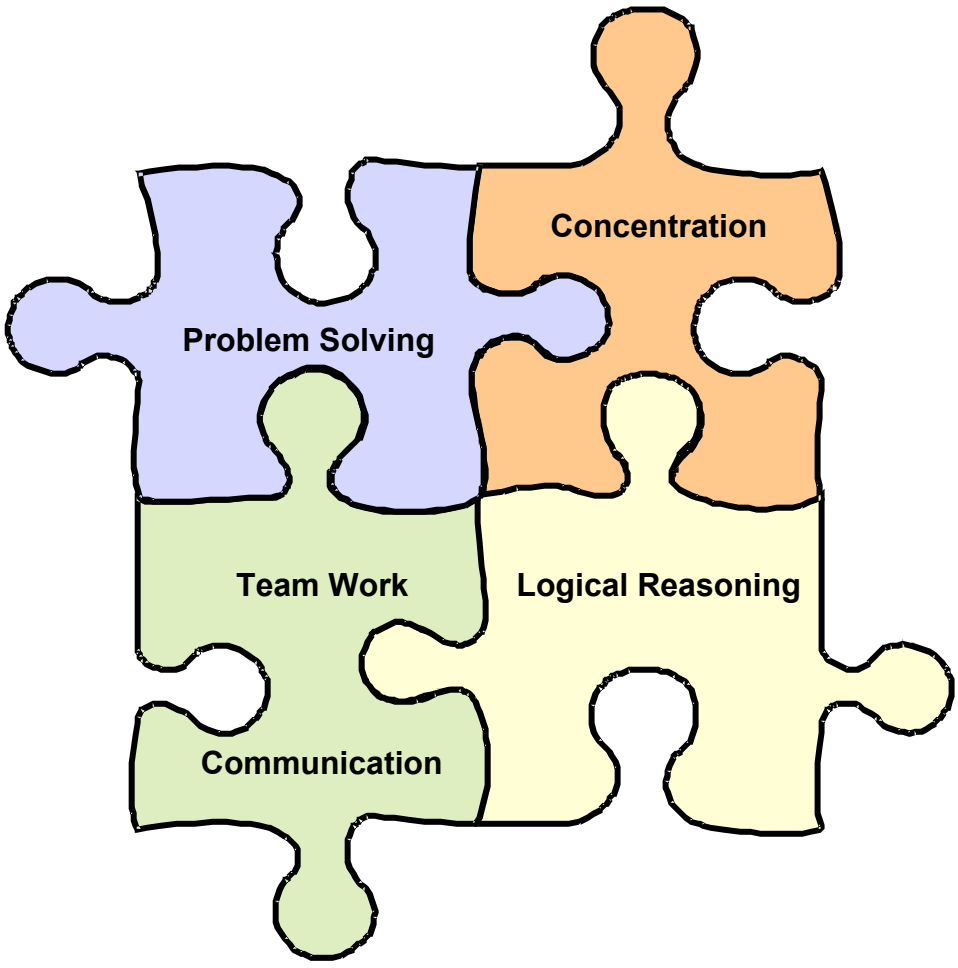
KMEP Presents

Classroom Puzzles



Kivalliq Math Education Panel
Kivalliq School Operations

Acknowledgements

The document *Classroom Puzzles* was compile, adapted, and developed by the Kivalliq Math Education Panel Kivalliq School Operations acknowledges and thanks the following teachers for their time and commitment to this project.

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For more puzzles check out the following web resources:

- www.puzzles.com/
- www.puzzles.ca/linklist.html)

Preface

Puzzles should be a challenging part of your daily routine. They may be given to your class as a group problem solving exercise or developed into centres. Puzzles help to develop the following skills in you class:

- reading
- problem solving
- logical reasoning
- lateral thinking
- perseverance
- concentration
- team work and communication

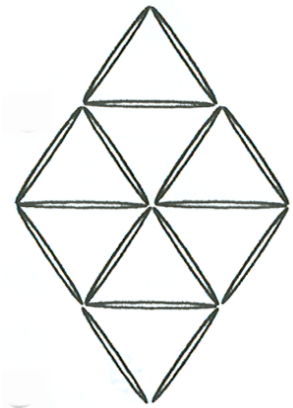
Knowing the answer is not a necessary requirement to using a puzzle in your classroom. In many ways, not knowing the answer helps the teacher to challenge the students to find the solution and show the whole class. If answers are known, teachers should not provide them to their students as this practice could reduce students' efforts to find the answers themselves.

