

Developing Highly Qualified Paraprofessionals  
Assisting the Teacher  
Module III: MATHEMATICS


Slide 1

Developing Highly Qualified Paraprofessionals

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Assisting the Teacher

Module III: MATHEMATICS



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Slide 2

**Mathematics Objective**

To meet the requirements of the No Child Left Behind Act (NCLB) by developing highly qualified paraprofessionals who possess

- knowledge of, and the ability to assist in, high quality mathematics instruction
- an understanding of key mathematics concepts and how to apply these to instruction

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Slide 3

**Key Concepts**

1. Number and Operation
2. Algebra
3. Geometry
4. Measurement
5. Probability and Data Analysis
6. Underlying Processes and Mathematical Tools (Problem Solving)

Key Concepts to be reviewed during this module

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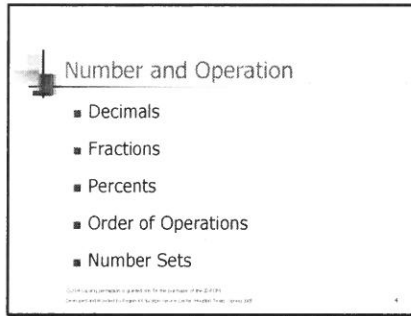
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Slide 4

A rectangular box containing a list of mathematical topics. At the top left is a small icon of a slide. The text reads: "Number and Operation" followed by a bulleted list: "Decimals", "Fractions", "Percents", "Order of Operations", and "Number Sets". At the bottom, there is small text: "Copyright permission is granted to the purchaser of the CD-ROM. Developed and Provided by Region 4 Education Service Center Houston Texas Spring 2005" and a small number "4" in the bottom right corner.

- Decimals
- Fractions
- Percents
- Order of Operations
- Number Sets

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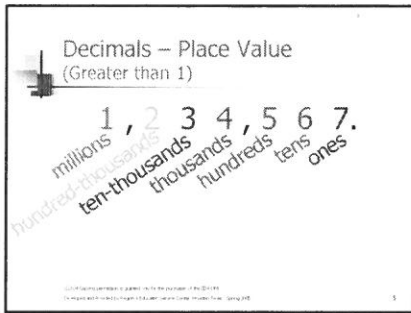
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Slide 5

A rectangular box containing a number line for place value. At the top left is a small icon of a slide. The text reads: "Decimals - Place Value (Greater than 1)". Below this, the numbers 1, 2, 3, 4, 5, 6, 7 are arranged in a slightly curved line. Below each number is its corresponding place value: "millions" under 1, "hundred-thousands" under 2, "ten-thousands" under 3, "thousands" under 4, "hundreds" under 5, "tens" under 6, and "ones" under 7. At the bottom, there is small text: "Copyright permission is granted to the purchaser of the CD-ROM. Developed and Provided by Region 4 Education Service Center Houston Texas Spring 2005" and a small number "5" in the bottom right corner.

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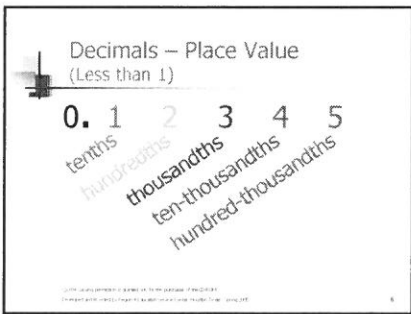
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Slide 6

A rectangular box containing a number line for place value. At the top left is a small icon of a slide. The text reads: "Decimals - Place Value (Less than 1)". Below this, the numbers 0.1, 2, 3, 4, 5 are arranged in a slightly curved line. Below each number is its corresponding place value: "tenths" under 0.1, "hundredths" under 2, "thousandths" under 3, "ten-thousandths" under 4, and "hundred-thousandths" under 5. At the bottom, there is small text: "Copyright permission is granted to the purchaser of the CD-ROM. Developed and Provided by Region 4 Education Service Center Houston Texas Spring 2005" and a small number "6" in the bottom right corner.

