# Math: It's all in Your Mind!



Primary Objectives: Students will:

- Practice grade-appropriate mental math skills and develop mathematical reasoning skills related to concepts of integers, fractions, equivalents, numerators, denominators, addition, subtraction, multiplication, division, money, and more.
- Use game components appropriately to develop understanding of mathematical algorithms, to facilitate problem solving, and to create accurate and reliable models of mathematical concepts.
- Find an unknown quantity in simple equations (ex. using whole numbers, fractions, decimals, and/or mixed numbers.)

### Examples of **Possible** Academic Standards to Incorporate:

Kindergarten:

- 6.2.1 Count objects in a set and use numbers, including written numerals to 25.
- 6.2.5 Model the numbers 1 through 10 as sums or differences of different sets of whole numbers (composing and decomposing numbers).
- 6.2.10 Recognize 6 through 10 as "five and some ones."
- 6.2.13 Add and subtract single-digit numbers whose total or difference is between 0 and 10.
- 6.2.14 Understand add as "put together" or "count on" and solve addition problems with sums less than 20.
- 6.2.15 Understand subtraction as "break apart" or "take away" and solve subtraction problems using numbers 1 through 10.
- 6.2.17 Understand that numbers can be represented by different groupings.

1<sup>st</sup> Grade:

- 6.1.8 Recognize the "word clues" and mathematical symbols for addition and subtraction.
- 6.2.3 Develop strategies for learning basic addition facts and related subtraction facts.
- 6.2.4 Use multiple representations (including groups of ten) to model two-digit addition and subtraction.
- 6.2.8 Relate "counting on" and "counting back" to addition and subtraction and understand them as inverse operations.
- 6.2.9 Add three single-digit numbers.
- 6.2.12 Use various models to develop strategies for solving arithmetic problems.
- 6.2.13 Solve problems that require addition and subtraction of numbers through 100.

### 2<sup>nd</sup> Grade

- 6.2.7 Develop fluency at recalling basic addition facts and related subtraction facts.
- 6.2.8 Use efficient procedures, and understand why they work, to solve problems involving the addition and subtraction of two- and three-digit whole numbers (including those that require regrouping for addition only).
- 6.2.9 Apply appropriate methods to estimate and mentally calculate sums or differences with ones, tens, and hundreds.
- 6.2.10 Add three two-digit numbers.
- 6.2.11 Solve addition and subtraction problems in context using various representations.

### 3rd Grade:

- 6.5.1 Organize, display, and analyze data using various representations to solve problems.
- 6.3.3 Find the missing values in simple multiplication and division equations.
- 6.5.3 Make predictions based on various representations of data.
- 6.2.2 Develop understanding of multiplication and related division facts through multiple strategies and representations.
- 6.2.4 Solve multiplication and division problems using various representations.
- 6.2.4 Use a variety of methods to perform mental computations and compare the efficiency of those methods.

### 4th Grade:

- 6.2.2 Develop fluency with multiplication and single-digit division.
- 6.5.2 Use probability to describe chance events.

- 6.3.1 Find an unknown quantity in simple equations using whole numbers, fractions, decimals, and mixed numbers.
- 6.2.3 Multiply two- and three-digit whole numbers.
- 6.2.4 Understand and use a reliable algorithm for multiplying multi-digit numbers and dividing numbers by a single-digit divisor accurately and efficiently.
- 6.2.6 Solve problems involving whole numbers, fractions, and/or decimals using all four arithmetic operations.
- 6.2.8 Generate equivalent forms of whole numbers, decimals, and common fractions (e.g., 1/10, ¼, ½, ¾).
- 6.2.9 Compare equivalent forms whole numbers, fractions, and decimals to each other and to benchmark numbers
- 6.2.10 Solve contextual problems using whole numbers, fractions, and decimals.

### 5th Grade:

- 6.2.3 Develop fluency with division of whole numbers. Understand the relationship of divisor, dividend, and quotient in terms of multiplication and division.
- 6.1.4 Move flexibly between concrete and abstract representations of mathematical ideas in order to solve problems, model mathematical ideas, and communicate solution strategies.
- 6.1.6 Read and interpret the language of mathematics and use written/oral communication to express mathematical ideas precisely.
- 6.5.1 Depict data using various representations, including decimal and/or fractional data.
- 6.1.6 Communicate answers in correct verbal and numerical form; including use of mixed numbers or fractions and use of units.

