



DESIGNING AND IMPLEMENTING HIGH YIELD STRATEGIES IN THREE-PART MATH LESSONS (GR. 3)

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Abstract

The completed project, *Designing and implementing high-yield strategies in three-part math lessons (Grade 3)*, provides twelve lessons across the five strands of mathematics recognized in the Revised Ontario Curriculum (Grades 1-8) Mathematics (2005). The lessons that were created will permit students to engage in active learning situations and to demonstrate student-generated solutions when solving open-ended problems. The intent of these lessons is to provide students with the opportunities to problem solve, to reason and to prove, to select tools and strategies, and to reflect on their own learning and the learning of others, as well as to connect to previous learning, to represent their thinking, and to communicate their learning. Each lesson is organized such that the lessons contain a “Getting Started” activity, a “Working On It” activity, and points for discussion during a “Reflect and Connect”/“What We Learned” component. Each lesson provides for Grade 3 teachers the prior knowledge required, lists of materials needed, sequenced instructions that encourage the use of high-yield strategies, and suggestions for related literature, follow-up activities, games, and/or summative evaluation tasks in the form of “exit cards”. All aspects of this project are reproducible for use by teachers in their classrooms.

Lesson 1

Math Strand: Measurement (Linear)

1. Overall Expectation: The students will compare and order objects using attributes measured in standard units.
2. Specific Expectations: The students will compare and order objects on the basis of linear measurements in centimetres and/or metres in problem solving contexts.
3. Previous Knowledge and Skills Required:
 - Using rulers, tape measures, metre sticks correctly as measuring tools,
 - Identifying benchmarks for cm and m units,
 - Recalling that $100\text{cm} = 1\text{m}$,
 - Using vocabulary of least to greatest, smallest to largest, when ordering length or height,
 - Demonstrating the ability to convert measurements greater than 1 metre into centimetres.

4. Materials:

“Getting started”:

- paper clip
- unsharpened HB pencil
- box of crayons
- 30cm ruler
- chart paper
- markers
- pictures of various common objects and estimated lengths for discussion (attached)

“Working On It”:

- one copy of the question for each pair of students (attached)
- chart paper
- markers

5 Initial Task-“Getting Started”:

The teacher will hand out bags containing 4 objects of various lengths as listed above (paper clip, pencil, box of crayons and 30cm ruler). The teacher will instruct the students to work with their elbow buddy (“think, pair, share”) and put the items in order. The teacher will then chart the results of how the students sorted their objects. Through discussion, the teacher will bring out the language of comparing the lengths (Why did you put that item first? It was the longest/shortest (compared the length). As a class, the teacher will display some pictures of various objects and their estimated lengths. The students will match the estimate with the corresponding picture as a class. The teacher will ask the students to help order the pictures from greatest to least and least to greatest length. The teacher should record these comparisons on chart paper.

6. “Working On It”:

Students should work in pairs (“think, pair, share”) to answer the following question. Use chart paper and markers. Provide each pair of students with a copy of the question (attached).

The picture shows Jennifer standing next to her front door.

Jennifer’s older brother, Robert, is 50cm taller than Jennifer. Their dog is 40cm shorter than Jennifer. About how tall is each family member?

Draw and label a new picture showing Jennifer, Robert, and their dog in order of their height. Explain your thinking.

Jennifer is _____ tall.

Robert is _____ tall.

Their dog is _____ tall.

7. Anticipated Student Responses:

- stating that Robert is 250cm, 150cm, 90cm
- stating that the dog is 40cm, 1m, 60cm
- stating that Jennifer is 2m, 1m, 100cm
- stating that Robert is tallest, then Jennifer, and last, their dog
- stating that the dog is the smallest, then Jennifer, and last, Robert

8. Reflect and Connect Focus Questions and Organizers (basis for students engaging in “accountable” talk as a whole class to review/ share their answers & summarize their learning):

- How tall is Jennifer? How do you know?
- How tall is Robert? How do you know?
- How tall is their dog? How do you know?
- How many different ways were they put in order?

9. What We Learned – Goals of the Lesson:

- We learned to add and subtract measurements of height.
- We learned how many centimetres are in a metre.
- We learned how to compare measurements and order them from least to greatest and from greatest to least.
- We learned that, for heights greater than 1m, we can change them to cm to find the answer.

10. Related Literature/Media Resources:

Polly’s Pen Pal, written by: Stuart J. Murphy (MathStart)

Super Sand Castle Saturday, written by: Stuart J. Murphy (MathStart)

Exit Card:

Which list shows lengths from least to greatest?

- a) 1m 20cm, 140cm, 1m
- b) 1m, 1m 20cm, 140cm
- c) 140cm, 1m 20cm, 1m
- d) 1m, 140cm, 1m 20cm

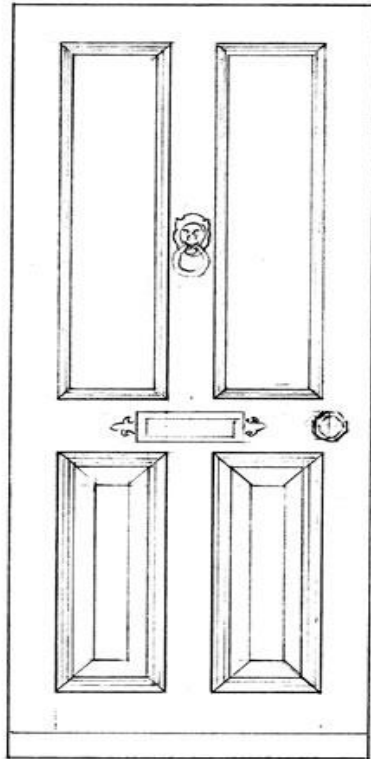
Working On It Challenge!

The picture shows Jennifer standing next to her front door.

2 metres



0 metres



Jennifer's older brother, Robert, is 50cm taller than Jennifer. Their dog is 40cm shorter than Jennifer. About how tall is each family member?

Draw and label a new picture showing Jennifer, Robert, and their dog in order of their height. Explain your thinking.

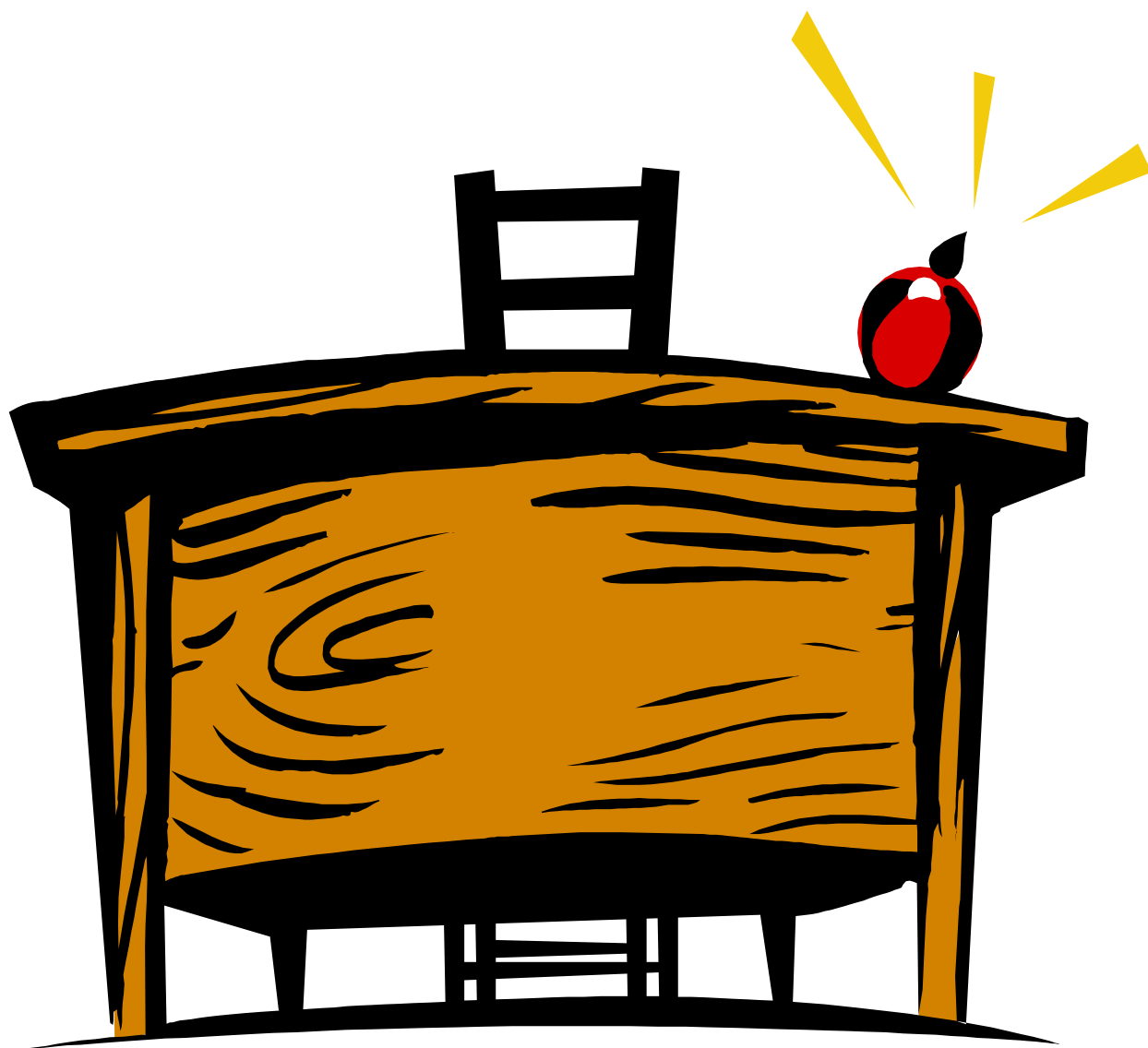
Jennifer is _____ tall.

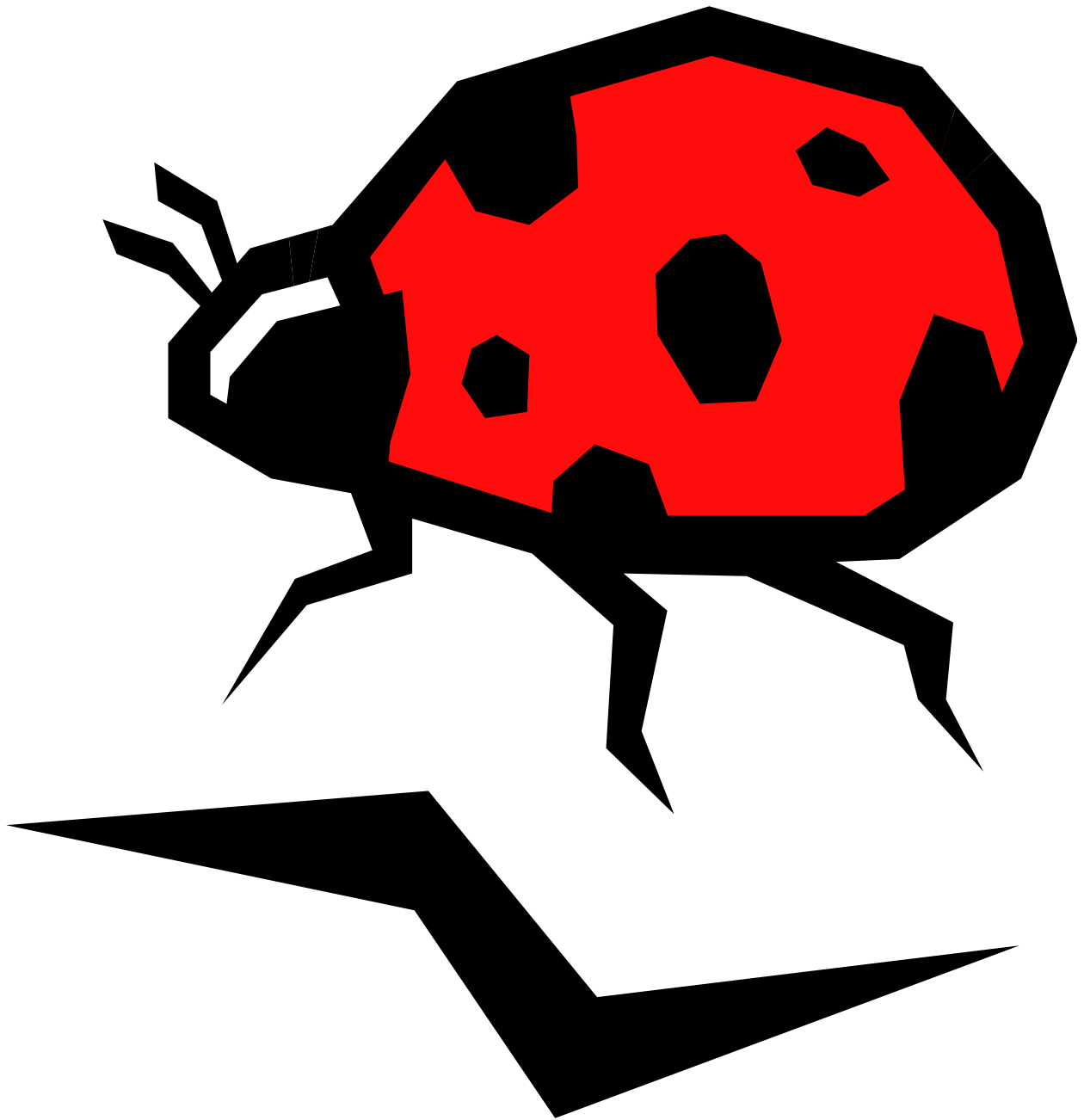
Robert is _____ tall.

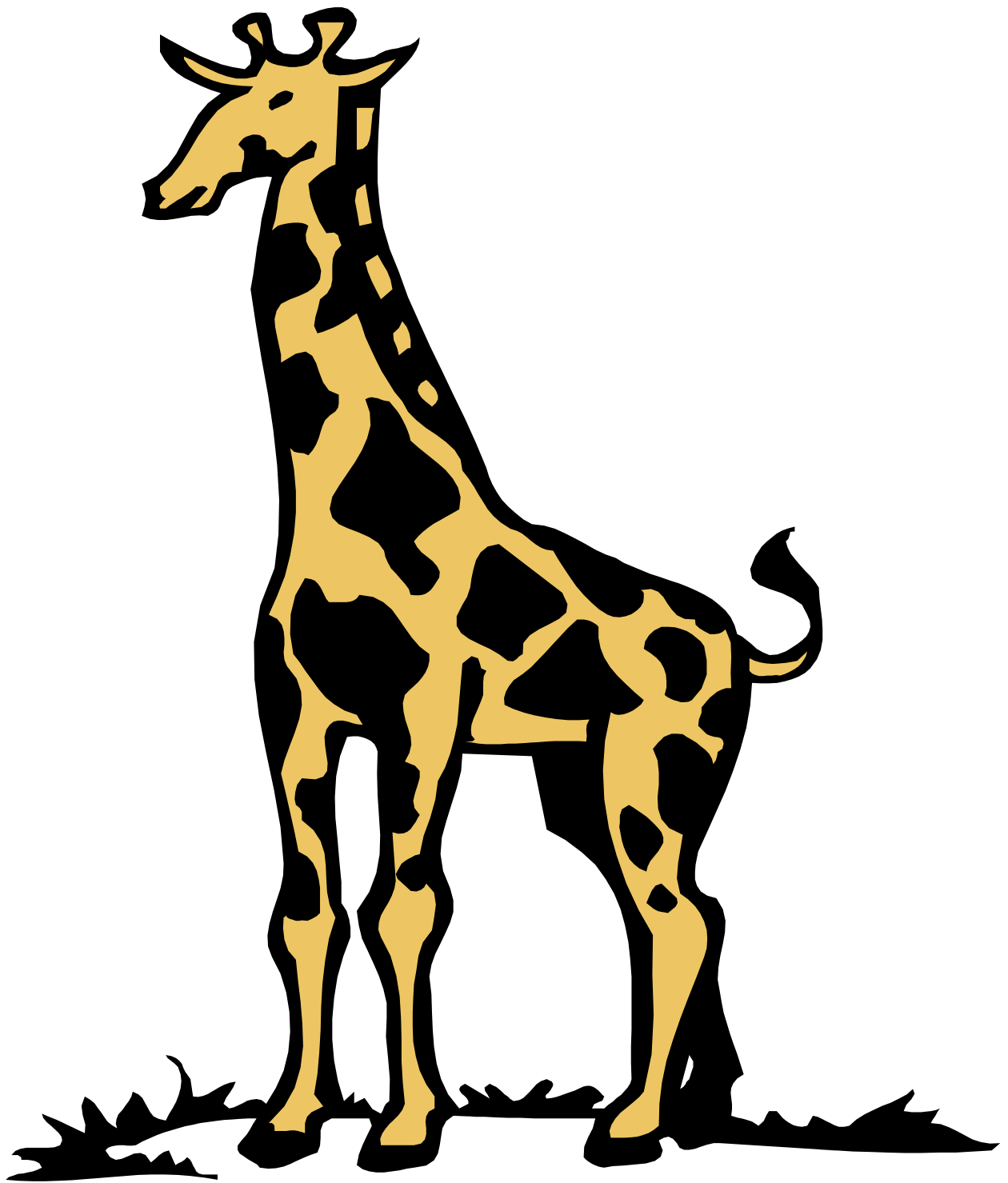
Their dog is _____ tall.