Math Puzzles of this type, can also be sent home with your students for their parents' help. Homework like this will get the whole family involved. An electronic version of this document can be found in the First Class System:

Kivalliq Conferences→Kivalliq Math→Math Month

Baker Lake
August 15, 2006

Stick Puzzles

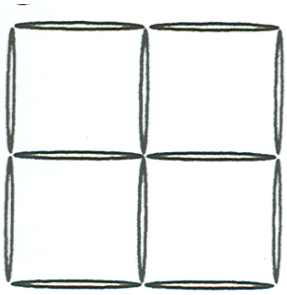


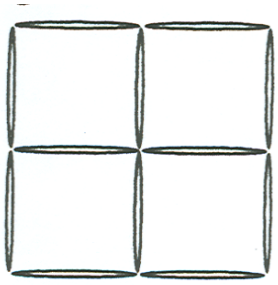
Sticks I

Use popsickle sticks or tooth picks to make the shape on the left. *Remove* the smallest number of sticks to leave four little triangles.

Sticks II

Use popsickle sticks or tooth picks to make the shape on the right. There are four small squares. *Move* as few sticks as possible to make three small squares. All sticks must be used.



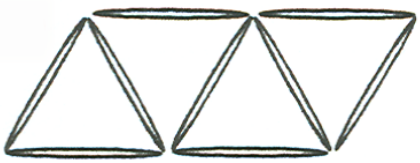


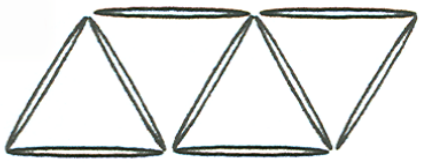
Sticks III

Use popsickle sticks or tooth picks to make the shape on the left. There are four small squares here. *Remove* as few sticks as you can to leave two squares.

Sticks IV

Use popsickle sticks or tooth picks to make the shape on the right. *Move* four sticks and make three non-overlapping parallelograms that are exactly the same.



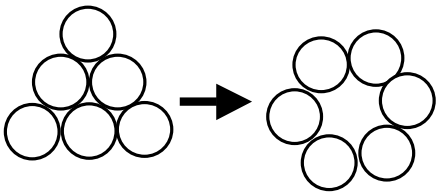


Sticks V

Use popsickle sticks or tooth picks to make the shape on the left. *Move* three sticks and make two non-overlapping quadrilaterals that are exactly the same.

Coin Puzzles

Sliding Pennies I

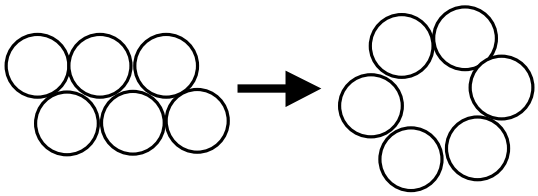


Six pennies are placed on the table to form a triangle as shown. By sliding one penny at a time, move them to form the shape on the far right. You can only move one penny at a time, without disturbing any other penny. When you move a penny, it has to be moved to a position where it touches two others.

The pennies have to stay flat on the table at all times.

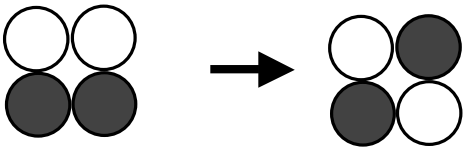
Sliding Pennies II

Place six pennies on the table in two rows as shown on the far left. The object is to turn these two rows into the coin circle shown in the right figure in only three moves.



A move consists of sliding one coin to a new position, where the moved coin has to touch two other coins.

Coin Squad



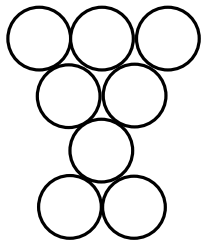
Take four coins of the same size or four two-colour counters and make a square as shown in the far left square in the illustration; two coins - heads up in the top row, and the other two - tails up in the bottom row.

The object is to make another square with two coins heads up on one diagonal and with two coins tails up on the other - as shown in the right square in the illustration.

This should be performed in the shortest possible number of moves.

A move consists of sliding a pair of the two adjoining coins to a new place. You have to slide the coins only orthogonally; it means that you are not allowed to rotate the pair of coins while you move it. The final square not necessarily needs to be formed exactly at the same spot as the start square was.

