Big Maths Day

The project Big Maths Day is a yearly initiative of the Freudenthal Institute
The project received funding from the Dutch ministry of Education.

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This translation is supported by Primas (www.primas-project.eu).
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Big Maths Day

enthusiastic pupils and teachers

Big Maths Day is a day full of exciting and challenging mathematics activities for pupils. But Big Maths Day does not only make pupils enthusiastic. Teachers (and student teachers) also learn from Big Maths Day.

Mathematics education can become more exciting. During Big Maths Day, when mathematics is the centre of attention all day long, you can bring richer mathematics into the school and work together with pupils and teachers from all grades to jointly solve problems. Teachers and teams are instructed by means of materials on the Internet, so that it becomes clear to them how to organise such a day. We show teachers how they can coach pupils and how they can reflect on the activities to make mathematics teaching more robust.

In recent years, Big Maths Day has grown into a real mathematics festival at many schools. Pupils and teachers realise that mathematics is enjoyable. Teachers experience an alternative way to structure their mathematics education. Big Maths Day shows that it is often a good idea to put pupils into open situations and give them enough time to truly discover their own solutions and approaches. This day also proves that it is a good idea to discuss the discoveries of pupils and to use them for teaching the entire class.

catalyst for professionalisation

We are increasingly seeing that substantive preparations are being made for Big Maths Day at primary schools, for example in a mathematics committee. Such a mathematics committee develops ideas about giving shape to Big Maths Day and proposes these ideas during a team meeting. In this meeting, the discussion of course focuses primarily on the practical aspects of Big Maths Day, such as collecting materials or recruiting parents as volunteers, or informing them about the event. But these team meetings also touch on the content of Big Maths Day.

A mathematics committee at the school turns out to be an effective means to give an impulse to the dialogue about mathematics education, and Big Maths Day is gratefully used as a topic for discussion. This is because Big Maths Day emphasises the attractive aspects of mathematics education. This is much different than when the discussion in the team is on a more serious topic, for example because the school has been classified as weak in mathematics, the education inspectorate has made remarks about its mathematics education or something has gone amiss with the educational yield for another reason.

Experiencing the phenomenon of chance is often surprising. Your chance is often larger or smaller than you would expect. In the activities during Big Maths Day, pupils learn that by experiencing chance and thinking about it, little by little they begin to grasp the situation, and ultimately start to fathom it. Whether this process is successful or not depends on the teacher, who must give the pupils the opportunity to formulate hypotheses and to test them empirically. In addition, the teacher must ask appropriate questions, so that pupils can shift their attention from a fair coin toss to looking at the number of paths through a grid.

To learn how to do this as a teacher, it is a good idea to first experience the game. To this end, the activity on the worksheet is an option. It is good if teachers allow them-

selves to be surprised by unexpected chance, and then explore the intuitive notions of pupils and use this exploration to take their thinking to a higher level.

introduction

In all grades, there is attention for smart and systematic counting. This happens at various levels. In grades K-2, the pupils are primarily involved in experimenting with tangible materials, and they will not yet systematically count the number of possibilities. In the higher grades, the pupils reflect on the given problems more schematically or more systematically. Such schematics or systems then help the pupils to quickly determine how many possibilities there are. Ultimately, this process leads to solutions at the formal level for some pupils.

Besides combinatorics, during Big Maths Day there is also attention for chance. In grades K-2 this is concerned only with the sense of wonder and the experience that chance is sometimes different than you expect. For example, this happens when you notice that the chances of various results when throwing two dice is not the same; the chance that you will throw a ‘2’ with two dice is much smaller than the chance that you will throw a ‘7’. In grades 3 and 4, the pupils also analyse the results of throwing two dice, but in these grades, the pupils' thinking about chance rises above the sense of wonder. This typifies the activities in grades 3, 4, 5 and 6. In these grades, the chance at a specific instant is also quantified. For example, this happens when chance is generated by spinning a top, and the results are described in terms of fractions or percentages.

In the margin of the activities in grades 1 and 2, pupils practice permutations for getting the sum of 10; with three dice, they are asked to find as many ways as possible to throw a 10. This practice is not an explicit aim of Big Maths Day, but it does provide an interesting additional benefit.
Here you will find specific instructions on how to give shape to Big Maths Day for grades 5/6. The instructions for other groups can be found on the Internet at www.rekenweb.nl (in Dutch). The activities in this book are suitable for filling a morning or afternoon, but can certainly create the basis for an entire day or several mornings or afternoons, especially if you want to continue with specific activities.

