

# *Discovering Math: Understanding Numbers*

## Teacher's Guide

**Grade Level:** K-2

**Curriculum Focus:** Mathematics

**Lesson Duration:** Three class periods

### **Program Description**

*Discovering Math: Understanding Numbers* – From written numerals to equal parts to cardinal and ordinal numbers, introduce young students to the basic properties and concepts of numbers.

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### **Lesson Plan**

#### *Student Objectives*

- Understand that numerals are symbols that represent quantities or attributes of real-world objects.
- Count cardinal and ordinal whole numbers.
- Understand symbolic, concrete, and pictorial representations of numbers.
- Understand basic whole number relationships that use  $<$ ,  $=$ , and  $>$ .
- Understand the concept of a unit and its subdivision into equal parts.

#### *Materials*

- *Discovering Math: Understanding Numbers* video
- Beans
- Pennies
- Centimeter cubes
- Paper clips
- Ruler
- Pencils
- Straws

- Chalk
- Stopwatch
- Charts 1-5 and documents Dot Flash Cards, Number and Order of Objects, Number Cards, and Number Line (see below)

## Procedures

The video covers many concepts, and each activity corresponds to a section. Choose lesson activities based on class make-up and student needs.

1. Students count and record the number of objects in a chart. Give each group of students a bag with several objects inside (beans, pennies, centimeter cubes, paper clips, and any other objects available to count). Have students count the total number of each object and record the number in Chart 1. Students can discuss and compare the numbers within their group. Emphasize the importance and use of numbers in counting.
2. Students measure the length of objects using a ruler. Give each student a ruler and each group of students a bag of objects to be measured (pencil, straw, block, piece of chalk, or other objects in the classroom). Model how to use the ruler by lining up the end of the object to be measured with the end of the ruler. Identify the length to the nearest inch. Have students measure the length of each object in the bag and record measurements in Chart 2. If time allows, students can measure other objects in their desk or around the room. Students can discuss and compare the measurements within their group. Emphasize the importance and use of numbers in measuring.
3. Students use a stopwatch to time how long activities take to complete. Pair the students and give each pair a stopwatch. Explain and model how to use the stopwatch. Give each pair a copy of Chart 3. Explain that students will find out how long it takes to perform tasks (sharpen a pencil, write their name, walk around the room, draw a picture, etc.). Have the students work together to time how long it takes to complete the tasks. Students should record the times in Chart 3. Students can discuss and compare times with other pairs. Emphasize the importance and use of numbers to measure time.
4. Display the terms "cardinal number" and "ordinal number." Explain to students that cardinal numbers are used when counting objects: one, two, three, four, etc. Ordinal numbers describe the order of objects: first, second, third, fourth, etc. Hand out copies of Number and Order of Objects and Chart 4. Model how to count the number of stars (★) and identify their place in line. Record information in Chart 4. Students can work in pairs or individually to complete the activity. If time allows students can create their own drawings with objects to be counted and assigned ordinal numbers. Emphasize the importance of cardinal numbers to count objects and ordinal numbers to identify position of objects.
5. Explain to students that numbers can be represented in many ways. Draw three dots on the board and write the number 3 next to the dots. Discuss how the three dots represent the number 3. Give each student a pack of dot flash cards (teachers will have to pre-cut the cards). Students can work in pairs to complete this activity. Students will count the number of dots on each flash card and write the number on the card. Students will then order the numbers from 1 to 10. If

students are able they can order the cards from 10 to 1. Tell the students that they will place the numbers on a number line. Explain that a number line is used to show the places of numbers. Give the students a copy of the blank number line. Have the students write the numbers 1–10 on the number line. Students can discuss and compare the numbers on the number line using words like greater than and less than.

6. Display the numbers 21 and 45. Compare the numbers using the terms less than and greater than. Introduce, explain, and model the  $<$ ,  $=$ , and  $>$  symbols. Give each student a numbered card (the numbers used should be based on students' ability levels). Have students walk around the room and introduced themselves to others by number ("Hi, I'm 25."). The students should write their number and compare it with the other students' numbers using the  $<$ ,  $=$ , and  $>$  symbols.

A variation of this activity is for students who need practice counting. Give each student a bag of beans. Have them count the beans and write the number. Then proceed with students "meeting" each other and comparing numbers.

7. Call four students to the front of the room, and ask the class how the four could be separated into two equal groups.

Additional situations:

Give another situation where half of eight cookies must be given to a friend. Have students brainstorm solutions and share with the class. Have them work in small groups according to ability.

