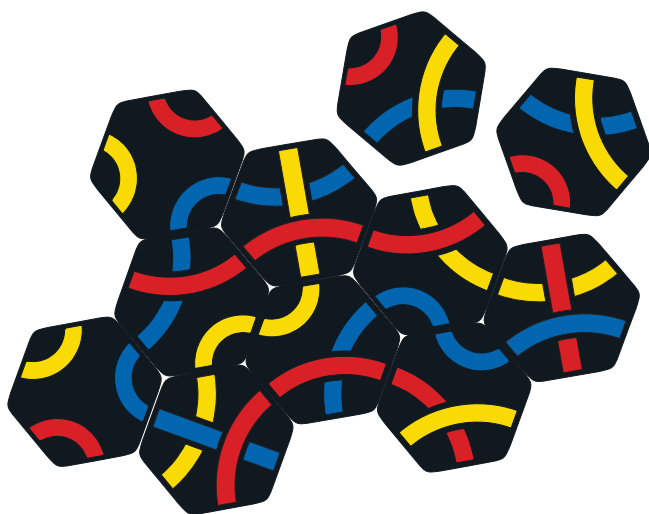


# TANTRIX



Teacher / Parent Guide  
for the use of Tantrix tiles with children of all ages

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# CONTENTS

Introduction .....	4
What is Tantrix? .....	4
How to make the best use of this guide .....	4
Activities .....	5
Notes for teachers .....	5
Kindergarten (age 4) .....	6
Activity 1- Sorting tiles .....	6
Activity 2- Simple patterns .....	7
Activity 3- Line building .....	7
Level 1 (ages 5-7) .....	8
Achievement Objective 1- Tiling .....	8
Achievement Objective 2- Symmetry .....	8
Achievement Objective 3- Line Building .....	9
Achievement Objective 4- Tantrix Discovery .....	9
Levels 2-3 (ages 7-11) .....	10
Achievement Objective 1- Tantrix Discovery continued.....	10
Achievement Objective 2- Tantrix tiles .....	11
Achievement Objective 3- Angles .....	11
Level 4+ (ages 11 and above) .....	12
Achievement Objective 1- Tantrix tiles .....	12
Achievement Objective 2- Simple loop theory .....	12
Achievement Objective 3- Complex loop theory .....	13
Other activities .....	14
Example solutions .....	15
Final note .....	22
Acknowledgements .....	22
Alternative tile sets .....	23
Background .....	23



# INTRODUCTION

## WHAT IS TANTRIX?

Tantrix is a collection of activities for 1-4 players using hexagonal tiles, each criss-crossed with three lines of different colours.

The full range of Tantrix products is shown on our website [www.tantrix.co.nz](http://www.tantrix.co.nz). This booklet can be used in association with all of them to some extent. However, it is best used with one of the following:

- Tantrix for Schools (28 tiles)
- Tantrix Solitaire (14 tiles)
- Tantrix Game Pack (56 tiles)

Although most Tantrix activities are suitable for children from the age of six, this guide attempts to put Tantrix into a more educational context in line with the goals set out in the New Zealand Curriculum Framework.

## HOW TO MAKE THE BEST USE OF THIS GUIDE

We recommend you use this guide with sets of 14 Tantrix tiles. You can do this by using our special 28-tile sets for schools or by splitting a standard Tantrix Game Pack into the four sub-sets of no-green, no-yellow, no-red, and no-blue tiles, in which case four groups of children can work on the tasks at the same time. When specific tiles are required, the tile numbers for the main 1-14 set are shown in the main task, with the numbers for the other three sub-sets shown on p. 23.



# ACTIVITIES

## NOTES FOR TEACHERS

The activities in this guide are loosely divided into the main levels of the New Zealand Curriculum Framework. However, activities in an adjacent higher or lower age group may be appropriate for some children.

There is no need to strictly follow the order in which the tasks are set out in this guide - feel free to pick out the tasks you consider most suitable, rearrange them, or even invent your own tasks.

There are example solutions to most of the tasks on pages 15-21.

Before you start, please read the section on How to make the best use of this guide on the previous page.



