

# 20 MATH STORIES

Classroom-tested  
**LESSON PLANS**

+

Powerful  
**INSTRUCTIONAL STRATEGIES**



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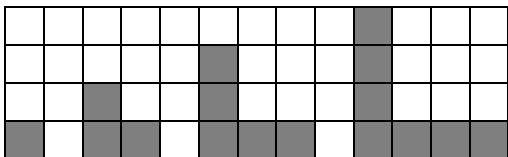
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# LESSON PLAN 1: Something Odd

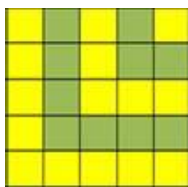
## IN BRIEF

The story *Something Odd* offers the following insights:

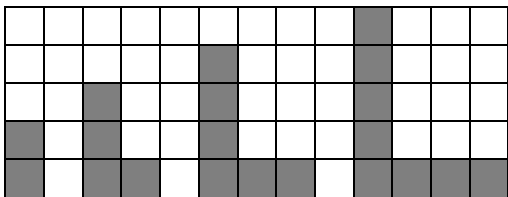
Odd numbers can be represented as a visual or concrete growing pattern.



Odd numbers fit together to form a square - they hide in squares!



If odd numbers hide in squares, where do even numbers hide?



## MATERIALS

- The story *Something Odd*
- Linking cubes (25 cubes in a plastic baggie, for each pair or group of students)
- Square grid chart paper and markers
- Activity Sheet 1 (attached)



## LESSON DEVELOPMENT, Grade 1-3

### Learning goals

#### Numbers

- Represent even and odd numbers concretely and visually

#### Patterning and Algebra

- Describe how the concrete/visual representations of patterns grow
- Extend patterns
- Predict the representations and numeric values of future stages

#### Communication

- Use words, numbers, symbols, diagrams, and storytelling to communicate learning

### Reading of *Something Odd*

#### Introduction

Write the numbers 1, 3, 5 and 7 on the board. Ask students to continue the patterns. Ask students what these numbers are called (odd numbers).

Tell class that the story you will read involves the Wolf and the Three Little Pigs. Ask for volunteers to retell the gist of “The Three Little Pigs”.

#### Reading

Students sit on the carpet or at their desks, in pairs, with a set of 25 cubes in a plastic baggie. The 25 linking cubes will be used to model the 5x5 chocolate bar in the story.

Read the story *Something Odd*, showing the class the pages as they are read. Pause at the end of page 5 and have students work in pairs to construct the 5x5 array of linking cubes.

Hold up a 5x5 array of linking cubes and ask, “What is a good estimate of how many linking cubes make up the 5 by 5 “chocolate bar”? After some students volunteer answers, ask, “How can we find out the exact number of linking cubes?”

Suggest the method of counting the linking cubes individually. Count slowly, “1, 2, 3, 4 ...” and stop at the number 10. Then say, “Could someone suggest a different method of counting, which would be faster than my method?”

Some students may suggest counting by 2s or by 5s. For the 5s method, ask the class to count along as you point to each row in the 5x5 square: “5, 10, 15, 20, 25.” Repeat the process by pointing to each column: “5, 10, 15, 20, 25.” Draw a 5x5 chocolate bar on the board or on chart paper and write: “5 rows of 5 make 25” and “5 columns of 5 make 25”. Also add, “There is a shorter mathematical way of writing this:  $5 \times 5 = 25$ ”.

Continue reading the story and have students follow along by using their linking cubes to construct the pieces of chocolate they break off each time as the Little Pig takes a piece. At the end of page 8, ask, “What might be the next piece the Little Pig breaks off?”

At the end of page 11, ask, “What does the First Little Pig mean when he says, ‘There are odd numbers hiding in squares?’”



After students volunteer explanations, draw a 5x5 grid and shade in the odd numbers using two different colours, so that they are easily identified. Then ask:

How many odd numbers are hiding in a 5 by 5 square? In a 4 by 4 square? In a 3 by 3 square? In a 2 by 2 square? In a 1 by 1 square? In a 6 by 6 square? In a 7 by 7 square? In a 10 by 10 square? In a 100 by 100 square? In a 1000 by 1000 square?