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Slide 7

Decimals – Place Value

# 67,890.12345

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Slide 8

Decimals – Operations  
(Addition and Subtraction)

- When adding or subtracting with decimal numbers, ALWAYS align the place values!
- Examples:

$\begin{array}{r} 27 \cdot 36 \\ + 05 \cdot 90 \\ \hline 33 \cdot 26 \end{array}$	$\begin{array}{r} 27 \cdot 36 \\ - 05 \cdot 90 \\ \hline 21 \cdot 46 \end{array}$
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Slide 9

Decimals – Operations  
(Multiplication)

- When multiplying with decimal numbers, it is NOT necessary to align the place values
- It IS necessary to count the digits that have a place value LESS than one
- Example:

$\begin{array}{r} 4 \cdot 12 \\ \times 5 \\ \hline 20 \cdot 60 \end{array}$	<div style="border: 1px solid black; padding: 5px; font-size: small;"> <p>There are TWO digits with a place value LESS than one.</p> <p>There are NO digits with a place value LESS than one.</p> <p>There are TWO digits with a place value LESS than one.</p> </div>
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Slide 10

**Decimals – Operations**  
(Division)

- When dividing a decimal number, maintain the position of the decimal point.
- Example:

$$\begin{array}{r}
 2.7 \\
 6 \overline{)16.2}
 \end{array}$$

Quotient: The answer to a division problem.

Dividend: The number being divided.

Slide the decimal point up from the dividend to the quotient.

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Slide 11

**Fractions: Vocabulary**

$$\begin{array}{r}
 3 \\
 \hline
 4
 \end{array}$$

Numerator

Denominator

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Slide 12

**Fractions: Operations**  
Addition and Subtraction

- In order to add or subtract with fractions, it is first necessary to establish a common denominator
- Establish a common denominator by generating equivalent fractions
- Generate equivalent fractions by multiplying both the numerator and denominator by the same scale factor

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Slide 13

Fractions: Operations  
 Addition and Subtraction

So what does that all mean? Let's take a look:

$$\frac{3}{4} + \frac{2}{3}$$

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Slide 14

Fractions: Operations  
 Addition and Subtraction

$\frac{3}{4} = \frac{3 \times 3}{4 \times 3} = \frac{9}{12}$

$\frac{2}{3} = \frac{2 \times 4}{3 \times 4} = \frac{8}{12}$

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Slide 15

Fractions: Operations  
 Addition and Subtraction

$\frac{3}{4} + \frac{2}{3} = \frac{9}{12} + \frac{8}{12}$

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Slide 16

Fractions: Operations  
 Addition and Subtraction

$$\frac{97}{12} + \frac{8}{12} = \frac{517}{1212}$$

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Slide 17

Fractions: Operations  
 Addition and Subtraction

$$\frac{3}{4} + \frac{2}{3} = 1\frac{5}{12}$$

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Slide 18

Fractions: Operations  
 Multiplication and Division

- Multiplication of and division by fractions do not require a common denominator
- Multiply two fractions by multiplying their numerators together, and then their denominators
- Division by a fraction is the same as multiplying by its reciprocal

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Slide 19

Fractions: Operations  
 Multiplication

Example:  $\frac{3}{4} \times \frac{2}{3} = ???$

$\frac{3}{4} \times \frac{2}{3} = \frac{6}{12}$  →  $\frac{3}{4} \times \frac{2}{3} = \frac{6}{12}$

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Slide 20

Fractions: Operations  
 Multiplication

$\frac{3}{4} \times \frac{2}{3} = \frac{1}{2}$

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Slide 21

Fractions: Comparing and Ordering

- To compare and order fractions, first convert the fractions to decimals by dividing the numerator by the denominator

Example:

$\frac{1}{4} \Rightarrow \begin{array}{r} 0.25 \\ 4 \overline{)1.00} \end{array} \quad \frac{1}{4} = 0.25$

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Slide 22

Fractions: Comparing and Ordering

Put the following fractions in order from least to greatest value:

$\frac{2}{3}$	$\frac{2}{5}$	$\frac{5}{8}$	$\frac{3}{7}$
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Slide 23

Fractions: Comparing and Ordering

Greatest value (largest number)

$\frac{2}{3} = 0.66$	$\frac{2}{5} = 0.4$	Least value
		(smallest number)

Third greatest value

$\frac{5}{8} = 0.625$	$\frac{3}{7} \approx 0.429$	Second greatest value
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Slide 24

Fractions: Comparing and Ordering

In order from least to greatest:

$\frac{2}{5}$	$\frac{3}{7}$	$\frac{5}{8}$	$\frac{2}{3}$
---------------	---------------	---------------	---------------

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Slide 25

**Percents**

- Percent is always out of 100 (per-cent)
- To find the percent of a number, convert the percent value to decimal value and then multiply
- Example: What is 6% of \$13.95?

