

## Puzzles and Games

- from [mrlsmath.com](http://mrlsmath.com)

Puzzles and Games are a great way to build **enthusiasm, excitement, and skills** in a math classroom. When these are used properly, there is always an underlying mathematical theme that is being explored or reinforced. Students learn the value of **logical thinking, proper planning, and long-term focus**.

Many of these puzzles build spatial sense and geometrical visualization and allow students to create conceptual models. Research says that **problem solving abilities increase** when students gain spatial reasoning skills, and doing so in such a creative way brings joy to the students and the classroom.

Mathematical games can develop a lot of **creativity and number sense** in students. Many times a game or puzzle at first looks overwhelming, but becomes manageable after focusing on the key concept. Motivation is almost always inherent in a game or puzzle; this creates **conceptual emotion** which is a key to successful learning.

Opportunities for **transitioning from number sense to algebra thinking** abound with puzzles. Number properties show their strength in supporting algebra throughout puzzle activities. It's always a pleasure to watch the enthusiasm and skills grow in students!

E

<b>7+</b>		<b>2</b>	<b>3-</b>
<b>5+</b>	<b>2</b>	<b>9×</b>	
			<b>2</b>
<b>2÷</b>		<b>1-</b>	

M

<b>3+</b>		<b>1-</b>	<b>2-</b>
<b>2÷</b>			
<b>4+</b>	<b>12×</b>	<b>2</b>	<b>7+</b>

E

<b>7+</b>		<b>2</b>	<b>3-</b>
<b>5+</b>	<b>2</b>	<b>9×</b>	
			<b>2</b>
<b>2÷</b>		<b>1-</b>	

M

<b>3+</b>		<b>1-</b>	<b>2-</b>
<b>2÷</b>			
<b>4+</b>	<b>12×</b>	<b>2</b>	<b>7+</b>

E

<b>7+</b>	2	4+	
	3×	2÷	
2			9+
3-			

E

<b>7+</b>	2	4+	
	3×	2÷	
2			9+
3-			

M

<b>3</b>	12×	2÷	
1-		2÷	7+
	8×		
		2-	

M

<b>3</b>	12×	2÷	
1-		2÷	7+
	8×		
		2-	

H

<b>12×</b>	2-		2
	1-	2÷	3-
5+			
		1-	

H

<b>12×</b>	2-		2
	1-	2÷	3-
5+			
		1-	

E

<b>2-</b>		<b>8×</b>	
<b>2÷</b>	<b>7+</b>		<b>4</b>
		<b>2</b>	<b>9×</b>
<b>2-</b>			

M

<b>2-</b>		<b>24×</b>	
<b>3-</b>	<b>9+</b>		<b>2÷</b>
<b>2÷</b>		<b>4+</b>	

E

<b>2-</b>		<b>8×</b>	
<b>2÷</b>	<b>7+</b>		<b>4</b>
		<b>2</b>	<b>9×</b>
<b>2-</b>			

M

<b>2-</b>		<b>24×</b>	
<b>3-</b>	<b>9+</b>		<b>2÷</b>
<b>2÷</b>		<b>4+</b>	

M

<b>2 ÷</b>	<b>48 ×</b>		<b>9 +</b>
	<b>2 ÷</b>		
<b>1 -</b>		<b>1</b>	
	<b>6 +</b>		

H

<b>1 -</b>	<b>2 ÷</b>		<b>4</b>
	<b>8 +</b>	<b>2</b>	<b>6 ×</b>
<b>6 +</b>			
		<b>3 -</b>	

NY Times and kenken.com 25 Sept 09

H

<b>1 -</b>	<b>2 ÷</b>		<b>4</b>
	<b>8 +</b>	<b>2</b>	<b>6 ×</b>
<b>6 +</b>			
		<b>3 -</b>	

H

<b>60 ×</b>			<b>6 ×</b>	
<b>4 -</b>		<b>8 +</b>	<b>4</b>	
<b>2 ÷</b>	<b>10 +</b>			<b>40 ×</b>
			<b>2 -</b>	
<b>4</b>	<b>3 +</b>			