Give each team a bag of beans (48 beans for a challenging activity, 24 for an average activity, and 12 for a beginning activity). Tell students to divide the beans into two equal groups (halves), then put the beans back together and divide into three equal groups (thirds), then put the beans back together and divide them into four equal groups (quarters or fourths), finally put the beans back together and divide into six equal groups (sixths). Students should record how many beans are in each group in Chart 5 (Equal Groups of Beans). Have students share their strategies for dividing the group into equal parts.

8. Discuss real-life situations of dividing a whole into parts.

## Assessment

Use the following three-point rubric to evaluate students' work for each activity during the lesson.

- **3 points:** Students produced complete charts including all the requested information; clearly demonstrated the ability to count objects, measure length and time, identify number of objects and position of object using cardinal and ordinal numbers, interpret numbers represented by dots, place numbers on a number line, compare numbers, and divide a whole group into equal parts; and clearly demonstrated an understanding of number theory.

- **2 points:** Students produced adequate charts including most of the requested information; satisfactorily demonstrated the ability to count objects, measure length and time, identify number of objects and position of object using cardinal and ordinal numbers, interpret numbers represented by dots, place numbers on a number line, compare numbers, and divide a whole group into equal parts; and demonstrated a satisfactory understanding of number theory.
- **1 point:** Students produced incomplete charts with little or none of the requested information; were not able to count objects, measure length and time, identify number of objects and position of object using cardinal and ordinal numbers, interpret numbers represented by dots, place numbers on a number line, compare numbers, and divide a whole group into equal parts; and did not clearly demonstrate the an understanding of number theory.

## Vocabulary

### **cardinal number**

*Definition:* A number that expresses an amount, as one, two, three, etc.

*Context:* Students use cardinal numbers such as one, two, and three to represent the number of objects counted.

### **compare**

*Definition:* To identify the differences and similarities between two numbers to determine the greater and lesser of the two numbers

*Context:* Students compare two numbers to determine which is greater than the other.

### **count**

*Definition:* To determine the number of objects in a group

*Context:* Students count the number of beans in a bag by taking them out one by one.

### **number line**

*Definition:* A line on which every point represents a real number, usually increasing in value from left to right

*Context:* The students place the numbers 1-10 on a number line to show their position and value.

### **ordinal number**

*Definition:* A number that expresses degree, quality, or position in a series, as first, second, third, etc.

*Context:* Students use ordinal numbers such as first, second, and third to identify an object's position in line.

## Academic Standards

### Mid-continent Research for Education and Learning (McREL)

McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education addresses 14 content areas. To view the standards and benchmarks, visit

<http://www.mcrel.org/compendium/browse.asp>.

This lesson plan addresses the following benchmarks:

- Mathematics: Understands and applies basic advanced properties of the concepts of numbers.

### National Council of Teachers of Mathematics (NCTM)

The National Council of Teachers of Mathematics (NCTM) has developed national standards to provide guidelines for teaching mathematics. To view the standards online, go to

<http://standards.nctm.org>.

This lesson plan addresses the following standards:

- Develop understanding of the relative position and magnitude of whole numbers and of ordinal and cardinal numbers and their connections.
  - Connect number words and numerals to the quantities they represent, using various physical models and representations.
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## Support Materials

Develop custom worksheets, educational puzzles, online quizzes, and more with the free teaching tools offered on the Discoveryschool.com Web site. Create and print support materials, or save them to a Custom Classroom account for future use. To learn more, visit

- <http://school.discovery.com/teachingtools/teachingtools.html>
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## DVD Content

This program is available in an interactive DVD format. The following information and activities are specific to the DVD version.

### How to Use the DVD

The DVD starting screen has the following options:



**Play Video**— This plays the video from start to finish. There are no programmed stops, except by using a remote control. With a computer, depending on the particular software player, a pause button is included with the other video controls.

**Video Index**— Here the video is divided into chapters indicated by title. Each chapter is then divided into four sections indicated by video thumbnail icons; brief descriptions are noted for each section. To play a particular segment, press Enter on the remote for TV playback; on a computer, click once to highlight a thumbnail and read the accompanying text description and click again to start the video.

**Quiz**— Each chapter has four interactive quiz questions correlated to each of the chapter's four sections.

**Standards Link**— Selecting this option displays a single screen that lists the national academic standards the video addresses.

**Teacher Resources**— This screen gives the technical support number and Web site address.

## Video Index

### I. Numbers Representing Amount (5 min.)

#### **Representing Amounts: Introduction**

Numbers represent amounts of objects from African animals to jets in formation.

#### **Example 1: Numbers of Objects**

Numbers are associated with the number of animals in a group. If you know how many, you can figure out if you see all of them, or if some are missing.

#### **Example 2: Numbers for Length**

A number can represent a length. A carpenter can cut a board the right length using a measurement, a number associated with the length.

#### **Example 3: Numbers for Time**

Numbers are associated with how much time activities take, such as running a distance, swimming, or baking bread.