## KINDERGARTEN (AGE 4)

### NOTES FOR TEACHERS

Once presented with the tiles, even very young children will spontaneously turn them all line-side up and try to join them together, instinctively trying to match the colours. However, children will soon reach a stage where they need help to develop their initial ideas further.

The tasks in this guide try to connect the way children intuitively play with the tiles to the goals set out in the New Zealand Curriculum Framework, such as using the numbers up to 20, using words like more or less, as well as talking about, recognising and recreating simple patterns.

### ACTIVITY 1- SORTING TILES

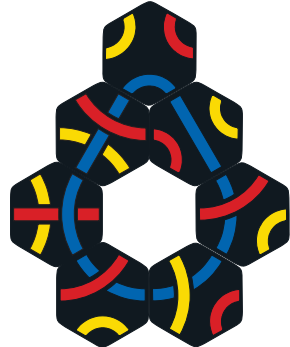
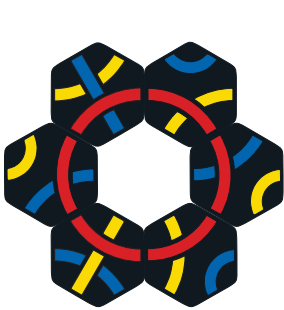
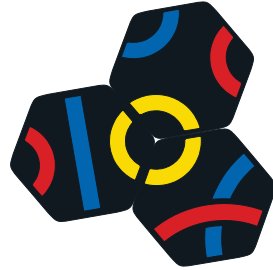
Look at a complete set of 14 tiles.

- a) There are four different patterns on your tiles. Find them.
- b) How many tiles of each type are there?
- c) Working together with others, give the different types of tiles names.
- d) Ask your teacher or a friend to describe a tile and see if you can find it among your tiles.



## ACTIVITY 2 - SIMPLE PATTERNS

- Make a small circle in one colour like the one shown on the right. How many circles can you make with a set of 14 tiles?
- Try to recreate and name some of the patterns below.



## ACTIVITY 3 - LINE BUILDING

- Pick up to five tiles and join them together to form a long path in one colour.
- How many tiles does your path run through?
- Find a friend whose path has the same colour. How many tiles does his or her path run through? Whose path is longer?
- See if you can join your paths together. How long is it now? Maybe you can make a really long line if you join up with several friends.



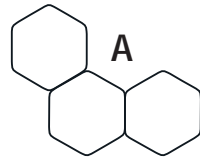
LEVEL 1 (AGES 5-7)

NOTES FOR TEACHERS

The tasks in level 1 build on what was learned in kindergarten and some of the activities from kindergarten may still be appropriate. New to this stage is the introduction of symmetry and the ability to tessellate large numbers of tiles.

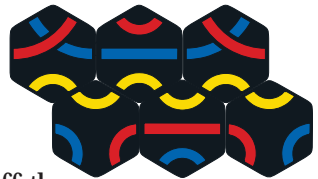
ACHIEVEMENT OBJECTIVE 1- TILING

- a) Put any three tiles together in the shape shown on the right so that all touching links match in colour.
- b) Can you find a tile to fit the space marked A?
- c) Try again with a different set of tiles.
- d) Is it possible to create a space where none of the remaining tiles will fit with the colours matching?



ACHIEVEMENT OBJECTIVE 2- SYMMETRY

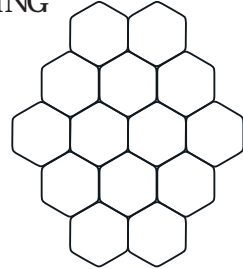
- a) Recreate this pattern:  
Is the line which runs through all the tiles symmetrical?
- b) Would it be symmetrical if you took one tile off the e
- c) What other symmetrical patterns can you think of?
- d) Complete the other half of this circle.  
Are all circles symmetrical?





## ACHIEVEMENT OBJECTIVE 3- LINE BUILDING

- Take all 14 tiles and put them together in the shape shown on the right.
- Turn each tile until all touching colours match. If necessary, swap 2 or more tiles.
- Count how many tiles the longest line of each colour runs through. Which one is the longest overall?
- Can you make your longest line even longer by taking a tile away from another place in your layout and adding it to your longest line? (There is no need to stick to the original shape for this.) What happens to the other lines if you do that?



