

Puzzles, games and enigmas.
How can you create your own enigma and solve it?



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Generació Plurilingüe (GEP)

Year 2
 2019-2020

Identification of the GEP project

Title	Puzzles, games and enigmas. How can you create your own enigma and solve it?
Authorship	Carles Ezquerra & Cati-Neus Díes
School	Institut Caparrella
Students' CEFR Level (A1, A2...)	A2
Grade	2nd ESO
Content area(s)	Mathematics and English

Template adapted from CLIL-SI 2015.

More information at: <http://grupsderecerca.uab.cat/clisi/>



Number of sessions (4, 6 or 9)	6
Teacher(s) involved	2
Keywords	Challenge, puzzle, enigma, algebra, geometry, creativity

1. OUR PROJECT

Introduction: In this project, students are shown some challenges and enigmas, and they have to discover how they work, linking the games and puzzles to mathematical content. It is a useful way, through PBL, to see how the theory explained in class, which sometimes does not make any sense, can be applied to solve some games. In a second part of the project, they will have to apply what they have learnt to create their own challenge.

This project will be related to problem solving. Problem solving is a powerful tool that will promote in the student multiple, creative and innovative skills.

To solve problems sometimes you need procedures and concepts from different areas, so this will **link different contents** and therefore will be good for student deep learning and will ensure a good understanding.

Driving question:

How can you create your own enigma and solve it?

Final product:

The creation of a genuine challenge or enigma and the performance of it

2. GOALS	2. HOW DO YOU KNOW STUDENTS ARE MAKING PROGRESS? (assessment criteria)
1. Create activities with mathematical content, related to games, puzzles and magic tricks.	1.1. Students will be able to create, (recreate) a puzzle with mathematical content.
2. Perform the puzzles and enigmas in front of an audience to create curiosity	They will be able to explain their puzzle to an audience while entertaining it



<p>3. Explain the content of the performance in a didactic way, making sure that all the games have a mathematical rule or pattern.</p>	<p>Students will be capable of explaining the solution in a didactic way, making the pattern or the rule, which is hidden inside the enigma, understandable.</p>
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3. CURRICULUM CONNECTIONS SPECIFIC COMPETENCES AND KEY CONTENTS

Subject-matter curriculum		Foreign language curriculum	
Specific Competences	Key Contents	Specific Competences	Key Contents
<p><u>Dimensió resolució de problemes:</u></p> <p>Competència 1. Traduir un problema a llenguatge matemàtic o a una representació matemàtica utilitzant variables, símbols, diagrames i models adequats.</p> <p>Competència 2. Emprar conceptes, eines i estratègies matemàtiques per resoldre problemes.</p>	<p>CC4. Llenguatge i càlcul algebraic</p> <p>CC3. Càlcul (mental, estimatiu, algorímic, amb calculadora).</p> <p>CC5. Patrons, relacions i funcions</p> <p>CC9. Figures geomètriques, característiques, propietats i processos de construcció.</p>	<p>Comunicació oral</p> <p>1. Obtenir informació i interpretar textos orals de la vida quotidiana, dels mitjans de comunicació i de l'àmbit acadèmic.</p> <p>2. Planificar i produir textos orals de tipologia diversa adequats a la situació comunicativa.</p> <p>3. Emprar estratègies d'interacció oral d'acord amb</p>	<p>1. Comprensió oral : global, literal i interpretativa</p> <p>2. Estratègies de comprensió oral</p> <p>3. Estratègies de producció oral</p> <p>4. Estratègies d'interacció oral</p> <p>5. Lectura en veu alta</p> <p>7. Comprensió escrita : global, literal, interpretativa i valorativa</p>

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<p>Competència 3. Mantenir una actitud de recerca davant d'un problema assajant estratègies diverses.</p> <p>Competència 4. Generar preguntes de caire matemàtic i plantejar problemes.</p> <p><u>Dimensió raonament i prova</u></p> <p>Competència 5. Construir, expressar i contrastar argumentacions per justificar i validar les afirmacions que es fan en matemàtiques.</p> <p><u>Dimensió comunicació i representació.</u></p> <p>Competència 10. Expressar idees matemàtiques amb claredat i precisió i comprendre les dels altres</p> <p>Competència 11. Emprar la comunicació i el treball col·laboratiu per compartir i</p>		<p>la situació comunicativa per iniciar, mantenir i acabar el discurs. Comprensió lectora</p> <p>4. Aplicar estratègies d'interacció per obtenir informació i interpretar el contingut de textos escrits d'estructura clara de la vida quotidiana, dels mitjans de comunicació i de l'àmbit acadèmic.</p>	<p>8. Estratègies de comprensió escrita</p>
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construir coneixement a partir d'idees matemàtiques			
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4. 21st CENTURY COMPETENCES

Collaboration	X	Information, media and technology	X
Communication	X	Leadership & Responsibility	X
Critical Thinking and Problem Solving	X	Initiative & Self-direction	X
Creativity & Innovation	X	Social & Cross-cultural	X
Others:			

5. KEY COMPETENCES

Template adapted from CLIL-SI 2015.

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Communicative, linguistic and audiovisual competence	X	Digital competence	X
Mathematical competence	X	Social and civic competence	X
Interaction with the physical world competence		Learning to learn competence	X
Cultural & artistic competence	X	Personal initiative and entrepreneurship competence	X

6. CONTENT (Knowledge and Skills)

CONTENT-RELATED KNOWLEDGE	CONTENT-RELATED SKILLS
<ul style="list-style-type: none"> - Puzzles, games and enigmas. - Examples of different mathematical challenges. - Identification of mathematical content behind a challenge or enigma - Tools to understand what is behind them. - Language scaffolding 	<ul style="list-style-type: none"> - Analysing the mathematical logic behind the games given. - Being able to propose a puzzle or game to the audience and later on

- Being able to explain what is behind it, its general rule, pattern or logic.
- Working in a collaborative way.
- Creating the appropriate language support for an specific content

7. REFERENCES

- Images from Creative Commons.
- Some pictures and videos are ours.
- Challenges and enigmas are of free use, they do not have copyright.
- Part of the methodology is taken from Alberta math teachers association.

