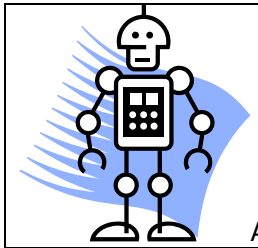


Activity F.4: Robot Miner

Special Note: This game focuses on planning and problem solving. It gives students another opportunity to practice multiples and can provide opportunity to practice adding a series of two digit numbers, if desired.

Learning Objectives:

1) Learn how to develop and execute a plan.
2) Develop fluency in multiples.
3) Apply the distributive property in calculations and problem solving.
4) Develop factoring skills.

Examples of Skills Accomplished:

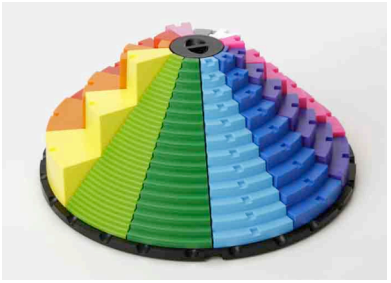
1) If 7 is the bonus value, then the total score = (1 x the sum of all captured tokens that are not multiples of 7) + (3 x the sum of all tokens that are a multiple of seven).
2) Multiples of 4 are on the 4x staircase, and the 4^{th}, 8^{th}, and 12^{st}, steps of any staircase.

Setup:

1) Use one Zillio for each team or allow them to take turns on one Zillio.
2) Staircases may be setup in any order. If using more than one Zillio allow each team to decide the staircase order.
3) Give each team one red token to be used blank side up as their robot.
4) Place the multiples on Zillio(s) blank side up for all staircases except 1x and 2x. These will now become jewels.
5) You will need two dice.
6) Make a copy of the 2D worksheet (Multiples) for each team to record jewels captured and tally their score.
7) Make a copy of a blank 2D worksheet for transitioning to paper if desired.

Maximum Number of Players for Small Group Activities: teams of 2 to 3 students

Players Positions: Standing



Game Objective: Maneuver your robot up and down Zillio to collect as many jewels as possible before your robot runs out of fuel.

1) Tell the students "You work for the McMartin Mining Company. You have just bought a robot to help you mine Zillio for jewels. There is one and only one jewel on every step. When your robot collects a jewel (by turning it number side up) it acquires enough energy to move only one more step. It can only move diagonally, to the next higher step or the next lower step, on neighboring staircases to the right or to the left of its present position. It cannot move horizontally (at the same elevation) or vertically (up or down on the same staircase). If it moves to a step whose jewel has already been claimed the robot must come to a complete stop and the play is over for that team.

2) Roll two dice to determine the bonus tokens. The sum of the numbers on the dice represents the multiples that are worth 3 times as many points as all other tokens.

   For example: If the numbers 2 and 5 are rolled, any jewel that is a multiple of 7 is worth 3 times as much as other tokens. Teams need to plan their starting point and their route to pick up as many of bonus tokens as possible.

3) Decide which of two ways teams will calculate their score:

   i. Each bonus token counts as 3 points; all other tokens are worth 1 point each.

   ii. Each bonus token counts as 3 times the face value of the token; any other token is worth the face value of the token.

4) Give each team five minutes to plan their strategy.

5) Roll the dice to determine which team goes first.

6) In turn each team places their robot on Zillio and begins collecting jewels by turning them over number side up.

7) When the robot runs out of accessible fuel (no longer can move diagonally to reach a jewel still blank side up), the team's turn is over and the score is calculated. Team members quickly record the jewels captured on their 2D score sheet by circling the

Hint: After playing several times (if there is still value to practicing multiples in this manner), allow students to create the role of a "claim jumper". A claim jumper can steal jewels that have not yet been claimed under pre-defined conditions. They will remove the jewel(s) from Zillio but neither team gets those points because the ownership of stolen jewels is under dispute. By removing strategic jewels, the opposing team can ruin the strategy of the team in play. In advance the students will need to decide the rules:

- When can a claim jumper strike?
- How many jewels can he/she take at a time or in total?
- What criteria can they use to steal?
- Is there any way to reclaim those jewels?
- And so on

For example rules could be setup to allow claim jumpers to steal 1 token after the opposing team has captured 20 jewels, as long as the jewel is not on an adjacent staircase to the robots present location.

tokens number side up and then begin tallying their score, while the next team gets ready to play. 8) The next team turns all tokens blank side up and then takes its turn. 9) The team with the highest score wins.	
Observe and Assess: 1) Interpersonal skills 2) Ability to predict the location of all bonus multiples. 3) If the option to calculate score on the face value of the jewels, observe the teams' ability to organize the work, divide up the tasks, and compute accurately.	
Group Discussion & Review of Findings: 1) N/A	
Transition to Paper: 1) Assign a blank 2D worksheet and have the students fill in all multiples of two numbers and then circle the common multiples.	

Elevations

1X	2X	3X	4X	5X	6X	7X	8X	9X	10X	11X	12X
36	36	36	36		36			36			36
35				35		35					
34	34										
33		33								33	
32	32		32				32				
31											
30	30	30		30	30				30		
29											
28	28		28			28					
27		27						27			
26	26										
25				25							
24	24	24	24		24		24				24
23											
22	22									22	
21		21				21					
20	20		20	20					20		
19											
18	18	18			18			18			
17											
16	16		16				16				
15		15		15							
14	14					14					
13											
12	12	12	12		12						12
11										11	
10	10			10					10		
9		9						9			
8	8		8				8				
7						7					
6	6	6			6						
5				5							
4	4		4								
3		3									
2	2										
1											


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