

Refresher “bomb”!

Secondary: (ages 11 – 14)

Mathematics

This activity is designed as an “escape game”: students work in teams in order to tackle a host of exercises and problems. The problem consists of a bomb with a countdown that they need to diffuse. The tasks include activities involving direct application of procedures covered beforehand, along with other more open problems that call for the use of more original, creative strategies.

Time allocation 1 lesson period

Subject content Basic arithmetic procedures (proportionality, percentages etc.)
Problem solving and application of mathematics to actual contexts
Estimation and rough calculation of measurements

Creative and critical thinking This unit has a **creativity** and **critical thinking** focus:

- Encourage lateral thinking and generate and play with several approaches to solve an unusual maths problem
- Make connections between maths concepts and to concepts from other disciplines
- Reflect on chosen maths approach relative to alternatives

Other skills Communication, Collaboration, Persistence/Perseverance

Key words Serious game; proposition; percentage; measurement; escape game; arithmetic; problem-solving; accuracy; wires; timed; lateral thinking

Products and processes to assess

This activity seeks to strengthen students’ capacity to follow procedures covered beforehand, focussing particularly on checking accuracy and the application of maths to everyday situations. Students need to organise their work in a team and solve problems in a creative manner, debating and reaching agreements on the various ways of solving a problem. At the highest levels of achievement, the student contributes to solving the problems by coming up

with imaginative ideas, questioning the strategies proposed by their classmates and building the optimal solution by bringing together the various proposals.

Teaching and Learning plan

This plan suggests potential steps for implementing the activity. Teachers can introduce as many modifications as they see fit to adapt the activity to their teaching context.

Step	Duration	Teacher and student roles	Subject content	Creativity and critical thinking
1	Lesson period 1	<p>When students arrive in class they find six tests spread out over several tables and a box containing a tablet or smartphone simulating the bomb which is already ticking. The countdown is started with 40 minutes remaining. The teacher briefly explains the general rules of the activity:</p> <ul style="list-style-type: none"> - The countdown, which began with 40 minutes remaining, shows the time until the bomb detonates. - In order to abort the detonation of the bomb, the students need to complete the activities spread around the classroom. - The bomb has an abort code and three wires (red, green and blue). - The abort code is a four digit number. There is one activity in order to work out each of the digits. - The students will only have one attempt to key in the code. If they fail, the bomb will detonate signalling the end of the activity. - One of the problems tells them which wire to cut in order to get the countdown to run slower. The other two wires will make the countdown speed up. - In addition, another activity will provide them with a joker that will give them any of the four digits. 	Introduction to the activity	
2		<p>The students spend around 10 minutes deciding how to organise their work and distribute the problems to be solved. If the group is particularly large, guidance can be given to them in this process; however, the activity is more interesting the more decisions the students have to make for themselves. These decisions include the following:</p> <ul style="list-style-type: none"> - How to organise themselves into small groups. - Whether each test will be solved by one or several groups to get confirmation of the result. - Who will be responsible for keying in the final answer on the bomb. - Whether any of the tests are more important than others. <p>The teacher observes and provides guidance where necessary.</p>	<p>Organising and planning the maths tasks and responsibilities and distributing them evenly</p> <p>Problem-solving and mathematical calculations</p>	<p>Generating and playing with several approaches and unusual ideas for how to approach the maths problem</p> <p>Making connections between maths concepts and to ideas from other disciplines to solve problems</p>

