New Wonderville.org Online Game RFP: Brief

Overview

This is a Request for Proposal (RFP) for the development of a math based game that will engage students in Grade 7 (and be approachable for students a few grades above and below that range). The game will provide a story and game mechanic to promote the understanding of how to apply transformations to a 2 dimensional object, and identify coordinate pairs on a Cartesian plane. Specifically, this game will support students in using computational thinking to solve challenges. These challenges will require students to use commands (such as those utilized in block-based programming) to move a point, line or 2-dimensional shape to different locations on a Cartesian plane, using transformations (reflections rotations and translations).

We value our vendor relationships and endeavor to be clear and consistent in our communication. If anything stated in this document is unclear or more detail is required, please contact us so we can clarify prior to *October 3rd*, 2019.

All Request For Proposal (RFP) responses must be received by MindFuel by 4pm MST on October 10th, 2019 *with a decision on vendor made by October 24t, 2019 and working commencing on October 28th, 2019.*

The game will be launched by April 15, 2020.

About Wonderville.org

Wonderville.org is an award-winning digital environment that houses creative activities that make science relevant, meaningful, fun and accessible to children, youth, teachers and families. In this virtual environment, the wonder of science happens on desktops in homes and schools in urban, rural, and remote communities throughout the world. Science content is presented in a way that makes learning science enjoyable and effective for children and youth. Wonderville.org's activities excel by providing opportunities for children to control and manipulate variables, and to test hypotheses in novel ways. Wonderville.org teaches while it entertains.

About MindFuel

MindFuel is a non-profit organization dedicated to igniting a passion for science in young minds through unique educational programs in the classroom and beyond. To us, science is much more than just textbooks and equations. To us, science is creative, entertaining and transformative, so we create educational programs that embody those values. From hands-on experiments to interactive online games and videos, we bring science to life in ways that are relevant and fun and fuel a lifelong interest in the world of science!

About The New Game

The following criteria need to be satisfied:

- Develop and implement fully functional HTML5 game for wonderville.org that can be played on a tablet, smartphone and desktop
- Game must satisfy the curriculum and science criteria provided by MindFuel during the project (see Appendix 1)
- Functionality-first approach: game mechanics to be prioritised over design details early in the project and testing cycle

- MindFuel will engage Subject Matter Experts to review the project at various intervals to ensure accuracy of the content, visuals and game mechanics that relate specifically to the mathematics
- User testing will be built into the overall schedule (testing will be carried out by MindFuel in collaboration with the vendor)

AUDIENCE & CONTENT

AUDIENCE: Youth aged 11-15

The game will provide a story and game mechanic to promote the understanding of:

- Plotting and identifying coordinate pairs on a Cartesian plane
- Performing transformations (translations, rotations, reflections) on a point, line segment, and 2 Dimensional shape
- Computational thinking using block-based programming

*Please refer to Appendix 1 for additional digital game details

**Please refer to Appendix 2 for the board game version that we originally piloted in classrooms. The digital game will not exactly follow the look and gameplay of the board game, it is provided for additional context.

Tools and Functionality

Technical Requirements

Final Version of the game will be playable in the following browser environments:
Tablet: iOS7.1, Android 4.3, Win8 (Chrome OS)
Mobile: iOS7.1 (consider 9.3), Android 4.3 (consider 5/5.1)
Desktop PC (Win7): Chrome/Firefox (latest version), IE 9+
Desktop PC (Win8): Chrome/Firefox (latest version), IE 10
Desktop Mac: Safari (latest version)

Additional Requirements

Low bandwidth
No installation or download required
Ability to collect metrics (methods TBD)
Ability to upload language file for it to be localized to French

Future Considerations (outside of current scope)

Save state
Ability to add additional levels
Localisation of content into French
App Creation

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Scope, Timelines & Budget

The new game is due to be launched prior to April 15, 2019, including several rounds of user testing which needs to be built into the overall schedule (please see below table).