At the end of page 13, hold up a 4x4 array of linking cubes and ask, “What is a good estimate of how many linking cubes make up the 4 by 4 “chocolate bar”?” After some students volunteer answers, ask, “How can we find out the exact number of linking cubes?”

Some students may suggest counting by 2s. Ask the class to count along as you point to each pair of linking cubes in the 4x4 square: “2, 4, 6, 8, 10, 12, 14, 16.”

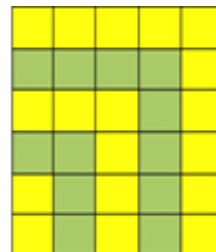
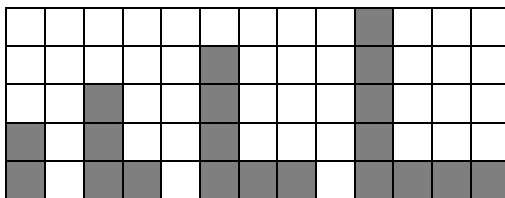
Some students may suggest counting by 4s. Ask the class to count along as you point to each row in the 4x4 square: “4, 8, 12, 16.” Repeat the process by pointing to each column: “4, 8, 12, 16.” Draw a 4x4 chocolate bar on the board or on chart paper and write: “4 rows of 4 make 16”, and “4 columns of 4 make 16”, and “ $4 \times 4 = 16$ ”.

Finish reading the story and ask students to share what they learned.

## Student activity

### Exploring where even numbers hide

Students work in pairs or small groups to determine “Where do even numbers hide?” They use linking cubes to model even numbers. They also use square grid chart paper and markers to record images of the even numbers and to show where they “hide”.



### Communicating their learning

Students summarize their learning following teacher prompts such as: “What did you learn? What surprised you? How did you feel?” Students use chart paper and colourful markers, and they communicate their ideas using words, symbols, diagrams and pictures. They share their learning with their peers, in a whole-class setting.

*Skits option.* Students create short skits using the prompt “What did you do in math today?” that could be shared at home, in a way that would elicit mathematical surprise and insight.

*Song option.* Using selected phrases that students write, both on their chart paper to summarize their learning and for their skits, create 3-4 stanzas to form a song that summarizes key ideas and celebrates student thinking. The lyrics could be put to music using the melody from “Row, Row Your Boat”, or other popular songs.

*Sharing with an older class option.* The grades 1-3 students visit a grades 6-8 class, where they share their learning and possibly perform some of their skits and their song. The grades 6-8 students explore these ideas at their level of complexity and sophistication (see lesson plan on next page).

## LESSON DEVELOPMENT, Grades 6-8

### Learning goals

#### Algebra

- Use algebraic expressions to represent the sum of consecutive odd numbers [ $N^2$ ], even numbers [ $N^2+N$  or  $N(N+1)$ ], and natural numbers [ $N(N+1)/2$ ]
- Use algebraic expressions to represent odd numbers [ $2N-1$ ], even numbers [ $2N$ ], and natural numbers [ $N$ ]
- Use concrete and visual representations of sums of odd, even and natural numbers as visual “proofs” of the algebraic expressions developed

#### Communication

- Use words, symbols, diagrams, and storytelling/drama to communicate learning

### Reading of *Something Odd*

#### Introduction

The grades 1-3 students (see pages 2-3) visit the grades 6-8 class and read the story, *Something Odd*. They share their findings about “where even numbers hide” and possibly perform their skits and song.

### Grades 6-8 student activity

#### Exploring concrete, pictorial and algebraic representations

Students work in small groups to complete the following using Activity Sheet 1 (attached):

- Determine the 10<sup>th</sup>, 100<sup>th</sup>, and n<sup>th</sup> term of each set of numbers
  - Odd numbers: 19, 199,  $2n-1$
  - Even numbers: 20, 200,  $2n$
  - Natural numbers: 10, 100,  $n$
- Find the sum of the first 10, 100 and  $n$  numbers in each set
  - Odd numbers:  $10 \times 10$ ,  $100 \times 100$ ,  $n \times n$  or  $n^2$
  - Even numbers:  $10 \times 11$ ,  $100 \times 101$ ,  $n(n+1)$
  - Natural numbers:  $10 \times 11/2$ ,  $100 \times 101/2$ ,  $n(n+1)/2$

Scaffold student thinking to determine the sum of the first  $n$  natural numbers. The picture on the right shows how 2 copies of concrete representations of the natural numbers 1-5 can be used to create a  $5 \times 6$  rectangle, which also represents the sum of the first 5 even numbers.