Grades 5 and 6
In grades 5 and 6, Big Maths Day begins with the ‘Grid walking game’. In this game, pupils walk on a grid, where the direction they walk is determined by tossing a coin. The unexpected result of this game leads to a discussion about the relationship between possible routes and the chance of arriving at an endpoint. In a circuit of activities, pupils explore more aspects of chance. Sometimes, chance involves flexible counting of amounts. In other cases, more proportional situations lead to chance. Big Maths Day in grades 5 and 6 closes with a quiz about chance.

grades 5 and 6
chance and counting

grades 5 and 6

overview of activities

During Big Maths Day, pupils in grades 5 and 6 participate in all kinds of activities to determine the possible results of experiments such as walking on a grid and throwing strange kinds of dice. They also investigate how to count the number of possibilities in such situations.

Grades 5 and 6 will begin with a class activity (Part 1) in the schoolyard, in which it is determined by chance whether a pupil turns left or right at a junction. In this way, a distribution of pupils across the endpoints of the routes through a grid is determined. Once the pupils have all returned, this activity is discussed briefly, and after that the 'chance and counting carousel'(Part 2) begins. In this part, the pupils complete a circuit of six activities on the topic of chance and counting. Instead of using a circuit, you may if you like also complete all the activities one-by-one with the entire class, whith about 15 to 20 minutes planned for each activity. The day ends (Part 3) with a chance and counting quiz for the entire class. Some of the questions on the quiz concern the topics from the various activities during the day.

This leads to the following plan for the group activities:

part 1 Outdoor activity (with the introduction indoors): 'walking on a grid'
Duration: 30 minutes

part 2 Chance and counting carrousel
Duration: 2 hours, including a break

part 3 Chance and counting quiz
Duration: 30 minutes

This schedule is a suggestion for the activities during the day. You are free to choose the most feasible schedule for your school and your class.

part 1 walking on a grid

materials
- for each pupil, you need a coin, a disk with different-coloured sides or a dice,
- sidewalk chalk or masking tape (for the preparation),
- a whistle.

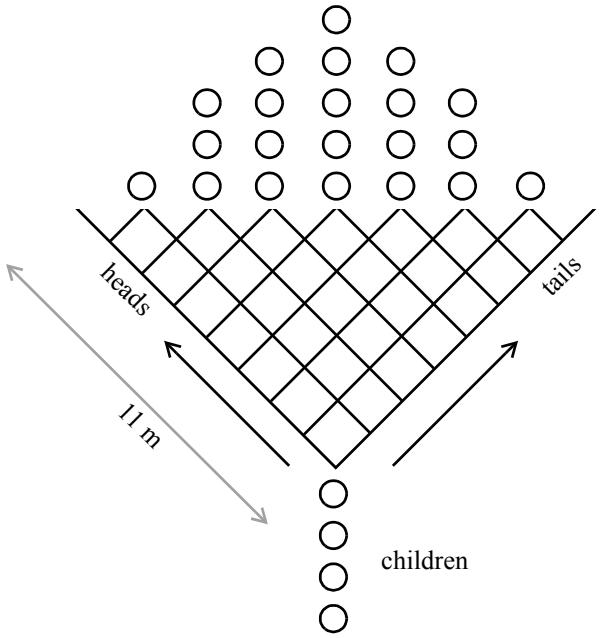
tip The grid is also available as a PowerPoint slide on the website of Big Maths Day.[1]

preparation Before the activity begins, draw a large grid in the schoolyard (see example on Worksheet 1).
The number of rows (endpoints) depends on the number of pupils:
- Fewer than 15 pupils - 3 rows (4 endpoints)
- 15-25 pupils - 4 rows (5 endpoints)
- 25-40 pupils - 5 rows (6 endpoints)
- 40-60 pupils - 6 rows (7 endpoints)

Make the gridlines approximately 2 m long and leave sufficient room at the junctions. For example, you can draw circular areas at the junctions; this is a good idea especially if you choose variant 2. See the game rules. It is also a good idea to place two arrows at every junction to indicate the two possible turns (right and left). Pupils sometimes

1 http://www.fi.uu.nl/rekenweb/groterekendag/welcome_en.html

get turned around and then no longer know which of the four directions they must take. The pupils should always walk towards the endpoints.



activity

Introduction in class

In the classroom, briefly introduce the activity. Explain the rules based on an illustration of the grid, which is shown to the class as a PowerPoint slide or video. Of course, you can also draw the grid on the blackboard. These materials are available on the website of Big Maths Day[1]. There are two variants of the grid walking game.