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Slide 26

**Percents**

Example: What is 6% of \$13.95?

$$6\% = \frac{6}{100} = 0.06 \Rightarrow 0.06 \times 13.95 = 0.837$$

So 6% of \$13.95 is 84¢

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Slide 27

**Order of Operations**

- When multiple operations are included in a problem, there is a specific order in which those operations are to be performed
- This is called the *Order of Operations*

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Slide 28

**Order of Operations**

**P E (MD) AS = Order of Operations**

P- Parentheses

E- Exponents

M- Multiplication    D- Division

A- Addition            S- Subtraction

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Slide 29

**Order of Operations**

**Exponents**

- An exponent is used to denote how many times a number is multiplied by itself
- Examples:

$3^2 = 3 \times 3 = 9$

$3^3 = 3 \times 3 \times 3 = 27$

$3^4 = 3 \times 3 \times 3 \times 3 = 81$

Note that  $3^2$  is NOT the same as  $3 \times 2!$

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Slide 30

**Order of Operations**

**Square Roots**

- Finding the square root of a number is the opposite of finding the square of a number
- Examples:

$3^2 = 9$	$4^2 = 16$	$5^2 = 25$
$\sqrt{9} = 3$	$\sqrt{16} = 4$	$\sqrt{25} = 5$

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Slide 31

 Order of Operations

Simplify the following expression using the correct order of operations:

$$4^2 \div 8(7 - 3)$$

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Slide 32

 Order of Operations

$$4^2 \div 8(7 - 3)$$
$$4^2 \div 8(4)$$
$$16 \div 8(4)$$
$$2(4)$$
$$8$$

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Slide 33

 Number Sets

- Rational vs. irrational numbers
- Prime vs. composite numbers
- Integers
- Counting numbers

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# Developing Highly Qualified Paraprofessionals

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Slide 34

**Algebra**

- Proportional relationships
- Functional relationships
- Variables and equations

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Slide 35

**Proportional Relationships**

- A ratio is a comparison of two values
- Two equivalent ratios form a proportion
- Proportionality is one of the most critical components of the mathematics standards
- Example:  
On a map, 1 inch represents 15 miles. If the distance between two cities on the map is 7 inches, what is the actual distance between those two cities?

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Slide 36

**Proportional Relationships**

**Example:**  
On a map, 1 inch represents 15 miles. If the distance between two cities on the map is 7 inches, what is the actual distance between those two cities?

$$\frac{1 \text{ inch}}{15 \text{ miles}} = \frac{7 \text{ inches}}{105 \text{ miles}}$$

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Slide 37

 **Functional Relationships**

- A functional relationship can exist when one quantity depends on another
- Examples of functional relationships:
  - The amount of my paycheck depends on the number of hours I work.
  - The distance I am able to drive in my car depends on the amount of gas in the tank.

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Slide 38

 **Variables and Equations**

- A variable is a letter or symbol that is used to represent a changing value
- Variables are used in formulas and algebraic equations
- Examples:
  - $d = rt$
  - $y = 3x - 9$
  - $3(6x - 5) + 9 = 120$

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Slide 39

 **Variables and Equations**

Let's try solving an equation:

$$3(6x - 5) + 9 = 120$$

$$18x - 15 + 9 = 120$$

$$18x - 6 = 120$$

$$\begin{array}{r} 18x = 126 \\ \underline{+6} \quad \underline{-6} \\ 18x = 126 \\ \underline{18} \quad \underline{18} \\ x = 7 \end{array}$$

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Slide 40

**Substitution**

$$3(6x - 5) + 9 = 120$$

Substitute 7 in place of x

$$3[6(7) - 5] + 9 = 120$$

Follow PEMDAS to simplify left side

$$3(42 - 5) + 9 = 120$$

$$3(37) + 9 = 120$$

$$111 + 9 = 120$$

$$120 = 120$$

It checks!

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Slide 41

**Geometry and Measurement**

- Vocabulary
- Coordinate system – graphing
- Transformations
- Angles
- Polygons
- Circles
- Perimeter / Area

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Slide 42

**Vocabulary**

- **Congruent ( $\cong$ ) – same size and same shape**
- **Similar ( $\sim$ ) – same shape but not necessarily the same size**
- **Parallel Lines – are always the same distance apart from each other; will never intersect**
- **Perpendicular – form right angles ( $90^\circ$ )**
- **Regular Polygons – all angles are equal and all sides have same length**

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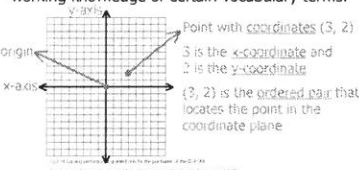
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Slide 43

#### Graphing

Graphing on a coordinate plane requires the working knowledge of certain vocabulary terms.



