

ZR Website (may 2016)

Website Basics	Create an Account Invite Students to Your Team	Set up an account on the ZR website Invite team members after everyone has made an account (mentors only)
IDE	Getting to Know the ZR IDE Using the Graphical Editor Introduction to Game Mode Intramural Competitions and Sharing Projects Submit Code for a Competition	Intro to the ZR programming environment Use the graphical editor as an alternative to writing code Select the appropriate Game Mode and test your code against a standard player Share code with your team and compete against a teammate. Submit code for a competition.

Beginner

Basic SPHERES Controls	Variables, Arrays, and the setPositionTarget Function More Simple Arrays and setAttitudeTarget	Create variables, arrays, and make the satellite move Practice using arrays and make your satellite rotate to face a certain direction
Programming Concepts	Conditionals: The Basics of "If-Then" Conditionals: More Fun with "If-Then", Logic Operators and Debugging Conditionals: Advanced Logic Operators Conditionals: Else-If For Loops Applied Conditionals Creating Functions Functions and the Step Counter Model	Intro to conditional statements Enhance the "if-then" statement with logic operators and learn to print to the debug console Use the "and" and "or" logic operators Learn about the "else-if" statement, nesting conditionals Use a "for" loop to repeat an action a set number of times, as well as find the position of the other satellite. Use getMyZRState in conditional statements Organize your code with procedural functions Learn to use a step counter and practice creating functions
Useful Math and Physics	Intro to Physics Kinematics Combining Vectors	Basic information on weightlessness, translation, and rotation Conceptual fundamentals of motion Fundamentals of using and combining vectors

Intermediate

More SPHERES Controls	setAttitudeTarget, Revisited Hints about SPHERES Loop Dynamics setVelocityTarget Force Spinning: Torque Spinning: Angular Velocity Spinning: Partial Turns	Write code to control the SPHERE's direction Get a better understanding of SPHERES dynamics and Newton's first law. Use setVelocityTarget for efficiency Learn Newton's Laws and use setForce Intro to torque and the setTorques function Make your satellite spin using angular velocity and setAttRateTarget Use dot product to perform partial rotations
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Advanced

Advanced Programming	Spinning: Tilted Axis Revolving: Polar Coordinates Revolving: Tilted Axis Recommended Functions	Use cross product to control spinning on a tilted axis Use polar coordinates to revolve in 2-D at the origin Use cross product to revolve on a tilted axis anywhere on the coordinate plane Descriptions of functions we recommend you add to your algorithms
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Optional Team Activities

SPHERES	Make Paper SPHERES Paper SPHERES Plan Label the SPHERES Communications Trilateration Ropes	Create a 3D SPHERES model Printable plan for Make Paper SPHERES Label the components of a SPHERES satellite Learn the basic principle of satellite communication Learn about trilateration and SPHERES positioning
Physics	Grids and Coordinates Vector Hunt Soccer Ball Demo Chairs on Wheels Thruster Balloons Free Body Diagrams Bottle Rockets Bouncy Balls Dry Ice Dynamics Speed of Sound	Reinforce basic algebra and explore the coordinate plane Underscore the importance of both magnitude and direction Use a soccer ball to understand Newton's First Law Use rolling chairs to understand Newton's Third Law Demonstration to reinforce Newton's Third Law Visualize forces with free body diagrams Design, build, and launch your own bottle rocket to better understand kinematics and force Understand core elements of physics using bouncy balls Experience frictionless dynamics with dry ice Demonstrate that sound travels slower than light
Programming	Programming Peanut Butter and Jelly Write it then Do it - Programming	Learn the fundamental principle of programming by making a sandwich Reinforce the concepts of explicitness and thoroughness in programming
Review	Jeopardy ZR Team Management FAQs	Test your knowledge with an interactive review game Questions and answers for mentors and competitors

Other Resources

Reference Documents	ZR User API CosmoSPHERES Game Manual	Quick guide to all non-game-specific ZR control functions Comprehensive guide to the 2013 high school tournament
Links	Middle School Student Materials Pope John Workshop y0b0tics! Circle Tutorial	Resources for students and educators in the ZR middle school summer program; may also be useful for high school teams using the graphical editor or needing more help with math or physics. Must be logged in to access. A series of videos and problem sets produced by Stephen Pendergrast, Pope John XXIII Regional High School, Sparta, NJ, to train new team members. Complementary to the tutorials on this page. A text-based tutorial to help new teams get off the ground. Courtesy of Team y0b0tics!, Montclair High School, Montclair, NJ.