Rules for the 'one-by-one' variant

- All children line up for the start, and each of them has a coin, a two-coloured chip or a dice.
- At every intersection (junction) they determine which way they walk by tossing the coin, chip or dice.

- With the coin: Heads means turn left, Tails means turn right.
- With two-coloured chip: one colour means turn left, the other colour means turn right.
- With dice: Even numbers (2,4,6) mean turn left, odd numbers (1,3,5) mean turn right.

  Make sure the class understands the rules.

1 http://www.fi.uu.nl/rekenweb/groterekendag/welcome_en.html

– The first pupil tosses his or her coin, chip or dice. Depending on the result, he or she turns left or right and stops at the next junction.
– Then he or she throws again.
– This process repeats 4, 5 or 6 times until the pupil reaches the endpoint. Then the pupil waits there (and/or writes his or her name on the endpoint).
– The next pupil proceeds through the grid in the same way.
– This process continues until all pupils have had a turn.
– At the endpoints, the pupils stop briefly, and the number of pupils at each endpoint is counted.

tip

The next pupil can begin as soon as the last pupil has left the starting point; the grid then fills up, and several pupils will be walking on the grid at the same time. It is important that the pupils always walk towards the endpoints (see instructions for the preparation). To keep things orderly, for example, they can all throw and walk simultaneously when you blow the whistle.

Rules for the 'everyone at the same time' variant

– All pupils stand at the starting line at the first junction.
– When you blow the whistle, they all throw their coin, chip or dice at the same time to determine which way they turn.

– With the coin: Heads means turn left, Tails means turn right.
– With the two-coloured chip: one colour means turn left, the other colour means turn right.
– With dice: even numbers (2,4,6) mean turn left, odd numbers (1,3,5) mean turn right.
Make sure the class understands the rules.

– When they hear the whistle, all pupils walk in the direction they have thrown, therefore they turn either right or left, and they stop at the next junction.
– At the following whistle, the pupils throw again and walk in the corresponding direction.
– This process continues until all pupils have reached the end.
– The number of children at each endpoint is counted.

In this variant, you will see the group 'thin out'.

tip

If you like you can record how the pupils are distributed across the junctions every time they move.

Playing the game in the schoolyard

Play the grid walking game once or several times. Make sure that someone keeps track of the final result after each game: how many children are standing at each endpoint? You will need this information for the follow-up discussion.

Follow-up discussion in the classroom
Record each final situation - how many children are standing at each endpoint? - on a drawing or on the projected grid (on the digital blackboard, if available). The pupils consult together about why so many ended up 'in the middle', and so few of them on the edge. At this point, the emphasis should be on thinking about the problem. No 'explanation' has to be given at this time. As the teacher, you do not have to explain the situation either. This game will return in the carousel and in the quiz. Pupils will then have the opportunity to continue investigating how the distribution across the endpoints occurs.

part 2 chance and counting carousel

Part 2 of Big Maths Day for grades 5 and 6 consists of five or six activities that can be offered in the form of a circuit (carousel). Each of these activities is described below. Assignment cards, aggregate lists and other materials are available in the appendixes. Several variants of the assignment are described. Choose a variant, or possibly expand the circuit. If you like, you can do one or more of the activities in the classroom. During the carousel, 'in-between' activities such as computer games can be used to fill time gaps if there are differences in duration. At the end of this section there is a list of such 'in-between' activities. We recommend that you go through all the activities yourself, so that you know what preparations are required and what will happen during the activity itself.
Divide the class into as many groups as there are activities, and have each group begin with one of the activities, and then complete the remaining activities in a fixed sequence. The activities last 10 to 20 minutes each.

carousel activity 1 - grid walking game on paper

materials
- one assignment card (appendix 1),
- sheet of paper (A3) with grid walking diagram,
- worksheet to write down routes and endpoint,
- one coin, two-coloured chip or dice,
- one pawn,
- coloured pencils or markers.

activity
The grid field that was drawn in the schoolyard is now drawn again on a large sheet of paper (A3) - (appendix 1). A coin is available. The pupils take turns doing this activity. Each pupil follows a route through the grid, as determined by tossing the coin (see appendix 1 assignment card). Each pupil records the route and the endpoint on the list (see appendix 1) and writes his/her name on the spot where they end up on the grid. If there is enough time, the game can be repeated. Before they start, ask the pupils to predict where they think they will end up. Also write down this prediction on the list.