### II. Counting Whole Numbers (6 min.)

#### **Counting: Introduction**

Cardinal numbers are useful to count objects, and ordinal numbers to express an object's location or position among others.

#### **Example 1: Racing Numbers**

Cardinal numbers express how many cars are in a group of cars. Ordinal numbers express a car's place in relationship to other cars during a race.

**Example 2: Wildebeest Numbers**

Cardinal numbers are used to count migrating wildebeest. Ordinal numbers express each wildebeest's place in a line of animals crossing a river.

**Example 3: Countdown Numbers**

Cardinal numbers are used to count down to a launch time and count up for objects.

**III. Representing Numbers (6 min.)**

**Representing Numbers: Introduction**

The rail cars in a model train can be counted with numbers, or their number can be represented with groups of counters.

**Example 1: Counting Rail Cars Using Numerals**

Rail cars are counted with numerals, symbols representing amounts.

**Example 2: Counting Rail Cars Using Symbols**

The number of rail cars can be represented with numerals or by groups of dots as symbols for the cars.

**Example 3: Number Lines**

Locations on a number line are used to represent numbers of rail cars or distances a train travels.

**IV. Whole Number Relationships (6 min.)**

**Number Relationships: Introduction**

Measurements vary for different things. A 200-pound baby elephant weighs more than an 8-pound human baby. The relationships between the measures are illustrated by sizes of squares.

**Example 1: Comparing One-Digit Numbers**

Numbers of elephants in different herds show comparisons between one-digit numbers. The relationships are shown in both directions, as less-than and greater-than.

**Example 2: Comparing One- and Two-Digit Numbers**

Two-digit numbers are always greater than one-digit numbers. Sizes of elephant herds illustrate how a number having a digit in the tens place is greater than a one-digit number.

**Example 3: Comparing Two-digit Numbers**

Ages of elephants are used to illustrate comparisons of two-digit numbers. First compare the digits in the ten's place, and if those digits are equal, compare the digits in the one's place.

**V. Equal Parts and Fair Shares (5 min.)**

**Equal Parts: Introduction**

Food can be shared among several people by dividing it into equal parts or portions.

**Example 1: Dividing Into Halves**

A whole thing is a unit. Some whole things can be divided into two equal halves, such as a sandwich and a candy bar.

**Example 2: Dividing Pizza Into Many Pieces**

A pizza divided into eight equal pieces can be shared evenly among two or four people.

**Example 3: Dividing a Dozen Donuts**

A box of a dozen donuts can be considered one unit. One person could take the whole unit, or it can be shared equally between two, three, four, six, or twelve people.

## Quiz

### I. Numbers Representing Amount

1. What do people use to count objects and help remember birthdays or addresses?  
A. sings  
B. letters  
C. numbers  
D. calendars

*Answer: C*

2. The researcher had to feed six chimps. He only fed three of them. How many more chimps does the researcher need to feed?  
A. 2  
B. 3  
C. 4  
D. 5

*Answer: B*

3. What tool does a carpenter use to measure the length of a piece of wood?  
A. saw  
B. drill  
C. tape  
D. tape measure

*Answer: D*

4. It takes Jack two minutes to swim one lap of the pool. How long will it take Jack to swim three laps of the pool?  
A. 3  
B. 5  
C. 6  
D. 10

*Answer: C*

## II. Counting Whole Numbers

1. What type of numbers is used to count things?
  - A. place numbers
  - B. ordinal numbers
  - C. position numbers
  - D. cardinal numbers

*Answer: D*

2. What type of numbers tells the order or position of something?
  - A. place numbers
  - B. ordinal numbers
  - C. position numbers
  - D. cardinal numbers

*Answer: B*

3. Six wildebeests stand in a line. What number tells the place of the last wildebeest?
  - A. first
  - B. six
  - C. sixth
  - D. sixst

*Answer: C*

4. What numbers end the countdown to a shuttle launch?
  - A. 1,2,3
  - B. 5,3,1
  - C. 2,4,6
  - D. 3,2,1

*Answer: D*

## III. Representing Numbers

1. What is the term for the symbols that represent numbers?
  - A. orders
  - B. figures
  - C. counters
  - D. numerals

*Answer: D*

2. Charlie is riding on a train that has an engine, four passenger cars, and a caboose. How many rail cars does this train have?
- A. 4
  - B. 5
  - C. 6
  - D. 7

*Answer: C*

3. On a horizontal number line, what happens to the numbers as you move to the right?
- A. the numbers get smaller
  - B. the numbers get larger
  - C. the numbers stay the same
  - D. the numbers go up and down.