8. COMMENTS (optional)






9. ACKNOWLEDGEMENTS (optional)

Skills: R: reading , S:speaking, L: listening, W: writing, I: Interaction

Interaction: T-S: teacher-student, S-S: student-student, SG: small groups, WG: whole group, S-Expert, S-World

Assessment: PA: Peer assessment, SA: Self-assessment, TA: Teacher assessment, AT: Assessment tools

10. UNIT OVERVIEW

Session	Activities	Timing 	Skills 	Interaction 	ICT 	Assessment 
1	Divide the students into groups of maximum four and show them the performance of a challenge	15'	L	T-S	screencastify	
	What do the words enigma, challenge and puzzle suggest to you? Share all the groups ideas. Activity to know the difference between exercise and challenge	15'	S,L,I	T-S S-S	Kahoot	TA AT
	Introduce the driving question: How can you create your own enigma and solve it?	15'		T-S SG WG		
2	Divide the class into groups of maximum 4.	5'		T-S		

Template adapted from CLIL-SI 2015.

 More information at: <http://grupsderecerca.uab.cat/clilsi/>


	Propose the first puzzle with some guidance . Give them some language support in order to allow them to explain how it is solved.	25'	R,S,L,W	T-S S-S SG WG		
	Share the possible solutions the different groups have found.	15'	L,S,R	WG		PA TA
3	Divide the class into groups of maximum 4.	5'	L	T-S		
	Propose the second puzzle with some guidance . Give them some language support in order to allow them to explain how it is solved.	25'	R,S,L,W	T-S S-S SG WG		
	Share the possible solutions the different groups have found.	15'	L,S,R	WG		PA TA
4	The class is divided into groups	5'				

	Explanation of the methodology (rules and requirements) the students must follow to create their own puzzle or enigma. Students will be given some language scaffolding in order to help them communicate in English.	20'	S-L	T-S, SG	google docs	TA
	Students will be given two kinds of input: hands on material which they will be able to try, and some links where they will find different types of challenges.	25'	R-L-I	S-S, SG	links	
5	Each group should check their challenge achieves (almost) all the requirements demanded. Teachers will check students have the language support they need to explain their challenge.	20'	R-S-L-I	T-S, SG	each group will use their own ICT or hands-on activity	SA,TA

	Each group of the class will perform the challenge they have created in front of their classmates.					
	The rest of the groups will try to solve the challenge they have been given. Language support will be provided in order to make it possible.	20'	R-S-L-I	S-S, SG		SA
	All the groups share the solutions they have come up with.	10'	S-L-I	T-S, S-S,WG		TA
6	Finish the round of challenges.	30'	L-S-W-I	S-S,SG		TA
	Each group votes the challenge they liked the most. They must give their reasons.	20'	L-W-S-I	S-S,T-S,SG,WG		TA



7	Performance of the challenge in front of an audience, outside of the school.	45'	S-R-L-W-I	SG,T-S		SA

11. SESSION PLANNING

SESSION 1: WHAT ARE ENIGMAS, CHALLENGES AND PUZZLES?






Objectives of the session:

- Make groups.
- Learn the concepts of enigma, challenge and puzzle
- Know the difference between an exercise and an enigma, puzzle or challenge.
- Share the different ideas with the rest of the groups.

Template adapted from CLIL-SI 2015.

More information at: <http://grupsderecerca.uab.cat/clilsi/>



	- Use the language support given to express ideas in English.					
	Content-obligatory language for the session: I think..... because....., how do you say in English.....?, I'm pretty sure that..... , There is..... , There are..... , challenge, puzzle, mathematical game, can you help us please?, hands-on, interactive					
	<p>Activities</p> <p><i>include : Name and description; Assessment tool (if any); Material (including language support)</i></p>					
1.1	<ul style="list-style-type: none"> - Teachers divide the class into groups of three, maximum four students. - The whole group watches the performance of a challenge. <p>video to be created</p>	15'	L	T-S	video screencastify	






1.2	The groups do a kahoot, answering questions about the concept of challenge, puzzle etc, versus problems or mathematical exercises. https://create.kahoot.it/share/baecf16d-cb31-4ded-a8da-ec32ec228379	5'	R,S	T-S	kah oot TA
1.3	Students share with their group the concepts learnt and then they share it with the whole class	10'	S,L	S.S	TA
1.4	For the first time we introduce the driving question. First, each student thinks individually and then shares it with their group (Think pair share) and finally with the whole class. Scaffolding will be provided.	15'	L,S	S.S	

SESSION 2: LET'S PLAY!

Objectives of the session:

- Understand how a puzzle works.
- Be able to solve it.
- Be able to explain how to solve it with language support.



	<p>Content-obligatory language for the session: After practising for a while.../ We have been practising and... / We think the solution is.... / This is the procedure we have followed.../ we must add.../ We have to reach.... / We must add up to 31./ In order to do so you must... 7 plus 3 equals...</p>					
	<p>Activities <i>include : Name and description; Assessment tool (if any); Material (including language support)</i></p>					
1.1	- Divide the class into groups of three, maximum 4 students.	5	`L	T-S		
1.2	<ul style="list-style-type: none"> - Students are given the first puzzle and the teacher gives them the instructions to play it. - After playing it for several times they reach the solutions and are able to explain how they have done it 	25'	S,L	S-S	UP TO THE STUDENTS	
1.3	- Each group shares the solution they have reached with the rest of the class	15'	L	WG		TA
...						

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SESSION 3: LET'S PLAY AGAIN!






Objectives of the session:

- Understand how a puzzle works.
- Be able to solve it.
- Be able to explain how to solve it with language support.

Content-obligatory language for the session:

After practising for a while.../ We have been practising and... / We think the solution is.... / This is the procedure we have followed.../ we must add.../ We have to reach.... / We must add up to 31./ In order to do so you must... 7 plus 3 equals...
The key to this puzzle is....