NY Times and kenken.com 25 Sept 09

# Take Your Places

A

	<input type="text"/>	<input type="text"/>
$\times$	<input type="text"/>	<input type="text"/>
<hr/>		

B

	<input type="text"/>	<input type="text"/>
$-$	<input type="text"/>	<input type="text"/>
<hr/>		

C

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<hr/>			

D

<input type="text"/>	?	<input type="text"/>
<hr/>		<hr/>
<input type="text"/>		<input type="text"/>

E

	<input type="text"/>	<input type="text"/>	<input type="text"/>
$\times$	<input type="text"/>	<input type="text"/>	<input type="text"/>
<hr/>			

F

<input type="text"/>	<input type="text"/>	<input type="text"/>
$\times$	<input type="text"/>	<input type="text"/>
<hr/>		

G

<input type="text"/>	(	<input type="text"/>	-	<input type="text"/>	)
----------------------	---	----------------------	---	----------------------	---

H

<input type="text"/>	+	<input type="text"/>
<hr/>		
<input type="text"/>		

# Take Your Places

I

$$\frac{\square - \square}{\square}$$

J

$$\frac{\square + \square}{\square - \square}$$

K

$$\frac{\square - \square}{\square \times \square}$$

L (exponent)

$$\square^{\square}$$

$$\square \square$$

M

$$\square \times \square^{\square}$$

N

$$\frac{\square!}{\square} \times \frac{\square}{\square!}$$

O

$$\frac{\square \times \square^{\square}}{\square}$$

P

$$\frac{(\square + \square) \times \square}{\square}$$

## Backwards Math

Name \_\_\_\_\_

Here are the answers to one hundred math problems. Use four 4's to create problems that will give these answers. Remember to use the correct order of operations to solve your problems: Parentheses, Exponents, Multiply or Divide, Add or Subtract.

1 = \_\_\_\_\_

26 = \_\_\_\_\_

2 = \_\_\_\_\_

27 = \_\_\_\_\_

3 = \_\_\_\_\_

28 = \_\_\_\_\_

4 = \_\_\_\_\_

29 = \_\_\_\_\_

5 = \_\_\_\_\_

30 = \_\_\_\_\_

6 = \_\_\_\_\_

31 = \_\_\_\_\_

7 = \_\_\_\_\_

32 = \_\_\_\_\_

8 = \_\_\_\_\_

33 = \_\_\_\_\_

9 = \_\_\_\_\_

34 = \_\_\_\_\_

10 = \_\_\_\_\_

35 = \_\_\_\_\_

11 = \_\_\_\_\_

36 = \_\_\_\_\_

12 = \_\_\_\_\_

37 = \_\_\_\_\_

13 = \_\_\_\_\_

38 = \_\_\_\_\_

14 = \_\_\_\_\_

39 = \_\_\_\_\_

15 = \_\_\_\_\_

40 = \_\_\_\_\_

16 = \_\_\_\_\_

41 = \_\_\_\_\_

17 = \_\_\_\_\_

42 = \_\_\_\_\_

18 = \_\_\_\_\_

43 = \_\_\_\_\_

19 = \_\_\_\_\_

44 = \_\_\_\_\_

20 = \_\_\_\_\_

45 = \_\_\_\_\_

21 = \_\_\_\_\_

46 = \_\_\_\_\_

22 = \_\_\_\_\_

47 = \_\_\_\_\_

23 = \_\_\_\_\_

48 = \_\_\_\_\_

24 = \_\_\_\_\_

49 = \_\_\_\_\_

25 = \_\_\_\_\_

50 = \_\_\_\_\_

Backwards Math

Name \_\_\_\_\_

Here are the answers to one hundred math problems. Use four 4's to create problems that will give these answers. Remember to use the correct order of operations to solve your problems: Parentheses, Exponents, Multiply or Divide, Add or Subtract.

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

“Thus a teacher of mathematics has a great opportunity. If he fills his allotted time with drilling his students in routine operations he kills their interest, hampers their intellectual development, and misuses his opportunity. But if he challenges the curiosity of his students by setting them problems proportionate to their knowledge, and helps them to solve their problems with stimulating questions, he may give them a taste for, and some means of, independent thinking.”

