



Discovering Decimal Pathways

A Game of adding and subtracting decimals

*Includes additional games in stating decimals correctly,
comparing decimals, and ordering decimals*

Decimal Background

Although he did not invent the decimal, (the Arabs and Chinese used decimals long before Stevin), Simon Stevin is considered the *father* of the decimal. Born in Bruges, Belgium, Stevin did much of his work in the Netherlands. In 1585, he published **Disme: Art of Tenths**, which introduced the use of decimal numbers for common application among ordinary people. It allowed bankers, shopkeepers, astronomers, and any other occupations that used numbers and measurement to apply these types of numbers rather than fractions in their daily computations. The word *dime* comes from *disme* meaning tenth part. On Art Tenths' hat is the decimal 3.1 representing Pi to the tenths place and on the pioneer's helmet is the decimal 3.141 representing Pi to the thousandths place.

Introduction

Be the quickest to help Art Tenths solve the puzzle of the missing sports equipment. Be the first to soar through space to a newly discovered planet while in the Galaxy of Dime. **DISCOVERING DECIMAL PATHWAYS** provides the students with 2 adventures while developing their decimal knowledge.

Features

DISCOVERING DECIMAL PATHWAYS includes:

- Double-sided game board providing different difficulty levels
- Ongoing practice in addition and subtraction of decimals
- Challenging game play for students in grades 3-5
- Easy to use Flip-Card Boards
- Game experience for 2-4 players
- Extension activities involving:
 - Adding and subtracting decimals at a more difficult level

- Comparing and ordering decimals
- Stating decimals correctly
- Writing creative space stories by using new terms and doing space research

Educational Objectives Are To Be Able To

- Recognize decimals in the tenths, hundredths, and thousandths
- Line up decimal numbers by their decimal points so that a student may either add or subtract the numbers
- Add and/or subtract decimal numbers correctly
- Regroup when doing decimal addition and/or subtraction problems
- Practice ordering and comparing decimals in extension activities
- Understand the importance of the word "and" in stating decimals correctly
- Research and apply new words to creatively write an interesting story
- Learn to both win and lose while playing an educational game

Materials

- Double-sided game board
- 4 Flip-Card Boards
- 1 Die
- 4 Playing Pieces
- Spinner
- Instructional Guide and Extension Activities

Pre-Game Practice

- One student puts on a Flip-Card Board a decimal number to the place that the students are studying, to the hundredths for example. The other students tell to what decimal place the number is and then orally say the number.

Hint: The teacher should help the students to understand that the word *and* is used to represent the decimal point. For example: 642.13 is stated as six hundred forty-two and thirteen hundredths - not six hundred and forty-two and thirteen hundredths. Confusion can also occur in numbers such as 0.642 versus 600.042. The first is stated as six hundred forty-two thousandths, whereas, the second is stated as six hundred and forty-two thousandths. The *and* creates a totally different number for both examples, and therefore, it plays a very important role in stating a decimal number correctly.

- The students practice adding and subtracting decimals to the area that they are studying by following the next steps:
 - Two students put decimals on their Flip-Card Boards to the area that they are studying. Unlike decimals may be added and subtracted here. For example, $2.4 + 8.28$
 - The students line up the two Flip-Card Boards by their decimal points with one card below the first. The greater numbered Flip-Card Board should be on the top for subtraction.
 - All students either add or subtract the problem on a sheet of paper.
 - The students display their answers to each other.

Game Setup

- The correct side of the **DISCOVERING DECIMAL PATHWAYS** game board is placed upwards. Therefore, either the side with the game, Art Tenths Solves the Skywards Clubhouse Mystery, or Journey to the Galaxy of Dime is displayed.
- The students choose the game they want to play – *Adding Decimals* or *Subtracting Decimals*.
- The students take a marker for moving along the game board and a Flip-Card Board.
- The students bring to the group a pencil and piece of paper. They use these to either add or subtract the decimals as required by the game.