	<p>Activities</p> <p><i>include : Name and description; Assessment tool (if any); Material (including language support)</i></p>					
1.1	<ul style="list-style-type: none"> - Divide the class into groups of three, maximum 4 students. 	5'	L	T-S		
1.2	<ul style="list-style-type: none"> - Students are given the second puzzle and the teacher gives them the instructions to play it. - After playing it for several times they reach the solutions and are able to explain how they have done it 	25'	S,L	S-S	<p>UP TO THE STUDE NTS</p>	
1.3	<ul style="list-style-type: none"> - Each group shares the solution they have reached with the rest of the class 	15'	L	WG		TA
...						

SESSION 4: WHAT SHALL WE DO? AND HOW?

Objectives of the session:

- Students must understand all the basic requirements they should follow.
- Make the students realize the importance of language support.
- Different interactive challenges and hands-on puzzles will be given.

Content-obligatory language for the session:

I think..... because....., how do you say in English.....?, I'm pretty sure that..... , There is..... , There are..... , challenge, puzzle, mathematical game, can you help us please?, hands-on, interactive

Activities

include : Name and description; Assessment tool (if any); Material (including language support)



4.0

The class will be divided into groups

5'

L

T-S

4.1

Explanation of the 2nd part of the project.

Read all together the list of rules and requirements that everybody should respect.

https://docs.google.com/document/d/1ZrrCBTDhIwyTZGGAxn5ZXm_IUFONuXp1/edit page 18

10'

L-R






T-S

goo
gle
docs

4.2	<p>Read all together some general language support that can be handy to add to the students' puzzles. worksheet general language support https://docs.google.com/document/d/1ZrrCBTDhlwyTZGGAxn5ZXm_IUFONuXp1/edit page 21</p>	10'	R-L	T-S	goo gle docs	
4.3	<p>Watch the video in youtube with subtitles: https://www.youtube.com/watch?v=7yDmGnA8Hw0 Play a pair of rounds in an interactive game https://nrich.maths.org/squareit from nrich.maths.org Play a few games with some hands-on puzzles or thinking games (own pictures). Own pictures</p>	30'	S-L- R-I	T-S, S-S	yout ube and intern et gam es	

SESSION 5: Solve classmates' enigmas and present the own challenge in front of the classmates

Objectives of the session: (objectives 1 and 2 should be accomplished after session 4 but before session 5)






	<ul style="list-style-type: none"> - Ensure the challenge proposed achieves the requirements. - Ensure the scaffolding attached is complete. - Performing in a clear, motivating and free way the challenge to the rest of the class. - Solving classmates' enigmas and trying to find the mathematical rule or pattern that it's behind it. 					
	<p>Content-obligatory language for the session: I think..... because....., how do you say in English.....?, I'm pretty sure that..... , There is..... , There are..... , challenge, puzzle, mathematical game, can you help us please?, hands-on, interactive, pattern, rule, You must take in consideration that, May I give you a clue?,</p>					
	<p>Activities <i>include : Name and description; Assessment tool (if any); Material (including language support)</i></p>					
<p>5.0</p>	<p>After session 4 and before session 5, different groups should verify that they achieve all the requirements for their puzzles within the check-list.</p> <p>After session 4 but before session 5 teachers will ensure that each group has a proper language support in order to make the comprehension easy.</p> <p>https://docs.google.com/document/d/1ZrrCBTDhlwyTZGGAxn5ZXm_IUFONuXp1/edit page 19</p>	<p>-</p>	<p>W- L-S- R-I</p>	<p>S-S, T-S</p>		<p>SA ,TA</p>

5.1	Some groups will exhibit their challenge to the rest of the class.	15'	S-R- L-I	S-S	UP TO THE STUDE NTS	PA, TA
5.2	All the groups try to solve the puzzles presented by the different groups. Every group must solve the challenges and find the general rule or the pattern that it's hidden behind the statement. And also they should be able to explain the solution in a clear and didactic way by using the language support attached.	20'	S- W- L-R-I	S-S		TA
5.3	All the groups share the solutions they have come up with.	10'	S- W- R-L-I	S-S		TA






SESSION 6: FINISH THE ROUND OF CHALLENGES AND DECIDE WHICH PERFORMANCE HAS BEEN THE BEST.

Objectives of the session:

1. Performing in a clear, motivating and free way the challenge to the rest of the class.

	<p>2. Solving classmates' enigmas and trying to find the mathematical rule or pattern that it's behind it.</p> <p>3. Individually assess all the groups and make a self group assessment.</p>					
	<p>Content-obligatory language for the session: I think..... because....., how do you say in English.....?, I'm pretty sure that..... , There is..... , There are..... , challenge, puzzle, mathematical game, can you help us please?, hands-on, interactive, pattern, rule, You must take in consideration that, May I give you a clue?,</p>					
	<p>Activities <i>include : Name and description; Assessment tool (if any); Material (including language support)</i></p>					
6.1	Some groups will exhibit their challenge to the rest of the class.	10'	S-R- L-I	S-S	free	
6.2	All the groups try to solve the puzzles presented by the different groups. Every group must solve the challenges and find the general rule or the pattern that it's hidden behind the statement. And also they should be able to explain the solution in a clear and didactic way using the language support.	20'	S-R- L- W-I	S-S		TA
6.3	All the members of the class must vote for the best performance, assessing different criterias. grid for vote.	20'	L-R	T-S	goo gled ocs	SA, PA

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...						

<h2>SESSION 7: HOW MATHEMATICS CAN BE USEFUL TO ENTERTAIN PEOPLE</h2> <p>Objectives of the session:</p> <ol style="list-style-type: none"> 1. Performance the challenge to an audience 									
<p>Content-obligatory language for the session:</p>									
<p>Activities</p> <p><i>include : Name and description; Assessment tool (if any); Material (including language support)</i></p>									

7.1	The best group voted by students and teachers will perform in front of a chosen audience	30'	S-L-I	SG	UP TO THE STUDE NTS	TA

Template adapted from CLIL-SI 2015.