About 1 cm

About 25 cm

About 2 m

About 8 cm

About 5 m

Lesson 2

Math Strand: Measurement (Area)

1. Overall Expectation: The students will measure and order area using non-standard units.
2. Specific Expectations: The students will measure and record area. The students will compare and order various shapes by area.
3. Previous Knowledge and Skills Required:
 - Recalling the names of pattern blocks
 - Identifying that area means the space covered on the inside of a shape
 - Using vocabulary of least to greatest, largest to smallest when ordering areas

4. Materials:

“Getting Started”:

- orange square pattern block tiles
- grid paper
- blank paper
- crayons

“Working On It”:

- pattern blocks
- pictures of three shapes
- chart paper
- markers

5. Initial Task-“Getting Started”:

The teacher will organize the students in groups of three or four members. The teacher will then hand out a different number of orange pattern block tiles (between 5 and 10 per student in the group) to each group. The teacher will instruct each member of every group to draw as many different shapes as possible with the same area on grid paper using all of their tiles in each shape. The members of each group will then view their work to determine if they have any of the same responses, which will then be recorded in the centre of the chart paper (“placemat” strategy). Then the teacher will instruct the students to draw some shapes using all their tiles on the blank paper to show the same area in different ways. The students should be challenged to produce as many figures as they can within five minutes. As a class, the groups will share their figures. The teacher will display the charts and will discuss ordering the areas from least to greatest or from greatest to least areas.

6. “Working On It”:

The students will work with a partner (“think, pair, share”). The teacher will provide each pair of students with three shapes (see attached). The students are to find the area of each shape using pattern blocks by any method they wish. The teacher will then ask students to calculate the area of each shape using one standard shape (“Can you cover these shapes using the same colour tiles?”). The teacher will ask the students to order the three shapes according to their areas.

7. Anticipated Student Responses:

- students will cover the shapes using all the same colour tiles
- students will use a combination of pattern block shapes
- students will have trouble fitting the pattern blocks into the shapes
- students may stack the tiles and build up to show how many ways they can find the area

8. Reflect and Connect Focus Questions and Organizers (basis for students engaging in “accountable” talk as a whole class to review/ share their answers & summarize their learning):

- Does the order of the area of the shapes change when you use a different sized pattern block to measure the area? (No)
- What math words can you use to explain your thinking?
- What was the most challenging part of the task?

9. What We Learned – Goals of the lesson:

- The order of the area of the shapes does not change when you change the size of the pattern blocks you measure with.
- To compare area you need to use the same unit on all shapes.

10. Related Literature/Media Resources:

Bigger, Better, Best! , written by: Stuart J. Murphy (MathStart)

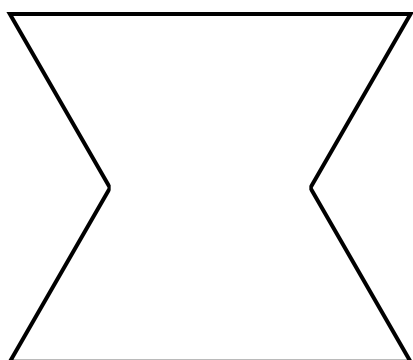
Sam’s Sneaker Squares, written by: Nat Gabriel

11. Games/ Extra Practice/ Problem of the Week Ideas:

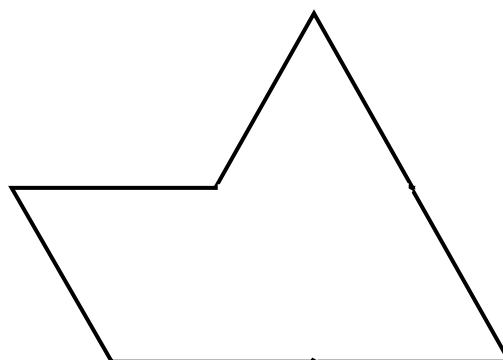
Exit Card:

Find the area of each shape using green triangles. Put them in order from largest to smallest.

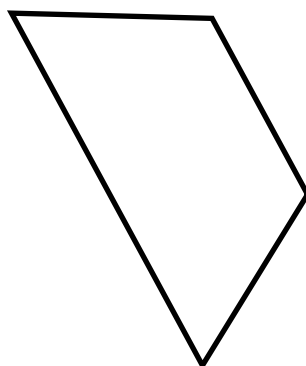
Shape A



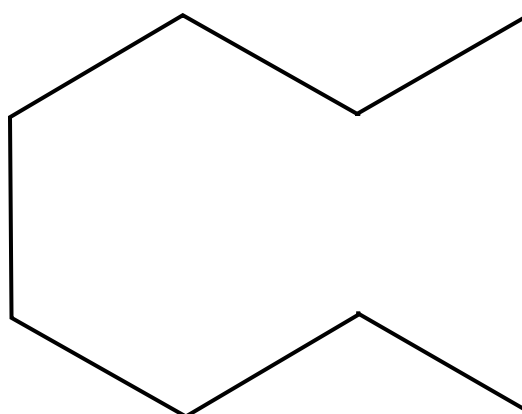
Shape B



Shape C



Shape D



Bonus: What is the total area of these shapes?

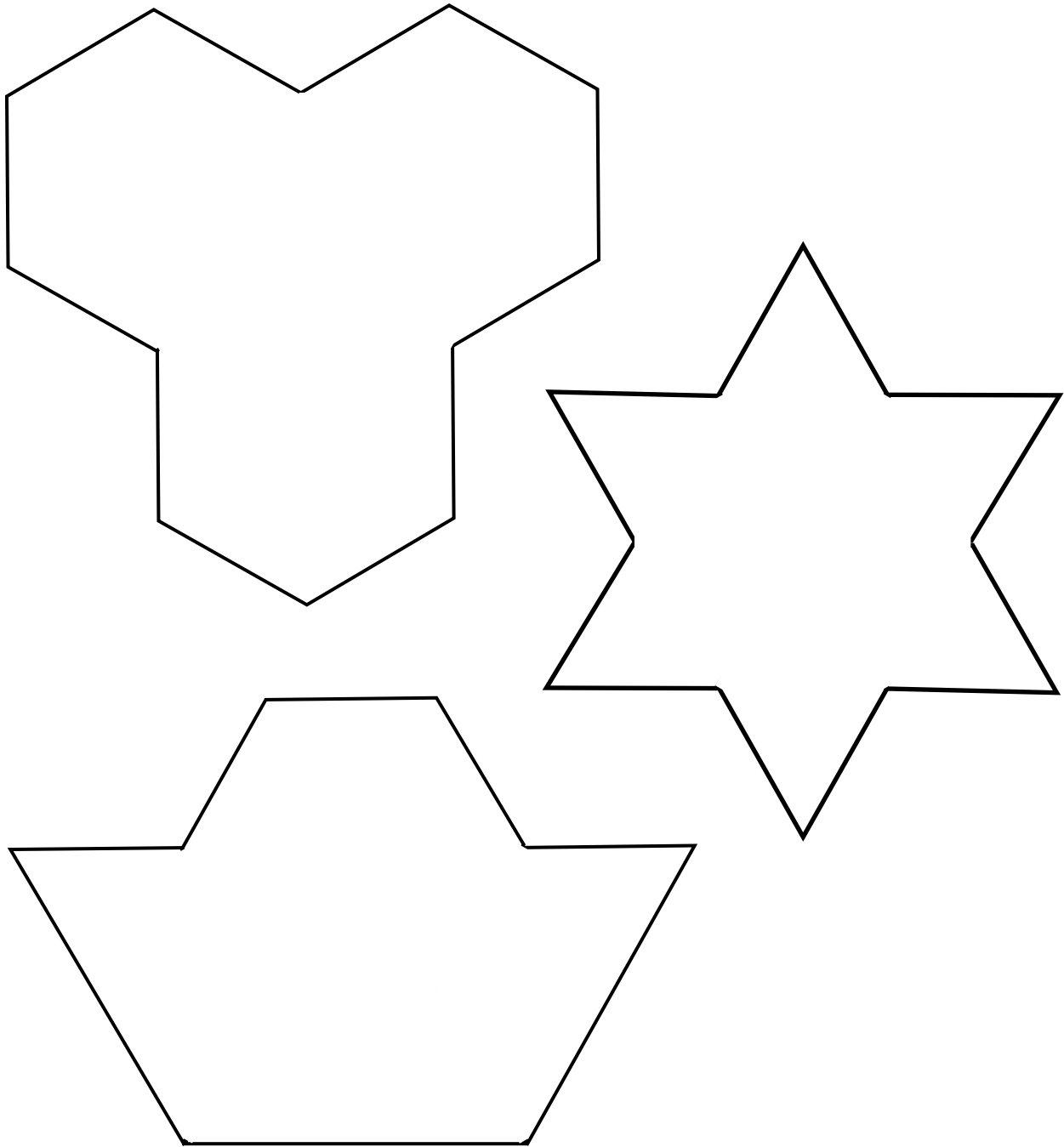
The total area is _____

Task Card for “Working On It”:

Find the area of these figures using pattern blocks.

Can you cover these shapes using the same colour?

Order the shapes according to their area.



Lesson 3

Math Strand: Measurement (Calendar Time)

1. Overall Expectation: The students will measure and record time using standard units.
2. Specific Expectations: The students will solve problems involving relationships between days and weeks using a variety of tools.

3. Previous Knowledge and Skills Required:

- Recalling information about the number of days in a week, the number of months in a year, the number of days in specific months, the approximate number of weeks in a month, the number of weeks in a year
- Recalling the order of and spelling of the names of the days of the week and of the names of the months in a year.

4. Materials:

“Getting started”:

- 3 calendars that are sequential months (1 set per pair of students) (teacher generated)
- chart paper
- markers

“Working On It”:

- one set of three calendars (attached) for each pair of or threesome of students (each set includes one partially completed calendar that shows the name of the month and one special day for either the month of February, May, August, or November and two blank calendars per student group)
- pencils
- chart paper
- markers
- question cards (attached)

5. Initial Task-“Getting Started”:

The teacher will provide three complete calendars (three sequential months) to each pair of students. The teacher will instruct students to work in pairs (“think, pair, share”) to circle a specific date on one calendar, and will ask them to determine the amount of time that will pass in order to reach yet another specified date on one of the calendars. The students will share results during whole class discussion. The teacher will guide discussion to focus on generating a chart about equivalency (i.e.: 7 days = one week, etc.) after discussing the possibility that answers could have been presented in terms of days or weeks or months.

6. “Working On It”:

Students will work in pairs or threesomes to complete the partially completed calendar they have received (for either the month of February, May, August, or November). The students will then work in their groups to complete the two blank calendars they have received by completing one calendar for the month preceding their partial calendar, and one calendar for the month following their partial calendar. The students will use chart paper and markers to generate their

answers to the questions indicated on the appropriate question card then provided by the teacher (attached).

For February calendars:

Using your three calendars, answer the following questions. Explain your thinking.

- 1. If Saturday is your favourite day, how often do you get to enjoy your favourite day during your three months?***
- 2. If your grandmother is coming to visit on Valentine's Day, but she is leaving after four weeks, on what date will she leave?***
- 3. How many days are there between New Year's Day and Valentine's Day?***
- 4. If you go swimming every Tuesday during your three months, how many times will you be able to go swimming?***

For May calendars:

Using your three calendars, answer the following questions. Explain your thinking.

- 1. If Saturday is your favourite day, how often do you get to enjoy your favourite day during your three months?***
- 2. If your grandmother is coming to visit on Victoria Day, but she is leaving after four weeks, on what date will she leave?***
- 3. How many days are there between April Fool's Day and Victoria Day?***
- 4. If you go swimming every Tuesday during your three months, how many times will you be able to go swimming?***

For August calendars:

Using your three calendars, answer the following questions. Explain your thinking.

- 1. If Saturday is your favourite day, how often do you get to enjoy your favourite day during your three months?***
- 2. If your grandmother is coming to visit on Canada Day, but she is leaving after four weeks, on what date will she leave?***
- 3. How many days are there between Canada Day and Labour Day?***
- 4. If you go swimming every Tuesday during your three months, how many times will you be able to go swimming?***

For November calendars:

Using your three calendars, answer the following questions. Explain your thinking.

- 1. If Saturday is your favourite day, how often do you get to enjoy your favourite day during your three months?***

2. *If your grandmother is coming to visit on Hallowe'en, but she is leaving after four weeks, on what date will she leave?*
3. *How many days are there between Hallowe'en and Remembrance Day?*
4. *If you go swimming every Tuesday during your three months, how many times will you be able to go swimming?*

7. Anticipated Student Responses:

- miscounting or counting correctly the number of cells in blank grids
- labelling the months or days correctly or incorrectly
- recalling or not recalling the number of days in their target months
- counting only days or only weeks in response to the questions
-

8. Reflect and Connect Focus Questions and Organizers (basis for students engaging in “accountable” talk as a whole class to review/ share their answers & summarize their learning):

- Explain how you got your answer.
- How did you begin this task?
- What was the most difficult part of this task? Why?

9. What We Learned – Goals of the Lesson:

- We learned that we can count forwards and backwards on calendars.
- We learned that certain months always have a certain number of days and that knowing this helps us find a correct answer.
- We learned that seven days is always a week, no matter from which day we begin counting.
- We learned that it is important to know the names of the days and months in order.

10. Related Literature/Media Resources:

Game Time, written by Stuart J. Murphy (MathStart)

Pepper's Journal – A Kitten's First Year, written by Stuart J. Murphy (MathStart)

11. Games/ Extra Practice/Problem of the Week Ideas:

A. The teacher will generate twelve calendars to represent one year of sequential months. Students should show their thinking while answering the following questions which may be posed as “exit cards”(attached):

Exit Card #1:

How many Saturdays are there in the month of August?

Which months end on a Wednesday?

Which months start on a Monday?

What is the date that is 8 days after October 29th?

What is the date that is 2 weeks before June 2nd?

What is the date that is 3 months after May 16th?

What is the date 5 days before November 3rd?

B. The students will answer the following questions in reference to their own birth dates and will show their thinking:

Exit Card #2:

My birth date is: _____ Today's date is: _____

How many days has it been since your last birthday?

How many days will it be until your next birthday?

How many weeks have gone by since it was your last birthday?


How many more weeks must you wait until your next birthday?

C. The students will show their thinking in answering the following question:


Exit Card #3:

***Do you know anyone who has lived close to 500 days?
Explain your thinking.***

February

Sunday						
				14  Valentine's Day		

May

Sunday						
	24 Victoria Day 					

August

Sunday						
	5 Civic Holiday					

November

Sunday						
				11 Remembrance Day		



Sunday						

Task Card for “Working On It”:

For February calendars:

Using your three calendars, answer the following questions. Explain your thinking.

- 1. If Saturday is your favourite day, how often do you get to enjoy your favourite day during your three months?**
- 2. If your grandmother is coming to visit on Valentine’s Day, but she is leaving after four weeks, on what date will she leave?**
- 3. How many days are there between New Year’s Day and Valentine’s Day?**
- 4. If you go swimming every Tuesday during your three months, how many times will you be able to go swimming?**

Task Card for “Working On it”:

For May calendars:

Using your three calendars, answer the following questions. Explain your thinking.