Milestone	Definition	Deliverables	Timeline/Duration
Project Initialization	The day in which the project will commence by the development company.	Contract signed	Late October 2019
Assessment Integration	Revising the project concept by integrating assessment criteria	Assessment/Game Flow	TBD
Game Mechanics Planning	Development Planning. Complete Concept	Treatment of the game. Description of game mechanics per screen.	TBD
Game Play Development POC	Build a preliminary build of the interfaces and elements to help refine the final development project.	Playable instance of the game with no final graphics. Single game play element	TBD
Concept Testing	1-2 rounds of internal testing and possible early user testing		Duration of at least 2 weeks to complete testing and provide feedback
Design Direction	Design and illustrations related to the creative direction of the project.	Illustrations & Graphics of 2 design directions	TBD
Alpha Version	Game version with limited production graphics and all basic game elements included.	Game Alpha Version 0.X	TBD
Alpha User Testing	Identify barriers to engagement and functionality		Duration of at least 2 weeks to complete testing and provide feedback
Beta Game Build	Game version with all production graphics and all game elements included	Game Beta Version 0.X	TBD
Beta User Testing	Identify barriers to engagement and functionality		Duration of at least 2 weeks to complete testing and provide feedback
Final Game Build	Version 1.0 build Complete and ready for final client review.	Game Final Build including source files, and portable files	April 2020
Client Approval	Final client approval of the game and complete functionality.		April 2020

The maximum budget for this project is $60,000 CAD including GST. This is a fixed bid contract. Pay will be made in instalments and tied to project milestones/deliverables.

MindFuel is a registered charity. As such, we graciously receive gifts in kind from our supporters. Should you feel that your organization would like to provide services in kind as well as those provided on a fee for services basis, MindFuel can provide sponsorship acknowledgement or a charitable tax receipt.

Please respond to this proposal with solutions/proposition to the following questions:

- Mood Board
- Concept, Flow, Mechanics
- Proposed game mechanic

All Request For Proposal (RFP) responses must be received by MindFuel by 4pm MST on **October 10th, 2019** with a decision on vendor made by October 24th, 2019.

Key Contact

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Appendix 1 – Additional Digital Game Details

Summary:

We are creating a math based game to support students in using computational thinking to solve challenges. These challenges will include a progression of levels with increasing difficulty, where the student will need to use commands to move a point, line or 2-dimensional shape to different locations on a Cartesian plane, using transformations (reflections, rotations and translations). This ties to the grade 7 math curriculum as follows:

Grade 7 Shape and Space - Curricular Outcomes
General Outcome
Describe and analyze the position and motion of objects and shapes.
Specific Outcomes
4. Identify and plot points in the four quadrants of a Cartesian plane, using integral ordered pairs. [
5. Perform and describe transformations (translations, rotations or reflections) of a 2-D shape in all four quadrants of a Cartesian plane (limited to integral number vertices).

1. Game Title: TBD

2. General Considerations

    a. Ensure to avoid “trial and error” method of progressing through the game. Must scaffold in student ability to think and reflect about what is going on
    b. There should be more than one way to complete a level
    c. There should be a reason to go back and try and improve
    d. Must support students at all levels
    e. Coding/Computational Thinking Elements - vertical blocks
        1. Functions
        2. Loops (Simple, nested)
        3. Conditionals
    f. Game Design/Story Line
        1. Attractive to all learners across genders and cultures, specifically those that are not traditionally
        2. Relevant/engaging

3. General Rules of Game Play:
    a. Randomization feature. For each level, user will get the same shape, with different coordinate pairs (level can be transformed)
    b. User will select coding blocks or functions to perform transformations on the coordinates of the shape, in order to move it to an indicated EXIT
    c. There will be a passive feedback after selecting code blocks - method(s) TBD
    d. There will be “coins” on the game board (Cartesian plane) that will boost users score
    e. There will be “obstacles” on the game board (cartesian plane) that will lower users score
    f. User will be limited by the number of “functions” (transformations) available to complete each level
    g. There may be other objects on the board that do something “special” - TBD
    h. Game will incentivize thoughtful attempts to complete each level - method TBD
    i. There will be checkpoints embedded so that user does not need to restart at level 1

4. Level Details

Size of Grid: 20 x 20 (-10 to +10 for each axis)