More information at: <http://grupsderecerca.uab.cat/clisi/>



HOW TO SOLVE AND CREATE A PUZZLE RELATED WITH MATHS.

1. Introduction

This project will be related to problem solving. Problem solving is a powerful tool that will promote in the student multiple, creative and innovative skills.

To solve problems sometimes you need procedures and concepts from different areas, so this will **link different contents** and therefore will be good for student deep learning and will ensure a good understanding.

This task, they are given, is divided into two different parts:

In the first one, all students (divided into groups of 3 or 4) will be given some puzzles or mathematical problems where they must do their best to solve them, in order to explain clearly to their classmates what mathematical rule is behind each puzzle.

It is essential that they feel free to try different strategies and to explore new paths without fear of failure. Therefore, it is time to take risks.

In the second part each group of students must create an enigma, puzzle, “mathemagical” game to present to an audience. They must pay attention because this challenge must meet some rules and requirements.

2. OBJECTIVES:

Students will learn and practice:

- strategies to solve different puzzles
- how to collaborate with fellows in order to achieve a common aim
- how to communicate the statement problem and later on its solution in a didactic way
- to persevere against difficulties

3. METHODOLOGY:

Each student could work on his own strategies and share them with their group because in this project students will need to work together, sharing ideas, knowledge and strategies. **Cooperative work.**

The role of the two **teachers** will be closer to a **coach**. Teachers will inspire, motivate, question, regulate and facilitate situations. Always paying attention to the appearance of great ideas.

There will be no place for telling, showing, giving answers. Sometimes teachers will give clues when necessary.

Groups should work keeping a minimum distance from the rest of groups so nobody will hear what others have discovered.

Group sizes depend on the teacher, the students, and the specific problem. It is preferred groups of 3-4 as a rule, but occasionally students work in pairs. Sometimes before solving in group students are asked to read individually and start thinking alone in order to find as many as possible potential ways to get to the solution. (think-pair-share for instance). **Flexibility.**

Random groups: It is an option to make **different groups** of work. Every session has different puzzles and challenges so in these first sessions it is better to work in random groups and change the groups in every session. So they must work with colleagues they usually share nothing. It's a training for real life.

In problem solving it is basic to understand all the vocabulary in order to be capable of solving the challenge, so there will find attached to every challenge a sort of **scaffolding or language support.**

It is important that the groups are encouraged to get an answer. Once they arrive at this aim, they will be asked to **check** it, to find a general rule or a pattern and finally lead them to **present** their solution to the classmates in an elegant way.

Different **techniques** can be applied to encourage students to work in a cooperative way. For instance, students solve their problems on a vertical surface. There is only one pen per group and it must be shared. The person with the pen is not allowed to write down his or her ideas. Remind them to share the pen! Another possibility is to assign different roles to the members of each group.

If the groups get **stuck** in the same problem, the teacher can encourage the students to walk around the classroom to see other groups ideas, to see different strategies... This is also a great way to provide feedback and produce new discussions.

When it is decided to use a specific group's work to discuss a strategy, some specific math, misconceptions, clue... first all of the students will be moved to the centre of the room, away from the work in order to remove ownership of it (alleviate fear, embarrassment, etc.). Then move students back to the work to discuss it.

When a group gets a possible answer, they must keep it in silence. Not share it with the rest of groups until the teacher decides it is the proper moment.

4. ASSESSMENT:

In this activity non-traditional assessments will be used such as observations, checklists, posters, videos, photos of work, written solutions that tell the story of how the problem was solved ... This allows students to show their problem solving process, to explain their thinking, and to showcase their understanding. Students can “present” their solutions as a group, in partners, or individually depending on what the teacher is assessing or needs to see.

CHALLENGE # 1. GAME OF 31.

Two players must compete one against the other. In alternative turns, each player must add points (+1 or +2 or +3 or +4 or +5), starting in zero till the common addition arrives to 31. The player who gets a total of 31 points wins the round.

Example: Two players A & B play starting at 0.