- 1. If Saturday is your favourite day, how often do you get to enjoy your favourite day during your three months?**
- 2. If your grandmother is coming to visit on Victoria Day, but she is leaving after four weeks, on what date will she leave?**
- 3. How many days are there between April Fool’s Day and Victoria Day?**
- 4. If you go swimming every Tuesday during your three months, how many times will you be able to go swimming?**

Task Card for “Working On It”:

For August calendars:

Using your three calendars, answer the following questions. Explain your thinking.

- 1. If Saturday is your favourite day, how often do you get to enjoy your favourite day during your three months?**
- 2. If your grandmother is coming to visit on Canada Day, but she is leaving after four weeks, on what date will she leave?**
- 3. How many days are there between Canada Day and Labour Day?**
- 4. If you go swimming every Tuesday during your three months, how many times will you be able to go swimming?**

Task Card for “Working On It”:

For November calendars:

Using your three calendars, answer the following questions. Explain your thinking.

- 1. If Saturday is your favourite day, how often do you get to enjoy your favourite day during your three months?***
- 2. If your grandmother is coming to visit on Hallowe'en, but she is leaving after four weeks, on what date will she leave?***
- 3. How many days are there between Hallowe'en and Remembrance Day?***
- 4. If you go swimming every Tuesday during your three months, how many times will you be able to go swimming?***

Lesson 4

Math Strand: Number Sense and Numeration (estimation and counting)

1. **Overall Expectation:** The students will compare, order, and round whole numbers to 1000 to solve problems involving addition and subtraction of multi-digit numbers.

2. **Specific Expectations:** The students will use estimation when solving problems involving addition and subtraction to help judge the reasonableness of a solution.

3. **Previous Knowledge and Skills Required:**

- comparing and ordering numbers to 1000
- recalling knowledge of and experience with rounding to the nearest “ten” on number lines which count by 1’s, 5’s, 10’s, and 100’s
- recalling meaning of place value in three-digit numbers
- stating knowledge of the terms “sum”, “difference”, “number sentence”, “equation”, “addends”.

4. **Materials:**

“Getting Started”:

- 3 blank number lines with ten intervals (1 set per pair of students) (attached)
- one “Getting Started” task card (attached) per pair of students
- pencils

“Working On It”:

- one “Working On It” task card (attached) per pair or threesome of students
- one teacher-prepared number line on large graph chart paper (minimum of 100 squares in length) with a marked midpoint
- markers

5. **Initial Task-“Getting Started”:**

The teacher will provide pairs of students with three unnumbered number lines divided into 10 intervals. The students will follow the instructions on the “Getting Started” task card in order to complete the three number lines. The students will use point form to answer the questions about which numbers are closer to specified “tens” or “hundreds”. The students will then view the work of other groups in order to determine whether their answers were the same or different (“gallery walk” strategy). The teacher will then record results on a tally chart (i.e.: the number of groups that said, for example, that 31 was closer to 30, or that 31 was closer to 40...). The teacher will guide class discussion to develop a chart about “Rules for Rounding Up and Down”. The teacher will pose the question, “The estimated sum of two numbers is 20. What MIGHT the sum actually be? Let’s explore the nine possibilities”. After the nine possibilities are generated by the class by using a number line drawn on chart paper or the blackboard, the teacher will pose the question, “What could the two addends be?”

6. “Working On It”:

Students will work in pairs or threesomes to answer the following question provided on a “Working On It” task card (attached). The estimated sum in the question should be placed on the midpoint of the number line.

The estimated sum of two numbers is 300. What MIGHT the sum be? For a few of your sums, tell the addition sentence (_____ + _____ = _____).

7. Anticipated Student Responses:

- having/not having difficulty identifying a range of sums
- providing/not providing two addends that have a sum of 300
- addition errors

8. Reflect and Connect Focus Questions and Organizers (basis for students engaging in “accountable” talk as a whole class to review/ share their answers & summarize their learning):

- What was the most difficult part of this task? Why?
- How do you know if your answer is correct?
- Why is there more than one correct answer?
- How many sums could there be?

9. What We Learned – Goals of the Lesson:

- We learned that 98 numbers can round to any 100.
- We learned that we can round up or we can round down.
- We learned that if a number ends in 5, round up to the nearest 10.
- We learned that if a number has 5 tens, round up to the nearest 100.

10. Related Literature/Media Resources:

Betcha!, written by Stuart J. Murphy (MathStart)

The Long Wait, written by Annie Cobb (Math Matters)

Coyotes All Around, written by Stuart J. Murphy (MathStart)

11. Games/ Extra Practice/Problem of the Week Ideas:

A. Students should show their thinking while answering the following questions which may be posed as “exit cards”(attached):

Exit Card #1:

There are three Grade 3 classes at Greenhill Public School. The students took a survey to learn about where they spent their summer vacation. All 63 students gave an answer.

The list shows the places at which the students spent their holiday:

- ***21 students went to summer camp***
- ***4 students stayed at home***
- ***24 students visited grandparents***
- ***_____ students went to Disney World***

Choose the CLOSEST number of students that went to Disney World.

Was it 40, 30, 20, or 10 students?

Explain your thinking.

Exit Card #2:

Here are some estimated sums and differences. Are they reasonable estimates? Tell “Yes” or “No” for each sum or difference. Explain your thinking by telling WHY the estimates are reasonable or not.

326 + 209 = about 500 because

214 + 301 = about 600 because

877 + 85 = about 900 because

427 - 290 = about 100 because

611 - 89 = about 200 because

485 - 115 = about 400 because

B. The teacher will provide a variety of hundreds charts from which students may choose in order to play the following game. The hundreds charts could range from 0 to 100, from 100 to 200, from 200 to 300, from 300 to 400, from 400 to 500, from 500 to 600, from 600 to 700, from 700 to 800, from 800 to 900, or from 900 to 1000.

Rounding Up and Down Game:

You will need 2 number cubes, a hundreds chart of your choice, and two centicubes to use as tokens.

- 1. Both players begin on the lowest number on the hundreds chart.***
- 2. The first player rolls the number cubes and adds to find the sum. He or she moves that number of spaces. If he or she lands on a number that has zero as the value in the ones column, then his or her turn ends. If he or she lands on any other number, then he or she must round up or down to the nearest ten and move his or her token to the nearest ten.***
- 3. The other player takes his or her turn.***
- 4. The first player to reach the highest number on the hundreds chart is the winner.***

Task card for “Getting Started”:

Put these numbers on a number line:

31, 32, 33, 34, 35, 36, 37, 38, 39

Which numbers are closer to 30?

Which numbers are closer to 40?

Put these numbers on a number line:

61, 62, 63, 64, 65, 66, 67, 68, 69

Which numbers are closer to 60?

Which numbers are closer to 70?

Put these numbers on a number line:

310, 320, 330, 340, 350, 360, 370, 380, 390

Which numbers are closer to 300?

Which numbers are closer to 400?

Task card for “Working On It”:

The estimated sum of two numbers is 300. What MIGHT the sum be?

For a few of your sums, tell the addition sentence

(_____ + _____ = _____).

Lesson 5

Math Strand: Geometry and Spatial Sense (3-D)

1. Overall Expectation: The students will compare three-dimensional figures and sort them by their geometric properties.
2. Specific Expectations: The students will compare and sort prisms and pyramids by geometric properties using concrete materials.
3. Previous Knowledge and Skills Required:
 - recalling that squares are a special kind of rectangle
 - recalling the meaning of the terms faces, edges and vertices
 - recalling the names of two-dimensional figures (pentagon, octagon, hexagon)
 - understanding the meaning of congruency

4. Materials:

“Getting Started”:

- prisms and pyramids manipulatives of various sizes and shapes
- boxes or objects from the real world that are shaped like prisms and pyramids (for example: a pencil grip, Toblerone chocolate box, picture of a roof top, picture of the Great Pyramids of Egypt)
- chart paper
- markers

“Working On It”:

- chart paper
- markers

5. Initial Task-“Getting Started”:

The teacher will display an assorted group of prisms and pyramids. The teacher will model how to play the “Secret Solid” game. The teacher will instruct the students to choose a solid and keep it a secret. The students will describe the solid to their elbow partner (“think, pair, share”) in as many ways as they can. Their partners will guess the solid. Players should play again for a few more rounds. Then, as a class, the teacher will direct a discussion about how to sort all the solids from the game in a T-chart on the carpet. The prisms and the pyramids should be grouped together. The teacher should explain that the pyramids are grouped together because they all have at least three triangle faces and the prisms are grouped together because they all have at least three rectangle faces. The teacher will then lead a discussion about how the names of prisms and pyramids are defined by the shape of the base of the solid. The teacher should write a chart of all the names of the prisms and pyramids in the T-chart. The teacher should model how to count the number of faces, edges and vertices on some of these solids.

6. “Working On It”:

The students will work in groups of two or three in answering the following question. Use chart paper and markers. Provide each group with a copy of the question.

A prism and a pyramid have the same number of faces. What type of prism and pyramid could they be? Can you think of another pair? How do you know? Show your work.

7. Anticipated Student Responses:

- square based pyramid and triangular prism
- pentagonal pyramid and rectangular prism
- pentagonal pyramid and cube
- hexagonal pyramid and pentagonal prism
- students may forget to count the base of a pyramid as a face
- students may count edges or vertices instead of faces
- solids may be misnamed

8. Reflect and Connect Focus Questions and Organizers (basis for students engaging in “accountable” talk as a whole class to review/ share their answers & summarize their learning):

- How do you know that the shape is a prism?
- How do you know that a shape is a pyramid?
- How did you get your answer?
- How could you explain prisms and pyramids to a friend?

9. What We Learned – Goals of Lesson:

- We learned that cubes are a special kind of rectangular prism.
- We learned that pyramids have at least three triangular faces.
- We learned that prisms have at least three rectangular faces.
- We learned to name pyramids by looking at their base.
- We learned to name prisms by looking at their end faces.
- We learned that the end faces of a prism are congruent.

10. Related Literature/Media Resources:

N/A

11. Games/Extra Practice/ Problem of the Week:

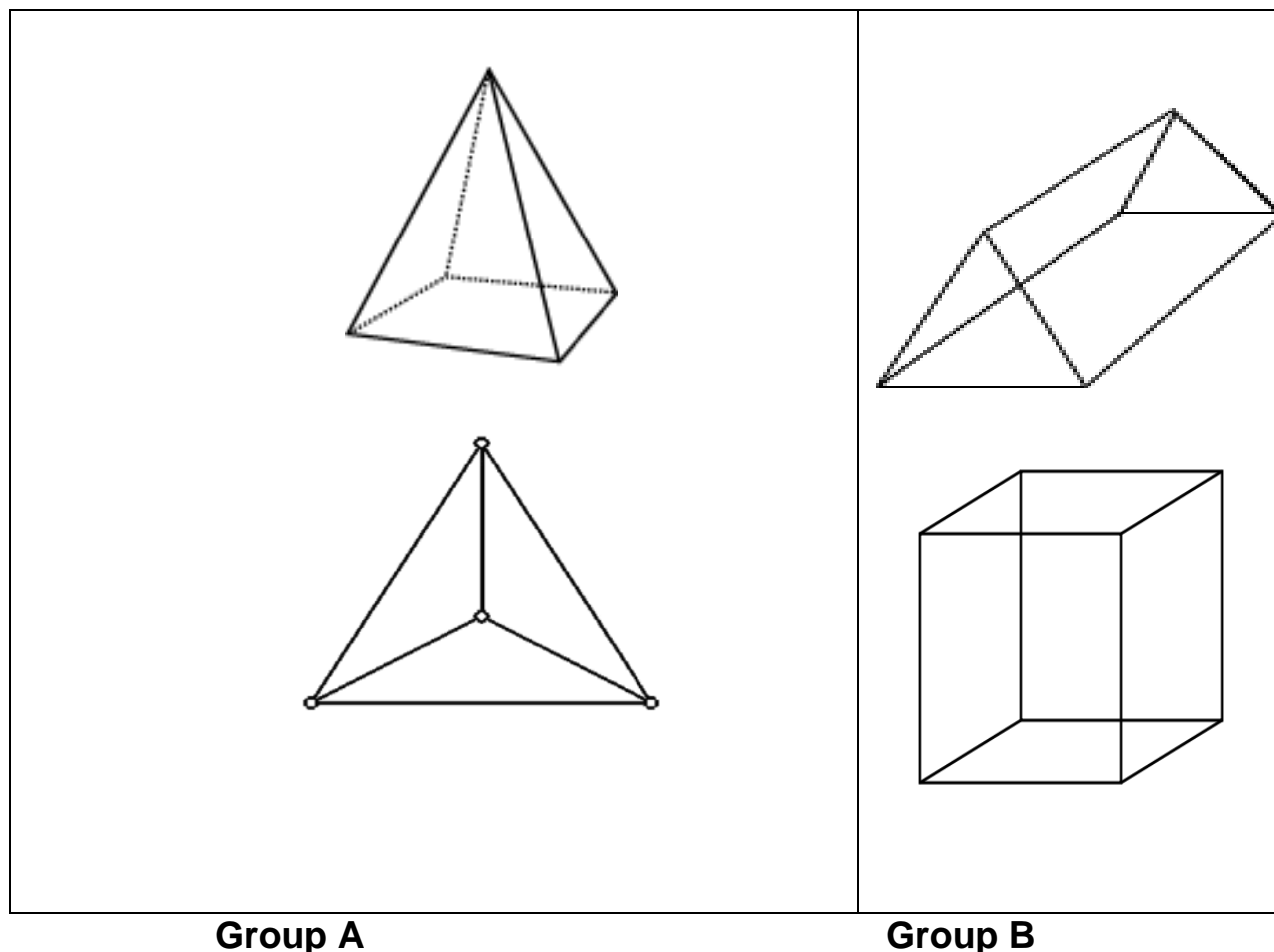
A. *Game – The Mystery Box*

Select a secret solid and place it in an interesting box so it cannot be seen. Give clues to the identity of the solid by focusing on its attributes.

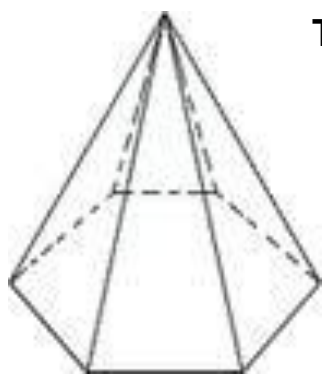
B. Students should show their thinking while answering the following question which may be posed as an “exit card” (attached):

Exit Card

Sarah sorts 4 figures into groups A and B.



In which group should Sarah place the following figure?



Tell why you think this.

Lesson 6

Math Strand: Geometry and Spatial Sense (2-D/3-D)

1. Overall Expectations: The students will describe the relationship between two-dimensional shapes and three-dimensional solids.
2. Specific Expectations: The students will identify and describe two-dimensional shapes that can be found in three-dimensional figures.
3. Previous Knowledge and Skills Required:
 - understanding of the concept of “faces” on a solid
 - understanding the concept of “nets”
 - recalling the meaning of congruency
 - recalling the names of two-dimensional shapes
 - recalling that a square is a special kind of rectangle

4. Materials:

“Getting Started”:

- construction paper
- markers
- scissors
- masking tape
- different sized boxes (a Kleenex box, a shoe box, a marker box, a puzzle box, etc.), one for each group
- three-dimensional solids manipulative set
- chart paper

“Working On It”:

- large cut outs of shapes **Red – 1 square, 1 equilateral triangle, Blue – 1 hexagon, 1 rectangle, Orange – 2 congruent triangles**
- activity card (attached)
- chart paper
- pencils

5. Initial Task –“Getting Started”:

Students should work in groups of 3 or 4. The teacher will hand each group a box to use. The boxes can be different shapes and sizes, for example a Kleenex box, a shoe box, a marker box, a puzzle box, etc. The teacher will instruct the students to trace all the sides of their box onto construction paper. Students will then cut out all the faces of the box and will then tape all these faces back together again to for another box. As the students work, the teacher will lead a discussion of how the students are making a net of their box. How do you know this is a net?

For what three-dimensional solid is it a net? Next, each group will be given a solid from the teacher's set of manipulatives. The students will trace all of its faces on chart paper. As a large group, the students will share their solid by discussing its attributes (tell how many faces, tell what shape the faces are, tell if there are any congruent faces). The teacher will then lead a discussion to help students discriminate the difference between the Kleenex box activity and the face tracing activity in that the purpose of the Kleenex box activity was to develop a net, whereas the purpose of the face tracing activity was to identify the shapes and the number of faces for each solid.