3	<p>The students have approximately 30 minutes left to diffuse the bomb. Based on the explanation at the start of the activity, the teacher is merely acting in a supervisory capacity overseeing students' performance, although they may help the students occasionally where necessary, particularly in order to help them overcome mental blocks or solve problems when it comes to organisation and distribution of the tasks.</p> <p>The students identify the problems and use the knowledge acquired in previous classes in order to solve said problems. They discuss and suggest varying strategies in order to solve the problems posed and come to agreements in an orderly fashion and they come up with strategies in order to verify and double check each answer.</p> <p>The students will need to collect the data secured from each test in order to ultimately key it in on the bomb simulator app with the timer. The teacher can help the students not to get ahead of themselves leading to the activity finishing too quickly with an adverse outcome.</p>	<p>Using the knowledge acquired in previous classes to solve problems.</p> <p>Coming to agreements about best ways to approach maths problems</p> <p>Verifying and double checking each answer.</p>	<p>Posing and envisioning how to meaningfully solve a series of maths problems</p> <p>Thinking quickly to appraise and review planned courses of action</p> <p>Considering different perspectives on how to solve a maths problems</p>
4	<p>Once the activity has ended - whether the bomb was defused successfully or not - the teacher guides the students for a moment to reflect on how they have carried out their work centring on what students are feeling about it, the effectiveness with which they have used their time, the discussions that have arisen in relation to potential solutions to the problems and possible areas where improvements could be made for similar activities in future.</p>		<p>Reflecting on steps take taken to pose a maths problem and on the chosen approach and solution relative to possible alternatives</p>

Resources and examples for inspiration

Web and print

- Information sheet for teachers (see appendix).
- Instruction sheets for students
- Answer sheet

Other

- Smartphone with app 'customizable time bomb' or similar downloaded

Opportunities to adapt, extend, and enrich

- The problems that need to be solved in order to detonate the bomb can involve any discipline or a mix of disciplines

Creativity and critical thinking rubric for mathematics

- Mapping of the different steps of the lesson plan against the OECD rubric to identify the creative and/or critical thinking skills the different parts of the lesson aim to develop

	CREATIVITY Coming up with new ideas and solutions	Steps	CRITICAL THINKING Questioning and evaluating ideas and solutions	Steps
INQUIRING	Make connections to other maths concepts or to ideas from other disciplines	2	Identify and question assumptions and generally accepted ways to pose or solve a maths problem	
IMAGINING	Generate and play with several approaches to pose or solve a maths problem	2,3	Consider several perspectives on approaching a maths problem	2,3
DOING	Pose and envision how to solve meaningfully a maths problem in a personally novel way	3	Explain both strengths and limitations of different ways of posing or solving a math problem based on logical and possibly other criteria	3
REFLECTING	Reflect on steps taken to pose and solve a maths problem	4	Reflect on the chosen maths approach and solution relative to possible alternatives	4

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Activity information sheet

The activity involves 6 tests or problems that students need to solve by working in teams. If they correctly solve these tests they will be able to abort the detonation of the bomb which has a countdown: the object of the activity. This bomb is simulated using a tablet or smartphone on which the app “Customizable Time Bomb”, available free for Android and IOS, has been downloaded.

Settings

The settings for this app for the purposes of our activity are as follows:

COUNTDOWN: 00:40:00

ABORT CODE: 3172

WIRES:

- Red: speeds the countdown up
- Green: gets the countdown to run slower
- Blue: speeds the countdown up

The materials needed for each of the tests are as follows:

1. First digit. Calculation of percentages

- Instruction sheet (Annex 1.1)
- Envelopes with different coloured cards:

ENVELOPE A: 12 white cards, 2 green cards

ENVELOPE B: 8 white cards, 3 green cards

ENVELOPE C: 10 white cards, 4 green cards

ENVELOPE D: 7 white cards, 1 green card

2. Second digit. Percentage increases and decreases

- Instruction sheet (Annex 1.2)

3. Third digit. Proportionality and measurement 1

- Instruction sheet (Annex 1.3)
- Tape measure

- Calculator

4. Fourth digit. Proportionality and measurement 2

- Instruction sheet (Annex 1.4)

- 5 building set pieces (polycubes, for example)

- Calculator

5. Wires. Logical riddle

- Instruction sheet (Annex 1.5)

6. Joker. Estimates

- Instruction sheet (Annex 1.6)

4 labelled envelopes with the intervals between which the students should choose. Each envelope contains a card specifying whether or not the answer is correct (Annex 2.1)

ENVELOPE 1: 350 – 500 pear trees

ENVELOPE 2: 500 – 650 pear trees

ENVELOPE 1: 650 – 800 pear trees

ENVELOPE 1: 800 – 950 pear trees

In addition, to help them gather together the information, the students will have a template in order to note down the abort code digits as they go about discovering them (Annex 1.7).

Lastly, included in the annexes is a sheet with the solutions to the problems (Annex 2.2)