A. Series of simple challenges and/or "open playground" where user learns what the operation coding blocks do

B. Build on prior knowledge (all below levels use block coding):
   i. How to get from A to B using words only (reflection, translation, rotation)
   ii. How to get from A to B using words (reflection, translation, rotation) and values (over the x axis, two units up, etc)
   iii. Mapping using code blocks (operations on x and y (Needs to be introduced/explained)
      I. Start with a coordinate pair
      II. Move to a line
      III. Move to a shape

C. Functions:

In an "open playground" or "shop" section of the game, users create their own functions to be used for subcases (ie transformation function includes blocks ___, ____, ___, reflection across the x axis includes blocks ___, ____, ___ etc) and functions with conditionals for transformations beyond subcases, in later levels

1. TRANSLATION Subcases
   a) Vertical Translation (Up and Down)
   b) Horizontal Translation (Left and Right)
   c) Note that it might be good to start with functions for left and right and then combine into horizontal. Same for up, down, and vertical
2. REFLECTION
   a) Reflection across x axis
   b) Reflection across y axis
   c) Reflection across a vertical line other than the Y-Axis
   d) Reflection across a vertical line other than the X-Axis
   e) Note that the line of reflection may be a side of the player's shape if it is horizontal or vertical (but not diagonal)
3. ROTATION (about the origin, about another point)
   a) Clockwise 90° about the origin (0,0)
   b) Counter clockwise 90° about the origin (0,0)
   c) Clockwise (or counter clockwise) 180 about the origin (0,0)
   d) Clockwise 90 about another point other than the origin
   e) Counter clockwise 90 about another point other than the origin
   f) Clockwise (or counter clockwise) 180 about another point other than the origin

D. Constraints as difficulty increases/progress through levels:

- Dependence on student defined functions

- Randomize levels for more variability when replaying game (by transforming previous levels)
- Difficulty will progress based on outcomes (gr 4-9) & depth of each outcome, game will primarily focus on 7th grade
- More difficult levels include more than one shape on the grid (these should be overlapping, tangential or connected)

E. When shape touches the objects on the board

Notes:

- All objects will be placed on integer coordinate pairs
- Size of object should not be larger than 1x1 (it should not touch any other coordinate pairs)

Negative objects:

- Take away points
- Destroy shape
- Other - TBD

Positive:

- Adds points
- Gives extra "coding blocks" or functions/transformations that may be used
- Other - TBD

F. Scoring

- Provide final feedback based on how well the student performs/provides evidence on meeting knowledge and/or skill outcomes
- Other suggestions/ideas:
  - Would need an incentive for point collection (time, ideally something other than time-> creativity?, efficiency/number of moves)
  - Have user play against "computer"?
  - Include a "scoreboard" for top scores?
  - Provide "bronze, silver, gold" for performance at each level?
  - Include a visual showing how "well" they did for each level to motivate students to return to levels and make improvements
  - "Currency" that can be used to unlock or change skins, for example

G. Open playground section:

- "Shop" aspect where they can experiment, build their functions, etc.
- Nice to have: build your own level

H. Bonuses

- TBD

5. Game “Pieces”

Coding “Blocks”
“Translation” (early levels)
“Reflection” (early levels)
X Or “Horizontal”
Y Or “Vertical”
Increment +1 or -1 Or “Add __ to”
loop
Factor of -1
“Rotation”
90°
“Clockwise”
“Counter clockwise”

Other
Negative Objects on Grid
Positive Objects on Grid
2-D Shapes
Cartesian plane / Grid

Score
Time
Grid/Cartesian Plane
Overall map/visual of user performance for each level

6. Data Collection

The following embedded assessment will need to be collected for each attempt of each level for research purposes:

a. Player ID
b. Level ID
c. Timestamps - start of attempt (note timestamp should be based on server time not the player's computer time)
d. Timestamp - end of attempt when "run" was hit
e. Was the attempt successful?
f. The number of changes in "code" made for the attempt
g. What was the final score/medal earned on the attempt
h. How many times "hints" or help was accessed during the attempt
i. Starting state of player's code/plan for the attempt (JSON or some other format captureing the functions/blocks used and configuration/order and settings
j. Final state of player's code/plan when "run" was hit.