– George Polya  
teacher of problem solving

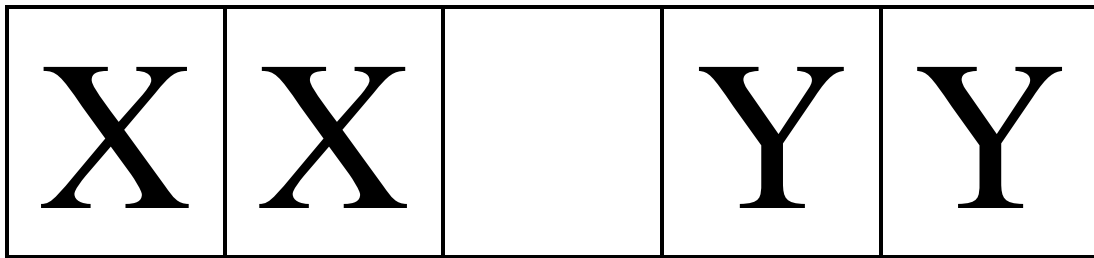
# Hoppy

- ✓ Engaging game format
- ✓ Easily customized to fit ability level of class
- ✓ Leads students towards algebraic generalizations
- ✓ Strategic thinking
- ✓ pattern and function relationship
- ✓ Vocabulary: finite differences, graphing, formulas, domain, range, independent vs. dependent variables

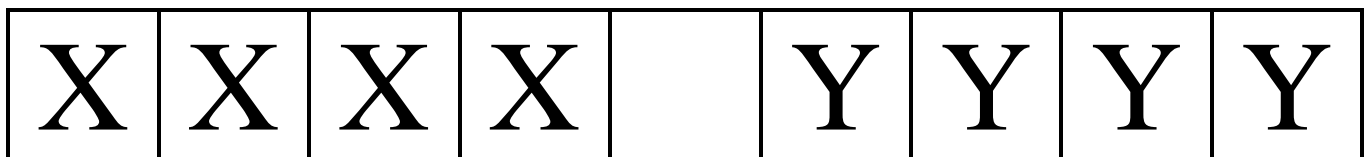
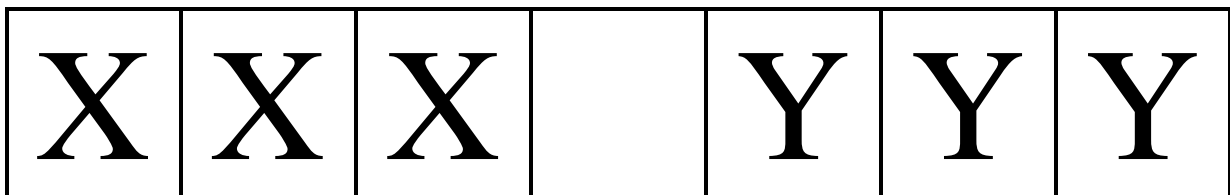
# Hoppy

Put two markers of type *X* on their places, and two markers of type *Y* on their places. Your goal is to exchange their places with the fewest number of moves. These moves are permitted:

- Sliding a marker onto an open space next to it.
- Jumping a marker over a single marker next to it, as long as you land on an empty space.



You can also play the game with more squares:  
Can you predict how many moves it will take?



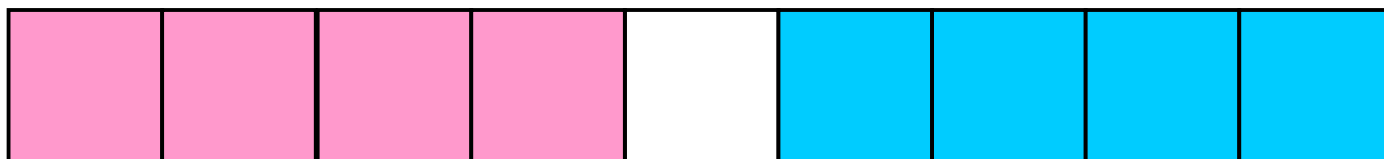
# Hoppy

Put two markers of type  $X$  on their places, and two markers of type  $Y$  on their places. Your goal is to exchange their places with the fewest number of moves. These moves are okay:

- Sliding a marker onto an open space next to it.
- Jumping a marker over any marker next to it, as long as you land on an empty space.



