Money Rock

Lesson Study in a Secondary Mathematics Classroom

Lesson Plan
## Trial 2

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The Lesson Plan

Item	Description
Lesson Title	**MONEY ROCK**
Subject	Mathematics
Year Group	Year 9 Track 3
Duration	40 mins
Teacher Name	Ms Janet Haber
Lesson Objectives	• During this lesson, students will use their problem-solving skills to come up with various strategies and methods to be able to solve the assigned task. • Students will be able to make connections between various aspects of mathematics including algebra, graphs (real-life graphs and/or straight line graphs), sequences and the use of spreadsheets. This will help the students become more aware that certain methods can be more concise but still efficient. • This inquiry task offers opportunities for differentiation and could easily be solved both by low and high achievers. • The lesson will serve as an opportunity for revision of various topics such as forming and solving equations, substituting values in an expression, generating a table of values and plotting of straight lines. • The lesson will also serve as a discussion starting point during which the teacher can expose the students to new ideas and topics such as functions and simultaneous equations.

	• Students are given the opportunity to express themselves using mathematical keywords to describe their method.
Lesson Outcomes	**Year 7 Track 3 LOF syllabus:** Strand 2 Objective 23 - I can work through situations involving addition, subtraction, multiplication and/or division of integers. Strand 3 Objective 46 - I can work out the input/output of number (function) machines involving up to two operations and can find the rule for a number machine involving up to two operations given a set of input and output values. **Year 9 Track 3 syllabus:** AL2 i. Solve linear equations in one unknown. AL2 ii. Solve problems by forming linear equations in one unknown AL3 ii. Use algebraic expressions to describe the nth term of a linear sequence. AL3 iii. Generate number patterns on a spreadsheet. AL6 i. Generate and plot coordinate pairs that satisfy a linear rule. AL7 i. Evaluate practical formulae by substituting variables with numbers. AL8 i. Draw and interpret linear and non-linear graphs arising from real-life situations.

	NEW CONTENT **<u>Year 9 Track 3 syllabus:</u>** AL4 i. Solve two simultaneous equations graphically. AL4 ii. Solve two linear equations simultaneously. AL4 iii. Solve problems leading to the solution of simultaneous linear equations. **<u>Year 11 Track 2 syllabus:</u>** AL36 v. Understand and use function notation.
Resources	Money Rock Powerpoint presentation Money Rock Student Activity Sheet - one per group Money Rock Student Reflection Sheet - one per student Money Rock Methods and Strategies Booklet - one per student Money Rock Flashcards (Group names 1 to 6; Mathematical keywords for methods/strategies – see attachment) Six charts - one per group Various resources: Markers, graph paper, protractors, compasses, tablets, geoboards and elastic bands, multi-link cubes, plastic money, probability kit
Classroom organisation	The students will work in groups of four. Various mathematical resources and instruments will be provided for the students and will be placed on table marked R as shown below.
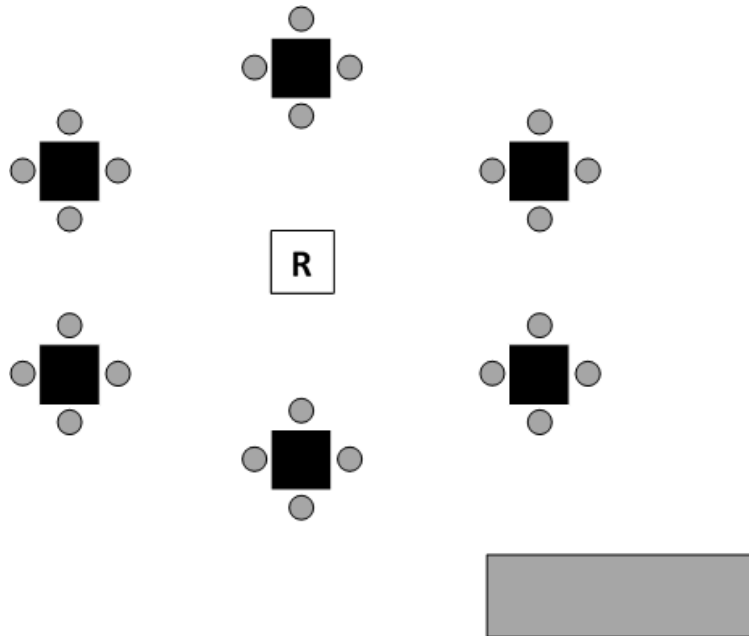
The teacher also sticks 6 pieces of cardboard to the whiteboard for use later on during the whole group discussion. Each group is assigned a cardboard.

Lesson phases

| **Introduction**
Individual work
(5 mins) | The teacher welcomes the students in class and starts the lesson by saying:
"Good morning/afternoon. As I already told you last week, today you are going to work on a task planned for you by a group of teachers. As you notice, we have various observers with us today. Try not to worry about them as they are not here to check how you are doing on the task but to observe the way you are tackling the task and what you are learning today."