afterwards
At the end of the carousel, the diagram is filled with routes and names. The diagram now shows a distribution of the pupils across the endpoints. After the carousel, you can compare the results of the outdoor grid walking game with the indoor one on paper. You can also keep the results to discuss them during a follow-up lesson later in the week. The aggregate list can then be analysed: which routes and how many different routes lead to each endpoint? Do you notice anything? Can you explain why so many players end up in the same points? Why is it that few or no players end up on other points?

carousel activity 2 - dice game

materials
- assignment card (appendix 2),

– for each group, several sheets of paper (including graph paper) for writing down the results and making the graph(s),
– chips,

– two different polygonal dice; these dice are available for all regular polygons,
– optional: three regular dice,
– optional: objects such as plastic cups, erasers in various shapes or pushpins.

activity

The pupils play this game as a group using the two polygonal dice.

The first pupil predicts the throw (the sum of the 'pips' on the dice or numbers on the polygons). He or she then throws the dice and writes down the result, possibly in a tally table. If the pupil predicted the result correctly, he or she earns a chip. The first pupil with three chips wins the game. Make sure that enough throws are made, especially if many different results are possible. If necessary, have the pupils continue playing.
Afterwards, all the pupils put the results of their throws in a graph. The graph contains all possible solutions; the pupils enter the solutions they have thrown in the graph. For example in a bar graph, they colour in one box on the bar for that result. Consequently, some bars can remain empty. If there is enough time, the pupils play the game again. These results are added to the graph.

variant

Ask the pupils in each group to choose the objects they are going to play with:
– three regular dice,
– two differently shaped polygonal dice,
– an eraser (the pupils record the side on which it falls - back, front or either side),
– a different combination of objects.

In these cases, make sure the pupils make a different graph, because the possible results of the throws will be different for each of the above choices.

afterwards

Together with the pupils, you can compare the graphs of the same game as played by different groups. Are there patterns in the results? Can the pupils explain these patterns? Who made the best predictions? How were they able to do that: pure luck or something else? Which result has the best odds, and why?

tip

In the table below - the sum of the pips of all possible throws with two regular dice - you can see that the sum 7 can be thrown in six different ways.

	1	**2**	**3**	**4**	**5**	**6**
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

For the polygonal dice, you can ask the pupils to make such a table themselves. This table shows all the possible results and how many different ways each result can be thrown. What does the table look like if two other polygon dice are used?

carousel activity 3 - how many possibilities?- The 'combination game'

The question that accompanies this activity is: how many truly different types of things (dolls, animals, towers, poems) can you make? Draw them or write them down.

Are you certain that you have all the possibilities? The objective is for pupils to think of a method to investigate this question and a way to write this down.

materials

- A3 paper for the posters,
- assignment card (appendix 3),
- pencils and markers,
- one or more of the materials shown below.

Below are a few examples of items you can use with the combination game:

putting dolls together

a book cut into three parts
(you can optionally make this book yourself)

advertisement game

Queneau's book of 100,000 billion sonnets
(14 lines, each with 10 variants)

combination blocks

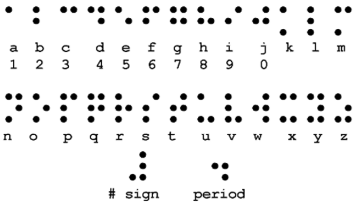
activity

For one of the available materials, each group investigates how many possibilities there are (dolls, advertisements, etc.). They make a poster to illustrate all the possibilities or describe them in such a way that everyone can immediately see that they have included all possibilities. Because there is only one set of each type, they must think of a clever way to keep track of how many possibilities they have gone through.

carousel activity 4 - coded letters and digits

materials

– for each pupil, one ‘Braille’ worksheet (appendix 4)



– for each pupil, one ‘Morse’ worksheet (appendix 5)

Morse Code Alphabet
The International morse code characters:

A	.-	N	-.	0	-----
B	-...	O	---	1	.----
C	-.-.	P	.--.	2	..---
D	-..	Q	--.-	3	...--
E	.	R	.-.	4	....-
F	..-.	S	...	5	.....
G	--.	T	-	6	-....
H	....	U	..-	7	--...
I	..	V	...-	8	---..
J	.---	W	.--	9	----.
K	-.-	X	-..-	Fullstop	.-.-.-
L	.-..	Y	-.--	Comma	--..--
M	--	Z	--..	Query	..--..