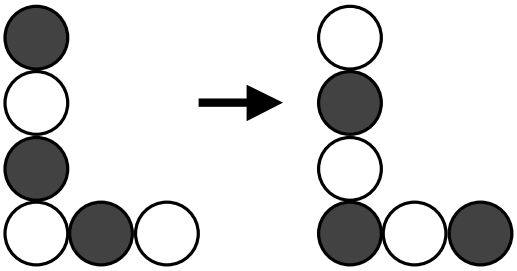
Tip the Cup



Make the depicted cup with eight coins of the same size as shown in the illustration. The object is to move only two of them in a new position to get the cup standing upside-down.

You're allowed to move the coins as you wish but at the end the cup has to have exactly the same shape only rotated at 180 degrees from its start position.

Exchange

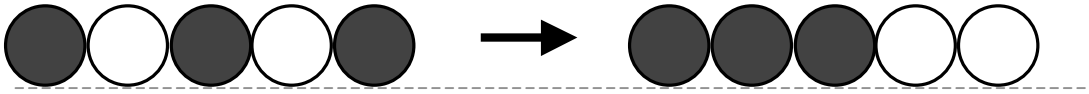


Take six two-colour counters of the same size and arrange them in the capital L altering colours as shown in the illustration - left position.

The goal is to make another L with all the two colour counters having their heads and tails exchanged as shown in the right position of the illustration. It should be performed in the fewest possible number of moves.

A move consists of sliding a pair of the two adjoining two colour counterss to a new place. You have to slide the two colour counterss only orthogonally; it means that you are not allowed to rotate the pair of two colour counterss while you move it. The final L not necessarily has to be formed exactly at the same spot as the start L was.

Sort the Counters



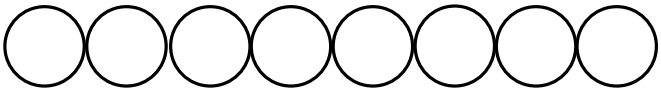
Arrange five two-colour counters (or coins) as shown above on the left.

The problem is to rearrange their positions to those shown on the right side of the diagram in the fewest possible number of moves.

A move consists of placing the tips of the first and second fingers on any two *touching* counters, always of the *different colours*, then sliding the pair to another spot along the imaginary line shown in the illustration. The two counters in the pair must touch at all times. The counter at left in the pair must remain at left; the counter at right must remain at right. Gaps in the chain are allowed at the end of any move except the final one. After the last move the counters need not necessarily be at the same spot on the imaginary line that they occupied at the start.

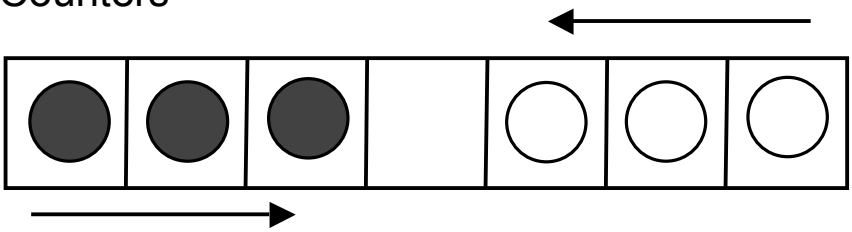
Pile Four

Place eight counters in a row as shown in the illustration. The object is to make from all the counters four stacks of two counters each and it should be done in four moves only.



Every move consists of jumping of a coin over any two counters (no matter lying flat or in a stack) in one direction, and stopping on the top of the next counter.

Jumping Counters

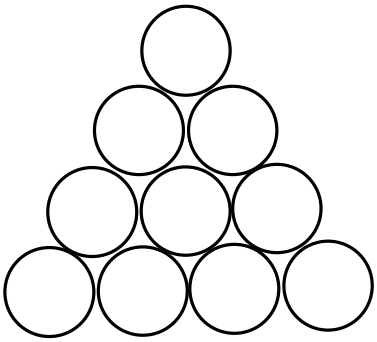


The three red counters and the three yellow counters have to change positions. The red counters can only be moved to the right and the yellow ones can only be moved to the left. A counter can move into an empty square if it is beside the empty square. A counter can jump over a different coloured counter as long as there is an empty square to land in. A counter cannot jump over two counters or over a counter of the same colour.