The teacher gives the following instructions:
"All you need on your desk is your pencil case and calculator. On the central desk, there are some resources related to mathematics that you can use |

if you want – graph paper, protractors, compasses, tablet, geoboards and elastic bands, multilink cubes, plastic money and probability kit."

The teacher introduces the problem on the interactive whiteboard by saying:

"Today you are going to work out the following task:

> **You have €38 in your savings account.**
> **You wish to buy a JBL speaker which costs €67. You decide to save €4 each week.**
> **After how many weeks will you have enough money to be able to buy the speaker?**
> **Solve in as many ways as you can."**

After the teacher emphasizes the fact that the students need to solve the task in different ways, s/he continues by saying:

"Now, working on your own, you have three minutes to think about different ways of how to solve the task."

Main Activity *Group work* (10 mins)	While the students are thinking on their own about how this problem can be solved, the teacher starts distributing the handout Money Rock Student Activity Sheet to the various groups. The teacher continues: **"Now you can share the methods you thought of with the rest of your group. Discuss amongst you**

which methods can be used and write them out on the activity sheet provided. Although there is space for four methods, do feel free to add as many as you like. You have eight minutes. Afterwards, one the members of your group will be asked to present your work."

The teacher sets up a timer on the interactive whiteboard and then makes class rounds, walking from group to group, commenting about their work.

At the same time, the teacher mentally keeps note of any groups which use different methods so as to ask those specific groups to share that distinctive method during the plenary. The following questions can be used to deepen the students' understanding:

"**What information does the task provide you to start with?"**

"**Can you think of a clearer way of writing out your method?"**

"**Is the working clear for your peers to understand?"**

"**What do those values represent?"**

"**What does your answer mean?"**

With students struggling to find different approaches, especially content involving higher order thinking such as algebra, finding the nth term and use of graphs, one may ask the following suggested questions to elicit deeper thought and further discussion amongst the students:

"**What other mathematical topics can be used in this task?"**

	"Can the unknown value be expressed in other ways without using arithmetic?" **"Is there a pattern in your work?"** (This question is to be used with students who used the repeated addition method.) **"Look at the resources provided. See if any can be used to come up with a different method."**
Plenary *Whole class discussion* (18 mins)	The teacher tells the students that they will be sharing their methods of how they solved the task with the rest of the class. The teacher says: **"I would like the whole group to come to the front of the class, and one of you share with us one method that you used to solve the task. Please write your method on the cardboard paper assigned. You can make use of the markers provided."** The teacher selects the first group to present one of the methods that they used. Following the first group presentation, the teacher asks: **"Anyone would like to add some comments to what this group have just said?"** Here, the teacher expects comments from the rest of the class including any comments about any mistakes done by the presenting group. During this time, the teacher expects the other students to identify such mistakes and give reasons why they think there is an error. If the students do not notice any of the errors or misconceptions present, the teacher should intervene by asking appropriate guiding questions to make the students

become aware of anything unclear. Such appropriate questions include:

"What is wrong in this part?"

"Is this part worked correctly?"

"What must be done/added/changed here?"

During the plenary, the teacher wishes that the students use keywords and phrases to describe the method that they used. S/he will ask the students to select these keywords and phrases from a set of flashcards and these are stuck to the cardboard near the students' work. The question that the teacher should use to achieve this is:

"What type of method do you think your group used?"

"Select the appropriate flashcard which best describes your method."

Finally, the teacher invites another group to present a different method. The teacher says:

"Who would like to share another different method?"

The same procedure is repeated until all the different groups present a method/strategy.

After all the students present their work, the teacher asks questions to help the students make connections amongst different mathematical areas and to make them notice that certain methods can be more concise but still efficient. Some questions to elicit this are:

"Let's compare method of Group [number] with that of Group [number]. What similarities do you notice?"

(This question can be applied to any method).

"How can this pattern be presented in a different way?" (This question can be used when method mentioned is repeated addition. It aims at making the students become more aware that they can solve the task using sequences or tabular form).

"Can this problem be expressed in a non-arithmetical way?" (This question can be used when method mentioned is arithmetical. It aims at making the students become more aware that they can solve the task algebraically by forming an expression and substituting or by forming an equation and solving it).

"Is there any other way of presenting a linear relationship?" (This question can be used when method mentioned is either sequences or tabular form. It aims at making the students become more aware that they can solve the task graphically too).

Conclusion *Teacher* *summary* (6 mins)	The teacher concludes the lesson by presenting a powerpoint presentation listing all the methods that could be used to solve the problem. Special attention would be given to those methods not mentioned by the students. Moreover, the methods exposed towards the end of the powerpoint lead to new ideas and content that the students are still not aware of and still have to be exposed to. The teacher has the opportunity to hint to these new areas: • Solving simultaneous equations algebraically • Solving simultaneous equations graphically • Using functions
Assessment (1 min)	The teacher distributes a handout to every student and explains the homework assigned by saying: **"Imagine that one of the student in your class was sick today. Explain to him/her what you learnt. This work needs to be done on your own for tomorrow."**