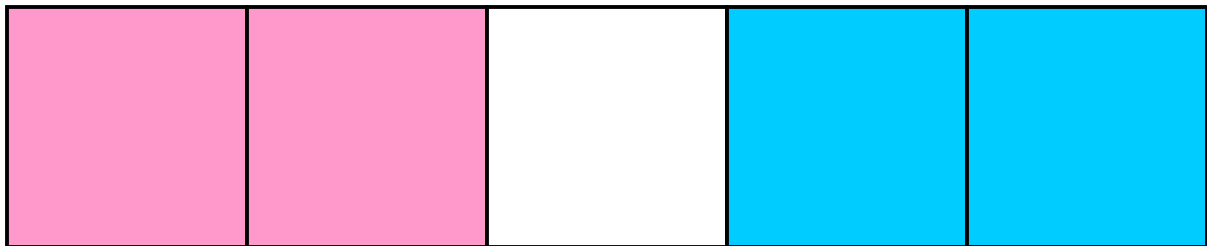
You can also play the game with more squares:  
Can you predict how many moves it will take?



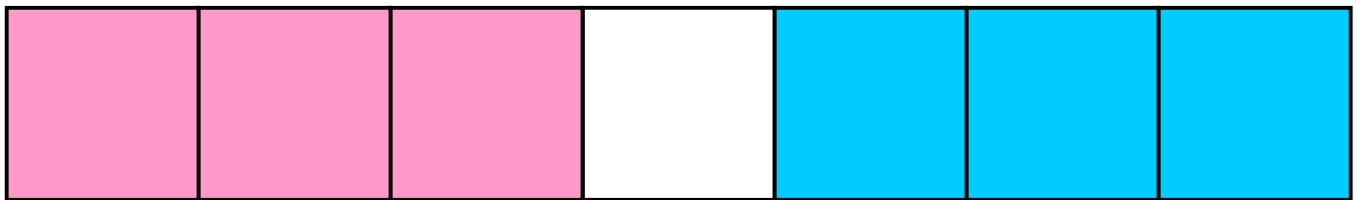
# Hoppy

Put two markers of type  $X$  on their places, and two markers of type  $Y$  on their places. Your goal is to exchange their places with the fewest number of moves. These moves are okay:

- Sliding a marker onto an open space next to it.
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You can also play the game with more squares:  
Can you predict how many moves it will take?



## The Hoppy Function

The number of moves required to change the places of the X's and Y's depends on the number you have to begin with.

What is the relationship?

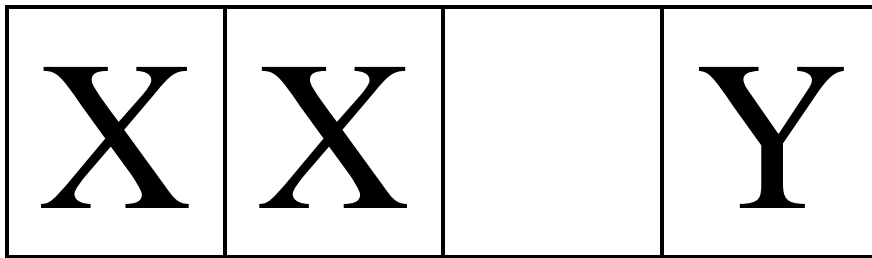
Number of X's and Y's	Number of moves needed
1	3
2	8
3	15
4	24
5	35
...	
$n$	$n(n + 2)$

What is the relationship when using different numbers of X's and Y's?

## Hoppy 2 – Unequal Numbers

Put two markers of type *X* on their places, and one marker of type *Y* on its place. Your goal is to exchange their places with the fewest number of moves. These moves are permitted:

- Sliding a marker onto an open space next to it.
- Jumping a marker over a single marker next to it, as long as you land on an empty space.



You can also play the game with more squares:  
Can you predict how many moves it will take?