*Answer: B*

#### **IV. Whole Number Relationships**

1. Sean has five books. Luke has three books. Which answer shows the correct way to write that Luke has less than Sean?
- A.  $3 > 5$
  - B.  $3 = 5$
  - C.  $3 < 5$
  - D.  $5 < 3$

*Answer: C*

2. Jen has 19 pencils, Bob has 4 pencils, Nick has 13 pencils, and Ryan has 9 pencils. Who has the most pencils?
- A. Jen
  - B. Bob
  - C. Nick
  - D. Ryan

*Answer: A*

3. Ken has 36 crayons in a box, but he wants a box with more crayons. Which box should he pick?
- A. Box A – 19 crayons
  - B. Box B – 29 crayons
  - C. Box C – 32 crayons
  - D. Box D – 46 crayons

*Answer: D*

**V. Equal Parts and Fair Shares**

1. Your candy bar has four pieces. If you cut it into equal pieces and give half to your friend, how many pieces will your friend have?  
A. 1  
B. 2  
C. 3  
D. 4

*Answer: B*

2. Three people are sharing a pizza that is cut into six slices. If each person gets the same number of slices, how many slices will each person have?  
A. 2  
B. 3  
C. 6  
D. 9

*Answer: A*

3. How many donuts are in one dozen?  
A. 4  
B. 6  
C. 12  
D. 20

*Answer: C*

*Chart 1*

<b>Object</b>	<b>Number</b>
beans	
pennies	
centimeter cubes	
paper clips	

Chart 2

Object	Measurement
pencil	
straw	
block	
chalk	

*Chart 3*

<b>Activity</b>	<b>Time</b>
Sharpen a pencil.	
Write your name.	
Walk around the room.	
Draw a picture.	

Chart 4









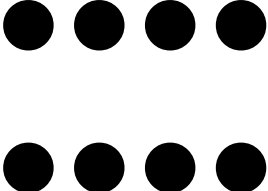


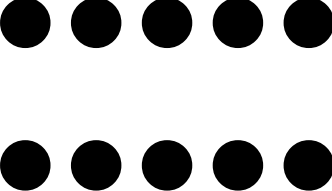

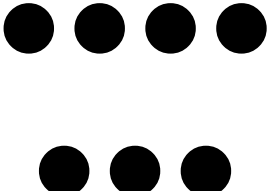

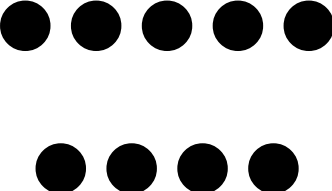
Object	Number (cardinal number)	Place in Line (ordinal number)
		
		
		
M		
		
		
		

Chart 5

### Equal Groups of Beans

Number of Beans	Number of beans in two equal groups ( <i>halves</i> )	Number of beans in three equal groups ( <i>thirds</i> )	Number of beans in four equal groups ( <i>fourths</i> )	Number of beans in six equal groups ( <i>sixths</i> )
48				
24				
12				

*Dot Flash Cards*

*Number and Order of Objects*

**Start**

**End**

***	☺☺☺	●●●	M M	☼☼	▲▲	□□□
***	☺☺☺	●●●	M M	☼☼	▲▲	□□□
***	☺☺☺		M	☼☼	▲▲	□□
***	☺			☼☼	▲▲	
				☼☼	▲	

*Number Cards*

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>
<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>
<b>31</b>	<b>32</b>	<b>33</b>	<b>34</b>	<b>35</b>	<b>36</b>	<b>37</b>	<b>38</b>	<b>39</b>	<b>40</b>
<b>41</b>	<b>42</b>	<b>43</b>	<b>44</b>	<b>45</b>	<b>46</b>	<b>47</b>	<b>48</b>	<b>49</b>	<b>50</b>

<b>51</b>	<b>52</b>	<b>53</b>	<b>54</b>	<b>55</b>	<b>56</b>	<b>57</b>	<b>58</b>	<b>59</b>	<b>60</b>
<b>61</b>	<b>62</b>	<b>63</b>	<b>64</b>	<b>65</b>	<b>66</b>	<b>67</b>	<b>68</b>	<b>69</b>	<b>70</b>
<b>71</b>	<b>72</b>	<b>73</b>	<b>74</b>	<b>75</b>	<b>76</b>	<b>77</b>	<b>78</b>	<b>79</b>	<b>80</b>
<b>81</b>	<b>82</b>	<b>83</b>	<b>84</b>	<b>85</b>	<b>86</b>	<b>87</b>	<b>88</b>	<b>89</b>	<b>90</b>
<b>91</b>	<b>92</b>	<b>93</b>	<b>94</b>	<b>95</b>	<b>96</b>	<b>97</b>	<b>98</b>	<b>99</b>	<b>100</b>

*Number Line*