Art Tenths Solves The Skywards Clubhouse Mystery

Using decimals in the tenths

Background Information

The Skywards' Soccer Clubhouse stands with the door lock broken. All the soccer equipment is missing. The children need to practice and use the equipment for the up and coming state championship game. Inspector Art Tenths is called in to solve the mystery of the missing equipment. The children are asked to help Art Tenths solve the mystery.

Game 1 – Adding Decimals

Game Objective

The object of the game is to solve the mystery first by reaching the middle circle of the game board. This is accomplished by *adding up* the times in the different places that the investigators visit.

Game Rules

- The students use their Flip-Card Boards in this game to display the total number of minutes a student obtains in each ring of the game. Before beginning the game, the students put 0s to the tenths place on their Flip-Card Boards as follows:

0	0	0	.	0		
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- To start, the students roll the die to see who begins. The first student rolls the die and moves the number of spaces indicated by the die along the outer ring of the board. The number on the board space represents the number of minutes that the student uses in one place to solve the mystery. After a student lands on a space, this amount is put on his/her Flip-Card Board. Next, the other students take their turns.
- Once all have taken their turns, the first student rolls the die again and moves to another board space in the first ring. This number is added to the total that the student has on his/her Flip-Card Board. The paper and pencil can be used to determine the total. The other pupils check the student's sum to see if he/she is correct. If incorrect, the student reworks the problem and puts the corrected total on his/her Flip-Card

Board. This continues with all students taking a turn, until one student has a total of 300 minutes or more. At this point, the student who reaches the 300 minutes of time puts his/her marker on the spin arrow that is next to the ring that the student just completed. The student spins the spinner and does as the spinner says. The other students continue in the first ring until they each obtain 300 minutes. Then, they follow the same steps as the first student.

3	0	0	.	0		
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- When a student reaches the second ring, the Flip-Card Board is placed on 0 unless otherwise stated on the spinner. The same procedure is followed with this ring as with the first ring. Likewise, a student moves through the third ring in the same way as rings 1 and 2.
- After completing the third ring, a student moves to the final spin arrow on the game board and spins the spinner. *For this spin, however, the student ignores the words on the spinner and enters the final circle only if he/she spins green.* The student loses this turn and the next turn if he/she spins blue. Therefore, the student cannot move into the final circle at this time. After missing two turns, the student spins again, and the same rules apply.
- When traveling through any ring, a student may hit a space that has words instead of numbers. For this turn, the student follows the instructions on the space. If the directions say to go to the next arrow or to go to the previous arrow, a student puts his/her marker on the described arrow. His/her Flip-Card Board is put at 0. The student spins the spinner and follows the directions on the spinner.
- The first student who reaches the inner circle, which states “Mystery Solved,” wins the game. He/she has solved the mystery of the missing soccer equipment.

- The students use their Flip-Card Boards to display the *remaining* number of minutes that are left from the 300-minute time amount allowed in each ring of the game. This is the time used to solve the mystery.
- To start, the students roll the die to see who begins. The first student rolls the die and moves the number of spaces indicated by the die along the outer ring of the board. This number represents the number of minutes that the student uses in one place to solve the mystery. This number is subtracted from the 300-minute ring total that the investigators are allowed. Next, the other students take their turns.
- Once all take their turns, the first student rolls the die and moves to another board space. This next number is *subtracted* from the remaining amount of time that the student has on his/her Flip-Card Board. The paper and pencil may be used to determine this amount. The other pupils check the student’s difference to see if he/she is correct. If incorrect, the student reworks the problem and puts the corrected difference on his/her Flip-Card Board. This continues with all students taking a turn, until one student reaches a 0 amount of minutes on his/her Flip-Card Board. At this point, the student who reaches this amount of time puts his/her marker on the spin arrow that is next to the ring that the student just completed. The student spins the spinner and does as the spinner says. The other students continue in this first ring until they reach 0 minutes left. After this, they follow the same rules as the first student.
- When a student reaches the second ring, 300 minutes are placed on the Flip-Card Board unless stated otherwise on the spinner. The same procedure is followed with this ring as with the first ring. Likewise, a student moves through the third ring in the same way as rings 1 and 2.
- After completing the third ring, a student moves to the final spin arrow on the game board and spins the spinner. *For this spin, however, the student ignores the words on the spinner and enters the final circle only if he/she spins green.* The student loses this turn and the next turn if he/she spins blue. Therefore, the student cannot move into the final circle at this time. After missing two turns, the student spins again, and the same rules apply.
- When traveling through any ring, a student may hit a space that has words instead of numbers. For this turn, the student follows the instructions on the space. If the directions say to go to the next arrow or to go to the previous arrow, a student puts his/her marker on the described arrow. His/her Flip-Card Board is put at 300. The student spins the spinner and follows the directions on the spinner.