### 6th Grade:

- 6.1.3 Use concrete, pictorial, and symbolic representation for integers.
- 6.2.8 Locate integers on the number line.
- 6.2.5 Develop meaning for integers; represent and compare quantities with integers.
- 6.1.1 Use mathematical language, symbols, and definitions while developing mathematical reasoning.
- 6.1.2 Apply and adapt a variety of appropriate strategies to problem solving, including estimation, and reasonableness of the solution.
- 6.1.8 Use technologies/manipulatives appropriately to develop understanding of mathematical algorithms, to facilitate problem solving, and to create accurate and reliable models of mathematical concepts.

• 6.1.11 Model algebraic expressions with manipulatives, technology, and pencil and paper.

### 7th Grade

- 6.2.1 Extend understandings of addition, subtraction, multiplication and division to integers.
- 6.2.2 ... compute efficiently with integers and rational numbers.
- 6.1.3 Check answers both by estimation and by appropriate independent calculations, using calculators or computers judiciously.
- 6.1.1 Use mathematical language, symbols, and definitions while developing mathematical reasoning.
- 6.1.6 Read and interpret the language of mathematics and use written/oral communication to express mathematical ideas precisely.

• 6.1.10 Model algebraic equations with manipulatives, technology, and pencil and paper. 8th Grade:

- 6.1.1 Use mathematical language, symbols, and definitions while developing mathematical reasoning.
- 6.1.6 Read and interpret the language of mathematics and use written/oral communication to express mathematical ideas precisely.
- 6.1.8 Use technologies/manipulatives appropriately to develop understanding of mathematical algorithms, to facilitate problem solving, and to create accurate and reliable models of mathematical concepts.

Academic Vocabulary to be used with this lesson: *Chosen vocabulary must consist of words that naturally and easily fit within the theme and framework of the lesson.* 

### Mathematic Academic Vocabulary

Kindergarten

- Addition
- Afternoon
- Classify
- Compare
- Difference
- Location
- Minus

- Number
- Order
- Pattern
- Position
- Shapes
- Sort
- Subtraction

- Sum
- Time
- Today
- Value
- Zero

1<sup>st</sup> Grade:

- Data
- Digit
- Direction
- Equal to
- Estimate
- Even
- 2<sup>nd</sup> Grade:
- Equivalent
- Event
- Extend

#### 3rd Grade

- Conclusion
- Decimal

### 4th Grade

- Accuracy
- Chance
- Convert

### 5th Grade

- Divisibility
- Formula
- Justify

### 6th Grade

- Integers
- Random
- Odds

### 7th Grade

- Function
- Greatest common divisor

### 8th Grade

Sequence

- Greater
- than/less than
- Numeral
- Odd
- Place value
- Plus
- Skip count
- Interpret
- Likely/unlikely
- Multiplication
- Factor
- Multiples
- Equation
- Expression
- Probability
- Model
- Remainder
- Round
- Experimental probability
- Rate
- Greatest common factor
- Property

- Solve
- Symbol
- Total
- Whole
- Whole number
  - Outcome
- Set
- Unknown
- Product
- Relationship
- Right
- Solution
- Variable
- View
- Sample
- Similarity

• Combination

# Math: It's all in Your Mind!



# Integer Football

Idea from: Scholastic Teachers. http://teacher.scholastic.com/lessonrepro/lessonplans/profbooks/funmath.pdf. All Rights Reserved.

Play this fun game and get ready for a kickoff of intensive integer computation practice. Students won't fumble positive and negative numbers again!

- Integer Football reproducible
- pencil and paper clip for each pair (to make the spinner)
- 3 different-colored counters for each student

Duplicate the Integer Football reproducible for each pair. Review the terms integer, positive, and negative with the class.

One player takes the side of the Touchdown

Negatives, while the other takes the side of the Pigskin Positives.

To start, each player's three counters are placed on the 0yard line. The object is for players to get all three of their counters to their own 50-yard lines (positive or negative)

first.

Players use a pencil and paper clip to make the spinner, spinning the clip around the pencil.

For each turn, a player spins the Yards spinner and moves a counter the number of positive or negative yards indicated. To clarify, draw the following number line on the board:



Suppose a player who had a counter on the 10-yard line spins a -30. Draw an arrow as below, or move a counter to show students that the player would move 30 yards to the left.



If all three of one player's counters land on the opposing side's 50-yard line, all those counters should be moved back to 0. A player does not need an exact spin to land on a 50-yard line. The first player to get all three counters on his or her own 50-yard line wins.

### Taking It Farther

To make the game harder, duplicate the 2<sup>nd</sup> reproducible, with the 5-yard lines between the 10-yard lines. Make copies of the new reproducible for students to play the game again. If you wish, have students add in +5 and -5, +15 and -15, and +25 and -25, etc on the lines

### **Assessing Skills**

Observe whether students understand which direction to move a counter that is already on the negative side of the board. If they spin a –10, do they move 10 yards to the left? Students may be confused and move to the –10 yard line instead.