– for each pupil, one ‘LED’ worksheet (appendix 6)

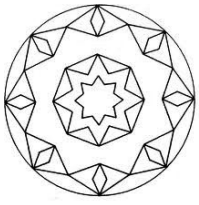
activity

The pupils investigate how the letters and digits can be formed within a particular system and how many different symbols are possible. Therefore, how does this coding system work? How many places and how many choices are there? How many symbols are possible? Additional assignment: Design a new system, which you can use to code at least all letters and all 10 digits.

carousel activity 5 - chance colours

materials

– assignment card (appendix 7),
– for each pupil, one copy of the mandala (appendix 7),



– for each group, one dice,

– coloured pencils (six colours). Each colour is assigned a fixed value of 1 through 6; for example, yellow = 2; green = 3; blue = 4; purple = 5 and orange = 6.

activity Each pupil colours the mandala according to a fixed procedure, from the inside to the outside. The colour is always determined by chance: for each new 'ring', the pupil first throws the dice once to determine the colour. This number is also written down on a list. It can happen that the same colour is thrown twice in a row. In that case, the pupil does not throw again, but uses the same colour for the next ring. The colouring sequence is as follows: innermost ring - next ring - (do not colour the small triangles) - the standing diamonds in the next ring (do not colour the remainder) - and finally the 'bent triangles' around the conference. All coloured mandalas are cut out and pasted onto a large sheet of paper.

afterwards The mandalas are examined. Are they all different? Is that possible? How many different mandalas are possible? Ask the pupils to think of a clever way to answer this question, without having to colour in all the mandalas. Which method do you think is cleverest, which is the least clever?

carousel activity 6 - Game of Hog

materials
– for each group, one assignment card with game rules (appendix 8),
– for each group, one score card (appendix 8),
– 10 dice.

activity The pupils play the Game of Hog with their group. In this game, they can decide themselves how many dice to use. The sum of the pips is the number of points. However, if there is a '1' in a throw, then they earn zero points for that throw. The winner is the first one to earn 100 points. Pupils record how many dice they are using and also record the score.

afterwards By studying the score cards, the pupils can determine how many dice result in the smallest chance of zero points.

'in-between' activities ICT

Various computer games and simulations about combinations and chance are available. During the circuit, you can give pupils the opportunity to briefly play such a game on the computer. For example, you can offer the computer game as an extra activity when the pupils would otherwise have to wait. You can find a list with suitable games and activities on the Big Maths Day website.

Part 3 – Quiz: count your chances

Big Maths Day 2011 for grades 5 and 6 closes with a class quiz, with questions about chance and counting. Some of the questions link up with the activities from earlier in the day. This gives you the opportunity to hold a follow-up discussion, and you can go more deeply into the questions and results of the pupils. See the suggestions that are described with each activity under the heading 'afterwards'.

materials
– PowerPoint presentation with the quiz and the answers.
– For each student, paper to write down the answers.

activity You can download the PowerPoint presentation from the Big Maths Day website[1]. The quiz takes place in class; each student writes down the answers individually. After completing the quiz, go through the questions with the entire class. See the suggesti-

1 http://www.fi.uu.nl/rekenweb/groterekendag/welcome_en.html

ons in the PowerPoint presentation for a follow-up discussion about the answers.

Sample questions

With the grid walking game, why do so few children finish at the endpoints on the edge?

A. because they cheat
B. because there's too little room there
C. because only a single route goes there
D. because of chance

2. The Netherlands has a new system for its license plates: two digits, three letters and one digit. How many different license plates can you make using this system?

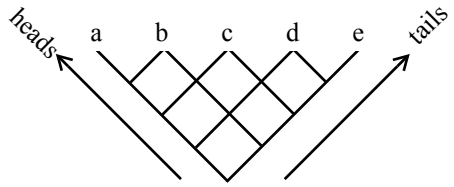
A. 100,000
B. 1,000,000
C. 10,000,000
D. 100,000,000

appendixes grades 5 and 6

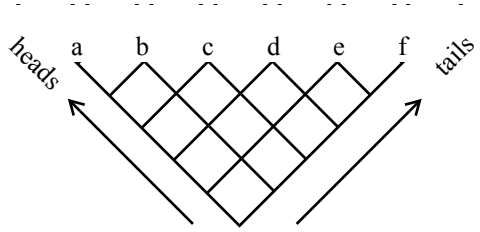
appendix 1 grid walking diagram

tips Also available as a PowerPoint slide.
Next to each junction, place two small arrows that indicate the walking direction, to prevent pupils from getting turned around

with 5 endpoints



with 6 endpoints



assignment card - grid game

- Take turns playing this game.
- Place the pawn at the start.
- Throw the coin. If it comes up heads, move the pawn to the left; if it comes up tails, move the pawn to the right. Continue until you reach an endpoint.
- Each pupil draws his or own route on the grid in a different colour, and writes his or her name next to the endpoint on the grid.
- On the aggregate list, write your name and show your route by writing L or R. You then have a series such as: LLRLR
- Also write down the endpoint on the list.
- Make sure that you always go left FORWARDS and right FORWARDS.
- If everyone has had their turn, play the game again.