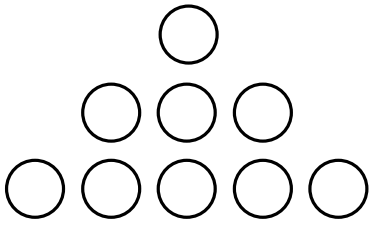
Try acting this puzzle out with boys and girls instead of red and yellow counters.

Triangles I

When the centers of any three counters lie in the corners of an equilateral triangle of some size, such counters form an equilateral coin triangle. How many equilateral coin triangles of different sizes can you count in the figure?



The object of the puzzle now is to remove the minimum number of counters so that no equilateral triangles remain. In other words, centers of any three counters among those that remained don't lie in the corners of an equilateral triangle.

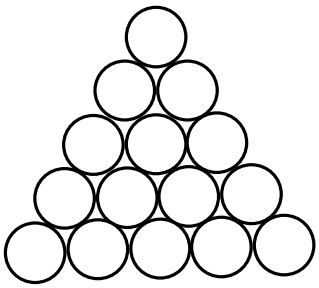


Triangles II

Move the coins dragging them. Change the triangle into a square by moving the minimum of the coins.

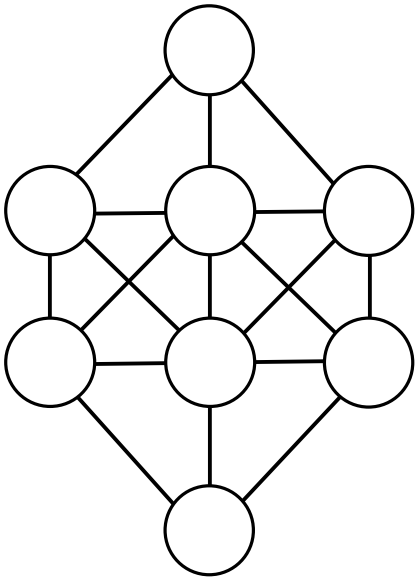
How many coins will you need to move to do this?

Simple Nim



Nim is a very old puzzle game that can be played many different ways. The rules given here are for a simple version of the game. Arrange fifteen counters to form a triangle, like the one shown here. Players take turns removing one, two, or three counters from the triangle. The player who removes the last counter or counters from the table, wins the game. Does the same player win all of the time? To understand the game and winning strategies, play the game with only 6 counters. Who wins this version? Increase the counters to 10 and play until you understand the strategy. Now try the game with twenty-one counters

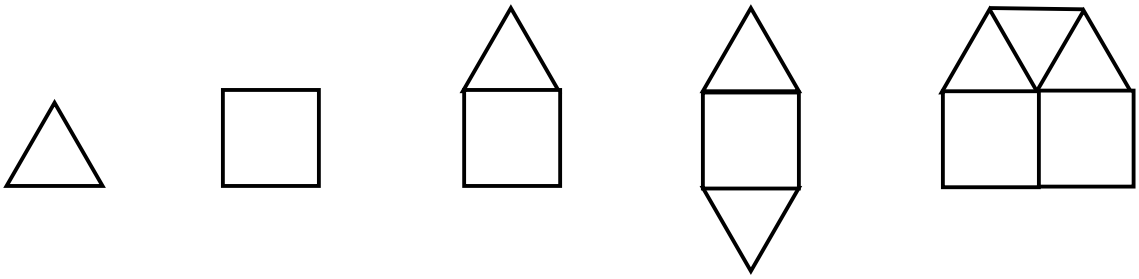
Number Pattern Puzzle



Write the numbers 1 through 8 in the circles so that no two numbers inside the circles joined by a line differ by 1. For example, if you put a 5 in the bottom circle, you cannot put a 4 0r a 6 in any of the circles in the row directly above it because those three circles are joined by lines.

Building Polygons

You are given many squares and equilateral triangles. All with the same side length. Your challenge is to arrange the squares and triangles to produce poly gons of 3, 4, 5, 6, 7, 8, 9, 10, 11, & 12 sides. Some examples are given below.



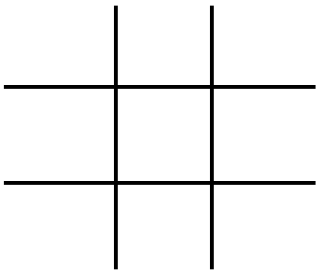
3 sides 4 sides 5 sides 6 sides or 6 sides

Thelon Puzzle I

A trapper comes to the Thelon River with a Ptarmigan, a Dog, and some Berries. To cross the river there is a small boat, with only room enough for the trapper and one of his items. He will have to make several trips across the river to transport all of his items. However, he can not trust his dog to be alone with the ptarmigan, for the dog is hungry and might eat it. Also he could not trust the ptarmigan to be alone with the berries for the ptarmigan is hungry and might eat them. How can the trapper get all of his items safely across the river?