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Algebra Readiness Scholastic Professional Books

## Times Tables Football

Create field of play using the overhead projector or on a white board. Then find, use, or create a deck of cards with times tables on one side. On the back of each card, place the answer, along with the results of a football play (e.g. 25 yard pass to wide receivver, 3 yard run by fullback, incomplete pass, Fumble - lose 5 yards). The deck should have about 100 cards. Most are good results, but some are bad to add some element of surprise.

Start on the 20 yard line at the beginning of the game, half, and after scores. On 4th down they may choose to try for a 1st down, punt (40 yards) or go for a field goal (must be at least on the 40 yard line). Extra points may be 1 point. (answer the next card correctly) or two points (answer the card and make at least 3 yards.) If during play, one player misses a times table, the other team gets a chance to answer it correctly. If they do, they recover the fumble and start with a first down.

Penalties can be assessed for not paying attention when it is not your turn, excessive talking, helping someone else, etc.

MATERIALS: overhead projector or chalk/white board, flash cards

### **Rolling for Yardage**

Divide students into teams of four. Every student begins on the 10-yard line and has to drive 40 yards for a touchdown (which means they are playing on a 50-yard field, but there will be more points, thus keeping interest up). The teacher asks a question, the teams buzz in, and whomever the teacher calls on answers and rolls a die. If the answer is correct, the team will move a given amount of yards in proportion to the die roll. If the team rolls a one or two, it moves three yards. A three or four results in a five-yard gain, a five results in a 10-yard gain and a roll of six



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results in a 12-yard gain. If the team answers wrong, however, the die will also determine the loss of yards. A roll of one or two will be no loss, a three or four results in a five-yard loss, a five

will result in a six-yard loss and a roll of six will result in a 10-yard loss. After making it into the end zone, the team gains six points. A bonus question is given, and if it's correctly answered within five seconds the extra point is good.

## Pass the Chicken!

In this game, nobody wants to hold the rubber chicken -- the game's only prop! To begin the game, all students sit or stand in a circle. Select one person to be It. That person holds the rubber chicken. The teacher or a "caller" shows a flashcard to the person holding the chicken, "3x5. Pass the chicken!" As soon as the caller says, "Pass the chicken," the person holding the chicken passes it to the right. Students quickly pass the chicken around the circle. If the chicken returns to the original holder before he or she can solve the problem, the holder is still It. Otherwise, the person holding the chicken when It finishes solving the problem is the new It.

## Number Tick Tack Toe

As surely as the sun rises and sets, kids will learn how to play tick tack toe. They do not have to be taught the game. Kids learn it the way they learn jump-rope rhymes and knock-knock jokes. Yet, kids lose interest quickly because tick tack toe is not challenging enough. There are only about a dozen different outcomes. By changing the rules and symbols slightly, you can give the game new life while giving students extended practice in mental math skills and addition and subtraction facts.

- 1. Students will practice basic addition and subtraction facts to twelve.
- 2. Students will use high level thinking skills to win at the game of tick tack toe.

RESOURCES/MATERIALS: Students will simply need lots of scratch paper and pencils.

How to Play:

1. The class will need to be divided into pairs.

2. Each pair makes a standard tick-tack-toe grid.

3. Instead of using X's and O's, students use the numbers 0 through 9. Use numbers 0 through 12 for a greater challenge. Each number can be used only once during a game.

4. The object of the game is to complete any row, column, or diagonal so that two of the three numbers add up to the third. The order of the numbers does not matter.

5. The first move may NOT be in the center. (If the first player is allowed to make that move, he or she can always win the game.)

6. The second and subsequent moves, however, can be anywhere on the grid.

#### Notes:

There is not any sure fire strategy for winning this type of tick-tack-toe game. Likewise, there seems to be no advantage in going first. The games, however, tend to end with a winner rather than in ties. Most losses result from carelessness. It's easy to make a mistake after four or five numbers have been played. That's when the game requires close attention, higher level thinking skills, and accurate adding and subtracting.

The game is far more complex than tick-tack-toe in that there are thousands of outcomes. The one constant is good number facts practice in an enjoyable context.

# How Long? How Many?

Math skills: This two-person game involves probability and strategy, and gives children experience with multiplication in a geometric context.

The object: to make rectangular arrays with Cuisenaire Rods and place them on 10-by-10-centimeter grids until no more space is available. The game encourages students to think strategically as they consider where to place their rectangles to avoid being blocked.