*Provide automatic feedback for teachers (nice to have) (student IDs are associated with a teacher ID -- when teachers enter their IDs they can see some stats on their students collected from the logged data)

7. Mathematical References:

Transformation Table

Transformation Rules		
Function Notation	**Type of Transformation**	**Change to Coordinate Point**
f(x) + d	Vertical translation up d units	$(x, y) \rightarrow (x, y + d)$
f(x) - d	Vertical translation down d units	$(x, y) \rightarrow (x, y - d)$
f(x + c)	Horizontal translation left c units	$(x, y) \rightarrow (x - c, y)$
f(x - c)	Horizontal translation right c units	$(x, y) \rightarrow (x + c, y)$
-f(x)	Reflection over x-axis	$(x, y) \rightarrow (x, -y)$
f(-x)	Reflection over y-axis	$(x, y) \rightarrow (-x, y)$

Appendix 2 – Snapshots of board game version

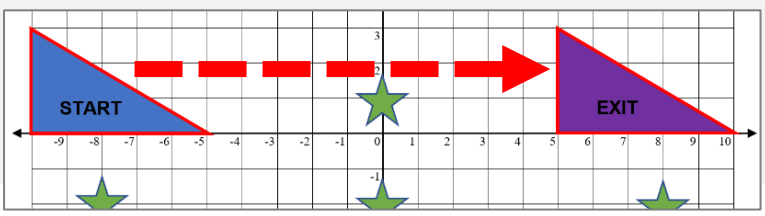
Example Transformation Sheet

Move	Details
	4
	3
	Y Axis
	X Axis
	$Y = 2$
	90° $(0, 0)$
	270° $(0, 0)$
	90° $P(2, 5)$

Name	Explanation
Vertical Translation	Shape is moved 4 units down
Horizontal Translation	Shape is moved 3 units to the right
Reflection	Shape is reflected in Y Axis (horizontally)
Reflection	Shape is reflected in X Axis (vertically)
Reflection	Shape is reflected (vertically) in parallel line to axis, line is $y = 2$
Rotation counter clockwise	Shape is rotated counter clockwise 90° about the origin $(0, 0)$
Rotation clockwise	Shape is rotated clockwise 270° about the origin $(0, 0)$
Rotation counter clockwise	Shape is rotated counter clockwise 90° about the point $P(2, 5)$

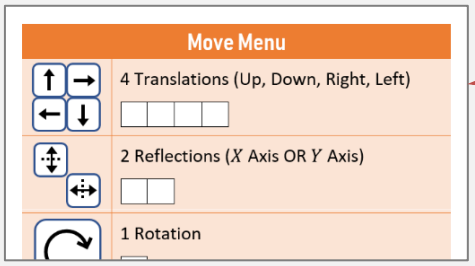
Rules and Examples

Move the Shape
Move the shape from START to EXIT.



Move Menu

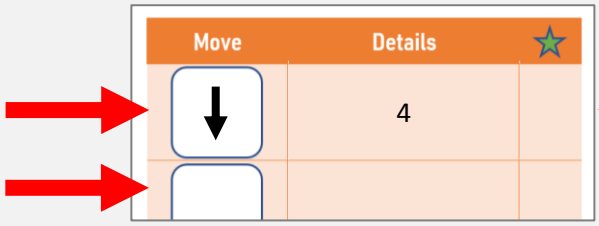
Use the Move Menu.



You have a **limited number** of moves, so choose wisely. You do not have to use all moves.

Play!

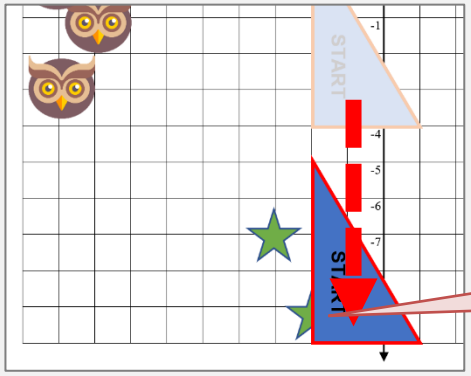
Write down your moves **here**, and use the Example Transformation Sheet for details and help.