A) $0+2 = 2$

B) $2+5 = 7$

A) $7+3 = 10$

B) $10 + 4 = 14$

A) $14 + 3 = 17$

B) $17 + 4 = 21$

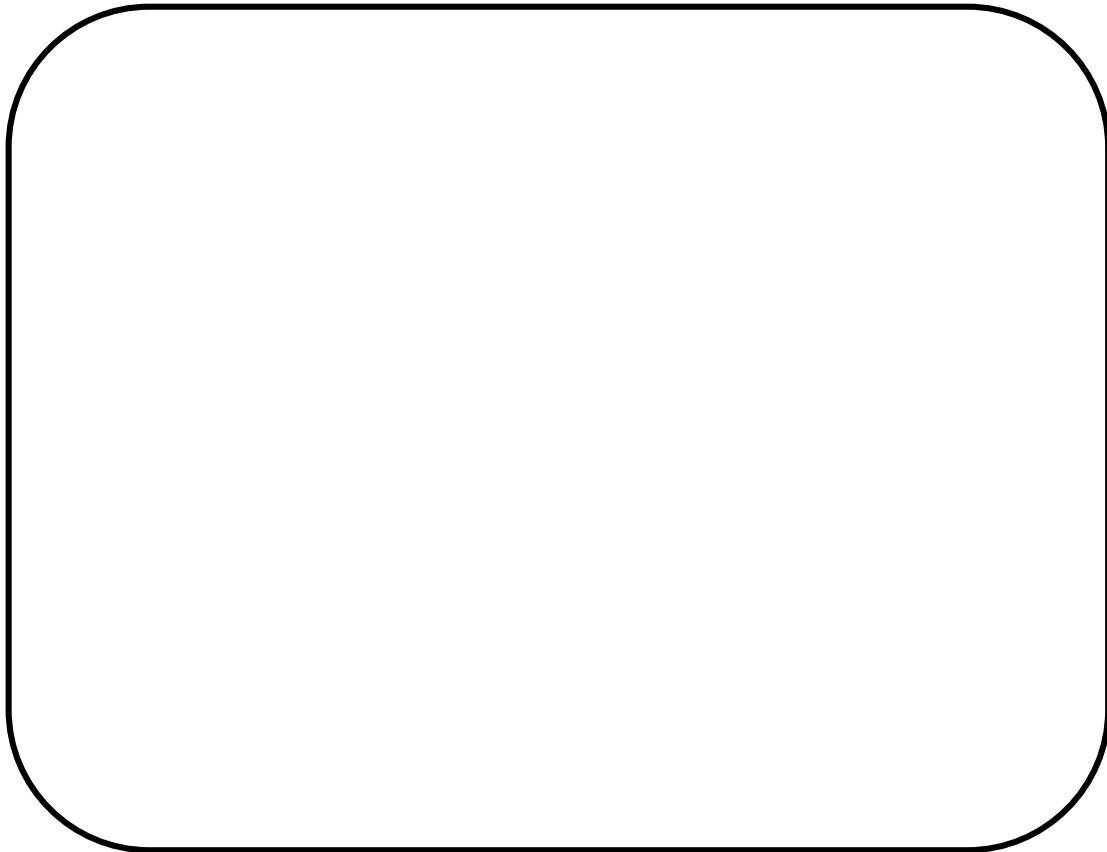
A) $21 + 5 = 26$

B) $26 + 5 = 31$ **player B wins the round!**

Play some rounds in pairs (you can change the opponent) and write down all together in the box below **the winning strategy** after checking your solution always run.

When do we know we will succeed in every game? Explain it clearly.

When two players know this strategy what will be the decisive factor?



CHALLENGE # 1. GAME OF 31. LANGUAGE SUPPORT

Vocabulary:

- Add
- Addition
- Rules

Structures in order to explain the solution:

- After practicing for a while... / we have been practicing and...
- We think the solution is...
- We have solved the enigma and here it is our procedure
- We must add...
- We have to reach....
- We have been working on this and we think....
- When you....
- You must add up 31
- In order to do so you must...
- 7 plus 3 equals 10

CHALLENGE # 2. DICES.

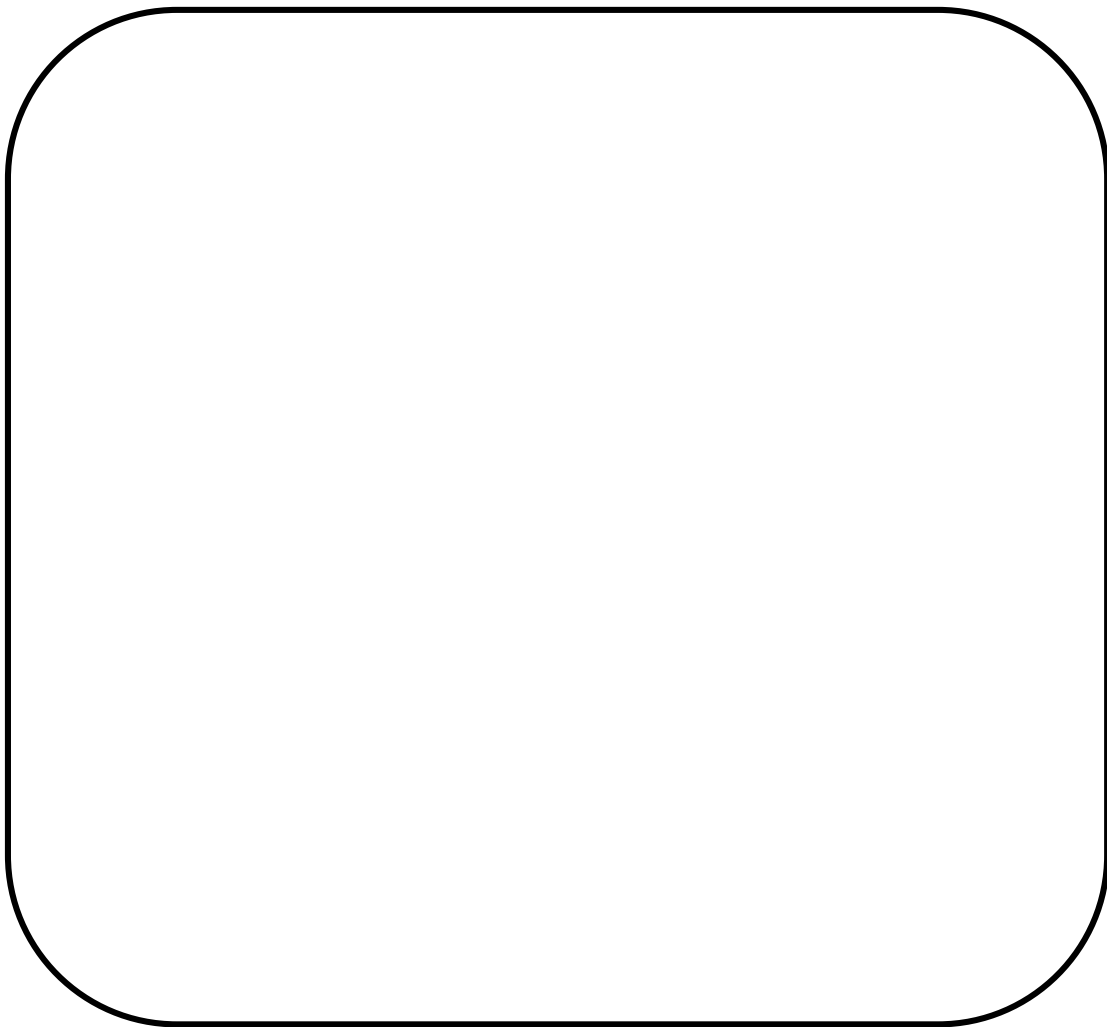
Ask someone to form a tower of 5 dice and ask him to guess the total addition of the points of the hidden faces.