aggregate list

Name	Route	Endpoint

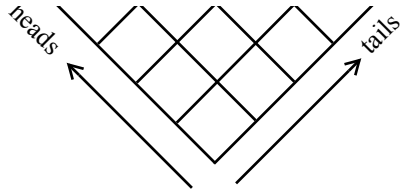
grid walking diagram

Depending on the number of pupils in the class, choose the version

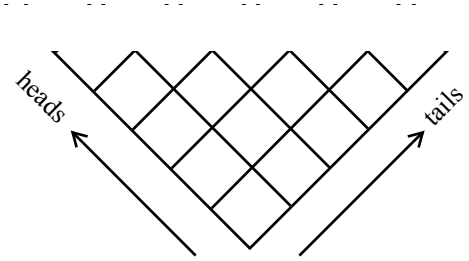
with 5 or 6 endpoints.

tip Allocate a letter to each endpoint (see assignment card); this also makes the follow-up discussion easier.

with 5 endpoints



with 6 endpoints



Next to each junction, place two small arrows that indicate the walking direction to prevent pupils from getting turned around.

2 assignment card - dice game

playing the game

- Choose two dice.
- Decide who will start.
- The first player predicts what he or she will throw.
- The first player throws with the two polyhedron dice and records the results on the aggregate list.
- If the player has predicted the result correctly, he or she earns a chip.
- Then the next player takes a turn.
- The first pupil with three chips wins the game.

recording and processing the results

During the game, keep track of the results (of the throws) on a table like the one shown below

Result	**Number of throws**

After the game, make a graph (bar graph) of the results. Make bars for all possible results (not just for the ones that are thrown). Some bars may therefore remain empty.

tip

To determine all possible results, you can make a table.

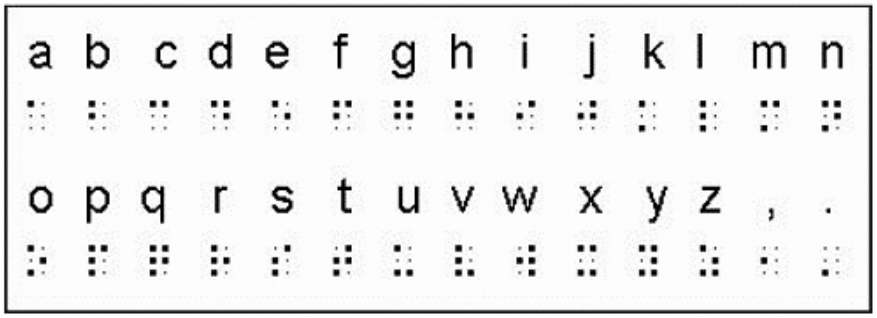
dice 1 dice 2	1	2	3	....	....	....	
1	**2**	**3**					
2		**4**					
3							
4							
5							
....							
....							

appendix 3 assignment card - How many possibilities are there?

- First, choose which material you are going to use for the assignment.
- Play briefly with the material to understand how it works.
- Determine how many and which ‘combinations’ are possible.
- Think up a clever way to do this.
- Make a poster which clearly shows how many and which combinations are possible. Make sure that it is clear to everyone that you have found all the possibilities.

appendix 4 coded letters and digits - assignment card Braille

Blind people use Braille for reading and typing. This is shown below.

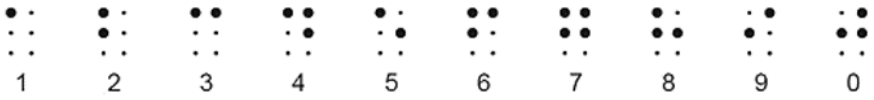


All symbols (letters, digits, punctuation) consist of a block with six points, which are raised or not raised.

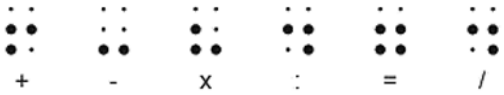
initial assignment

- Write your name in Braille.
- The alphabet is coded using a particular system. Try to discover that system.
- Could you easily learn the Braille alphabet by heart? Why or why not?

