Moto Math
The Game

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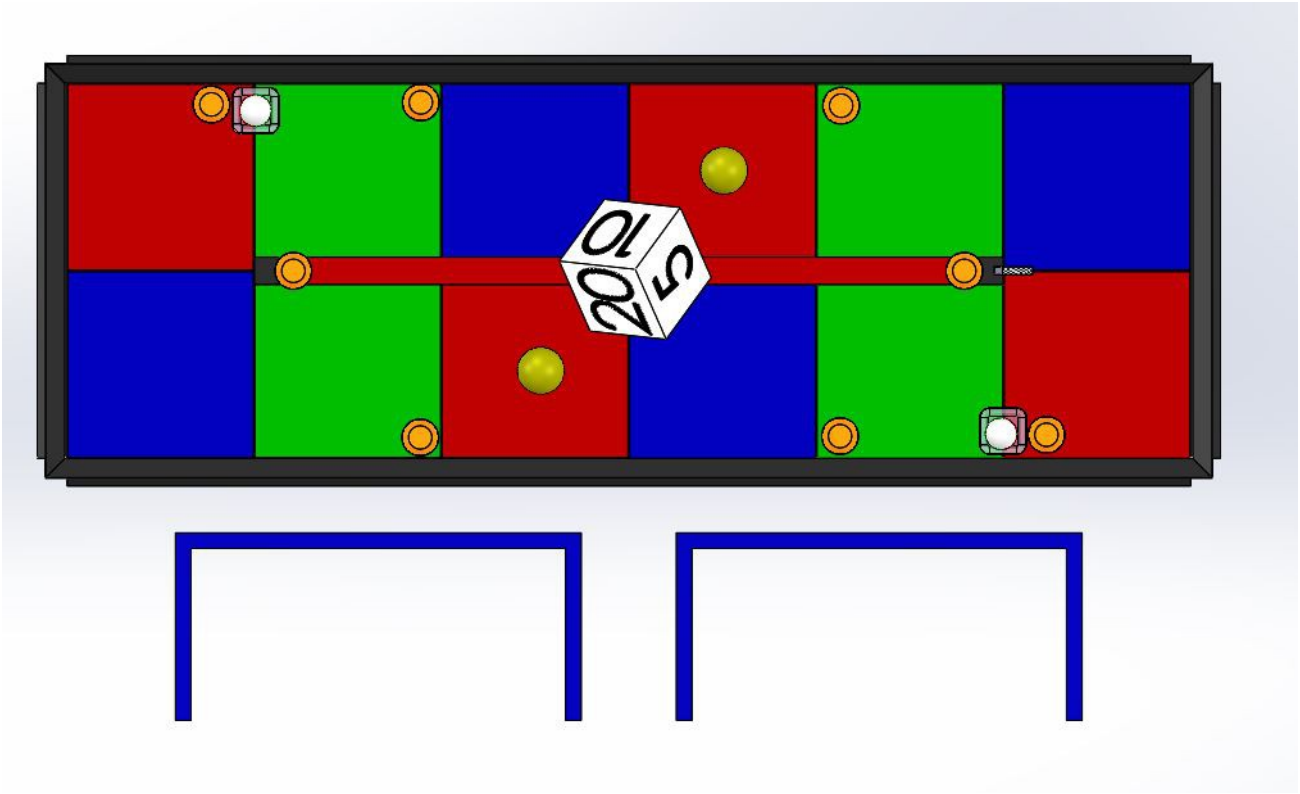
Section 2 – The Game

2.1 – Overview

This section describes the CREATE Junior game called *Moto Math.* It also lists the game definitions and game rules.

2.2 – Game Description and Field Drawings

Matches are played on a field initially set up similar to the figure below.



Two teams, making up an Alliance, collaborate in each match. The object of the game is to attain the highest score possible by working together to lift, race, upend and manipulate scoring objects to maximize your probability of success. There are 10 Fibonacci Flags. Maximize your score by knocking them all down. Race around the track as fast as you can to exponentially increase your lap score while you are placing the spheres back on their green home tiles. Don't leave even a fraction of the max points available. Have your partner's second driver focus on increasing the probability of getting the highest score possible with the probability cube and at the last minute park on the same colored tiles to get the parking bonus. But be aware, if you park on just the right tiles you can get 100% of the parking bonus allowed.