#### Communicating their learning

Students use chart paper and colourful markers to communicate their ideas using words, symbols, diagrams and pictures. They also create short skits that could be shared at home.

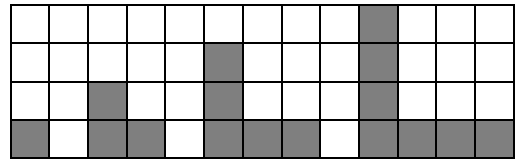
*Song option.* Using selected phrases that students write on their chart paper to summarize their learning and for their skits, have students create 3-4 stanzas to form a song that summarizes key ideas and celebrates student thinking. The lyrics could be put to music using the melody from a popular song.

*Sharing with a younger class option.* The grades 6-8 students visit the grades 1-3 class, where they share their learning and possibly their song.

## ACTIVITY SHEET 1. Something Odd

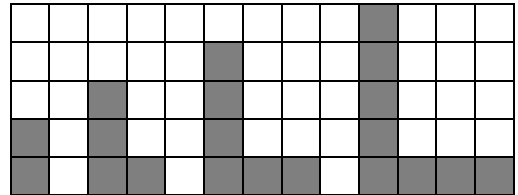
1. Find each of the following.

- the 10<sup>th</sup> odd number
- the 100<sup>th</sup> odd number
- an expression for the n<sup>th</sup> odd number



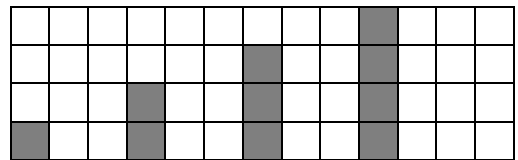
2. Find each of the following.

- the 10<sup>th</sup> even number
- the 100<sup>th</sup> even number
- an expression for the n<sup>th</sup> even number



3. Find each of the following.

- the 10<sup>th</sup> natural number
- the 100<sup>th</sup> natural number
- an expression for the n<sup>th</sup> natural number



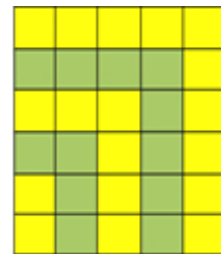
4. Find each of the following. Use the image on the right as a hint.

- the sum of the first 10 odd numbers
- the sum of the first 100 odd numbers
- an expression for the sum of the first n odd numbers



5. Find each of the following. Use the image on the right as a hint.

- the sum of the first 10 even numbers
- the sum of the first 100 even numbers
- an expression for the sum of the first n even numbers



6. Find each of the following. Use the image on the right as a hint.

- the sum of the first 10 natural numbers
- the sum of the first 100 natural numbers
- an expression for the sum of the first n natural numbers



## INSTRUCTIONAL STRATEGIES - BEFORE THE STORY

### CONCEPT ATTAINMENT

Add to the table from the data set

YES	NO
5	14
13	2
9	6
—	—
—	—
—	—

DATA SET: 15, 8, 10, 12, 7, 11, 20, 17

PATTERN RULE: \_\_\_\_\_

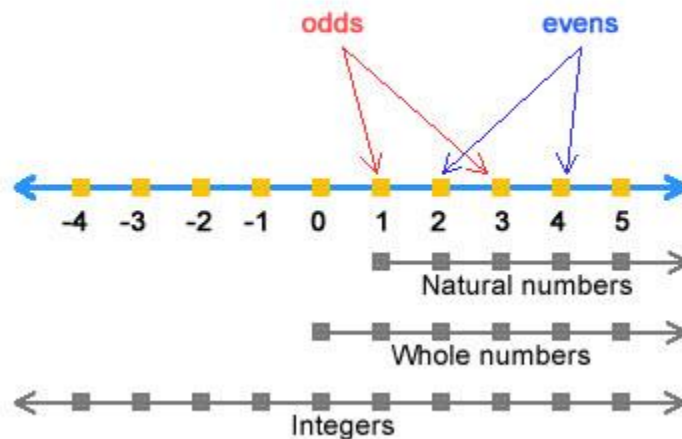
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### HOW TO PLAY