How to play: students need Cuisenaire Rods printouts, or make their own out of the blank squares, one die, and a



grid sheet for each (Make a 10cm x 10cm grid. Also leave space for students to record how many of their squares are covered and uncovered.) The rules are:

1. On his or her turn, a player rolls the die twice to determine which Cuisenaire Rods to take. The first roll tells "how long" a rod to use. The second roll tells "how many" rods to take.

2. Players arrange their rods into a rectangle, place it on their grid, and trace it. They write the multiplication sentence inside.

3. The game is over when one player can't place a rectangle because there's no room on the grid. Then players figure out how many of their squares are covered and how many are uncovered and check each other's answers.

After students have had experience playing the game, talk with them about strategies for placing rectangles and figuring out their final scores.

### Make Your Own Cuisenaire Rods





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#### How to play the game:

- Distribute the cards randomly to your students. Some students may get more than one card.
- Select a student to begin by reading their card aloud. (example: I have 35. Who has who has 4x4?)
- The student who has the card with the correct answer to the previous student's "Who Has..." question reads their card aloud. (example: I have 16. Who has 10x3?) And so on.

I Have...Who Has... Multiplication Game

- Students must listen for their turn and try not to break the chain.
- When the chain is circles around to the first student, the game is over.

#### Suggestions:

- Print out the "I Have, Who Has" flashcards on card stock and laminate them so they will last for many years to come.
- Practice the game once with your students so they understand how the game works, then see if they can "beat the timer." Set a timer for 2 minutes, 5 minutes, or whatever. Challenge them to finish the game before the timer goes off.

#### Answer Chain:

A: | have 35. Who has  $4 \times 4$ ? **B:** | have 16. Who has 10 x 3? **C:** | have 30. Who has 3 x 8? **D:** I have 24. Who has 5 x 5? **E:** | have 25. Who has  $6 \times 6$ ? **F:** I have 36. Who has  $9 \times 3$ ? **G:** | have 27. Who has 7 x 7? **H:** I have 49. Who has  $3 \times 3$ ? I: I have 9. Who has 7 x 3? J: I have 21. Who has  $9 \times 5$ ? K: | have 45. Who has  $8 \times 5$ ? L: | have 40. Who has  $4 \times 5$ ? **M:** | have 20. Who has  $7 \times 6$ ? N: | have 42. Who has  $8 \times 8$ ? **O:** I have 64. Who has 8 x 6? **P:** I have 48. Who has  $7 \times 1$ ?

Q: I have 7. Who has 9 x 7?

- **R:** I have 63. Who has 9 x 6?
- **S:** I have 54. Who has 8 x 9?
- **T:** I have 72. Who has 3 x 2?
- **U:** I have 6. Who has 10 x 10?
- V: I have 100. Who has 10 x 5?
- W: I have 50. Who has 8 x 7?
- X: I have 56. Who has 7 x 4?
- Y: I have 28. Who has  $8 \times 0$ ?
- Z: I have 0. Who has 4 x 8?
- AA: I have 32. Who has 3 x 4?
- BB: I have 12. Who has 9 x 9?
- CC: | have 81. Who has 5 x 3?
- DD: I have 15. Who has 4 x 2?
- EE: I have 8. Who has 6 x 3?
- FF: | have 18. Who has 2 x 7?
- **GG:** | have 14. Who has 1 x 5?
- HH: | have 5. Who has 7 x 5?





















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CALLER CARDS

L 4x5	4x4 (16)	<b>3x9</b> (27)	(18)	(12) (12)	(9) (9)	2x2	   0x8     0x8
F — — — — — — — — — — — — — — — — — — —	5x7 (35)	5 <b>x6</b> (30)	5x3 (15)	4 <b>x</b> 9	4x8	<b>4x7</b> (28)	
7x8 (56)	<b>7x7</b> (49)	<b>7x6</b> (42)	7 <b>x3</b> (21)	7 <b>x 1</b> (7)	<b>6 X 9</b> (54)	<b>6x8</b> (48)	5x9 (45)
				(81) (81)	<b>8x9</b> (72)	<b>8x8</b> (64)	



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20	35	48	36	42
63	12	15	40	81
30	18	FREE SPACE	21	64
45	4	49	16	56
54	0	9	32	28

		R	C	0
64	27	24	16	48
45	30	15	72	12
28	0	FREE SPACE	54	9
40	35	20	81	56
42	63	49	32	7

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28	49	63	54	0
12	18	FREE SPACE	56	24
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30	40	64	35	72

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54	32	30	48	72
4	81	56	21	20
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81	18	21	0	7
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9	54	FREE SPACE	15	36
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27	64	12	28	56