6. "Working on It":

*Before the lesson, the teacher must prepare sets of large cut outs in different colours:

Red – 1 square, 1 equilateral triangle (this could make a square-based pyramid or a triangular prism)

Blue – 1 hexagon, 1 rectangle (this could make a hexagonal prism)

Orange – 2 congruent triangles (this could make a square-based pyramid, a triangle-based pyramid, a triangular prism, etc.)

Students will work in pairs. The teacher will hand out the large cut outs to each pair of students. The students will work on identifying what solids could be made using the large cut outs as some of its faces. Early finishers could draw the nets of each of the solids they have identified.

7. Anticipated Student Responses:

- accurately naming 2 solids for the first and third pairs of shapes
- accurately identifying that only one solid can be built with the second pair of shapes
- incorrectly naming the solids
- tracing shapes that cannot be translated into a solid

8. Reflect and Connect Focus Questions and Organizers(basis for students engaging in "accountable" talk as a whole class to review/ share their answers & summarize their learning):

- How did you find your answer? What clues helped you solve the problem?
- Why did the second set only have one answer?
- What was the most challenging part of the task?

9. What We Learned – Goals of Lesson:

- We learned that we can list the number and type of two-dimensional shapes needed to make a three-dimensional solid (To make a triangular prism, I need ...)

10. Related Literature/Media Resources:

Captain Invincible and the Space Shapes, written by Stuart J. Murphy (MathStart)

11. Games/ Extra Practice/ Problem of the Week Ideas:

Students should show their thinking while answering the following question which may be posed as an “exit card” (attached):

Working On It – Task Card:

What solids can you make using the red faces? How do you know?

What solids can you make using the blue faces? How do you know?

What solids can you make using the orange faces? How do you know?

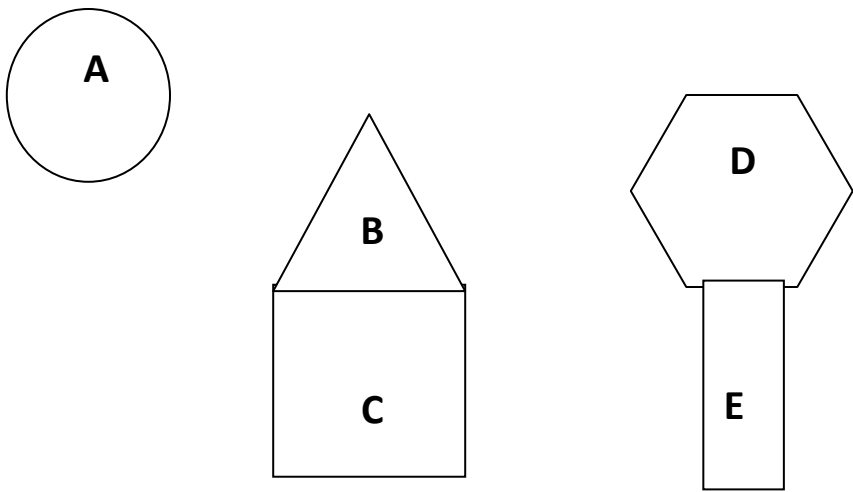
Challenge!

Draw the nets of each of the solids you named on chart paper.

Exit Card:

Bob’s teacher asks him to make a picture out of shapes.

The teacher gives Bob **3-D** figures to trace.



What **3-D** figures could Bob have traced to make each shape in the picture? (The first one is done for you.)

Shape	3-D Figure Traced
A	Cylinder Cone
B	
C	
D	
E	

Lesson 7

Math Strand: Geometry and Spatial Sense (grid location and movement)

1. **Overall Expectation:** The students will identify and describe the location and movements of shapes and objects.

2. **Specific Expectations:**

The students will identify flips, slides, and turns using concrete materials and physical motion.

The students will describe movement from one location to another using a grid map.

3. **Previous Knowledge and Skills Required:**

- defining reflections, translations, rotations, transformations
- identifying individual examples of flips, slides, and turns
- understanding directional words such as up/down, left/right, diagonal, horizontal, and vertical.

4. **Materials:**

“Getting started”:

- 1 sheet of ledger paper per pair of students on which are drawn 10 transformations of polygons on grids (attached)
- 1 piece of chart paper per pair of students on which is written headings by which to sort the transformations (i.e.: rotation / reflection / translation)
- glue
- scissors

“Working On It”:

- one “Working On It” task card (i.e.: a grid on which is drawn a starting point and an ending point) (attached)
- large grid chart paper
- markers
- one “happy face” on cardstock with which to perform the transformations

5. **Initial Task-“Getting Started”:**

The students will work in pairs to cut out, sort, and glue the ten pictures of transformations under the correct headings on the chart paper. Students will prepare reasons (“think, pair, share”) to share during discussion of their decisions during “accountable talk” with the whole class. The whole class will reconvene to discuss each group’s decisions. The teacher will guide the generation of definitions of the transformations and will record the definitions of a reflection, a translation, and a rotation on a chart by using the guiding question, “How did you know?”

6. “Working On It”:

The teacher will review the question with the class. The teacher will remind students that it is acceptable to turn the “happy face” upside-down. The teacher will provide each group of two or three students with the problem, a “happy face” manipulative, and grid paper/markers. In groups of two or three, the students will describe, on chart paper, three different sets of instructions, which include transformation and movement-on-a-grid vocabulary, to explain how the “happy face” travelled from start to finish.

7. Anticipated Student Responses:

- making errors in counting squares
- making errors using directional words
- misnaming transformations
- providing correct directions

8. Reflect and Connect Focus Questions and Organizers(basis for students engaging in “accountable” talk as a whole class to review/ share their answers & summarize their learning):

- How many ways were found in total by the class?
- How can you tell if the directions were accurate?
- What was the most popular set of instructions?
- What was the simplest set of instructions?
- What was the most complicated set of instructions?

9. What We Learned – Goals of the Lesson:

- We learned that there is more than one way to travel from a starting point to a finish point.
- We learned how to tell the difference between the different types of transformations.
- We learned that some transformations may appear similar to others.
- We learned that more than one type of transformation may result in the same end point.
- We learned that movement of objects can be described with transformation words and direction words.

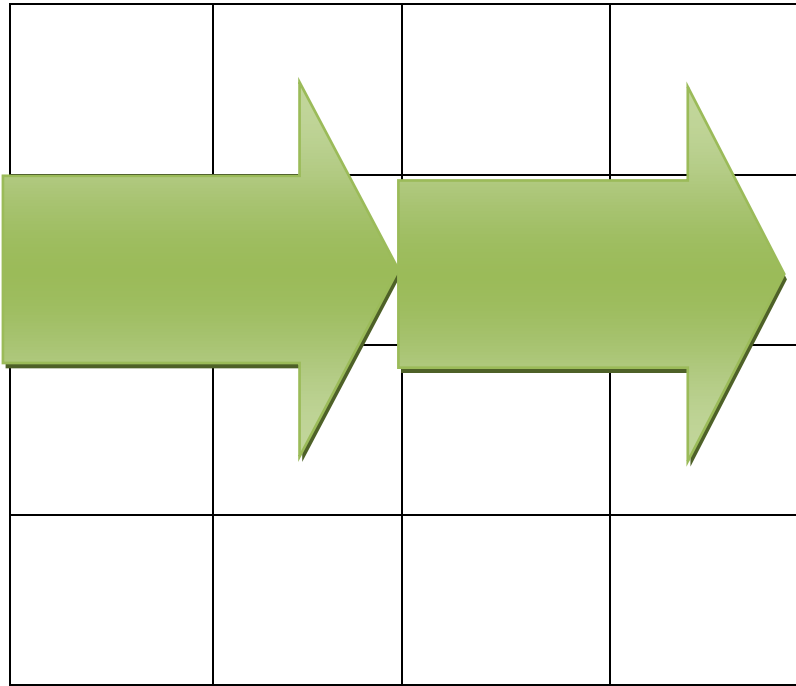
10. Related Literature/Media Resources:

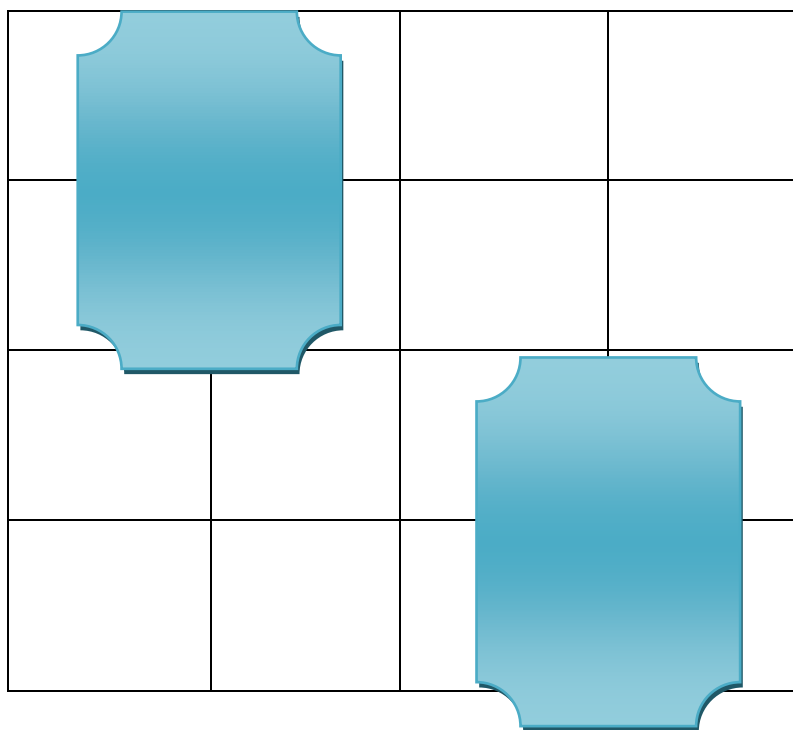
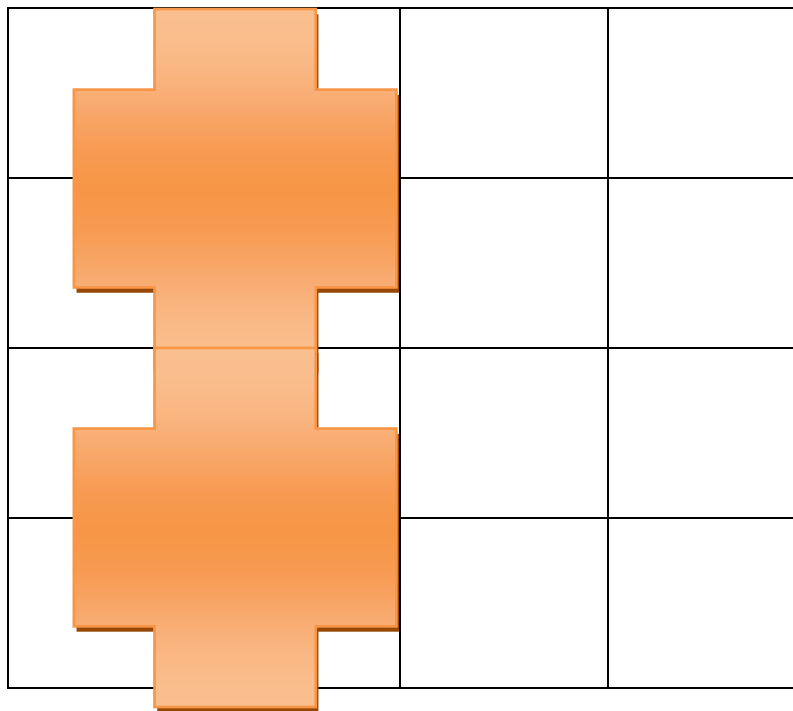
X Marks the Spot, written by Lucille Recht Penner (Math Matters)

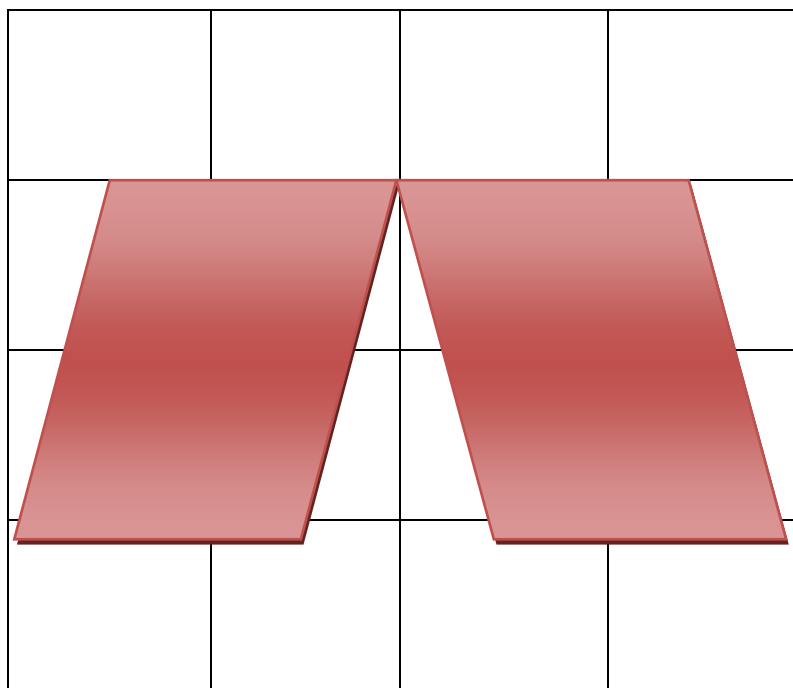
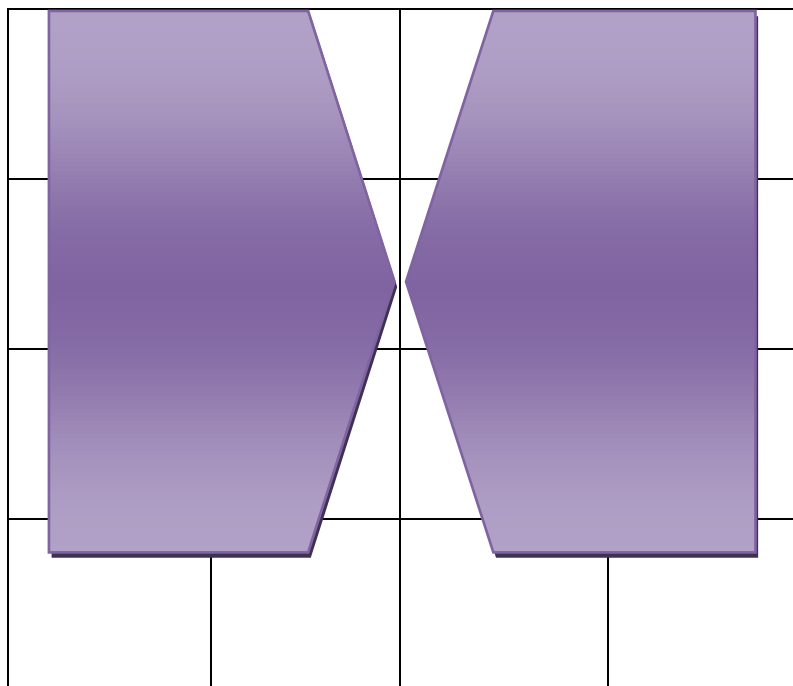
11. Games/Extra Practice/Problem of the Week Ideas:

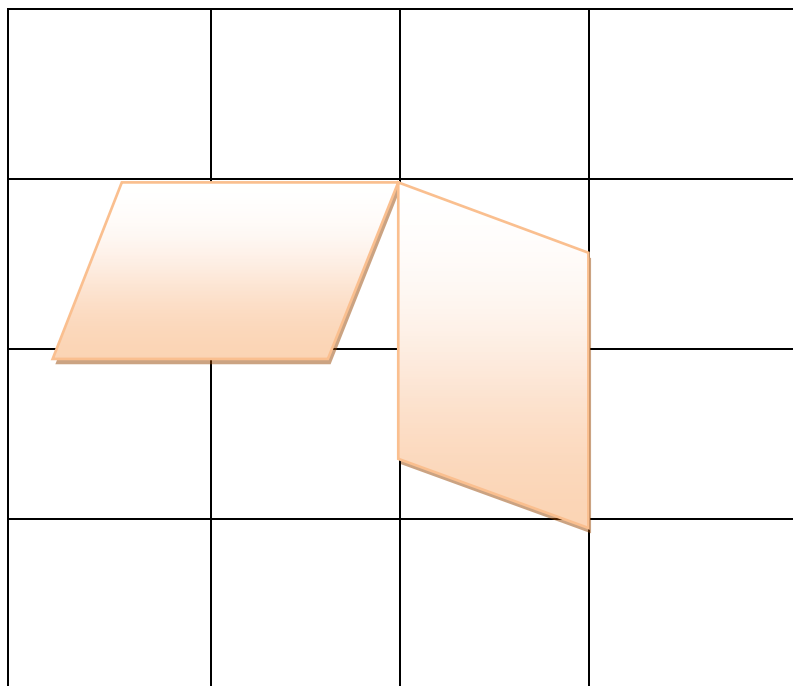
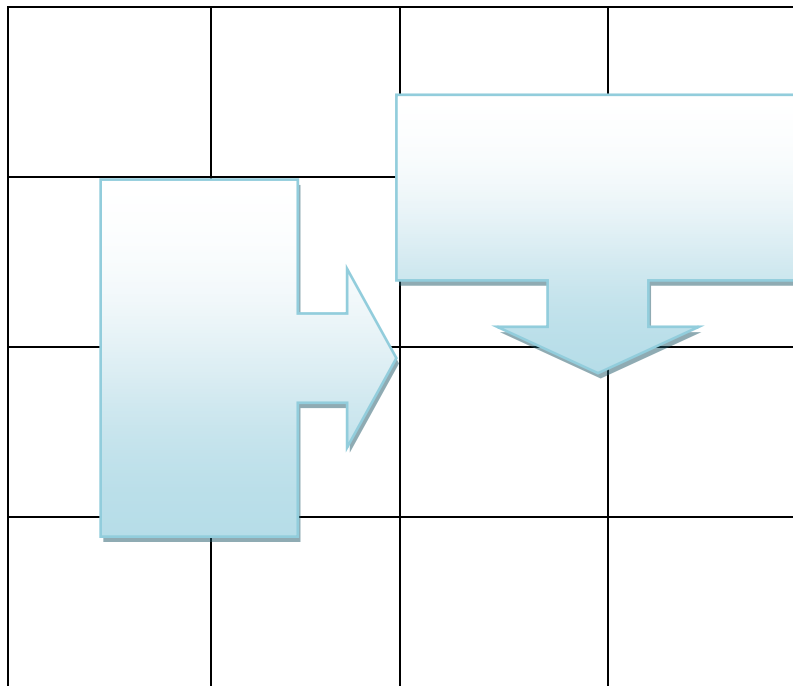
A. Students will play a barrier game using pairs of 5 x 5 grids. One student will give his/her partner oral instructions which include transformation and movement-on-a-grid vocabulary to direct his/her partner to move an object from a start point to a finish point.

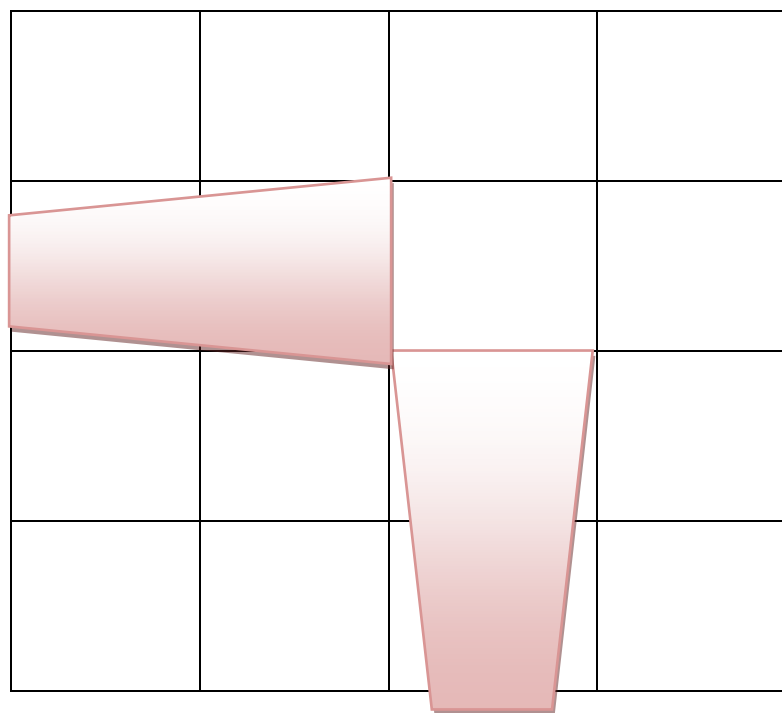
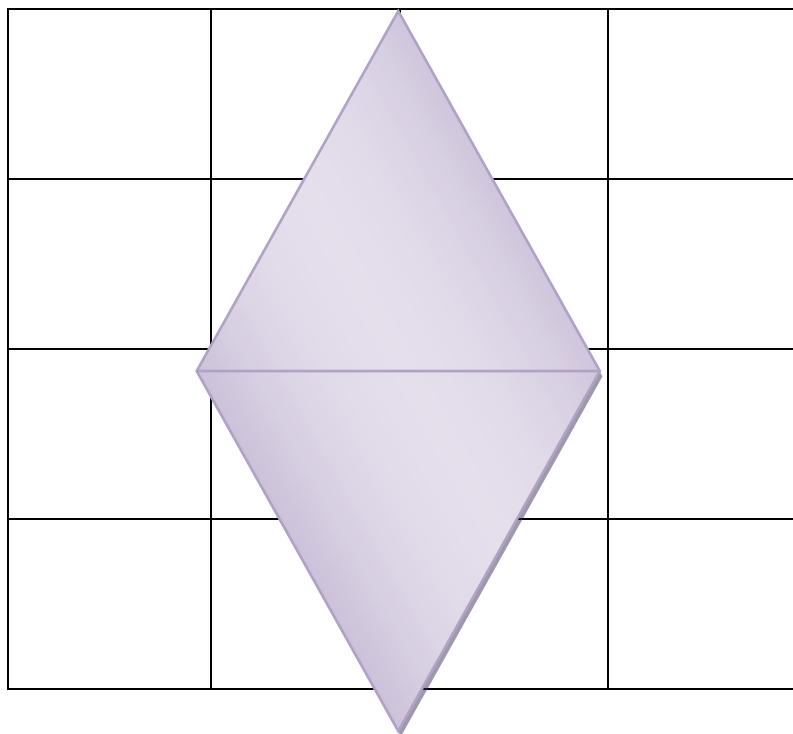
B. Students will make a “polygon collage” by first creating a “tracer” on cardstock. The “tracer” should be an irregular polygon. Students will trace their polygon lightly with pencil onto ledger paper. Students will then move their “tracer” into different positions on the ledger paper, outlining the new position lightly in pencil each time. The polygons should overlap and each polygon may then be outlined in a different colour of crayon. Twenty polygons per collage are visually effective.

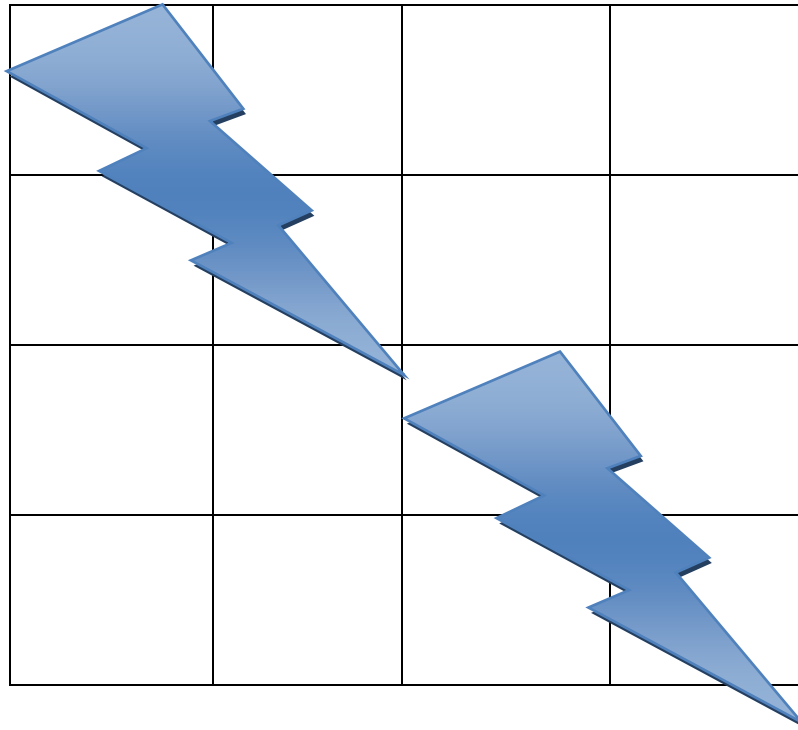






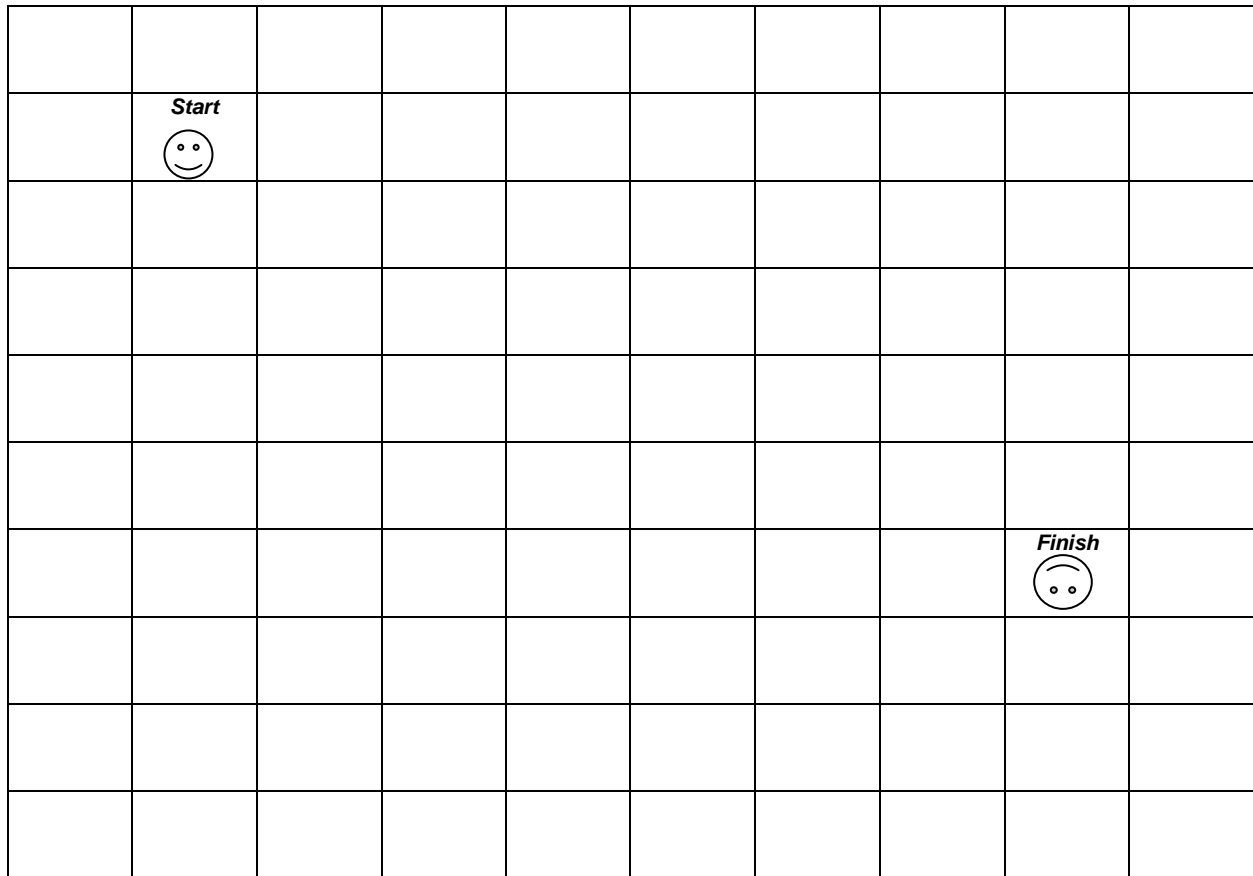






Task card for “Working On It”:

Tell three(3) different ways to move the “happy face” from “Start” to “Finish” on the grid. You may use transformations and movement-on-a-grid vocabulary.



Lesson 8

Math Strand: Data Management and Probability (graphing)

1. **Overall Expectation:** The students will collect and organize primary data and will display the data using graphs with appropriate labels.

2. **Specific Expectations:**

The students will display data in vertical/horizontal bar graphs and pictographs with appropriate titles and labels using many-to-one correspondence.

3. **Previous Knowledge and Skills Required:**

- skip counting by 2's, 5's, 10's
- understanding the meaning of the terms "horizontal", "vertical", "represent"
- using a ruler to mark equal intervals along an axis
- knowing that a symbol can be simple and arbitrary
- counting squares on grid paper

4. **Materials:**

"Getting started":

- one chart summarizing primary data per pair of students (attached)
- $\frac{1}{2}$ piece of large grid chart paper per student
- markers/pencils
- rulers

"Working On It":

- one chart summarizing primary data per pair of students (attached) with instructions
- $\frac{1}{2}$ piece of large grid chart paper per student
- markers/pencils
- rulers

5. **Initial Task-"Getting Started":**

In pairs, the students will review the primary data presented on the chart provided. Each student will generate his/her own graph which he/she will then share with his/her partner. The students will record the similarities between their graphs ("placemat" strategy). The whole class will reconvene to discuss each group's graphs. The teacher will guide discussion to summarize the different types of graphs (i.e.: horizontal bar graph, vertical bar graph, pictograph) and will list criteria of a complete "Grade 3 level" graph (i.e.: must have a title, labelled axes, a scale or key, many-to-one correspondence) on a chart.

6. **"Working On It":**

The teacher will review the data and the question with the class. The teacher will remind students that each pair of students must make two graphs (one pictograph and one bar graph). The teacher will specify for each pair of students as to whether they will be making vertical or horizontal bar graphs and pictographs. Pairs of students will exchange graphs and each pair of students will evaluate whether the graphs made by another pair of students meet the criteria

previously outlined for a “complete Grade 3 level graph”. The class will reconvene and discuss results.

7. Anticipated Student Responses:

- using one-to-one correspondence
- marking unequal intervals on scales
- producing graphs with missing parts
- producing correct graphs
- providing a scale versus a key on a pictograph
-

8. Reflect and Connect Focus Questions and Organizers (basis for students engaging in “accountable” talk as a whole class to review/ share their answers & summarize their learning):

- Which graphs are easier to read? Why?
- Which graphs are easier to make? Why?

9. What We Learned – Goals of the Lesson:

- We learned that complete graphs have labelled axes, titles, and scales or keys.
- We learned that scales can count in increments of greater than one.
- We learned that graphs can display data horizontally or vertically.
- We learned that different types of graphs and graphs with different scales can show the same data.

10. Related Literature/Media Resources:

Lemonade for Sale, written by Stuart Murphy (MathStart)

Tally O'Malley, written by Stuart Murphy (MathStart)

11. Games/Extra Practice/Problem of the Week Ideas:

- A. Students will create graphs using data provided by the teacher on an exit card (attached).
- B. Students will interpret graphs provided on an exit card (attached).

Task Card for “Getting Started:

Make graphs to show this data in 2 different ways:

Favourite Healthy Snacks of Grade 3 Students

<i>Type of Snack</i>	<i>Number of Students Who Chose This Snack</i>
<i>banana</i>	<i>10</i>
<i>apple</i>	<i>15</i>
<i>yoghurt</i>	<i>5</i>
<i>cheese</i>	<i>25</i>
<i>grapes</i>	<i>10</i>

Task Card for “Working On It”:

Make graphs to show this data in 2 different ways. Your group must make a bar graph and a pictograph. You must use a scale of greater than one.