## ACHIEVEMENT OBJECTIVE 4- TANTRIX DISCOVERY

Tantrix Discovery covers everything learned so far - tiling, line building and symmetry. NB. Not all loops (ie closed lines) are perfect circles. Try these puzzles and discuss after each one whether the loop is a circle or not and whether it is symmetrical. NB: Make sure that all lines that touch match in colour.

- Take tiles 1, 2 and 3 and make a yellow loop.
- Break up the first three tiles, add tile 4 and make a new loop with all four tiles. The colour of the number on the tile just added tells you what colour loop to make, so the 4-tile loop is red.
- Continue as above with five and then six tiles.
- For a really tough challenge try the puzzle with seven tiles. Remember that a loop can be any closed shape.



## LEVELS 2-3 (AGES 7-11)

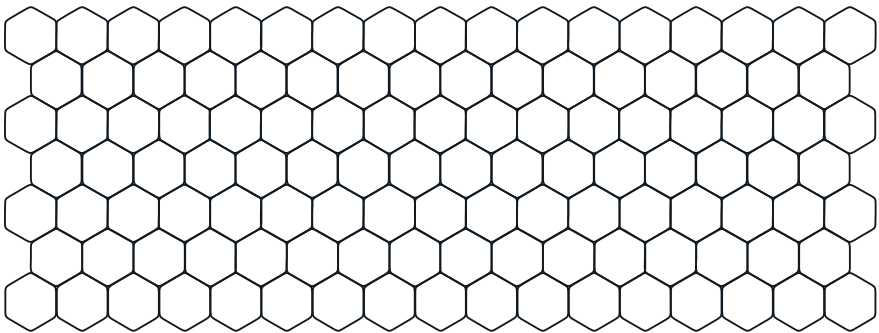
## NOTES FOR TEACHERS

At this stage we continue to build on the concept of symmetry as well as introducing some basic principles of geometry such as the properties of a Tantrix tile and measuring the angles of sectors in a circle.

## ACHIEVEMENT OBJECTIVE 1- TANTRIX DISCOVERY continued

Following on from the Discovery puzzles in level 1, continue to make loops with seven (blue) and eight tiles (blue).

- Draw your solution to the eight-tile puzzle. (You can use the grid below to help you with this.)
- There are four different solutions to the eight-tile puzzle. Find as many as you can and draw each one.
- Which of the solutions are symmetrical and which ones are not?



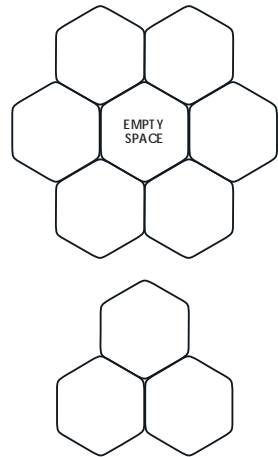


## ACHIEVEMENT OBJECTIVE 2 - TANTRIX TILES

- What is the mathematical name for the shape of a Tantrix tile?
- How many lines of symmetry does a Tantrix tile have?
- As you know, Tantrix tiles can be tiled (or tessellated) perfectly. Are there any other shapes that fit together without any gaps?
- What would it be like to play with those other shapes?

## ACHIEVEMENT OBJECTIVE 3 - ANGLES

- Build a perfect circle using six tiles.
- Draw your circle in the grid on the right.
- The six tiles split the circle into six sectors. Draw these sectors on your drawing like slices of a cake.
- Do the same with a three-tile circle, except that now of course there are only three sectors.
- Compare the two drawings. The 'cake slices' of which circle have wider internal angles?
- Measure the internal angles of the two different types of sector.
- Considering the size of the angles and the number of sectors in the circles, how many degrees does each circle have? Are the sums of the internal angles of the two circles different or are the total internal angles of all circles the same?