Thelon Puzzle II

A mother, father and two children want to cross the Thelon River in a small boat that can only carry one adult or 2 kids at a time. Both kids are good rowers, but how can the whole family reach the other side of the Thelon River?



Wild Tic-Tac-Toe

This game is the same as ordinary tic-tac-toe, except that at each turn the player can choose to play an X or an O. You win if you get three X's in a row, or three O's in a row. If the first player doesn't make any mistakes, he or she can always win.

Measuring Cups

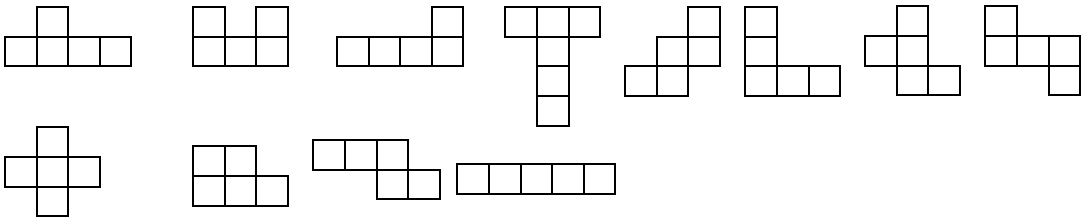
You are given a 3-ounce measuring cup and a 5-ounce measuring cup. Using only these two cups, explain how you could measure out the following amounts.

1 ounce
2 ounces
3 ounces
4 ounces
5 ounces
6 ounces
7 ounces
8 ounces
9 ounces
10 ounces
100 ounces

Pentominoes (www.numeracysoftware.com)

Ask to connect 5 multilink cubes together in as many different 2-dimensional arrangements as possible. This is a very worthwhile activity because it raises the important question of what we mean by 'different'. It is likely that many pupils will duplicate at least one of the arrangements, with one being a reflection or rotation of another. They will have constructed the SAME SHAPE but in a DIFFERENT ORIENTATION. This can be the focus of valuable discussion with individuals and the entire class.

There are 12 different pentomino arrangements as illustrated below.

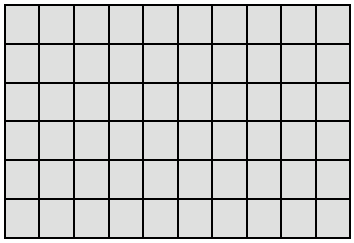


Once pupils have produced the complete set they can be used in various follow-up activities:

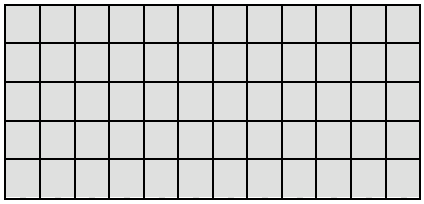
- Line Symmetry – ask pupils to draw the lines of symmetry on all of the pentominoes.
- Rotational Symmetry – ask pupils to identify those pentominoes that have rotational symmetry.

- Perimeter – Sort the twelve pentominoes according to the length of their perimeters.
- Tessellation – Which of the pentominoes will tessellate? Tessellating the pentominoes is far more interesting and challenging than tessellating simple regular shapes!

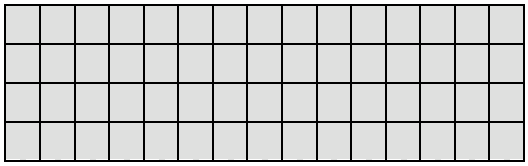
If your class has a set of plastic pentominoes they can be used in a puzzle centre. See if you students can arrange the pentominoes to make the following solid rectangles.



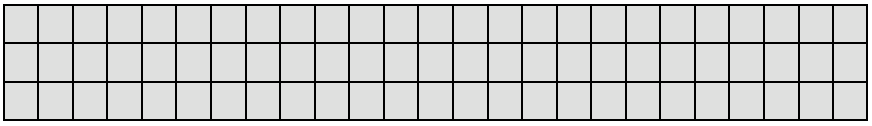
6 x 10



5 x 12



4 x 15



3 x 20

Rush Hour

Introduction

Rush Hour® is one of the most elegant and fun sliding block puzzles to come on the market in years. It's designed to challenge players of all ages all around the World. Rush Hour® teaches logical progression, problem solving and sequential-thinking skills.