Digits



Arithmetic symbols



assignment: digits and sums in Braille

- Examine the digits and arithmetic symbols in Braille.
- Compare them to the letters; Do you notice anything? Write the number 125 in Braille.
- Each pupil makes two arithmetic problems in Braille. Exchange the problems and solve them. Discuss the problems with the whole class.

research assignment

- Figure out how many different symbols you can make with the Braille system.
- Does changing one Braille point matter?

appendix 5 coded letters and digits - assignment card Morse code

Morse code is a communication code consisting of long and short signals. You can send Morse code with sound or light. You can also write it down with dots and lines.

Letter	Morse	Letter	Morse	Digit	Morse	Symbol		Morse
A	·—	N	—·	0	—————	.	period	·—·—·—
B	—···	O	———	1	·————	,	comma	——··——
C	—·—·	P	·——·	2	··———	?	question mark	··——··
D	—··	Q	——·—	3	···——	-	hyphen	—····—
E	·	R	·—·	4	····—	/	fraction line	—··—·
F	··—·	S	···	5	·····	:	colon	———···
G	——·	T	—	6	—····	'	apostrophe	·————·
H	····	U	··—	7	——···	-	minus sign	—····—
I	··	V	···—	8	———··	)	close parenthesis	—·——·—
J	·———	W	·——	9	————·	;	semicolon	—·—·—
K	—·—	X	—··—			(	open parenthesis	—·——·
L	·—··	Y	—·——			=	equal sign	—···—
M	——	Z	——··			@	at sign	·——·—·

initial assignment

- Write your name in Morse code.
- Is the alphabet coded using a particular system?
- Could you easily learn the Morse alphabet by heart? Why or why not?

assignment Numbers and sums

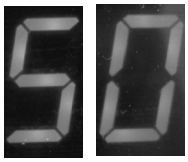
- Examine the numbers and arithmetic symbols in Morse code. What system is used?
- Write the number 125 in Morse code.
- Each pupil makes two arithmetic problems in Morse code. Exchange the problems and solve them. Discuss the problems with the whole class.

research assignment

- Figure out how many different symbols you can make with the Morse code system. What does that depend on?

appendix 6 coded letters and numbers- worksheet digital letters and numbers

Digital numbers and letters can be created with 'lines'. Each line is an electronic light, also called an LED (Light Emitting Diode). Every number below is created with seven LEDs.



initial assignment

How many LEDs are turned on for each of the digits? Fill in the table.

NumberNumber of lines

Number	Number of lines
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

- How are letters formed? Write your name with LED letters.
- In your group, compare how you did this. Which letters are difficult to make? Why?

research

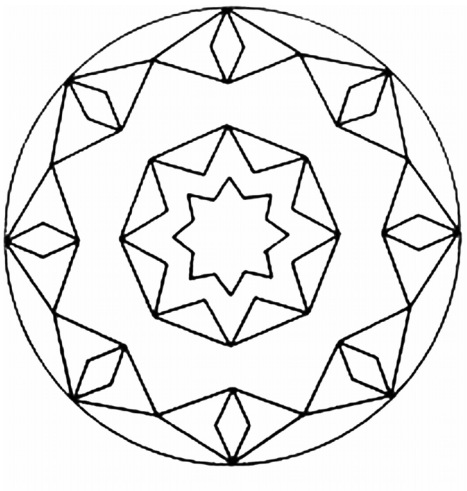
- How many different symbols can you make with the 7 LEDs?

design

- Design a display with more than 7 LEDs that you can use to make all the letters and the numbers 0-9. Draw the entire alphabet and all these numbers on a poster.

appendix 7 assignment card - chance colours

You are all going to colour in the mandala on the next page using colours determined by chance.



Do this as follows:
Throw a dice to determine the first colour. Write down the number next to your name on the list.

