cup to tell what the capacity of this container is. Should they place the measuring cup beside the new container as they did with a ruler and find which marking the top of the container reaches? (no) Pour the contents of the container into the measuring cup and have students determine the capacity of the container. If the water level is between two marks, ask your students how they measured length when an object ended between the marks on a ruler. (Which mark is closest?)

**Activity**

Give students more containers and have them estimate and measure capacity using their measuring bottles. They can record the results in their Journals or on BLM Estimate and Measure Capacity.

**Extensions**
1. If 2 scoops of beans fill a pail, how many scoops are needed to fill 2 pails, 3 pails, 5 pails, 8 pails, and 15 pails? Use skip counting to find out.

2. A game for two. Player 1 chooses a container and measures its capacity in marbles, scoops of beans, or glasses of water. She shows the container to her partner and tells him the capacity of the container but not the units. Player 2 has to guess the units.
ME1-39
Problems and Puzzles
pages xxx–xxx

The worksheet and the following extensions will help students to review and consolidate their learning in this unit. The questions on the worksheet treat the clock as a number line.

Extensions

1. Continue the pattern:
   September, October, November, ____________, ____________, ____________, ____________, ____________, ____________, ____________, ____________.  
   Bonus: What is the core? How long is the core?

2. On BLM Picture or Frame? students predict whether a picture or its surrounding frame has a bigger area, and then check using big (2 cm) connecting cubes.

3. Students can use BLM Compare Two Units to predict and check which of two units they will need more of to measure the area of their desk.

4. Students can use pennies to determine which cookie on BLM Cookies is bigger.

5. Look for patterns on a calendar. Show the calendar for a month that starts on a Wednesday. ASK: What day of the week is the 1st? What day of the week is the 8th? Repeat with calendars for different months until the pattern emerges: the 1st and 8th days of any month are always the same day of the week. What other dates fall on the same day as the 1st and 8th? (the 15th, 22nd, and 29th) What dates are the same day as the 10th? Repeat for the 9th and the 11th. Then show students how, if the 1st day of the month is a Wednesday, you can quickly figure out that the 23rd is a Thursday. (If the 1st is a Wednesday, so too are the 8th, 15th, and 22nd; the 23rd is the day after the 22nd.) Repeat with different dates. EXAMPLE: If May 1st is a Tuesday, what day is May 16th? If December 1st is a Sunday, what day is December 31st?

Then ASK: If May 5th is a Sunday, what day is May 12th? How do you know? Relate calendars to a hundreds chart: To move down a row in a hundreds chart, you add 10 to the number because there are 10 numbers in each row. To move down a row in a calendar, you add 7 to the number because there are 7 numbers in each row.

Online Guide: BLMs for Extension 5