

Algorithmic thinking resources

Year 2: Obstacle course challenge



In this lesson students find the most efficient ways to earn points completing an obstacle course using their knowledge of repeated subtraction.

Level 2 - Number and Algebra | Patterns in Algebra
/ Apply repetition in arithmetic operations, including multiplication as repeated addition and division as repeated subtraction (VCMNA114)

MATHEMATICAL LANGUAGE

Repeated addition, repeated subtraction, multiplication, division, total, arrays, number lines

MATERIALS

- Playing cards for the warm-up game
- Place Value charts (or paper & pencils to make these)
- Obstacle course materials (tables, chairs, boxes, hoops, ropes, ladder and small balance beams)

- Obstacle Course Chart
- Plastic counters

WARM UP - LARGEST NUMBER - PLACE VALUE CARD GAME

- Give each student a Place Value chart with 'ones, tens, hundreds and thousands' on it, or alternatively ask students to make their own chart as seen below

Thousands	Hundreds	Tens	Ones

- Ask students to pair up and put a deck of cards, face down, between them. Remove the face cards, establish that the Ace card is equal to one. If using number cards, remove all numbers over 9.
- The aim of the game is to make the highest 4-digit

number. The student who does this is the winner.

- One student takes the top card off the pile and turns it over. This student then decides where to place their card – under the thousands the hundreds, the tens, or the ones column – on their own Place Value chart.
- Once they have placed their card under one of the columns, their partner takes a card from the top of the pile and chooses where they would like to place this card on their own Place Value Chart.
- Play continues until four cards have been placed on each student's Place Value Chart forming a 4-digit number.
- The students compare their numbers and decide who has the largest number. The person with the largest number is the winner. They can then repeat this process and play the game again. Alternatively, they can play again, but this time they try to make the smallest 4-digit number they can.
- The number of place value columns can be easily modified to appropriately challenge and include all students; for example, consider playing with two place value columns (tens, ones), three place value columns (hundreds, tens, ones) or five place value columns (introducing ten thousands).

LAUNCH

Tell the students that there are four obstacle courses set up that they need to go through. Tell them they will work in pairs. Each pair will start off with 30 points each, and every time each pair goes through an obstacle course some points will be deducted. Each obstacle course takes away a different number of points. Their goal is to get to zero. How many times do they need to go through each obstacle course to reach their goal?

THE OBSTACLE COURSE

Obstacle course	Description	Points	Number of times
Chairs and tables	Climb over and under an arrangement of chairs and tables	2	
Hoops	Hop through eight hoops that are arranged flat on the ground	3	
Boxes and beams	Crawl through boxes and walk across low beams	5	
Ropes and ladders	Walk between two ropes and then through the rungs of a ladder (laid flat)	10	

EXPLORE

Organise the students into pairs. Give each pair 30 counters. These counters represent their points. They may use these to help them deduct/subtract points to figure out how many times they need to go through each obstacle before they reach their goal of 'zero'. Encourage them to go through each obstacle course at least once, or if they wish they can enact the whole scenario as they are working out the problem. Encourage them to use different ways to solve the problem. Ask them to record and display how they solved the problem. Give them a copy of student resource The Obstacle Course to record their final answers. Ask them to use the back of this paper to record their thinking and how they worked out each solution.

SUMMARISE

Choose students to share how they worked out their solutions, ensuring that you cover a variety of methods. Discuss the various methods with the students. Ask them which they think would be the most efficient.

You could point out, if they haven't already noticed, that if 5 points are taken away when you go through the 'boxes and beams', and 10 points are taken away when you go through the 'ropes and ladders' then all you need to do is halve the number of times it takes to go across the 'boxes and beams' to get to their goal of zero.

ENABLING PROMPTS

- Ask the students to work out the number of times needed to go through only two obstacle courses, instead of all four. You can assign which of these two obstacle courses you want them to use or you

can allow the students to choose which obstacle courses they would like to use.

- Give the students 20 points instead of 30 points and cut out the 'hoops' course. You will need to give them an alternative recording sheet.

EXTENDING PROMPTS

- Increase the number of points the students start with, such as 60.
- Ask the students to design their own obstacle course and assign the number of points to be deducted and then work out how many times they would need to go through this obstacle course to reach the goal of zero.
- Ask the students, 'Instead of going through the same obstacle course a number of times to get to zero, are you able to go through a number of different obstacle courses to get to zero? If so, how could you do this?' Show and explain how you would do this. (Example: 'Go through the tables and chairs' five times and 'go through the ropes and ladders' two times)

QUESTIONS TO ENCOURAGE DEEPER THINKING

How many different combinations of obstacle courses can you use to get to your goal of 'zero'? Give some examples. How would you know when you have found all the different possibilities?

EXTENDED VICTORIAN CURRICULUM LINKS MATHEMATICS

Level 2 - Number and Algebra

Number and Place Value

- Investigate number sequences, initially those increasing and decreasing by twos, threes, fives and ten from any starting point, then moving to other sequences (VCMNA103)
- Explore the connection between addition and subtraction (VCMNA106)
- Solve simple addition and subtraction problems using a range of efficient mental and written strategies (VCMNA107)
- Recognise and represent multiplication as repeated addition, groups and arrays (VCMNA108)
- Recognise and represent division as grouping into equal sets and solve simple problems using these representations (VCMNA109)

Patterns and Algebra

- Solve problems by using number sentences for addition or subtraction (VCMNA113)
- Apply repetition in arithmetic operations, including multiplication as repeated addition and division as repeated subtraction (VCMNA114)

Level F-2 - Critical and Creative Thinking

Meta - Cognition

- Investigate ways to problem-solve, using egocentric and experiential language

Level F-2 – Digital Technologies

Creating Digital Solutions

- Follow, describe and represent a sequence of steps and decisions (algorithms) needed to solve simple problems

PROFICIENCIES

Problem Solving

Students develop the ability to make choices, interpret, formulate, model and investigate problem situations, and communicate solutions effectively. Students formulate and solve problems when they use mathematics to represent unfamiliar or meaningful situations, when they design investigations and plan their approaches, when they apply their existing strategies to seek solutions, and when they verify that their answers are reasonable.

Reasoning

Students develop an increasingly sophisticated capacity for logical thought and actions, such as analysing, proving, evaluating, explaining, inferring, justifying and generalising. Students are reasoning mathematically when they explain their thinking, when they deduce and justify strategies used and conclusions reached, when they adapt the known to the unknown, when they transfer learning from one context to another, when they prove that something is true or false, and when they compare and contrast related ideas and explain their choices.

ASSESSMENT OPPORTUNITIES

Teachers can assess students using a checklist or anecdotal notes through observation. Student samples and photos of students engaging in the activity can be kept as evidence. Any of the above-mentioned curriculum links can be assessed through this activity.

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Student names:

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