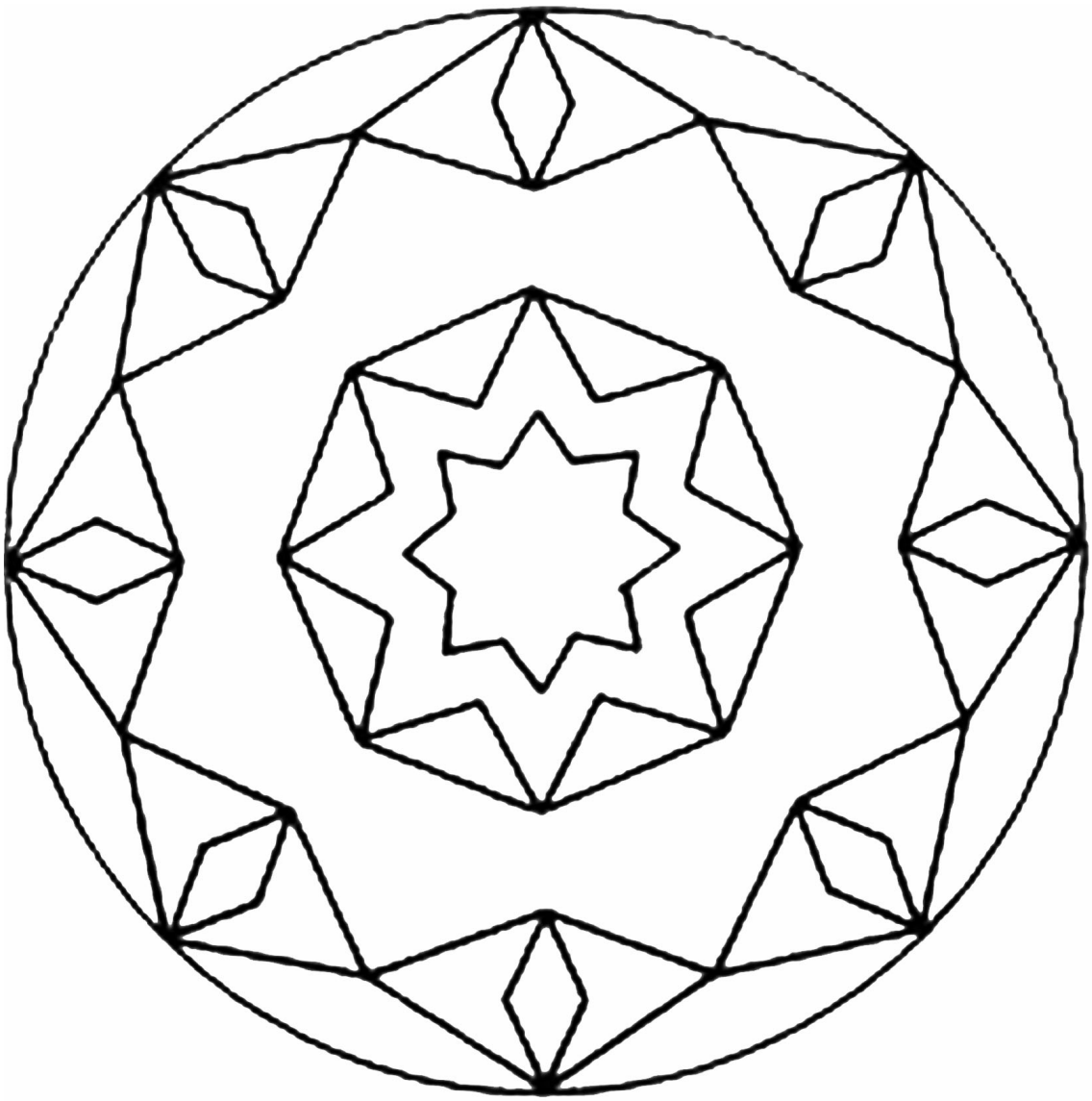
1	2	3	4	5	6
red	yellow	green	blue	purple	orange

Colour the innermost ring with the colour that corresponds to the number you have thrown.
Throw the dice again and colour the next ring - going from the inside to the outside - with the colour you have thrown. Write down the number of the colour on the list.
Continue on in this way, using the following sequence.

- innermost ring
- the surrounding ring (do not colour in the small triangles)
- the ring surrounding that one
- the diamond shapes (leaving the area around them uncoloured)
- The 'bent triangles' adjacent to the outer circumference.
- Cut out your mandala and paste it onto the flap

aggregate list for mandala colours

name	colour 1	colour 2	colour 3	colour 4	colour 5



appendix 8 assignment card - ‘Game of Hog’ rules

1. Take turns playing this game. Decide who will start.
2. The player decides how many dice he or she wants to throw (1 - 10), and writes this on the scorecard.
3. The player throws; if there is a ‘1’ in a throw, then he or she earns zero points for that throw. If there are no ones, the player can add up all the pips and earns that many points. The points are written on the scorecard (keep a running total).
4. The next player takes a turn. Before every turn, each player can determine how many dice he or she wants to throw.
5. The first player who earns 100 points or more is the winner.

scorecard

name						
	number of dice	total score	number of dice	total score	number of dice	total score
round 1						
round 2						
round 3						
round 4						
round 5						
round 6