Game 2 – Subtracting Decimals

OBJECTIVE

The object of the game is to solve the mystery first by reaching the middle circle of the game board. This is accomplished by *subtracting* the times from a given amount in the different places that the investigators visit.

GAME RULES

- Before starting the game, the students put on their Flip-Card Boards the number of 300. Since the students are studying decimals to the 10ths, their Flip-Card Boards appear as:

- The first student who reaches the inner circle, which states “Mystery Solved,” wins the game because he/she has solved the mystery of the missing soccer equipment.

Journey To The Galaxy Of Dime

Using decimals in the tenths, hundredths, and thousandths

Background Information

A mission is to be carried out in which 100 astro-pioneers are sent to colonize a planet that will support life in the Galaxy of Dime. Since it is such a far distance, several generations of families will be born before the undertaking is completed. Many spaceships are being sent due to the length and danger of the mission. The first ship that arrives at the new planet wins the game, since they will be able to set up their homes in the most desirable places.

Game Board Space Vocabulary

- *Water recycling machine* – A machine that recycles water, from all possible places that water can be found on the spaceship including crewmates breath, sweat, cabin humidity, wastes from fuel cells, lab animals, or people. It involves 2 types of filtering processes and a final stage of killing bacteria and viruses.
- *Internal energy* – The energy systems inside the ship that control such things as temperature, guiding instruments, electricity, air flow, and day to day machines needed for the space pioneers to exist.
- *Carbon dioxide buildup* – Humans and lab animals exhale carbon dioxide, which can be toxic in large quantities. The air filtration system needs to be working correctly to rid the ship of this gas.
- *Space vacuum* – The vacuum of space is considered to be empty space, which is void of anything. However, some scientists now think that some space vacuums have energy reservoirs that could generate immense power, and therefore, make nuclear power outdated.
- *Meteorite shower* – These are small stone or iron objects either traveling through space or around the sun. They can be destructive to a spaceship if too many are traveling together.
- *Wormhole* - Wormholes are passages that connect a black hole to a white hole. As the black hole takes in information and material, the white hole spews it out. Some think that this could one day create short routes

through space. Others think that this would destroy whatever goes into it.

- *Proxima Centauri* – It is our sun’s nearest neighbor. It is a tiny Red Dwarf star 4.22 light-years away from our sun. It has only 10% of our sun’s mass.
- *Bacteria* – These are small organisms that can cause disease and ruin food and water supplies. Space pioneers spend months in the same quarters, breathing recycled air and drinking recycled water. This makes spaceships an ideal breeding area for bacteria. In addition, weightlessness and higher radiation levels may increase the rate at which bacteria grows.
- *Heat shields* - These help the spaceship by protecting it from the extreme heat when entering and leaving the Earth’s atmosphere. If a spaceship does not have heat shields, it would literally burn up. The shields are made of insulating tiles.

Game 1 – Adding Decimals

Game Rules

On the board there are decimal numbers to the thousandths. These numbers represent the number of months that the spaceship travels through its long journey. This game is played with the same rules as *ART TENTHS SOLVES THE SKYWARDS CLUBHOUSE MYSTERY – GAME 1* except for the following ways:

- The ending total is 300 months instead of 300 hours.
- Since the students are studying decimals in the hundredths and thousandths, their beginning Flip-Card Boards should appear as:

0	0	0	.	0	0	0
---	---	---	---	---	---	---

- The student who reaches the space *Planet Found* instead of the space *Mystery Solved* first wins the game.