## LEVEL 4+ (AGES 11 AND ABOVE)

### NOTES FOR TEACHERS

At this stage, the children will already be able to do many of the more difficult activities contained in a standard Tantrix Game Pack (see p. 14). This guide continues to look in more detail at the geometric properties of hexagons, loops and circles.

### ACHIEVEMENT OBJECTIVE 1- TANTRIX TILES

Look at a set of 14 tiles.

- a) One possible pattern with each of the three line colours ending on two edges of the tile is missing. Which one is it and how many tiles could you add to the set to complete it?
- b) Why do you think the additional tiles have been left out? (Clue: Think of the section on 'tiling' from KS1-1.)

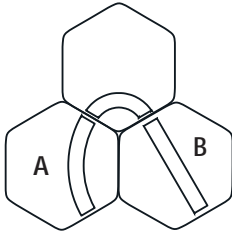
### ACHIEVEMENT OBJECTIVE 2 - SIMPLE LOOP THEORY

As seen in level 2-3, a circle made up of shallow bends contains six Tantrix tiles. One bend therefore makes up  $1/6$  of a circle. Similarly, a narrow curve is  $1/3$  of a circle. The straight does not form part of a circle - its value is 0.

Solve the Discovery puzzles with 3, 4, 5 and 6 tiles (see level 1-4). For each puzzle count the number of straights, bends and narrow curves that form part of the loop. Show how adding up their values will always give you a total of 1. For example, the 3-tile loop contains  $1/3 + 1/3 + 1/3 = 3/3 = 1$



### ACHIEVEMENT OBJECTIVE 3- COMPLEX LOOP THEORY



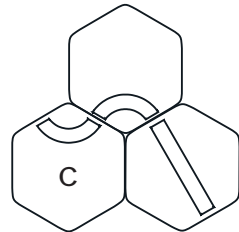
In the Discovery puzzles up to six tiles all narrow curves and bends curve inwards, ie they are supporting links. Example: the bend played at A on the left.

The straight line curves neither inwards nor outwards. This means it is a neutral link. E.g. the straight line played at B on the left.

- a) What happens if one of the links in your loop is a non-supporting link, ie if the link on the tile faces outwards such as the narrow curve played at C on the right?

Try the 7-tile Discovery puzzle and count the number of straights, bends and narrow curves that form part of the loop.

What do you need to do in order to make sure the total of all parts of a loop is no more than 1?



- b) If the total sum of all bends and curves that form part of a loop is greater than 1, how much of the extra amount needs to be subtracted from the total to get a total of 1? What is the consequence for attempts to build loops with an uneven number of bends (value  $1/6$ )?
- c) Your findings under b) will help you to solve Tantrix loop puzzles that don't tell you the colour of the loop. In what way can loop theory help you to predict the shape of a Tantrix loop? Try out your findings on the 10-tile Discovery puzzle.



## OTHER ACTIVITIES

Older students can try to solve the advanced puzzles which are contained in the Tantrix Game Pack, which include 40 puzzles of many types and varying difficulty, from the basic Tantrix Discovery puzzles covered in this guide right up to two near-impossible puzzles.

### TANTRIX STRATEGY

Depending on the age of your students you may like to introduce them to the Tantrix strategy game. We have found that from the age of eight, children are quite capable of playing and enjoying the game. In fact, some of the best players in the world are teenagers:

At the time of writing, the youngest ever tournament player was seven years old (the oldest was 59). The youngest World Junior Champion was just 9 years old and the youngest ever winner of an adult tournament was a 12-year-old from Australia.

### TANTRIX ONLINE

If you have a PC with Internet access then you can meet, chat with and play against other players from around the world by connecting to [www.tantrix.com](http://www.tantrix.com). This opens up all sorts of possibilities such as interschool competitions maybe even against schools on the other side of the world!

We are happy to advise on organising such a competition and maintain a database of schools wanting to play against other schools (either online or offline), so if you are at all interested, please let us know.