What pattern is behind this challenge?

Idea: You can simplify the puzzle by doing it with less dice.

Can you find a formula or algebraic statement that expresses the total points in hidden faces based on the number of dice? Shall we take in consideration another variable?

(y = total points in hidden faces; x = number of dice; z =?)



CHALLENGE # 2. DICES. LANGUAGE SUPPORT

Vocabulary:

- Dices
- Hidden faces
- Pattern hidden
- Addition
- Algebraic statement

Structures in order to explain the solution:

- After practicing for a while... / we have been practicing and...
- We think the solution is...
- We have solved the enigma and here it is our procedure
- We must add...
- We have been working on this and we think....
- When you....
- In order to be able to solve this you must
- The key to this puzzle is...

CHALLENGE # 3. JUMPING FROGS.

We want the 3 A frogs to take up the space of the 3 B frogs and vice versa.

Frogs can only do 2 types of movements: move forward one space or jump over another frog if there is free space in the cell behind the frog that can be jumped.

Can you change the position of the 6 frogs respecting these two rules?

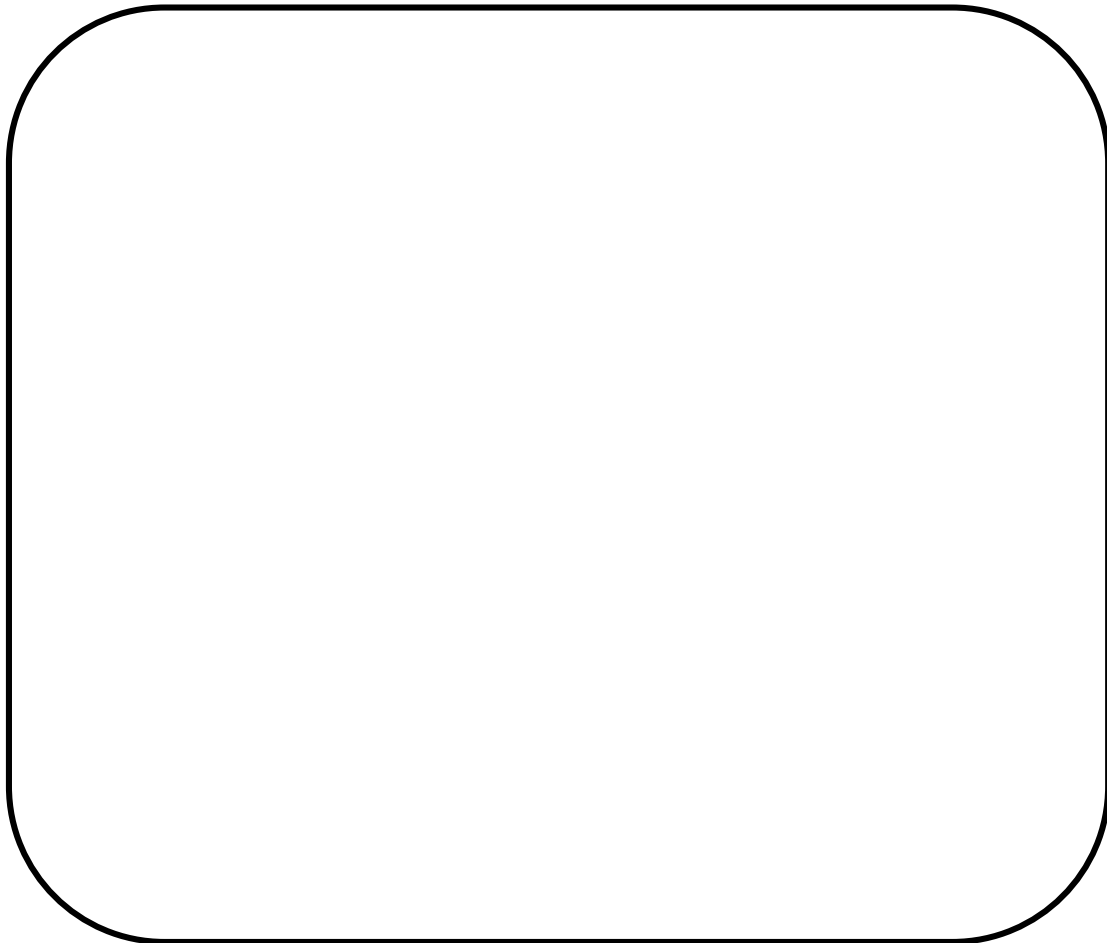


Practice with 6 paper marbles (use two different colours)



You can reduce the number of frogs and cells to make the puzzle easier.

Can you do it with more frogs? Should A and B be the same number of frogs?



CHALLENGE # 3. JUMPING FROGS. LANGUAGE SUPPORT.

Vocabulary:

- cell/ free cell
- forwards
- backwards
- jump over
- paper marbles

Language structures:

- After practicing for a while... / we have been practicing and...
- We think the solution is...
- We have solved the enigma and here it is our procedure
- We must add...
- We have been working on this and we think....
- When you....
- In order to be able to solve this you must
- If you move, you.....
- The key to solve this challenge is

CHALLENGE # 4. MAGIC CARDS.

MAGIC CARD

Before playing:

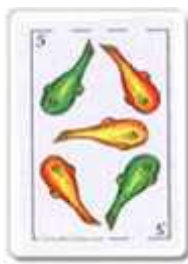
- Put away in your pocket the number 5 of the suit of Spanish playing cards we have chosen.

Description:

- We show to our audience one suit of cards and ask them to choose one card.
- To the value of the card they have chosen, they must add its consecutive number.
- We will continue, adding a 9 to the previous result, and afterwards, we will divide it into 2
- To the result we have, we will subtract the number of the chosen card.

Explanation:

- The result will always be 5. Why?