There are a total of ten(10) Fibonacci Flags (cups). Knocking over the cups scores in the classic Fibonacci Series:

Flags Knocked Down	Points
1	0
2	1
3	1
4	2
5	3
6	5
7	8
8	13
9	21
10	34

The maximum score you can attain via the Fibonacci Flags is 34. But you can get more points by placing the four (4) spheres back onto their green home tiles. The maximum points you can attain this way is 40 points with each sphere scored earning a fraction of the max allowed. Here is a breakdown:

Spheres on Green	Fraction of Max Allowed	Points Earned
1	¼	10
2	½	20
3	¾	30
4	1	40

But remember only one sphere per green tile and the sphere cannot touch a tile of any other color.

In the center of the field, perched upon two of the Fibonacci Flags is the Cube of Probability. This six sided cube has 3 sides worth 5 points, 2 sides worth 10 points and 1 side worth 20 points. This object can only be scored by the second driver. Push the cube out of the race track and the number showing on the top is your point total. Once the cube is outside the race track it can no longer be manipulated so be sure it lands with the 20 side up. Your odds of it coming up 5 points is 3 in 6 or 1/2. Your odds of it coming up 10 points is 2 in 6 or 1/3, and your odds of it coming up 20 points is also 1 in 6. To increase your probability of a maximum score you can turn the cube to any side you would like prior to pushing it out.

Rack up the points exponentially by completing laps. A lap is considered to be completed if any part of either robot breaks the plane of the finish line. But don't go backwards, if you back up past the finish line your lap will be removed. For a lap to be counted you must go around each pole at the ends of the track. You may cross over in the middle, but you must completely go around each pole. Each robot counts laps. If one robot finishes 2 laps and their partner finishes 3 laps the alliance will be awarded a total of 5 laps. Exponential scoring of laps will be based upon 2^5. Here is how it works.

Laps Completed	Exponent of 2	Points Earned
1	1	2
2	2	4
3	3	8
4	4	16
5	5	32

So 32 is the maximum number of points you can get from finished laps.

One last way to increase your score is percentage parking. The maximum score allowed for the percentage parking is 20 points. To score the parking bonus each robot must be on the same color tile, but on different tiles. Your robots must be touching only 1 color tile. And where you park increases the percentage of the max score allowed. Here is the breakdown:

Parked On	Percent of Max	Points Earned
Red Tiles	25.00%	5
Blue Tiles	50.00%	10
Green Tiles	100.00%	20

2.3 – Game Definitions

Alliance – Two randomly paired teams that work together during a match.

Coach - A student or adult designated as the team adviser during the tournament.

Driver - A team member responsible for operating and controlling the Robot. Only the two drivers from a team are allowed to be in the Driver's Station during a match.

Driver Change – Changing from the first to the second driver in the middle of the match. The change must occur between :30 and :60 seconds.

Driver's Station – The designated region where the drivers stand during any match.

False Start – A robot moving before the match begins will be considered to have false started. A five (5) point penalty will be assessed for each robot that false starts. If the false start is severe, at the discretion of the referee, the robot may be disqualified.

Fibonacci Flags – The ten (10) cups positioned around the race track.

Fraction Spheres – The four (4) balls, two (2) small and two (2) large, that begin the match on red tiles.

Laps – One complete counter clockwise revolution of the race track by the robot. Don't back up behind the finish line or your lap will no longer count.

Match - A one minute and thirty second driver controlled period. A match starts when the referee says "Go".

Parked – A robot is considered to be parked when it is in contact with only 1 colored tile.

Percentage Parking – A method of scoring that requires the two robots to be parked on the same colored tile.

Probability Cube – The large six sided cube that begins the match in the center of the race track.

Pre-placement of Robots – Each team is allowed to place their robot on the race track in the following manner. One robot must be placed completely within the in blue tile just beyond the finish line and the other robot must be placed completely within the red tile just behind the finish line. As long as all wheels are touching their starting tile of their choice they may be in any part of that tile.

Removed from the field – Any game object that leaves the field stays out the duration of the match.

Robot – Anything (which has passed inspection) a team places on the field prior to the start of a match.

Team Member – Any of the participants that make up the team. Team members may assist the drivers with the pre-placement of the robot. Only the two drivers (per team) are allowed in the Driver's Station for the match.

2.4 – Game Rules

2.4.1 – Scoring

- Fibonacci Flags are considered scored if they are knocked over on their sides. They cannot be supported, either fully or partially, by any game object, goal or field wall. They can be either inside or outside the field.

Flags Knocked Down	1	2	3	4	5	6	7	8	9	10
Points	0	1	1	2	3	5	8	13	21	34

- Fraction Spheres are considered scored if they rest inside a green tile. No part of the sphere may be touching a tile of a different color and only one fraction sphere per green tile will be scored.