## EXAMPLE SOLUTIONS

### KINDERGARTEN (AGE 4)

#### ACTIVITY 1 - SORTING TILES

- a & b) In a set of 14 tiles, there are:
- 6 tiles with 1 narrow curve and 2 bends
  - 2 tiles with 3 narrow curves
  - 3 tiles with 2 narrow curves and 1 straight line
  - 3 tiles with 1 straight line and 2 bends
- c) Obviously, there are no limits to the children's imagination in this task. We have had, for example, several reports of children calling this tile the 'angry face'.



#### ACTIVITY 2 - SIMPLE PATTERNS

- a) The maximum number of circles you can make without using any tile twice is 3. If you join some of the tiles together, it is possible to make up to four circles.
- b) Possible names are 'circle' or 'wheel', 'waves' and 'raindrop'. Again, the children are free to invent their own names.

#### ACTIVITY 3 - LINE BUILDING

There are no right or wrong answers to this task. It is simply designed to let the pupils learn to add up, join colours and create patterns while having lots of fun.



LEVEL 1 (AGES 5-7)

ACHIEVEMENT OBJECTIVE 1- TILING

- b) The best way to find a tile that fits a space like 'A' is to 'read' the coloured links ending in the space in a clockwise direction. The space on the right, for example, is a red-blue-yellow space. Then read the coloured links around the edges of the other tiles the same way.



NB: Empty spaces which are surrounded by three tiles like 'A' above are known as 'forced spaces' in the Tantrix game. Identifying the tiles that can fit a forced space and hence being able to put together large numbers of tiles is a key skill in most Tantrix activities.

- d) If the coloured links ending in space A are all the same colour, it is not possible to fill the space, as one colour can only ever end on two sides of a Tantrix tile.

ACHIEVEMENT OBJECTIVE 2- SYMMETRY

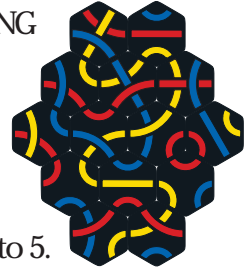
- a) No, it is not symmetrical. (This answer will suffice at this stage. To be precise, the pattern is rotationally symmetrical but not axially symmetrical.)
- b) Yes.
- c) For inspiration, please see the patterns on p. 7. There are plenty of other patterns too.
- d) All circles are symmetrical.





### ACHIEVEMENT OBJECTIVE 3 - LINE BUILDING

Again, there are no right or wrong answers. In the example on the right, the longest red line runs through 4, blue through 7 and the longest yellow line through 12 tiles. Adding the two other yellow links to the end of the yellow line will reduce the longest blue line to 5.



### ACHIEVEMENT OBJECTIVE 4 - TANTRIX DISCOVERY



Circle: yes  
symmetrical: yes



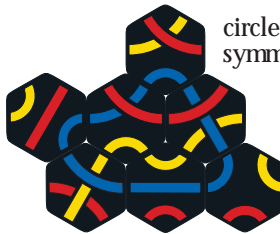
circle: no  
symmetrical: yes  
(2 lines of symmetry)



circle: no  
symmetrical: yes  
(1 line of symmetry)



circle: no  
symmetrical: yes,  
but only rotational, ie  
no lines of symmetry



circle: no  
symmetrical: no

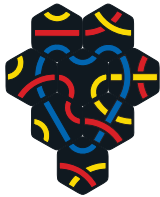
NB: If you are using Discovery tiles (instead of a 14-tile set), please note that with these sets number 7 is red as explained in level 3-3) a) on p. 20.



LEVELS 2-3 (AGES 7-11)

ACHIEVEMENT OBJECTIVE 1- TANTRIX DISCOVERY

a-c) The different solutions to the 8-tile puzzles are:



symmetrical  
(1 line of  
symmetry)



not  
symmetrical



not  
symmetrical

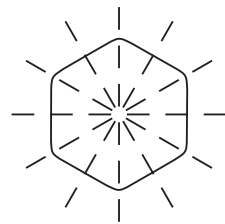


symmetrical  
(2 lines of  
symmetry)

The two loops in the middle are not symmetrical. They are, however, mirror images of each other.