Types of Pets in Grade 3 Students’ Homes

<i>Type of Pet</i>	<i>Number of Students Who Own This Type of Pet</i>
<i>cat</i>	<i>16</i>
<i>dog</i>	<i>12</i>
<i>hamster</i>	<i>15</i>
<i>bird</i>	<i>10</i>
<i>fish</i>	<i>2</i>
<i>reptile</i>	<i>5</i>

Exit Card #1:

Make graphs to show this data in different ways:

Favourite Pizza Toppings of Grade 3 Students

<i>Type of Topping</i>	<i>Number of Students Who Chose This Topping as Their #1 Favourite</i>
<i>pepperoni</i>	<i>6</i>
<i>mushrooms</i>	<i>12</i>
<i>sausage</i>	<i>14</i>
<i>green peppers</i>	<i>25</i>
<i>olives</i>	<i>10</i>
<i>onion</i>	<i>2</i>
<i>extra cheese</i>	<i>15</i>

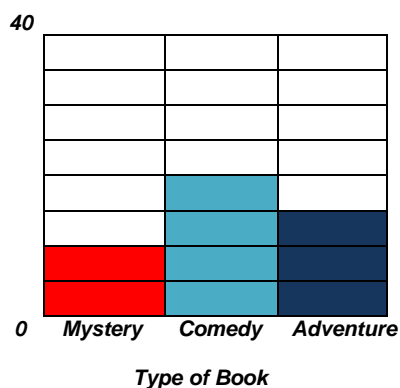
Exit Card #2:

Interpret these displays of data by answering the following questions:

1. Do the graphs show the same information? How do you know?

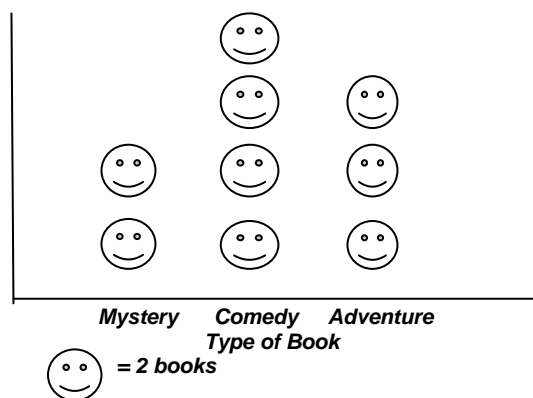
Graph One:

Kinds of Books Read in Grade 3



Graph Two:

Kinds of Books Read in Grade 3



2. Which graph matches the tally chart? How do you know? What is missing from the bar graph?

Types of Books Read	Number of Students Who Read This Type of Book
Mystery	10
Comedy	20
Adventure	15

3. Write a question about the data in each of the graphs.

Lesson 9

Math Strand: Data Management and Probability (graphing)

1. Overall Expectation: The students will read, describe and interpret primary data presented in charts and graphs.
2. Specific Expectations: The students will interpret and draw conclusions from data presented in charts, tables and graphs.
3. Previous Knowledge and Skills Required:
 - recalling that “altogether” means to find the sum
 - recalling that “how many more” means to find the difference
 - recalling that “describe”, “interpret” and “tell about” mean the same thing
 - understanding comparative words such as more, less, most, least, greatest, in order from...
 - recalling how to skip count by 2’s, 5’s and 10’s
 - identifying the differences between bar graphs and pictographs
 - recalling where to locate the scale on bar graphs and pictographs
4. Materials:

“Getting Started”:

- 2 copies each of sample horizontal bar graphs, vertical bar graphs, horizontal pictographs, vertical pictographs (attached)
- chart paper
- markers

“Working On It”:

- a different sample of a vertical pictograph (attached)
- a different sample of a horizontal bar graph (attached)
- chart paper
- markers

5. Initial Task – Getting Started:

Students will work in groups of 3 or 4. The teacher will divide the groups so that half of the groups rotates between one set of the four graphs, and the other half rotates between the other set of the same four graphs. The students will rotate to each sample graph and record at least one statement about the graph on the chart paper which is found with each graph (“carousel” strategy). Each group needs to think of and write about a different piece of information they gleaned from each graph they visit. All graphs will then be displayed. Once all the groups have gone to all the sample graphs, the teacher will lead a whole class discussion about simple statements that relate to only one aspect of the graph versus higher level statements that relate

data on the graph. The teacher will record on chart paper the question being answered by each student-generated statement for each graph.

6. “Working On It”:

The teacher will instruct the students to work in pairs to complete their responses to the following set of instructions on chart paper:

Working On It – Task Card

Pretend you are the teacher. Make up some questions about these graphs. What questions could you, the teacher, ask your students about these graphs? Make sure you ask questions using words like “How many more than...” or “How many less than...” or “How many ...altogether”. Make an answer bank for each of your questions.

Students should record their comparative questions on the chart paper.

7. Anticipated Student Responses:

- generating only simple questions involving one aspect of the graph
- generating higher level questions that compare more than one aspect of the graph
- asking questions that the graph could not answer
- generating statements telling about the graph rather than asking questions

8. Reflect and Connect Focus Questions and Organizers (basis for students engaging in “accountable” talk as a whole class to review/ share their answers & summarize their learning):

- How do you know if you are asking a higher level question?
- What was the most difficult part of this task?
- How could you teach the difference between simple and higher level questions to a friend?

9. What We Learned – Goals of Lesson:

- We learned the difference between simple and higher level questions that relate data from the graph.
- We learned that simple questions only tell about one aspect of the graph.
- We learned how to create questions that compare data when interpreting graphs.

10. Related Literature/ Media Resources:

The Best Vacation Ever, written by Stuart J. Murphy (MathStart)

Lemonade for Sale, written by Stuart J. Murphy (MathStart)

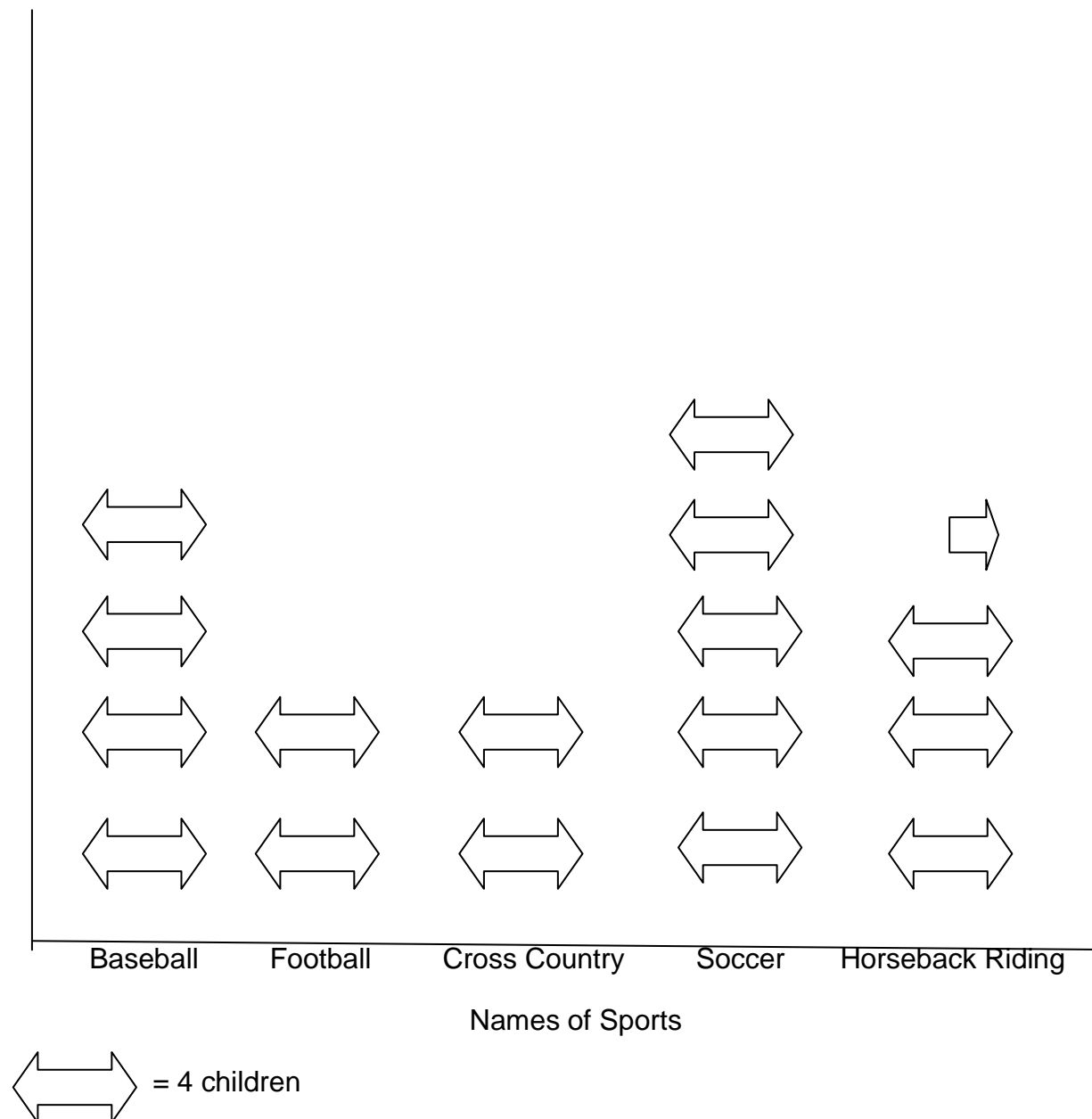
11. Games/ Extra Practice/ Problem of the Week Ideas:

Students should show their thinking while answering the following question which may be posed as an “exit card” (attached):

Graphs for “Getting Started”:

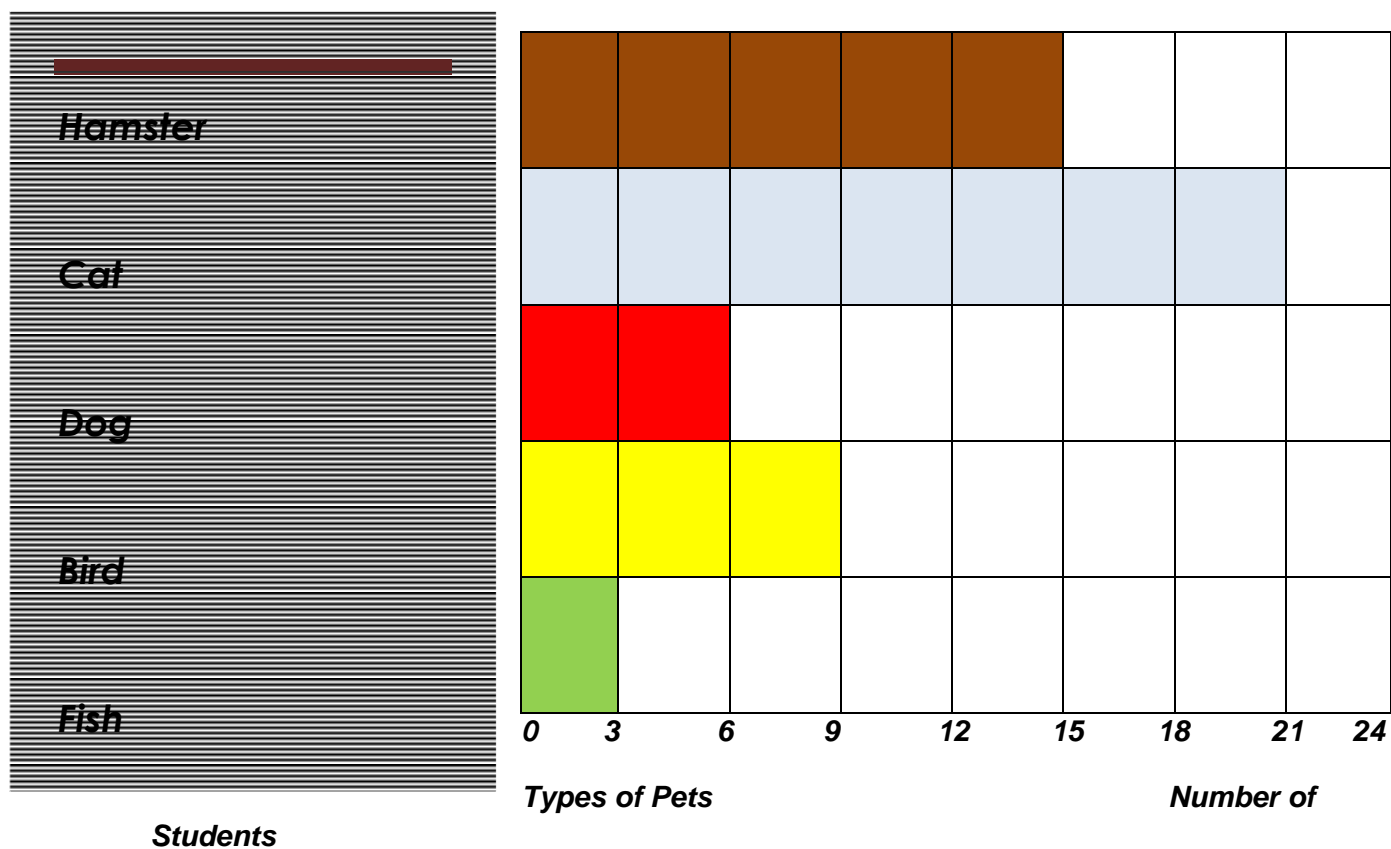
Graph One:

Favourite Sports



Graph Two:

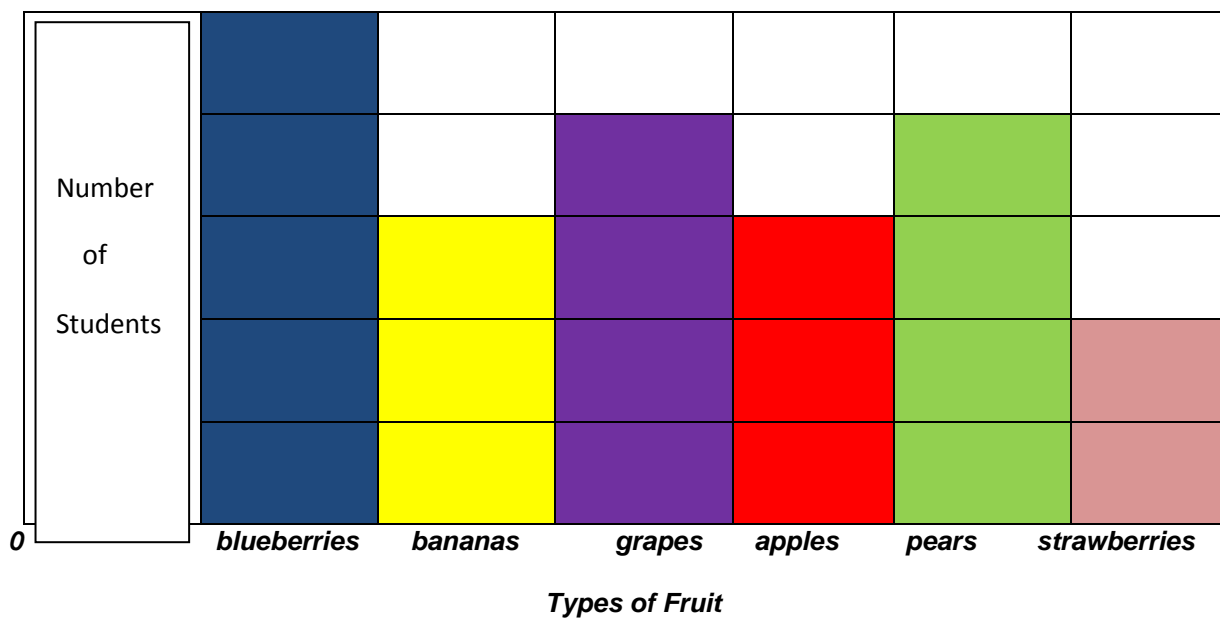
Favourite Pets



Graph Three:

Favourite Fruit

50



Graph Four:

Favourite School Subject

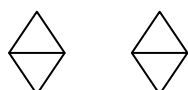
Art



Math



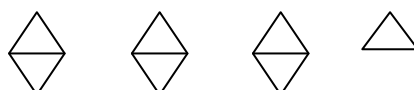
Science



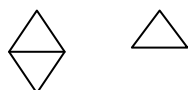
Gym



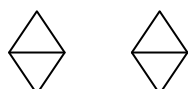
Reading




Writing



Music



School Subjects

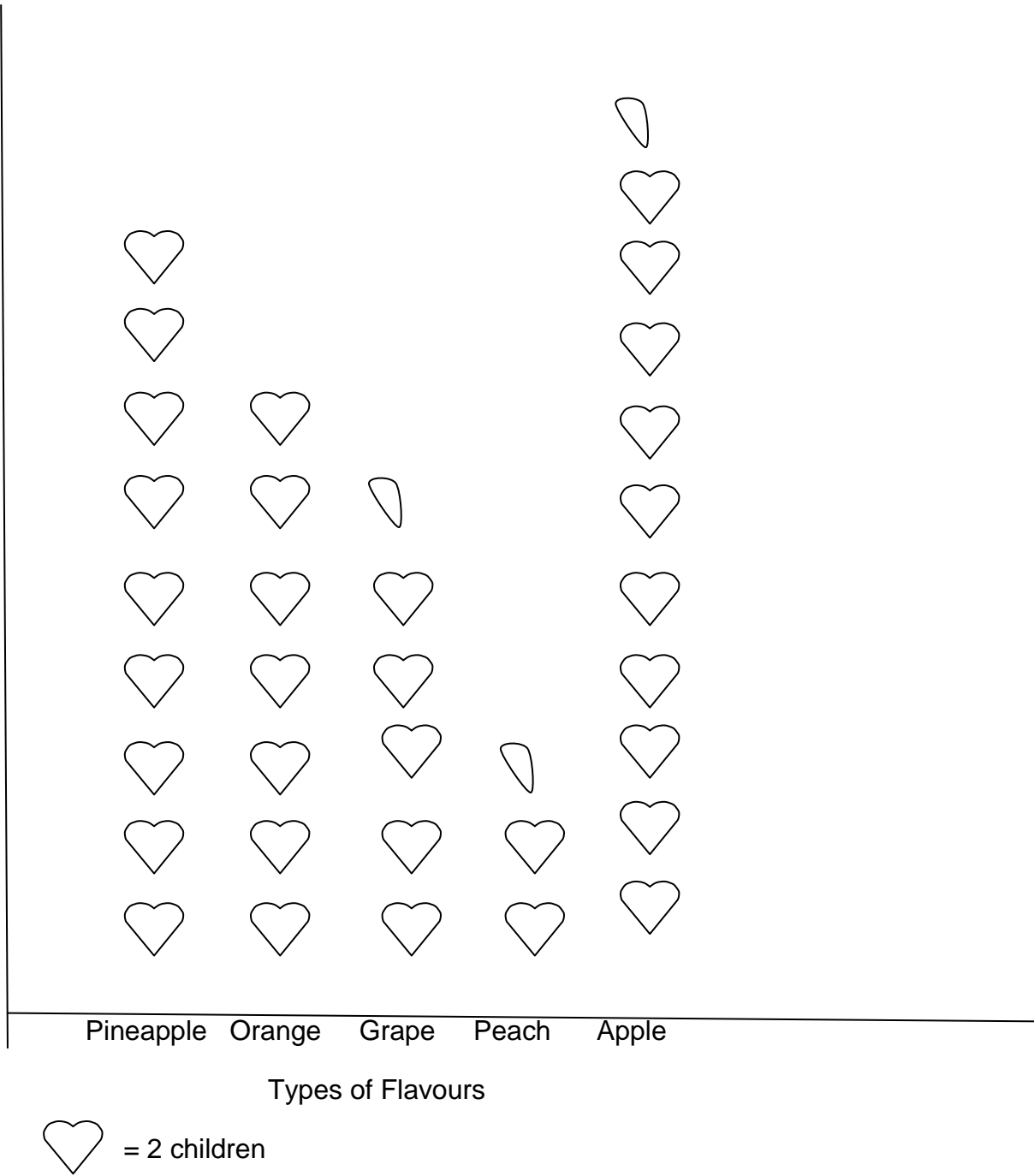
 = two children

Working On It – Task Card

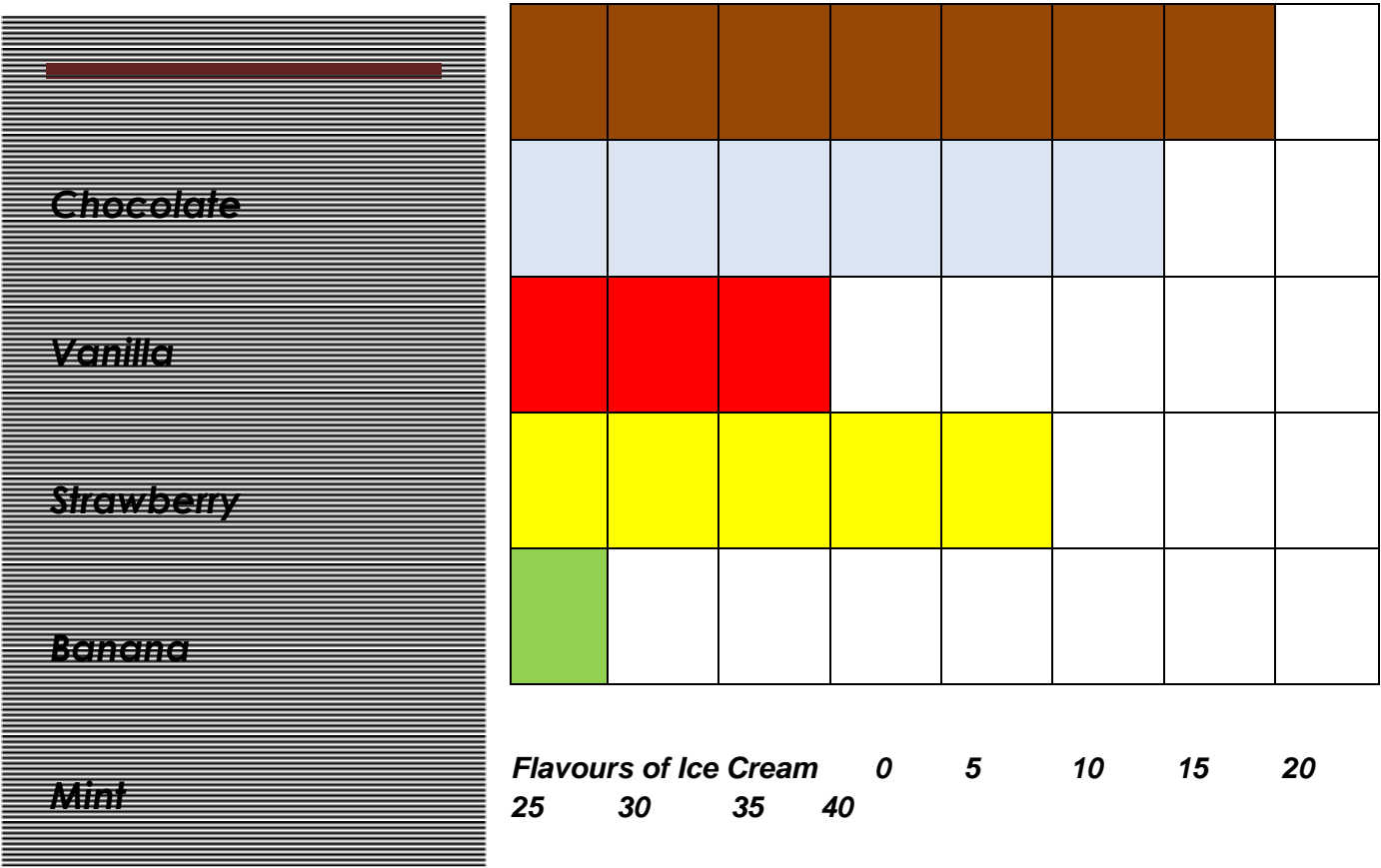
Pretend you are the teacher. Make up some questions about these graphs. What questions could you, the teacher, ask your students about these graphs? Make sure you ask questions using words like “How many more than...” or “How many less than...” or “How many ...altogether”. Make an answer bank for each of your questions.

Graphs for “Working On It”:

Graph One: Favourite Flavours of Juice



Graph Two: Favourite Ice Cream Flavours

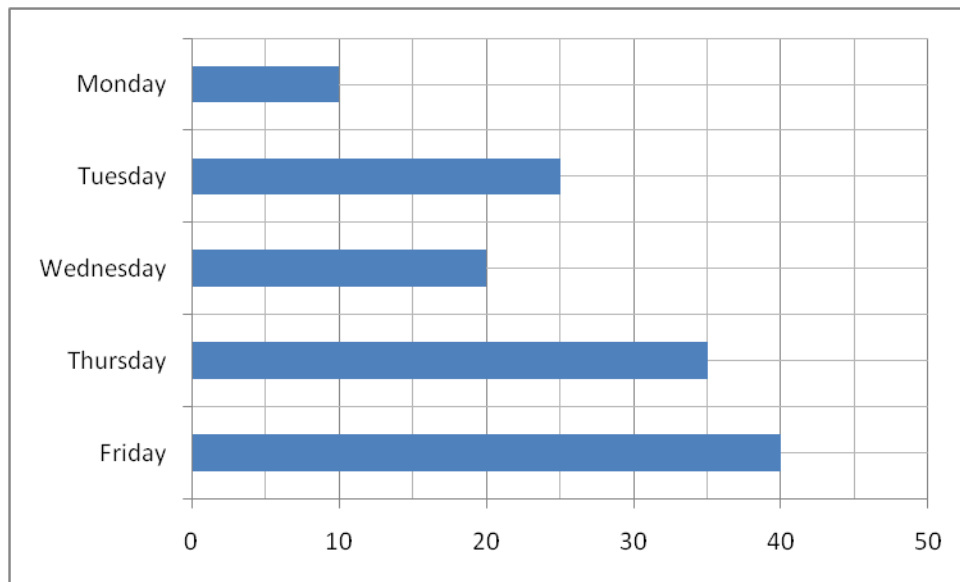


Exit Card

This graph shows how many frozen yogurt cups the Grade 3 class sold to raise money to help the food bank. The class hopes to sell at least 25 cups of frozen yoghurt each day.

Frozen Yoghurt Cups Sold

Days of
the week



Number of Cups

Answer the questions on the worksheet.

Exit Card worksheet:

Name: _____

1. On which day did the Grade 3 class sell the most cups?

2. On which day did they sell the least cups?

3. On what days did the children **not** sell what they hoped to sell?

4. On which day did they sell twice as many cups as Monday?

5. On which day did they sell half as many cups as on Friday?

6. How many frozen yoghurt cups were sold altogether?

7. Put the sales in order from the least number of yoghurt cups sold to the most number of yoghurt cups sold.

8. How many fewer cups were sold on Tuesday than on Wednesday?

9. How many more cups were sold on Friday than on Monday?

10. Write your own question about the graph. Answer your question.

Lesson 10

Math Strand: Data Management and Probability (Fairness in Games)

1. **Overall Expectations:** The students will predict and investigate the frequency of a specific outcome in a simple probability experiment.
2. **Specific Expectations:** The students will demonstrate, through investigation, an understanding of fairness in a game and relate this to the occurrence of equally likely outcomes.
3. **Previous Knowledge and Skills Required:**
 - recalling the meaning of odd and even numbers
 - using vocabulary of likely, equally likely, certain, impossible, possible and unlikely and telling how they relate to the idea of fairness of outcomes
 - understanding how to express probability as a ratio (1 in 2 chance)

4. **Materials:**

“Getting Started”:

- a set of number cards from 1 to 15
- a paper bag
- paper and a marker to keep score

“Working On It”:

- Game 1 – 15 yellow counters
 20 red counters
 a paper bag
 pencil and paper to record results
- Game 2 - a number cube
 pencil and paper to record results
- Game 3 - spinner (attached)
 pencil and paper clip as a spinner needle
 pencil and paper to record results

5. Initial Task – “Getting Started”:

The teacher will demonstrate this game to the class. The teacher will place a set of number cards labelled 1 through 15 into a paper bag. The class may be divided into two teams and will draw numbers from the bag. Team A gets a point if the number is even. Team B gets a point if the number is odd. After each draw, the number card is returned to the bag. The teacher will ask the class who they think will win the game and why. The teacher will record the results of the game in a tally chart. The first team to get to 10 points wins the game. The teacher will ask: Does each team have an equal chance of winning? How can we check?

6. “Working On It”:

The students will work in pairs. The teacher will distribute all the materials outlined for the 3 games described below. Students will play each game. On chart paper, the students will indicate if the game is fair or unfair. The students will also list any changes required to ensure fairness in each game. Charts will be shared with the class.

Working On It – Task Card

- 1. Are all these games fair?**
- 2. How do you know?**
- 3. What changes could you make to ensure that each game is fair?**

Game 1 – Red or Yellow?

Materials: 15 yellow counters
 20 red counters
 a paper bag
 pencil and paper to record results

How To Play:

1. Put the counters in the paper bag.
2. Take turns pulling a counter out, recording the colour, and returning it to the bag.
3. Player 1 gets a point if the counter is yellow. Player 2 gets a point if the counter is red.
4. The first player to score 10 points is the winner!

Game 2 – Roll the Cube

Materials: a number cube
 pencil and paper to record results

How To Play:

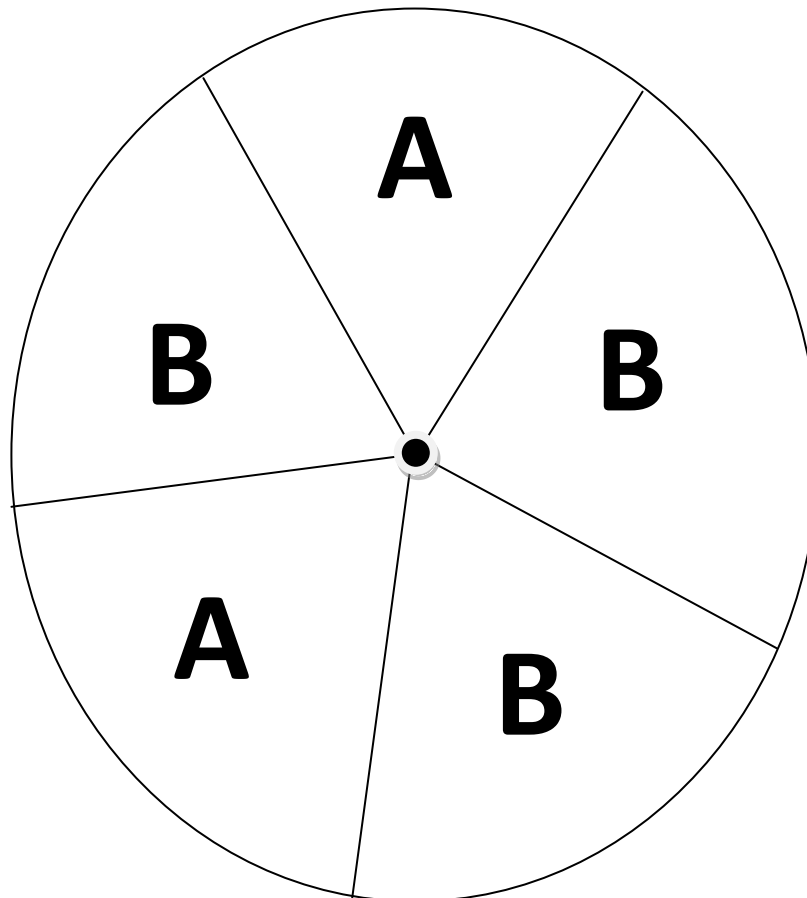
1. Take turns rolling the number cube.
2. Player A gets a point if the number rolled is odd. Player B gets a point if the number rolled is even. Record the results of each roll in a tally chart.
3. The first player to score 10 points is the winner!

Game 3 – Spinner Time

Materials: spinner
 pencil and paper clip as a spinner needle
 pencil and paper to record results

How To Play:

1. Take turns spinning the paper clip on the spinner board.
2. One player gets a point if the spinner lands on A. The other player gets a point if the spinner lands on B. Record the results of each spin in a tally chart.
3. The first player to score 10 is the winner!



7. Anticipated Student Responses:

- recording results inaccurately
- recording results accurately
- judging games that are unfair to be fair
- changing a fair game to be unfair
- successfully changing an unfair game to be a fair game

8. Reflect and Connect Focus Questions and Organizers (basis for students engaging in “accountable” talk as a whole class to review/ share their answers & summarize their learning):

- How did you decide if the games were fair or unfair?
- What changes would you make to games that are unfair?