Game 2 – Subtracting Decimals

Game Rules

On the board are decimal numbers to the thousandths. These numbers represent the number of months that the

spaceship travels through its long journey. The game is played with the same rules as *ART TENTHS SOLVES THE SKYWARDS CLUBHOUSE MYESTERY - GAME 2* except in the following ways.

- The beginning total is 300 months instead of 300 hours.
- Since the students are studying decimals in the hundredths and thousandths, their beginning Flip-Card Boards should appear as:

3	0	0	.	0	0	0
---	---	---	---	---	---	---

- The student who reaches the space *Planet Found* instead of the space *Mystery Solved* first wins the game.

Game Extensions

Add Two Game

- This game is played with the same rules as *ART TENTHS SOLVES THE SKYWARDS CLUBHOUSE MYESTERY – Game 1* and *JOURNEY TO THE GALAXY OF DIME – Game 1* except a student rolls 2 times for each move.
- The student adds the sum of his/her two rolls to the last total on his/her Flip-Card Board.

Largest Total

- The object of this game is to have the greatest number on one's Flip-Card Board when reaching the end of the game board.
- Either the *ART TENTHS SOLVES THE SKYWARDS CLUBHOUSE MYESTERY* or *JOURNEY TO THE GALAXY OF DIME* game board may be used depending on what the students are studying.
- All students start at the beginning space. The students take turns rolling the die. For every space on which a student lands, this number is added to the last total number that the student has on his/her Flip-Card Board.
- All students move their markers *counterclockwise* instead of the direction in which the board arrows point.
- The students only travel around each ring until they reach the yellow arrow, not quite the full distance around the ring. When they reach the yellow arrow, they must go to the next ring.
- The students continue until they reach the inner circle. The students do not have to have equal turns.

- When all students are at the end, the student with the greatest total wins the game.
- If a student's number reaches 1,000, this student automatically wins, since the Flip-Card Board cannot be any greater than 999.9 when using decimals to the tenths and 999.999 when using decimals to the thousandths.

Reaching "0"

- Either the *ART TENTHS SOLVES THE SKYWARDS CLUBHOUSE MYESTERY* or *JOURNEY TO THE GALAXY OF DIME* game board may be used depending on what the students are studying.
- The object of this game is to subtract numbers found on the board from 999.9 if the students are studying numbers to the tenths and from 999.999 if the students are studying numbers to the thousandths until 0 is obtained.
- The game rules are the same as for *LARGEST TOTAL* except the students subtract decimal numbers instead of add them. If a student reaches 0, he/she automatically wins.

Higher Decimal

- Either the *ART TENTHS SOLVES THE SKYWARDS CLUBHOUSE MYESTERY* or *JOURNEY TO THE GALAXY OF DIME* game board may be used depending on what the students are studying.
- The object of the *HIGHER DECIMAL* game is to reach the inner circle first.
- All students start at the beginning space. The markers are moved *counterclockwise* instead of the direction in which the board arrows point.
- The students only travel around each ring until they reach the yellow arrow, not quite the full distance around the ring. When they reach the yellow arrow, they must go to the next ring.
- To begin the game, the students roll the die and move their markers the indicated number of spaces. The students compare their decimal numbers. To do this, they put their numbers on a Flip-Card Board. The students compare the numbers by lining up the decimal points for each number. In this way, they compare which number is greatest. For the student with the largest number, he/she rolls the die and moves the additional spaces indicated by the die.
- After this, the students roll the die again, and the game continues with the same directions.
- The first student who reaches the inner circle wins the game.