ACHIEVEMENT OBJECTIVE 2 - TANTRIX TILES

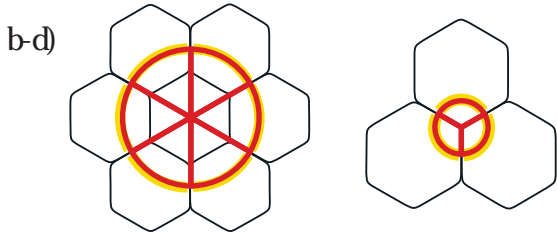
- a) Hexagon
- b) Six (see right)  
The number of lines of symmetry in a regular polygon is equal to the number of its sides.



- c) Rectangles and triangles.
- d) For the coloured links to end on two different sides, the shape must have an equal number of sides, else one side would be unused. Hence, the triangle is not suitable. The square would have only two lines per tile instead of three and only two different types of tiles.



### ACHIEVEMENT OBJECTIVE 3 - ANGLES

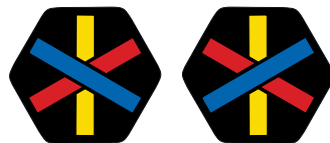


- e-f) With  $120^\circ$ , the sectors in the smaller circle are wider than the  $60^\circ$  sectors in the larger circle.  
g) The larger circle has  $6 \times 60^\circ = 360^\circ$   
The smaller circle has  $3 \times 120^\circ = 360^\circ$   
The internal angles of all circles sum up to  $360^\circ$ .

### LEVEL 4+ (AGES 11 AND ABOVE)

### ACHIEVEMENT OBJECTIVE 1- TANTRIX TILES

- a) The two tiles called 'triple intersection' are missing:  
b) All other tiles each fit six types of 3-sided space. The triple intersections only fit three types of 3-sided space each, as the sequence of colours around the edge of the tiles repeats itself (eg yrb, rby, byr, then again yrb, rby, byr for the first tile above). Therefore, the triple intersections (which were included in early versions of Tantrix) tended to stay in players' hands longer than the other tiles and considerably handicapped the players who were unlucky enough to pick them up.





## ACHIEVEMENT OBJECTIVE 2 - SIMPLE LOOP THEORY

$$3 \text{ tiles: } 3 \times 1/3 = 3/3 = 1$$

$$4 \text{ tiles: } 2 \times 1/6 + 2 \times 1/3 = 2/6 + 2/3 = 2/6 + 4/6 = 6/6 = 1$$

$$5 \text{ tiles: } 2 \times 1/6 + 2 \times 1/3 + 0 = 2/6 + 4/6 + 0 = 6/6 = 1$$

$$6 \text{ tiles: } 2 \times 1/6 + 2 \times 1/3 + 2 \times 0 = 2/6 + 4/6 + 0 = 6/6 = 1$$

## ACHIEVEMENT OBJECTIVE 3 - COMPLEX LOOP THEORY

- a) The blue 7-tile loop consists of:  
 $3 \times 1/3 + 2 \times 1/6 + 2 \times 0 = 1 + 1/3$   
 In order to achieve a sum of 1, the angle of the non-supporting link must be subtracted from the total, ie:  
 $3 \times 1/3 + 1/6 + 0 - 1/6 = 1$



NB: If you are using Discovery tiles (instead of 14-tile sets), number 7 is red. In fact, the -tile loop can be solved both in red and in blue. However, please note that the red loop is a slightly different shape. Therefore, the calculation differs too:

$$2 \times 1/3 + 3 \times 1/6 + 0 - 1/6 = 1$$

- b) Theoretically, the total of the extra amount should be subtracted. However, in Tantrix loop puzzles it is not possible to just remove the extra tiles. Each outward facing tile must be cancelled out by an inward facing tile of the same value or equivalent. It is therefore necessary to subtract only half of the extra amount as with the 7-tile loop above. If a loop is just one bend over 1, it is  $1/6$  over. That means a tile with a value of  $1/12$  (half of  $1/6$ ) needs to face outwards. As such a tile does not exist, tile sets with an uneven number of bends cannot be made into loops.



(If a set of tiles is one curve over 1 on the other hand, the tile that needs to face curve over 1 must have a value of  $1/6$ , ie it must be a bend.)