- When a guess is made, say "correct" or "incorrect" and place the number in the appropriate column
  - Do not discuss or reveal the pattern rule until the Yes column is complete

### ADVANCE ORGANIZER

SETS OF NUMBERS



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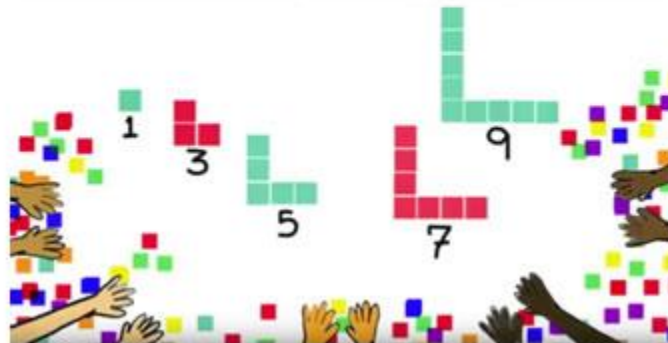


## INSTRUCTIONAL STRATEGIES - DURING THE STORY

### TACTILE

#### YOU CAN TOUCH NUMBERS!

Use linking blocks to make odd numbers you can touch. Slide them together, to fit like spoons, to make a square. What shape do even numbers make?



### ACT IT OUT

#### CHORAL READING

Have different groups read for the different characters in the story. You also need a narrator for the parts not in quotation marks. Choral readings are fun!

#### PREDICT & PERFORM

Pause reading the story. Work in pairs or small groups to predict what might happen next. Then perform it for your class.



# THINK-PAIR-SHARE

## BRAINSTORM & SHARE

Think: what is the key math idea or math event in the story? Share and discuss with your partner.

Share with the class.



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# LEARN A LANGUAGE

## COMPARE & CONTRAST

**English:** "There are odd numbers hiding in squares?" he said, half surprised, half curious, half excited, and a little bit scared.



**Français:** « Il y a des nombres impairs qui se cachent dans les carrés ? », a-t-il dit, tout en étant moitié surpris, moitié curieux, moitié impatient, et en ayant un peu peur.

**Español:** "¿Hay números impares que se esconden en los cuadrados?" Él dijo, medio sorprendido, medio curioso, medio emocionado y un poco asustado.


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# INSTRUCTIONAL STRATEGIES - AFTER THE STORY

## ACADEMIC CONTROVERSY

### SEE IT FROM OPPOSING SIDES


In pairs or small groups, pick a controversy, then brainstorm how opposing sides might portray it:

-- Is zero odd or even? 

-- Odds are taking evens to court for calling them "odd" - they want to be called "un-even"



-- Can negative numbers be odd or even?

-- Can you have -2 friends? 

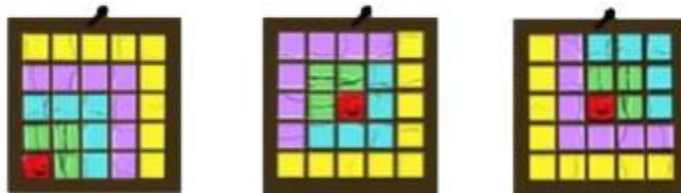
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## VISUAL

### MAKE MATH ART!

Take a 5 by 5 grid and use different colours to shade the first 5 odd numbers to fit inside.

Orient them different ways.



Now try it with even numbers.