Increasing Decimals

- Either the *ART TENTHS SOLVES THE SKYWARDS CLUBHOUSE MYSTERY* or *JOURNEY TO THE GALAXY OF DIME* game board may be used depending on what the students are studying.
- The object of this game is to reach the inner circle first.
- All students start at the beginning space. Their markers are moved *counterclockwise* instead of the direction in which the board arrows point.
- The students only travel around each ring until they reach the yellow arrow, not quite the full distance around the ring. When they reach the yellow arrow, they must go to the next ring.
- To begin the game, one student rolls the die and moves the number of spaces indicated by the die. The decimal number on the space where the student lands is put on the student's Flip-Card Board. The student rolls again. If the decimal number on the space from the second roll is greater than the decimal number from the first roll, this new number is put on the student's Flip-Card Board. The student continues rolling the die and changing the numbers as long as the new number is greater than the last number. When the new number is smaller than the last one on the student's Flip-Card Board, the student stops rolling, and it is the next student's turn to roll.
- For the beginning student's next turn, he/she rolls the die and moves his/her marker along the game board. The first number is put on the student's Flip-Card Board. Again the student rolls until he/she does not roll a higher number. The other students continue with these same steps.
- With equal turns, the student who is first to the inner circle wins the game.
- If a tie occurs, the students roll the die to see who wins.

Decreasing Decimals

- Either the *ART TENTHS SOLVES THE SKYWARDS CLUBHOUSE MYSTERY* or *JOURNEY TO THE GALAXY OF DIME* game board may be used depending on what the students are studying.
- The object of this game is to reach the inner circle first.
- The directions for this game are the same as for the *INCREASING DECIMALS* game except that the students order decimals in decreasing order rather than increasing order.

State The Decimal

- The *JOURNEY TO THE GALAXY OF DIME* game board

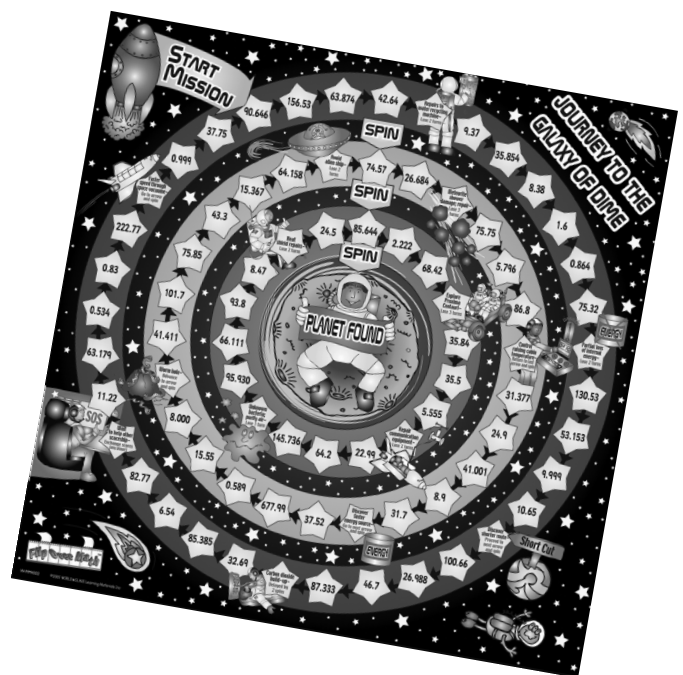
is used for this game. The students should be studying decimals to the thousandths.

- Important rules:
 - The word **and** is used only to represent the decimal point and is not used as a word when stating whole numbers.
 - For whole numbers, no *th* is used. Example – 426,000 is stated as four hundred twenty-six thousand.
 - For decimals, the *th* is used. Example - 0.426 is four hundred twenty-six thousandths.
- The object of the this game is to reach the inner circle first by:
 - Correctly putting on one's Flip-Card Board a decimal number that is stated by another student and
 - Stating correctly the decimal number found on the game board space on which the student lands.
- The students use the *STATE THE DECIMAL* chart. This chart has whole and decimal numbers on the front and the answers of the correct way to say the numbers written on the back.
- Only 3 students may play this game. For each play, one student states any decimal or whole number from the chart, and the other students put the decimal or whole number on their Flip-Card Board or Boards. Since some numbers may be in the hundred thousands and millions, two Flip-Card Boards are put together to display these types of numbers.
- The students start at the beginning space. All students move their markers counterclockwise instead of the direction in which the board arrows point. The students only travel around each ring until they reach the yellow arrow, not quite the full distance around the ring. When they reach the yellow arrow, they must go to the next ring.
- To begin the game, the students roll to determine who first uses the chart to state the whole number or decimal. Without showing the other students the numbers or the answers on the back of the chart, the student chooses any whole or decimal number and says this orally. Without showing each other, the two students put the whole or decimal number on their Flip-Card Board/Boards.
- Before the Flip-Card Boards are displayed, the student who stated the whole or decimal number checks on the back of the chart to see if the number was stated correctly. If not, the student restates the whole or decimal number, and the students are allowed to change the numbers on their Flip-Card Boards before displaying them.