- c) Following on from your findings under b), divide the total amount by which the total of all curves and bends in the loop is greater than 1 by 2 to arrive at a number x:

$$x = (\text{All curves and bends} - 1) / 2$$

This number equals the total value of curves and bends in the loop that must face outwards.

For example, the red no 10 Discovery puzzle consists of 2 curves, 6 bends and 2 straights, ie

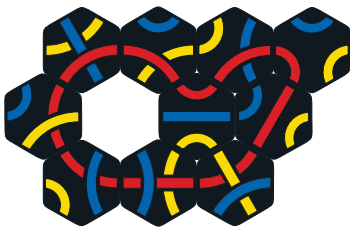
$$2 \times 1/3 + 6 \times 1/6 + 2 \times 0 = 2/3 + 6/6 + 0 = 1 \ 2/3$$

Applying the formula above means:

$$x = (1 \ 2/3 - 1) / 2 = 2/3/2 = 2/6$$

∴ Either two bends ( $2 \times 1/6$ ) or one curve ( $1/3$ ) must face outwards.

In fact, both solutions are possible, though solutions without a hole in the middle are generally preferred in Tantrix.



One curve facing outwards



Two bends facing outwards

NB: The 10-tile Discovery puzzle can also be solved in blue and yellow.



## FINAL NOTE

You will no doubt discover many other ways to use Tantrix in your teaching environment. Please send us your ideas - we may include them in future revisions of this Activity Guide.

Please feel free to contact Tantrix Games Ltd if you have any queries or comments:

Tel: 03 540 3537  
Email: [info@tantrix.com](mailto:info@tantrix.com)  
Address: 600 Old Coach Road RD1,  
Mahana, Nelson 7173

An electronic copy of this guide can be downloaded for free from our website [www.tantrix.co.nz](http://www.tantrix.co.nz)

It is also possible to get replacement tiles (details at website).



## ALTERNATIVE TILE SETS

When using a Tantrix Game Pack, tiles 1-14 are the same as the special school tile sets. The equivalent numbers for each of the other sub-sets of 14 tiles are shown below. The colours indicate the individual loop colours for the Discovery puzzles:

no-green	1 y	2 y	3 y	4 r	5 r	6 b	7 b	8 b	9 y	10 r	11 r	12 y	13 b	14 b
no-blue	15 y	18 y	21 y	34 g	22 g	35 r	20 r	19 r	32 y	17 g	31 g	33 y	16 r	23 r
no-red	43 y	48 y	54 y	50 g	49 g	44 b	56 b	55 b	51 y	53 g	46 g	52 y	47 b	45 b
no-yellow	24 g	25 g	41 g	40 r	30 r	39 b	37 b	38 b	42 g	36 r	27 r	29 g	26 b	28 b

## BACKGROUND

Tantrix was invented by Mike McManaway of New Zealand in 1987. Since then, it has won major awards around the world.

In 1994, Tantrix underwent a detailed testing programme using groups of school children in France. The study found Tantrix a useful, versatile and fun tool for the development of logic and reasoning, visual discrimination and observation skills.

In 1996, Tantrix won the National Parenting Association Award in the USA and in 2003 it won the gold award in the UK Good Toy Guide, another publication which uses rigorous play-testing by adults and children to determine its award winners.

# WHAT OTHERS SAY

"Tantrix not only helps the player develop strategic thinking, but also spatial ability, non-verbal problem solving, planning ability, and memory skills... Simple enough to learn, yet with the possibility to be infinitely complex!" Linda Palmer, Department of Behavioural Sciences Louisiana University, USA.

"Tantrix is the best educational product I have seen at the Australian Toy Fair." J. Gassner Gering, Australia.

"A good progression of difficulty levels means this game will be loved by adults and can be introduced to children as young as 6. The series of games are great for teaching children problem solving and logic skills [...], concentration and observation, hand-eye coordination and small movements, creativity and imagination."  
The Good Toy Guide, UK.

"Tantrix is great. The kids love it and it makes them think.  
Ruth Davis, Primary School Teacher, Victory Primary School  
Nelson, NZ.