MATERIAL

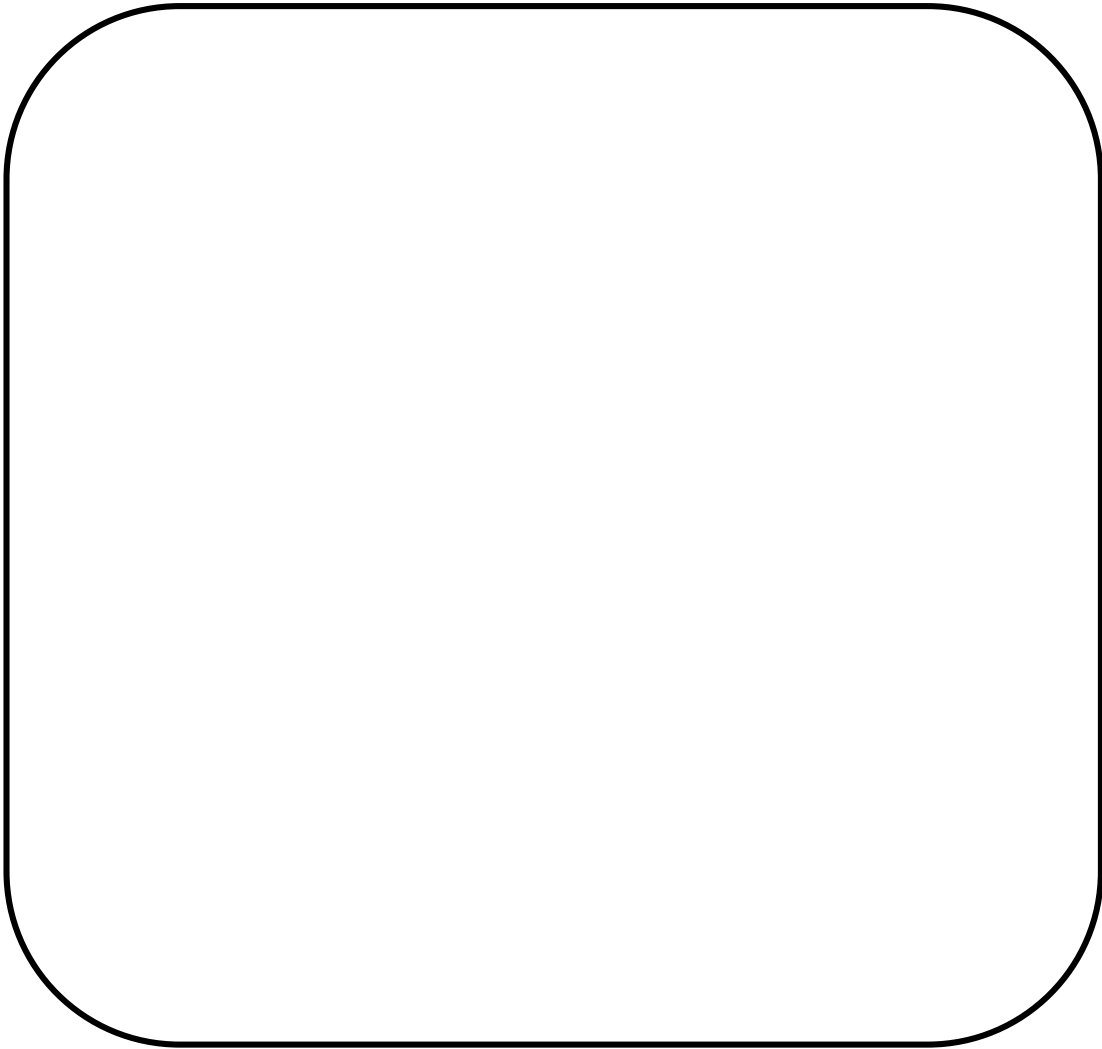
- A suit of Spanish playing cards

MATHEMATICAL CONTENT

- Mental calculus
- Combination of calculations

What is behind this challenge? Which branch of mathematics can help you to solve it?

Explain step by step how did you solve this challenge in a way, that everybody can understand you.

A large, empty rounded rectangular box with a black border, intended for the student to write their explanation of the challenge and the mathematical branch used to solve it.

CHALLENGE # 4. MAGIC CARDS CHALLENGE.


Vocabulary:

- Suit of Spanish playing cards.
- Add
- Subtract
- Consecutive number
- Result

Language structures:

- After practicing for a while... / we have been practicing and...
- We think the solution is...
- We have solved the enigma and here it is our procedure
- We must add...
- We have been working on this and we think....
- When you....
- In order to be able to solve this you must
- If you move ..., you...
- The key to solve this challenge is

CHALLENGE # 5. ENCHANTED DOMINOES

MAGIC DOMINO		
Description: <ul style="list-style-type: none">- Students must pick up a domino piece, without showing it.- They must pick up a number of the two showing on the piece, and multiply it by 5, add 7, then multiply it by 2, and finally, add the other number of the domino piece- After all the above operations, students will be asked the final result. Explanation: <ul style="list-style-type: none">- To guess the exact domino piece, we must subtract 14 to the final result, getting a number of two figures, each figure being one of the numbers of the domino piece		
MATERIAL Domino pieces	EXAMPLE 	MATHEMATICAL CONTENT <ul style="list-style-type: none">- mental calculation- combined operations- double of a number

What is behind this challenge? Which branch of mathematics can help you to solve it?

Explain step by step how did you solve this challenge in a way, that everybody can understand you.

CHALLENGE # 5. ENCHANTED DOMINOES.