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## CONCEPT FORMATION

### DATA SET

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30

### TASK

- Fill in numbers that belong to the 3 labelled groups
- Create and label 3 more groups

<b>EVEN</b> 2, 4 ...	<b>PRIME</b> 2, 3 ...	<b>MULTIPLE OF 5</b>
_____	_____	_____

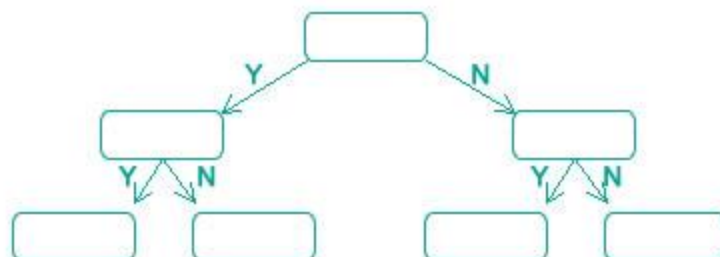
## INQUIRY TRAINING

### DATA SET

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30

### TASK

- I'm thinking of a number from the data set
- Which number am I thinking of?
- You may ask questions that have Yes or No answers
- You can't ask the same question twice
- Plan your first 3 questions



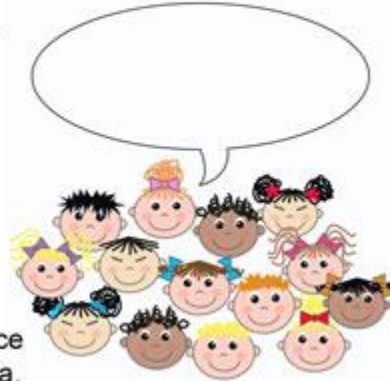
# WHAT WE KNOW TOGETHER

## OUR COLLECTIVE KNOWLEDGE

Work in pairs or small groups to summarize your learning on chart paper, using words, symbols, diagrams etc.

Share in a gallery walk.

Back in your pairs/groups, create a song, a skit, a poster or other performance to share your favourite idea.



## INSTRUCTIONAL STRATEGIES - CODING

### CODE YOURSELF

Follow the algorithm below to “code” yourself.

```
number = 1
repeat 5 times
  say number
  hop number times
  increase number by 2
```



Create an algorithm that “codes” you to say and to hop even numbers.

What else is possible?

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### EXPLORE A SIMULATION

Where do numbers hide?

Sum =  $5 \times 5$   
= 25

Explore this Scratch simulation at the link below.

<https://scratch.mit.edu/projects/71969822/#player>

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## MODEL IT WITH PYTHON

### PRINT ODD NUMBERS

Go to [cscircles.cemc.uwaterloo.ca/console](http://cscircles.cemc.uwaterloo.ca/console), enter this Python code, then click on Run Program to get the output on the right.

```
1 stage = 1
2 while stage <= 10:
3     print (2 * stage - 1)
4     stage = stage + 1
```

How could you change the code to print even numbers? Multiples of 3?

1  
3  
5  
7  
9  
11  
13  
15  
17  
19

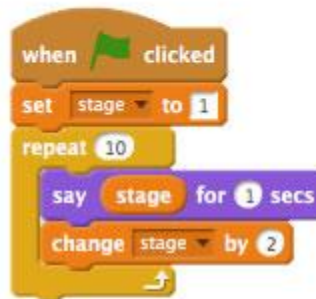
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Here's the Python link: [cscircles.cemc.uwaterloo.ca/console](http://cscircles.cemc.uwaterloo.ca/console)

## MODEL IT WITH SCRATCH

### PRINT ODD NUMBERS

Go to [scratch.mit.edu](http://scratch.mit.edu), click on Create, make a variable called **stage**, then build the code on the right to get the Cat to say the first 10 odd numbers.



How could you change the code to get even numbers? Multiples of 3?



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Here's the Scratch link: [scratch.mit.edu/projects/editor](http://scratch.mit.edu/projects/editor)

# INSTRUCTIONAL STRATEGIES - HOME CONNECTION

## SURPRISE ME!

### WHAT DID YOU DO IN MATH TODAY?

Your family and friends might ask: "What did you do in math today?"

- Share with them the surprise that odd numbers "hide" in squares.
- Ask them: "Where do even numbers hide?"



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### BACK AT SCHOOL

- Share your experience

## SHARE A MATH STORY

Read or retell the story "Something odd" to family and friends. Ask them to share what they learned and what they felt.



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### BACK AT SCHOOL

- Share your experience