9. What We Learned – Goals of Lesson:

- We learned that games are fair if all players have an equal chance of winning.
- We learned that if a game is fair then the probability of each outcome will be equal.

10. Related Literature/ Media Resources:

Probably Pistachio, written by Stuart J. Murphy (MathStart)

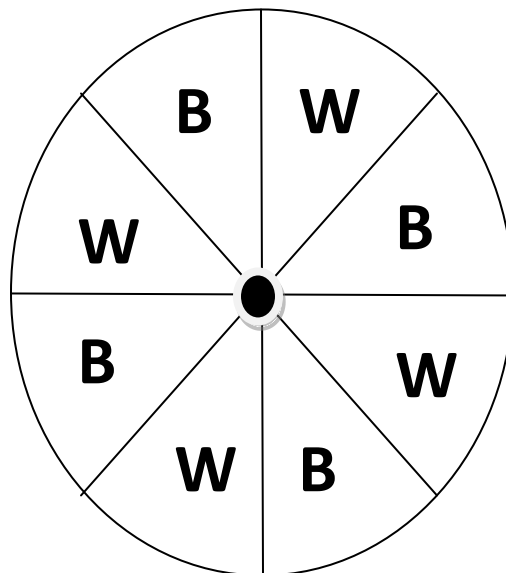
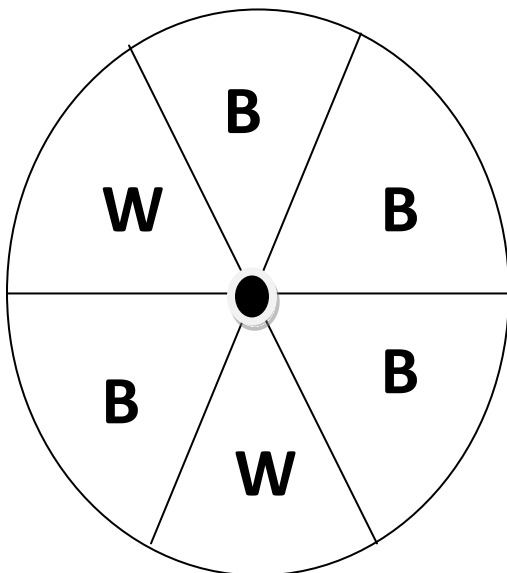
Bad Luck Brad, written by Gail Herman (Math Matters)

11. Games/ Extra Practice/ Problem of the Week Ideas:

Follow-up activity – in groups, the students can be given the opportunity to redesign the unfair games into fair games. Once the games have been made fair, they can be played with a classmate.

Exit Card:

Look at the spinners below. For each spinner, Player 1 gets a point if it lands on black and Player 2 gets a point if it lands on white. Which spinner would you choose to enjoy a fair game? Tell why.



Lesson 11

Math Strand: Patterning and Algebra (numeric and geometric patterns)

1. Overall Expectation: The students will describe, extend, and create a variety of numeric and geometric patterns.

2. Specific Expectations:

The students will extend repeating, growing, and shrinking patterns.

The students will represent simple geometric patterns using a number sequence, a number line, or a bar graph.

3. Previous Knowledge and Skills Required:

- knowing that patterns are repeated operations
- knowing that patterns can be growing or shrinking
- knowing that patterns can be represented on graphs, on number lines, or in input/output charts
- understanding the vocabulary “rows”, “frames”, “figures”
- knowing that patterns rules can include information about number, position, colour, and size

4. Materials:

“Getting started”:

- one “Getting Started” task card per group of two or three students (attached)
- chart paper
- markers

“Working On It”:

- one “Working On It” task card consisting of 3 “pattern starters” per group of three or four students (attached)
- markers/pencils
- number line (counting by 1’s to 75)
- graph chart paper
- t-chart (no headings) on ledger paper for use as an input/output chart
- 11” x 17” ledger paper (blank) for drawing extensions of patterns
- pattern blocks (15 blue rhombuses, 35 yellow hexagons, 35 orange squares)

5. Initial Task-“Getting Started”:

In pairs or groups of three, the students will identify and extend a linear geometric pattern by representing the pattern on chart paper. The students will share their work with the class. The students will identify different ways in which patterns were communicated. The teacher will summarize different ways of representing patterns by modelling use of input/output charts, number lines, and a bar graph on chart paper.

6. “Working On It”:

The teacher will review the question with the class. The teacher will remind students that each group of students must choose a different method for each pattern they are extending by which to communicate/represent the pattern rules. Students will compare their representations of each of the patterns with representations by other groups of the same patterns (“gallery walk” strategy). The teacher will post representations and will guide discussion summarizing the pattern extensions and the ways in which the patterns were communicated.

7. Anticipated Student Responses:

- patterns will be extended incorrectly/correctly
- patterns will be represented incorrectly/correctly

8. Reflect and Connect Focus Questions and Organizers (basis for students engaging in “accountable” talk as a whole class to review/ share their answers & summarize their learning):

- How did you determine how many pattern blocks were needed for each frame?
- How can we find the pattern rule on the table, on the number line, or on the chart?
- Can all of these representations be used to communicate both shrinking and growing patterns?
- Which representation do you like using the best? Why?

9. What We Learned – Goals of the Lesson:

- We learned that geometric patterns can be represented by numbers.
- We learned that chart, graphs, and number lines can be used for organizing and communicating patterns.
- We learned that both growing and shrinking patterns can be represented in a number of ways.

10. Related Literature/Media Resources:

N/A

11. Games/Extra Practice/Problem of the Week Ideas:

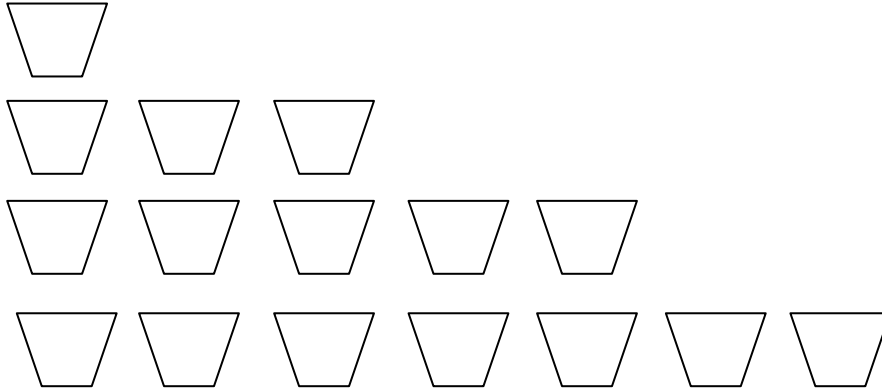
A. Students will create their own patterns with pattern blocks to show a growing or shrinking pattern rule (Exit card attached).

B. Students will create growing geometric patterns while playing a computer game @

http://teams.lacoe.edu/documentation/classrooms/linda/algebra/activities/pattern_grow/pattern_farm.html

Task Card for “Getting Started”:

Here are the first four rows of Olivia’s growing pattern:



On chart paper, add two more rows to Olivia’s pattern.

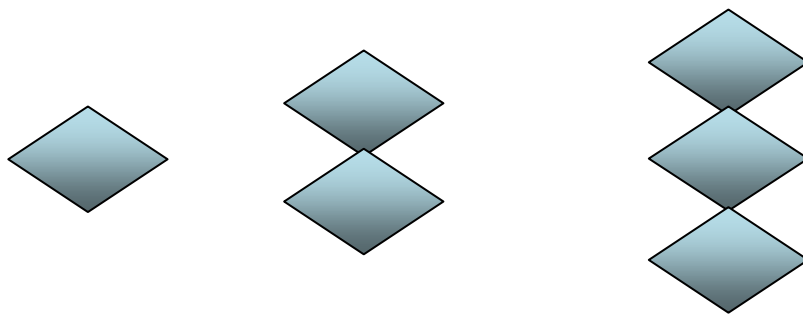
How many trapezoids will Olivia need altogether to complete all six rows of her pattern?

What is the pattern rule? How will you communicate this pattern to others?

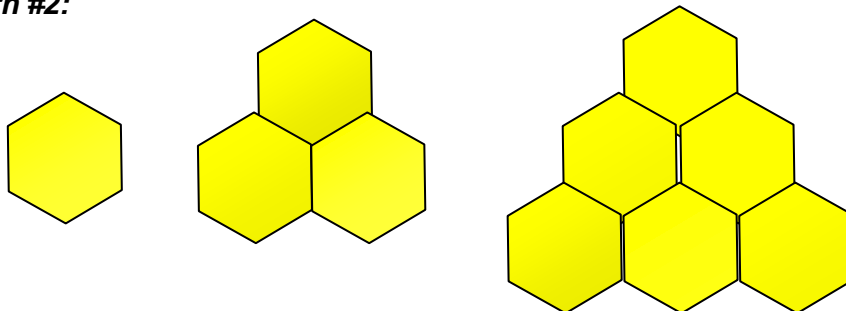
Task Card for “Working On It”:

Extend these patterns by using patterns blocks to add two more frames for each pattern. Draw all five frames of each pattern on ledger paper. Communicate about each pattern and the rule for each pattern, but make sure you communicate about each pattern in a different way.

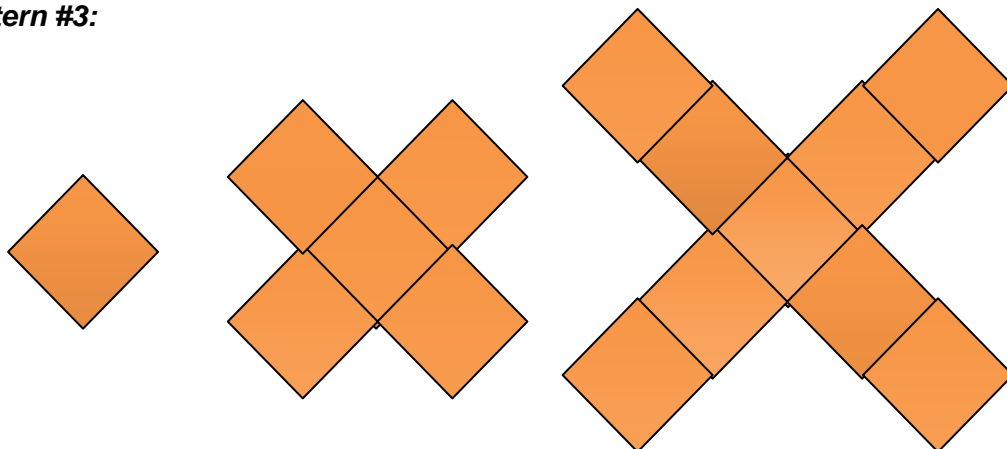
Pattern #1:



Pattern #2:



Pattern #3:



Exit Card:

Make your own patterns from pattern blocks to show growing or shrinking pattern rules. Your patterns must have at least five frames. Represent your patterns with an input/output chart, a number line, or a graph.

Lesson 12

Math Strand: Patterning and Algebra/Number Sense and Numeration (equality, rounding, and counting)

1. Overall Expectation: The students will demonstrate understanding of equality between pairs of expressions using addition and subtraction of one and two digit numbers.

2. Specific Expectations:

The students will identify and use the associative property of addition to facilitate computations with whole numbers.

The students will round two-digit numbers to the nearest ten in problems arising from real-life situations.

The students will count forwards by 1's and 10's from various starting points.

The students will use a variety of mental strategies to solve problems involving addition and subtraction.

3. Previous Knowledge and Skills Required:

- rounding numbers to the nearest ten
- counting by 10's from any starting point
- counting by 1's from any starting point
- knowing the meaning of the terms "addend", "sum"
- recalling the meaning of place value

4. Materials:

"Getting started":

- base ten blocks
- deck of 10 cards numbered "0" through "9"

"Working On It":

- one "Working On It" task card (attached)
- markers/pencils
- chart paper
- base ten blocks
- counters
- 10 frames
- place value mats
- number lines (to 100)
- hundreds charts
- clipboards with paper for "gallery walk" (one per group of three or four students)

5. Initial Task-“Getting Started”:

The teacher will invite four students to assist at the front of the room. Each of the four students will receive one of the nine one-digit cards from the deck. The four students will agree amongst themselves as to what two 2-digit numbers they would like to form with the four cards. The first pair of students will choose another student from the class to “be their number” and will sit down. The second pair of students will choose another student from the class to “be their number” and will also sit down. The student selected by the first pair of students will be the “starting point” in an addition problem. The second student selected will be the “addend being added” to the “starting point” number. The teacher will ask yet another student to hand the correct number of base ten blocks to the child who is the “starting point” to represent his/her number. Another student will be invited to hand the correct number of base ten blocks to the child who is the “second addend” to represent his/her number. The teacher will write the problem to this point on the board $\text{_____} + \text{_____} =$ (sum not yet known). The teacher will direct the child who is acting as the “second addend” to hand his/her tens rods to the “starting point” child one at a time while the class counts on from the starting point by 10’s each time a rod is handed over. Once the tens rods are exhausted, then the student who is acting as the second addend will hand over his/her ones units to the “starting point” child while the class counts on by ones until the ones units are exhausted. The teacher will invite a child to complete the addition sentence on the blackboard. The teacher will relate this strategy to the use of number lines and will remind students that this is only one available strategy for addition of 2-digit numbers. The class may discuss other suggestions for finding this sum.

6. “Working On It”:

The teacher will review the question with the class. The teacher will remind students that there are a variety of ways in which the sums of addends may be found. Students will work in groups of three or four to solve the addition problems by using a different method for each of the three questions on the task card. The teacher will post student work in preparation for a “gallery walk”. The groups will circulate through the various displays of student work and will record the methods for addition that they are observing. The class will reconvene and will identify and categorize the strategies which the teacher will record on a chart of available strategies for addition.

7. Anticipated Student Responses:

- sums will be determined by counting on by 1’s
- sums will be determined by splitting numbers
- sums will be determined by making leaps of ten
- sums will be determined by “finding ten”
- sums will be incorrectly determined
- sums will be determined by trading base ten blocks
- sums will be determined through traditional algorithm

8. Reflect and Connect Focus Questions and Organizers (basis for students engaging in “accountable” talk as a whole class to review/ share their answers & summarize their learning):

- Which method for finding the sums did you prefer? Why?
- What strategy did you learn about or try for the first time today?
- What was the most commonly used strategy?
- What was the least commonly used strategy?

9. What We Learned – Goals of the Lesson:

- We learned that counting on by 1's takes a really long time for larger numbers.
- We learned that counting by 10's, then by 1's, is an efficient strategy.
- We learned that strategies can be combined (i.e.: finding ten and splitting numbers, finding ten and counting on by 1's, etc...).
- We learned that splitting numbers means breaking them into their place value components (e.g.: $47 + 34 = 40 + 30 + 7 + 4$).
- We learned that finding ten means rounding up or down to the nearest ten and then increasing or decreasing the other addend by the amount that was moved to get to the nearest ten for the first addend (e.g.: $47 + 34 = \text{think } 50 + 31$, or $47 + 34 = \text{think } 50 + 30 + 1$).
- We learned that using a traditional algorithm means adding the ones first, and that we might have to regroup, and that we can represent this with base ten blocks.
- We learned that we can break up and add numbers in any order.

10. Related Literature/Media Resources:

N/A

11. Games/Extra Practice/Problem of the Week Ideas:

A. Students will practise while playing a “chipmunk game” on the computer from Math Strategies-Primary which is available for purchase from the Nectar Foundation at <https://www.nectar.ca/>

Task Card for “Working On It”:

Mr. Green’s class, Mrs. Brown’s class, and Mr. White’s class are all participating in a reading challenge. The principal is asking them to keep track of how many books they have read in two weeks. The class that reads the most books will have an extra recess!

Here are the number of books that each class read at the end of both the first week and the second week. Which class is the winner? How do you know? Use a different method for finding the total number of books for each class. Make sure you show your thinking.

<i>Week</i>	<i>Mr. Green</i>	<i>Mrs. Brown</i>	<i>Mr. White</i>
<i>1</i>	<i>46</i>	<i>57</i>	<i>55</i>
<i>2</i>	<i>38</i>	<i>24</i>	<i>38</i>