- After this, the students display their Flip-Card Boards. These answers are checked with the *STATE THE DECIMAL* chart. If the students are correct, they roll the die and move that many spaces along the game board. If any student is incorrect, he/she does not roll the die for that turn.
- The student who stated the decimal is also able to roll the die. This student only rolls the die and moves his/her marker if he/she said the number correctly the first time.
- Any student who moves on the first turn also has a chance to move again. To do this, a student must say the decimal number correctly on the space where he/she lands. This student may then roll again and move that many spaces on the game board.
- After this first turn, another student in the group reads a whole or decimal number from the chart and the same steps are followed.
- The student who reaches the end of the board first wins the game. If all decimal numbers are read during the game, the numbers may be repeated until someone reaches the end of the game board. During the game, the students should put a light pencil check by the numbers as they state them, so that they know which numbers have been used. After the game, these can be erased.

Related Subject Extension

- The students write a creative story about space. In their story, the students use some of the terms written in the game directions of *JOURNEY TO THE GALAXY OF DIME* plus they find at least 10 space terms by doing research on their own.
- The students write a believable story. This story is read to the class. While the student reads the story, one-half of the class takes notes on the happenings in the story that they think could really take place. The other half of the class takes notes on what happenings in the story that they think could not possibly occur.
- After the student finishes reading his/her story, the class has a debate type discussion on why the events could or could not happen in the student's story. They use their notes for this discussion.
- While doing research for his/her creative story, the student looks up facts and theories that back up what he/she is proposing for his/her space journey. The Internet has a wide range of materials concerning space with different scientists' ideas on how space travel in the future may be possible.
- In this story, the time can take place at any future period, since man is not capable at this point to travel great distances in space.



Other Games by this Author

A Day at the Zoo – Elapsed Time

(MM4092)

- 3 different difficulty levels
- Problems include hour through less than 5-minute intervals

Tour de Time – Beginning and/or Ending Time

(MM4093)

- A double-sided game board for 2 different games
- Reinforces the longest or shortest time to complete a task

Plot Your Course – Ordered Pairs

(MM4094)

- 3 different difficulty levels
- Finding point in a single figure to points in three intersecting figures

Magic Island Search – Measurement

(MM4095)

- 4 different difficulty levels
- Includes mass/weight, length and capacity problems

About the Author

Creating an environment in which children want to learn is one of the greatest challenges for educators today. In creating the Flip Over Math series over the last 9 years, Nancy McWilliams; B.S. in Education; M.B.A., found that creating varying games to excite and motivate students is the most effective method to obtain pupil interest, to reach all type of student personalities and abilities, and to help children grow the most academically. This philosophy was used successfully throughout her 15 years of teaching grades 2-6 in both the Texas and Illinois school systems and helped in the development of the games in the Flip Over Math series.

During her years as an educator, Nancy McWilliams created the advanced math program for the second grade classes in her school. This program was incorporated into the curriculum. Ms. McWilliams formed the first math/science invention convention for her school in which the students were interviewed on local TV. For many years she served as grade level team leader, upper elementary tutor, and student teacher cooperating teacher. Ms. McWilliams was selected to serve as her school's at-risk representative taking courses and providing teachers with information on how to reach the slower learner. In addition, she was selected to represent her school as a candidate for Outstanding Texas State Teacher. For her 5th grade team, Ms. McWilliams wrote a book summarizing the skills found in the math-standardized tests. She attributes this book as the reason 99.7% of all her students passed the standardized math tests including at-risk, resource, and special needs students.



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