Point with coordinates (3, 2)  
3 is the x-coordinate and 2 is the y-coordinate  
(3, 2) is the ordered pair that locates the point in the coordinate plane

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Slide 44

#### Transformations

- Reflection – mirror image 
- Rotation – turn 
- Translation – slide 
- Dilation – change in size 

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Slide 45

#### Angles

- Right angle – measure is exactly  $90^\circ$  
- Acute angle – measure is less than  $90^\circ$  
- Obtuse angle – measure is greater than  $90^\circ$  but less than  $180^\circ$  

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Slide 46

**Triangles**

Triangles can be classified by their angle measures:

- **Right Triangle** – one right angle
- **Acute Triangle** – all acute angles
- **Obtuse Triangle** – one obtuse angle

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Slide 47

**Triangles**

Triangles can also be classified by their side lengths:

- **Scalene Triangle** – no sides are the same length
- **Isosceles Triangle** – at least two sides are the same length
- **Equilateral Triangle** – all three sides are the same length

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Slide 48

**Other Polygons**

- **Quadrilaterals have four sides and include:**
  - **Squares** – all four sides are the same length and all angles are right angles
  - **Rectangles** – all angles are right angles, but all four sides are not necessarily the same length
- **Pentagon** – five sides
- **Hexagon** – six sides
- **Octagon** – eight sides

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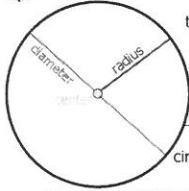
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**Circles**



Circumference:  
the distance around a circle  
 $C = 2\pi r$  OR  $C = \pi d$

Area of a circle:  
 $A = \pi r^2$

Pi is the ratio of the  
circumference to the diameter  
of a circle:  $\pi \approx 3.14$

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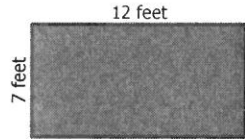
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Slide 50

**Perimeter and Area**



12 feet

7 feet

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Slide 51

**Applying Similarity**

What is the length of the larger rectangle?



$\frac{2m}{5m} = \frac{4m}{??}$

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Slide 52

 Probability and Data Analysis

- Independent vs. dependent events
- Measures of central tendency
- Reading and interpreting various displays of data

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Slide 53

 Independent / Dependent Probability

- Independent event – one in which the outcome of one event DOES NOT depend on the outcome of another event
- Dependent event – one in which the outcome of one event DOES depend on the outcome of another event

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Slide 54

 Independent / Dependent Probability

Ameena has a bag full of jelly beans in her backpack. There are 6 blue jelly beans, 9 red jelly beans, 4 green jelly beans, and 5 pink jelly beans.

- What is the probability of randomly choosing a blue jelly bean from the bag, replacing it, and then choosing a green one?
- What is the probability of randomly choosing a blue jelly bean from the bag, eating it, and then choosing a green one?

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Slide 55

**Independent Probability**

Ameena has a bag full of jelly beans in her backpack. There are 6 blue jelly beans, 9 red jelly beans, 4 green jelly beans, and 5 pink jelly beans.

What is the probability of randomly choosing a blue jelly bean from the bag, replacing it, and then choosing a green one?

$$\frac{6}{24} \times \frac{4}{24} = \frac{24}{576} = \frac{1}{24}$$

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Slide 56

**Dependent Probability**

Ameena has a bag full of jelly beans in her backpack. There are 6 blue jelly beans, 9 red jelly beans, 4 green jelly beans, and 5 pink jelly beans.

What is the probability of randomly choosing a blue jelly bean from the bag, eating it, and then choosing a green one?

$$\frac{6}{24} \times \frac{4}{23} = \frac{24}{552} = \frac{1}{23}$$

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Slide 57

**Measures of Central Tendency**

- Mean: average
- Median: middle
- Mode: most frequently occurring

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Developing Highly Qualified Paraprofessionals  
Assisting the Teacher  
Module III: MATHEMATICS

Slide 58

Measures of Central Tendency

78, 72, 75, 79, 72, 73, 76

72, 72, 73, 75, 76, 78, 79

Mode      Median

Range:  $79 - 72 = 7$

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Slide 59

Reading and Interpreting Various Displays of Data

- Lists
- Tables / Charts
- Graphs
  - Circle graphs (Pie graphs)
  - Bar graphs

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Slide 60

Manipulatives

- Base-ten blocks
- Color tiles
- Number lines
- Number cubes
- Counters (dinosaur)
- Unifix cubes

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Slide 61

Resources

- <http://www.tea.state.tx.us>
  - Texas Education Agency
- <http://www.nctm.org>
  - National Council of Teachers of Mathematics
- *The Mathematics Dictionary and Handbook*
  - Nichols Schwartz Publishing
  - ISBN: 1-882269-09-8

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