Vocabulary:

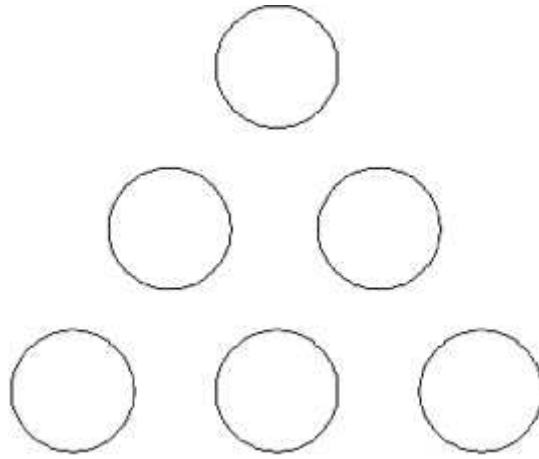
- Domino piece
- Add
- Subtract
- Multiply
- Figures

Language structures:

- After practicing for a while... / we have been practicing and...
- We think the solution is...
- We have solved the enigma and here it is our procedure
- We must add...
- We have been working on this and we think....
- When you....
- In order to be able to solve this you must
- If you move ..., you.....
- The key to solve this challenge is

CHALLENGE # 6.

In this triangle with 6 round blanks you should place numbers from 1 to 6 (without repeating) until you obtain 9 as an addition of each side. Are you able to do it with 10? And 11? And 12? Once you have solved this challenge, can you explain what the key to solve it is? What main difference do you observe between the addition 9 and the addition 12?



A large, empty rounded rectangular box with a thick black border, intended for the student to write their solution to the challenge.

CHALLENGE # 6.

Vocabulary:

- Round blanks
- To place numbers
- Addition
- Highest number
- Lowest number

Language structures:

- After practicing for a while... / we have been practicing and...
- We think the solution is...
- We have solved the enigma and here it is our procedure
- We must add...
- We have been working on this and we think....
- When you....
- In order to be able to solve this you must
- If you move ..., you...
- The key to solve this challenge is

CHALLENGE #7:

Square It

Age 11 to 16 ★

This game can be played against the computer, or against a friend.

Players take it in turns to click on a dot on the grid - first player's dots will be blue and the second player's (or computer's) will be red. The winner is the first to have four dots that can be joined by straight lines to form a square.

Squares can be any size and can be tilted.

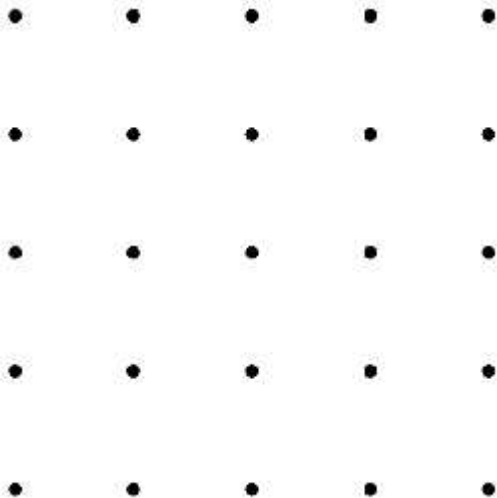
If you've played a few times against a friend, you might like to discuss your strategies, and then test them by playing against the computer.

For an extra challenge, why not increase the size of the grid using the arrow buttons?

If you are not using the interactivity, you may like to print off some [dotty paper](#).

[Full Screen and Mobile Version](#)

Square it!



CREATE YOUR OWN CHALLENGE:

After solving these challenges and seeing the mathematical content behind it, it is time to **SHOW** your **CREATIVITY**. You must create your own challenge or mathematical game, and it must have the following **requirements**:

It must be of your **own** doing and creation. It would be awesome if it is completely different from the ones you have seen.

It must have **mathematical content**: algebra, logic, geometry... and you must be able to explain the connection between your challenge and maths.

You must be able to **show** your game to an **audience** in a clear, motivating and challenging way.

You must also know **how to solve** your own challenge or game. You must know the appropriate **vocabulary** and have the appropriate **tools**, **which** will help you explain it to the public and make it understandable to them.

Create **scaffolding** like the one you have been given.

When explaining the solution, you must also **explain the maths behind** the challenge, explaining the how and why

If you want this activity to work properly, it is essential that each group work **hermetically**, in an autonomous way.

The best groups will be selected to perform in front of an audience!

CHECK LIST:

To check you have all the steps needed to succeed in this PBL ensure you can tick the following statements:

Statement	Yes	No
You have looked for different game challenges		
You have created a completely different game. 100% original.		
You have discussed in group which one to make up after a debate		
The challenge created has mathematical content		
You have looked for some language support (vocabulary and language structures)		
You have written some instructions		
You have assigned roles to the different members of the group, so every member has a task to achieve		
You have been able to solve your own puzzle or enigma		
You have rehearsed the performance of your challenge		
You must be able to explain your game and its mathematical content		
You are ready to perform in front of an audience		
You have work hermetically so nobody knows a possible solution		

WHAT SHALL WE DO AND HOW?

Language structures:

- We have created this new _____ and its name is _____
- We think it is funny / different / peculiar / easy / hard / enjoyable....
- These are the rules you must follow in order to / to solve it:
- In these game there are....
- You must look for....
- You must take into account that....
- Can you see the mathematical logic behind it?
- Can you explain how your group has solved it?
- This is very interesting, but it is not the solution
- Very good! You have done an excellent job!

HOW DO WE CREATE OUR OWN PUZZLE CHALLENGE OR ENIGMA?

VOCABULARY:

- Mathematical problem
- Algebra
- Repetition
- Challenge
- Puzzle
- Enigma
- Logic
- Solution

LANGUAGE STRUCTURE:

- To create a challenge we need / must / have to...
- We must / should / be funny/ genuine...
- It must be entertaining / easy / difficult...
- We must share... because we want to....
- To reach an agreement we should... because...
- It is important to agree because....
- All the members of the group have to / should / must....

VOTE FOR THE DIFFERENT GROUPS:

GROUP 1	EXCELLENT (3 points)	GOOD (2 points)	POOR (1 point)	TOTAL POINTS
LANGUAGE SUPPORT				
WELL EXPLAINED				
ORIGINALITY OF THE PUZZLE				
PERFORMANCE				
GRADE OF COLLABORATION				
MATHEMATICAL CONTENT				
TOTAL AMOUNT>>>>>>>>>>>				