Spheres Scored	1	2	3	4
Fraction	¼	½	¾	1
Points	10	20	30	40

- The Probability Cube is considered scored if it is completely outside the field of play laying flat on one side. The side up will be the points scored. 4 of 6, 4/6 or 2/3 of the sides, will score 5 points. 1 of 6 sides, 1/6, will score 10 points and 1 in 6 sides, 1/6, will score the maximum of 20 points. The Probability Cube may only be scored by the 2nd driver. If pushed out by the 1st driver the cube will count as zero.

- Laps are considered scored when either robot completes one loop around the race track going around each pole. If each robot laps the track twice that will be counted as four (4) laps. A robot must break the plane of the finish line with any part of their robot to score a lap. Don't back up or you might just lose your scored lap. A maximum of five (5) laps will be scored for a maximum lap score of 32.

Laps Completed	1	2	3	4	5
Exponent	1	2	3	4	5
Points	2	4	8	16	32

- Percentage Parking points are scored when time expires with both robots on different tiles of the same color. The robots must only be touching the tile of one color. The closer to the center of the race track the more points that will be scored.

Parked On	Red Tiles	Blue Tiles	Green Tiles
Percent of Max	25.00%	50.00%	100.00%
Points	5.00%	10	20

2.4.2 – Safety Rules

<S1> If at any time the *robot* operation is deemed unsafe or has damaged the playing field, surface, barriers or wall, by the determination of the referees, the offending team may be disqualified. The *robot* will require re-inspection before it may take the field again.

<S2> If a robot gets hung up on the perimeter or drives out of the field, teams MAY place the controller on the ground. The **driver** may slowly walk around the field to the stranded robot to place it back into the field. The robot should be placed just inside the point that it got stuck and should follow the guidelines below. The driver may then walk back to the driver's station and pick up the controller to continue as before. If teams are not performing this action safely, the Alliance may be disqualified at the discretion of the referee.

a. The robot should be placed in the field as near to where it became caught on the side rail as possible.

b. The robot cannot be touching any robot or any game elements that were not already captured by the robot at the time of getting stuck. An object is captured if the robot can be lifted straight up and the object stays with the robot.

<S3> If a *robot* goes completely out-of-bounds (outside the playing field) and continues to move, clear intent of returning to the field MUST be demonstrated. If a robot is being driven with any other intent, the robot/Alliance may be disqualified or stopped and the match ended at the discretion of the referee. A robot may not re-enter the field in a scoring position.

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2.4.3 – General Game Rules

<G1> At the beginning of a match, each *robot* must not exceed a volume of 14 inches wide by 14 inches long by 14 inches tall. An offending *robot* will be removed from the *match* at the Head Referee's discretion.

a. Alignment devices (templates, tape measures, lasers, etc.) that are not part of the *robot* may NOT be used to assist with the positioning of the *robot*.

<G2> For each match, teams shall include two *drivers*. The *drivers* may change from match to match.

<G3> During a *match*, the *drivers* are the only people allowed in the drivers station.

<G4> **Any** team member may assist in Pre-placement of the robot.

<G5> Scoring objects that leave the playing field are considered out of play. They will not be returned to the field for that match.

<G6> *Drivers* are prohibited from making intentional contact with any game or field object. The first instance of intentional contact will result in a warning, with any following instances resulting in disqualification.

<G7> During a *match*, *robots* may be remotely operated only by the *drivers*.

<G8> *Robots* may not intentionally detach parts during any *match*, or leave mechanisms on the field. Multiple infractions may result in disqualification for the entire competition.

<G9> *Robots* must be designed to permit easy removal of scoring objects from any grasping mechanism without requiring that the *robot* have power after the *match*.

<G10> Field tolerances may vary by as much as +/-1”. Teams must design their *robots* accordingly.

<G11> At the discretion of the event partner the lowest score from each team may be dropped in determining final standings.

2.4.4 – Moto Math Specific Game Rules

<SG1> At the beginning of each *match*, the *robots* must be placed such that one is completely within the blue tile just beyond the finish line and the second is completely within the red tile just behind the finish line.

<SG2> It is legal for a robot to cross over the race track median. Laps will be counted as long as the robot has gone around each of the poles. Laps are to proceed in a counter clockwise fashion.

<SG3> *Drivers* must change (*Driver change*) sometime between 30 and 60 seconds of the *match*. *Driver* one may hand the remote to *driver* two anytime between 31 and 59 seconds on the clock. If a team exchanges the remote too early or too late in a *match* the robot may be disqualified for that *match* at the discretion of the referee. If the remote is exchanged significantly outside of the designated time, the referee may disqualify the *alliance,* which will receive a zero score for that *match*.

<SG4> Only the second driver may score the Probability Cube.

<SG5> The containers holding two (2) of the Fraction Spheres may be knocked over. They are not attached to the field. However the spheres must be OUT of the containers to count.