The Object

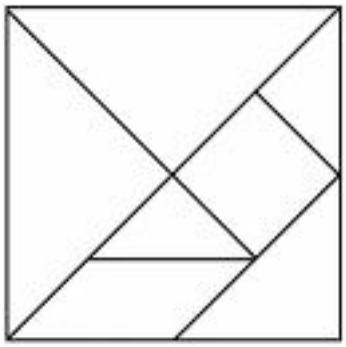
Your goal is to drive your red car out of the playing grid and escape to freedom… To do so, set up the traffic on a game grid to match one of 40 playing cards, then shift all blocking cars and trucks out of your way, and you win!

Play Game

Rush Hour® is a genuine puzzle phenomenon with legions of fans. There are some great places on the Web dedicated to this most successful sliding block puzzle of these years. We'd like to introduce here some of them. Good Luck!

- www.puzzles.com/products/rushhour.htm
- www.woodlands-junior.kent.sch.uk/Games/rush/rushHour_test.html

Tangram

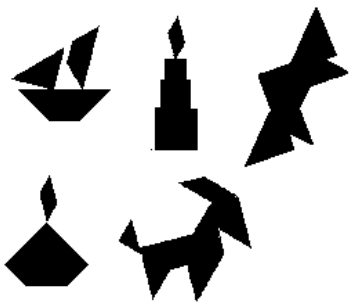


Introduction

Tangram is an ancient Chinese puzzle, consisting of 7 geometric shapes that are moved around to make a surprising number of different pictures.

The Object

Your goal is rearrange the seven puzzle pieces to make a given picture, like the ones below.



Play Game

Tangrams may be made from paper or cardboard or purchased from math resource suppliers

- www.tangrams.ca/

Simple Sudoku

(www.thinks.com or www.sudoku.com or www.sudokuforkids.com/)

Sudoku puzzles were first published in the US in the 1970s and are sometimes known as "Number Squares". They have been popular for many years in Japan, where the name "Sudoku" (meaning "single number") was coined. The current craze was started late in 2004 when a UK newspaper started publishing the puzzles.

The Challenge

The aim of the puzzle is to insert numbers in the boxes to satisfy only one condition: each row, column and 3x3 box must contain one each of the digits 1 through 9. There is a unique solution, which can be found by logical thinking.

This means that — The digits to be entered are 1, 2, 3, 4, 5, 6, 7, 8, 9.

9	6	3	1	7	4	2	5	8

This is a **row**, 9 cells wide. A filled-in row must have one of each digit. That means that each digit appears only once in the row. There are 9 rows in the grid, and the same rule applies to each of them.

9
1
2
8
4
7
5
3
6

This is a **column**, 9 cells tall. A filled-in column must have one of each digit. That means that each digit appears only once in the column. There are 9 columns in the grid, and the same rule applies to each of them.

This is a **box** on the right, containing 9 cells in a 3x3 layout. A filled-in box must have one of each digit. That means that each digit appears only once in the box. There are 9 boxes in the grid, and the same applies to each of them.

9	6	3
1	7	8
2	5	4

You can't change the digits already provided in the grid. You have to work around them.

Every puzzle has just one correct solution.

Sudoku in the Classroom

Sudoku are suitable for Kivalliq math classrooms because:

- They develop logic, reasoning skills and brainpower.
- They are fun.
- They are great time-fillers for a spare moment, in the classroom or at home.

7	8	9	5	1	2	4	3	6
1	2	4	6	3	8	5	7	9
5	3	6	7	9	4	1	8	2
6	7	1	8	4	9	2	5	3
8	9	3	1	2	5	6	4	7
2	4	5	3	6	7	8	9	1
3	6	8	9	5	1	7	2	4
9	5	2	4	7	6	3	1	8
4	1	7	2	8	3	9	6	5

Solution to the Sudoku puzzle on the next page. Don't Cheat!

Sudoku puzzles are perfect for classroom use, as time-fillers for children who finish early, as whole class activity, or as "homework".

Sudoku: Try one out!

	8						3	
1	2			3			7	9
			7	9	4			
		1		4		2		
	9	3	1		5	6	4	
		5		6		8		
			9	5	1			
9	5			7			1	8
	1						6	

The answer to this puzzle is on the other side of this page, but try not to look .