Moves have symbols. Also, fill in details for each move.

Collect Points & Avoid Obstacles

Collect points , and avoid obstacles such as OR in each level.



Touch with your shape to get **+1**.

Scoring & Medals

There are Bronze, Silver, Gold, and Diamond scores in each level. Circle your medals!

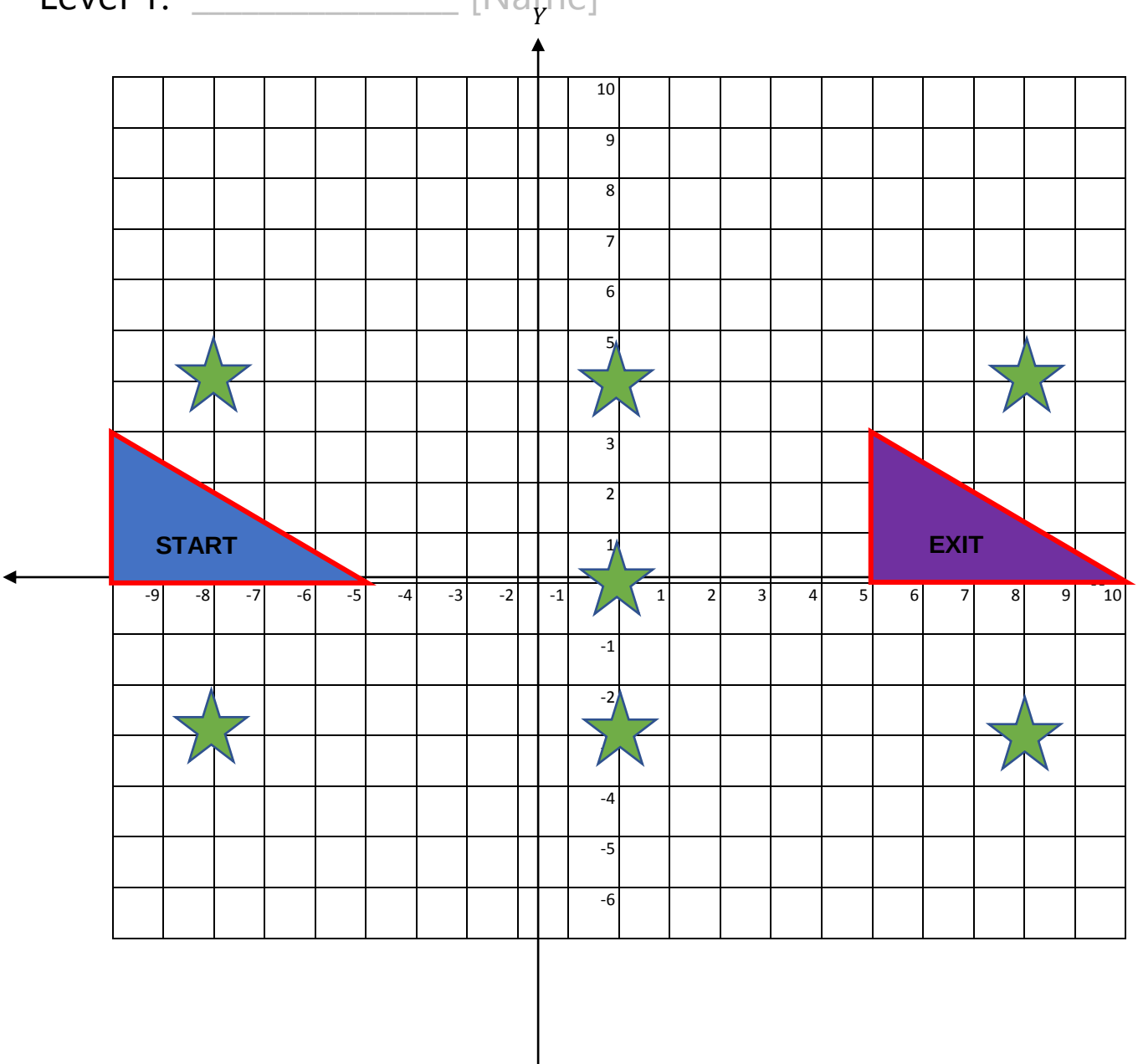
Scoring	
Bronze	Reach the EXIT with score of at least +1
Silver	Reach the EXIT with score of at least +3
Gold	Reach the EXIT with a score of at least +5
Diamond	Reach the EXIT with score of 0

Team Name

This is a 2 player game. Write down your team name.

Team Name:	

Level 1: _____ [Name]



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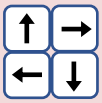
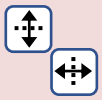
									-7										
									-8										
									-9										

Move Menu	
	5 Translations (Up, Down, Right, Left) ☐☐☐☐☐
	2 Reflections (X Axis OR Y Axis) ☐☐

Legend	
	START; where you start the level
	EXIT; move your shape here to exit the level
	PICK UP; worth 1 point

Scoring	
Bronze	Reach the EXIT with score of at least +1
Silver	Reach the EXIT with score of at least +3
Gold	Reach the EXIT with a score of at least +5
Diamond	Reach the EXIT with score of 0

Rules
To play Diamond level: Must earn Gold first.
Maximum number of moves: 5

Move	Details	★

Move	Details	★

Medal/Total				

Move	Details	

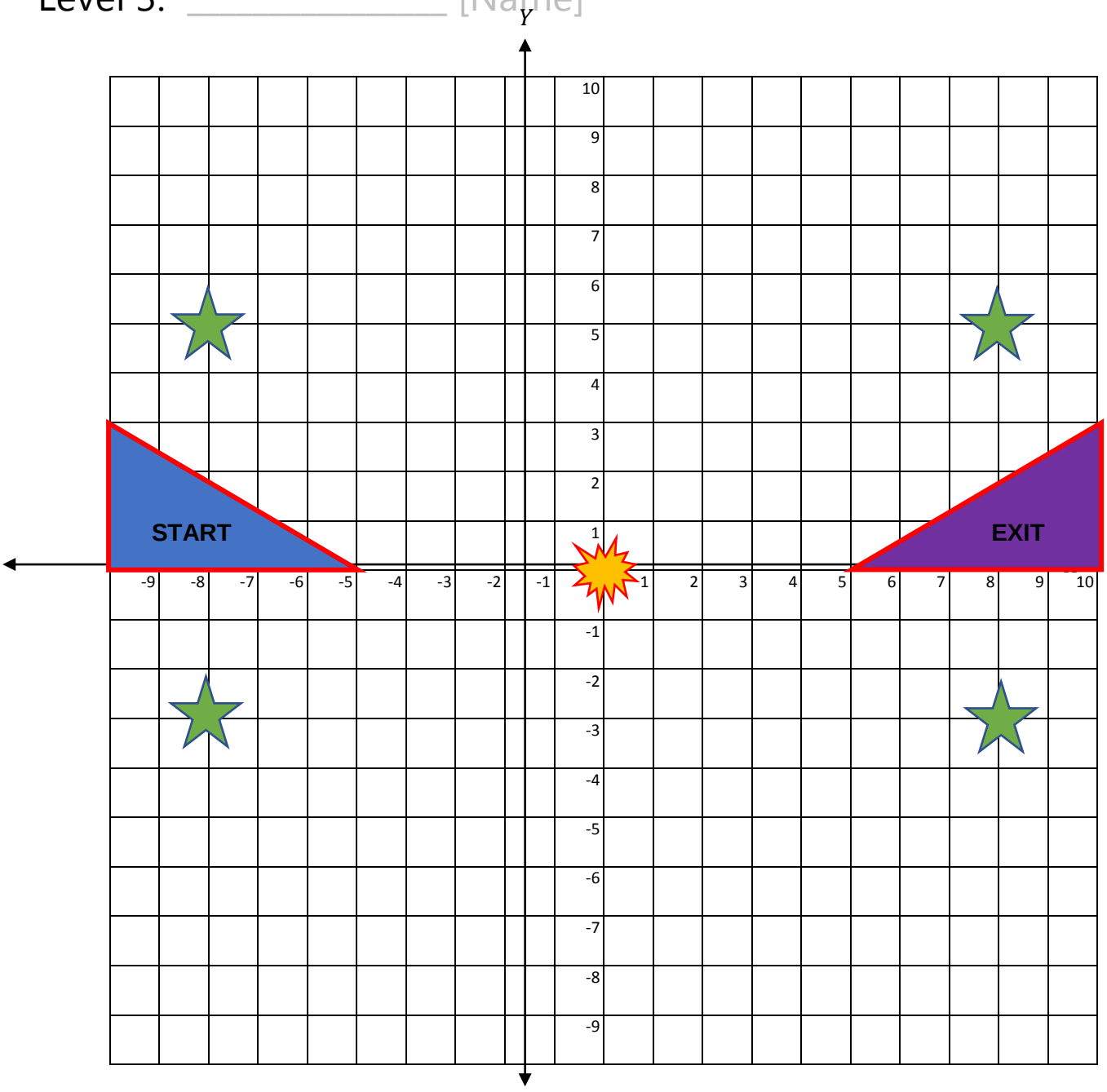
Medal/Total				

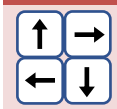
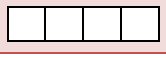
Medal/Total				

Move	Details	

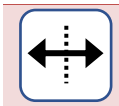
Medal/Total				

Level 3: _____ [Name]



Move Menu	
	4 Translations (Up, Down, Right, Left) 

Legend	
	START; where you start the level

	1 Reflection (Y Axis) ☐
	1 Rotation ☐

	EXIT; move your shape here to exit the level
	PICK UP; worth 1 point
	HAZARD; hit this and lose the level

Scoring	
Bronze	Reach the EXIT
Silver	Reach the EXIT with score of at least +2
Gold	Reach the EXIT with a score of at least +3
Diamond	Rotate around the origin $(0, 0)$ as one of your moves

Rules

To play Diamond level: Must earn Gold first.

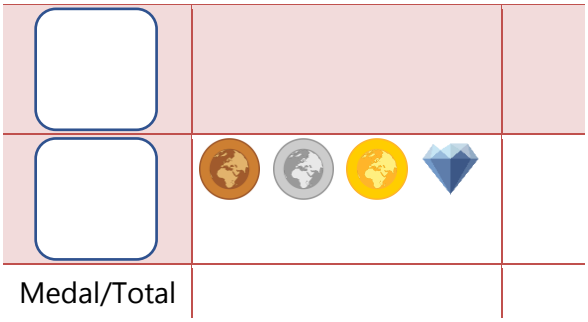
Maximum number of moves: 4

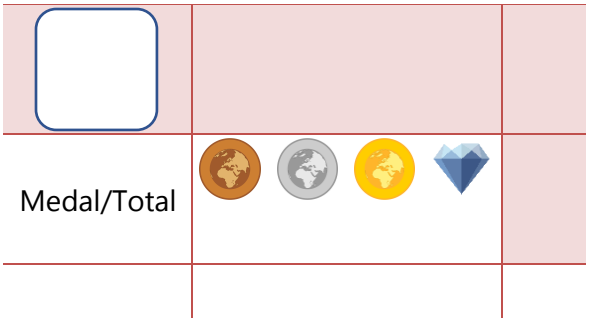
Move	Details	★
Medal/Total		

Move	Details	★
Medal/Total		

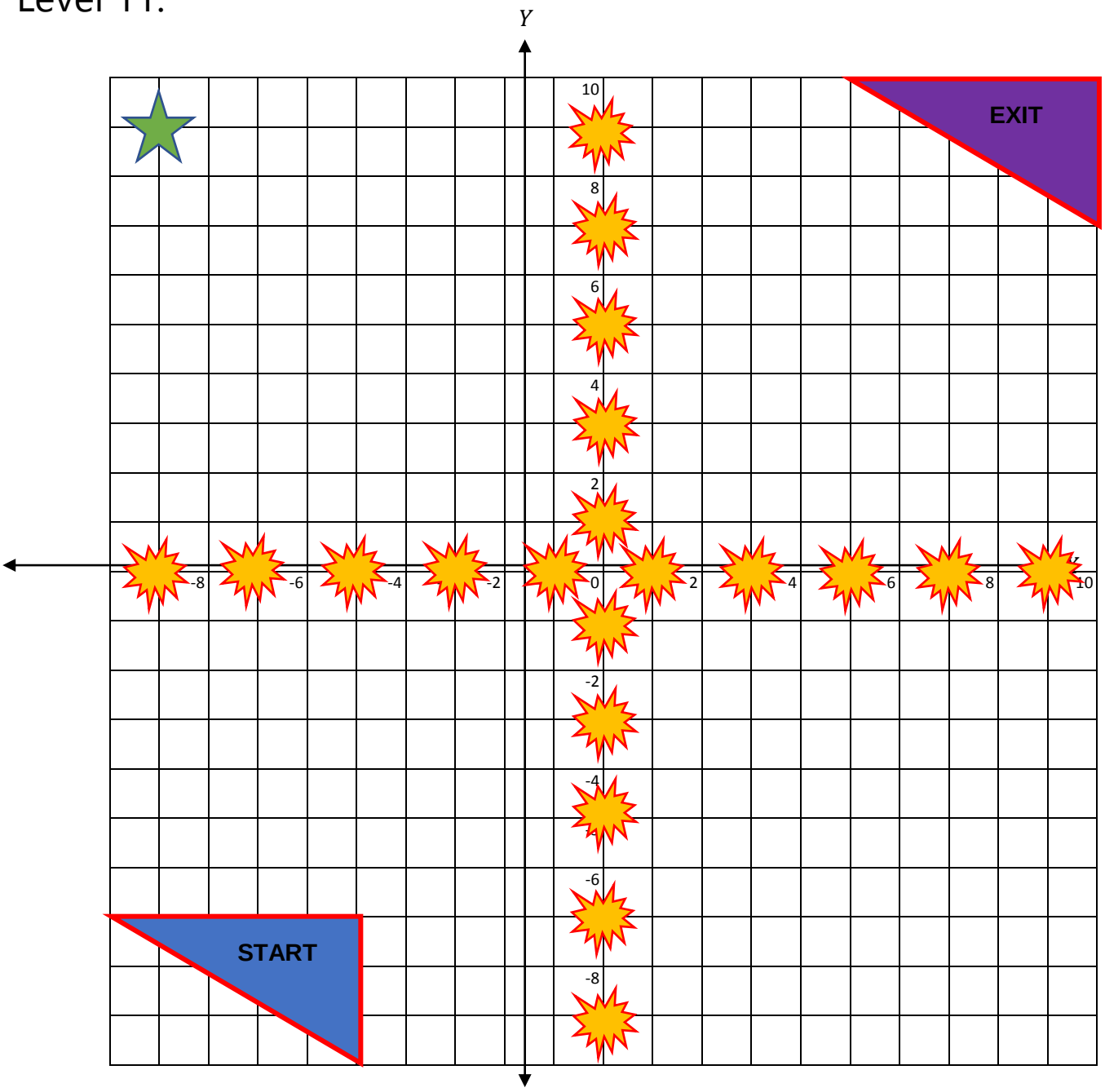
Move	Details	★

Move	Details	★


Medal/Total


Medal/Total

Level 11:


Y
EXIT
START
10
8
6
4
2
-2
-4
-6
-8
-8
-6
-4
-2
0
2
4
6
8
10

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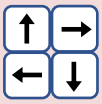
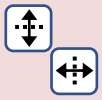
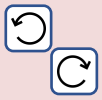
Move Menu	
	4 Translations (Up, Down, Right, Left) ☐☐☐☐
	2 Reflections ☐☐
	3 Rotations (clockwise OR counter clockwise) ☐☐☐

Legend	
	START; where you start the level
	EXIT; move your shape here to exit the level
	PICK UP; worth 1 point
	HAZARD; hit this and lose the level

Scoring	
Bronze	---
Silver	Reach the EXIT
Gold	Reach the EXIT with a score of at least +1
Diamond	Reach the EXIT in five moves or less

Rules
To play Diamond level: Must earn Gold first. Maximum number of moves: 9

Move	Details	☆

Move	Details	☆