

TekBot General Lesson Ideas			As generated by SPIRIT teachers (February 1, 2008)	
Context				
Moving TekBot	TekBot Const.	Eng Notebook	Concept	Lesson Idea
1			Angles	If you can change the angle of direction of the TekBot, what do you have to do to stay within an obstacle course? How about declination or inclination? (ramps)
1			Angles	How many degrees can the TekBot turn within a specific limited space?
1			Angles	How does the TekBot handle ramp angles? Calculate TekBot speed at different angles.
1			Area/Perimeter	Move TekBot in shapes and then solve for A or P, based on TekBot path measurements.
1			Area/Perimeter	Student moves robot to form shape with pre-given area or perimeter.
	1		Astronomy	Compare TekBot to Mars Rover in its construction.
		1	Astronomy	Research Mars and moon robots
		1	Astronomy	Show how robots are used in space today.
1			Basic Facts	Move TekBot around flash cards and students answer the question.
1			Basic Facts	Put answers to math basic facts on floor. Partners drive TekBot to answer the problem.
1	1		Batteries	How batteries function in a TekBot
1	1		Batteries	Measure how long different types of batteries last.
1			Batteries	Use fully charged vs. not fully charged batteries to see effect on TekBot performance.
	1		Bridge engineering	Understanding the design of bridges and have TekBot traverse bridge.
	1		Bridge Engineering	Examine the weight limits of a bridge and test with a TekBot moving across the bridge.
1	1	1	Cell Biology	Can you make a comparison chart of cell structures to that of TekBot components?
1			Cell Biology	How do TekBot circuits compare with cell communication?
1		1	Chemical Reaction	How long will the battery go before depletion? Rechargeable versus disposable can connect to slope.
1			Chemical Reaction	Observe batteries with different levels of charge and observe different reactions (movement of TekBot) How long does a battery type last?
	1	1	Chemical Reaction	What happens when a resistor is overloaded? Also, how do capacitors work? (the metals used, etc.). Documentation of results of tests.
			Circuit and Ohm's Law	How does the TekBot represent the equation $V=IR$? Also, find $I =$ instead of V , etc., solving for each variable.
	1		Circuits	Use design process to solve problems related to circuits.
	1		Circuits	Building a circuit out of popsicle sticks and tin foil which models a TekBot circuit.
	1		Circuits	Drawing open/closed circuits as they might exist on the TekBots.

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1			Circumference	TekBots move around in circles and measure the circumference of those circles.
1			Circumference	Have the TekBot create several different type circles with students outlining the circle.
	1		Circumference	Using a shoebox full of wheels, how do different sizes impact TekBot motion?
1	1		Consumer decision: Honda vs. Hummer	Is a TekBot like a Honda or a Hummer? Compare mass, force needed, etc. to make a consumer decision. Futuristic applications.
1		1	Coordinate Axis	Graphing movement as TekBot moves on a large grid.
1			$d = r \times t$ Algebra Equation	Can you explain how different equations represent TekBot motion?
1	1	1	Decimals	What is the force being applied by the TekBot?
1	1		Decimals	Can you explain how the TekBot is moving using mathematics? Conversions, etc.
1			Decimals	How close can you measure TekBot movement? For example, to the nearest centimeter, etc.
	1		Decimals	If I was an engineer for this TekBot how much would it cost to build it?
1			Definition of Life	Is the TekBot alive? Does it move, seek shelter, seek food, etc.
1			Definition of Life	What defines life? Is the TekBot living? Why or why not?
1	1	1	Design	If you were to design a robot that made you breakfast, what would it need to do?
		1	Design Process	Illustrating it as you complete and create TekBot enhancements.
		1	Design Process	Design your own TekBot with a different purpose.
		1	Design Process	Figure out how to improve TekBot and make suggestions.
		1	Dialectic Notebook	Can you explain your TekBot experiment? Your objectives? Your mistakes? Have handout made to have students use layout for labs.
1			Dinosaur	Velcro a dinosaur on the TekBot. Create a game to review dinosaur information.
	1		Dinosaurs	Create mobile dinosaurs using the TekBot
		1	Dinosaurs	Compare/contrast TekBots to computers (old and future), then to cars; things must evolve/become better!
1			Division	Apply $r \times t = d$ to find speed ($r = d/t$) when discussing motion.
1			Division	Use it to show differences in sizes and scale.
	1	1	Electricity	How does the TekBot use resistors? How about capacitors?
	1	1	Electricity	How does a particular circuit work on the TekBot?
	1		Electricity	Your instructor has disabled your TekBot, how do you find what is wrong?
	1		Electricity	Can you create a simple circuit using tinfoil, popsicle sticks, LED, and battery?
	1		Electricity/ Positive-Negative	What stops the flow of electricity? What happens when you hook things up wrong in a particular part of the TekBot?

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1	1	1	Engineering as a Career	Can you create a KWL chart to discuss the topic of engineering?
		1	Engineering Fields	What types of things need to have an engineer design them?
1	1	1	Engineering Problem Solving	Can you find a group solution to a particular TekBot situation/task?
	1		Following Directions	Can you give multistep directions to follow in moving the TekBot?
1			Force	TekBot pushes things on different surfaces.
1			Force	Experiment with adding weight to the TekBot and observe performance.
1			Force	Show how different forces make it move differently, and use vectors to illustrate the forces.
1	1		Formulas	Can you explain TekBot speed mathematically (velocity)? Can you explain its acceleration?
1			Formulas	Can you move the TekBot to show $D = R \times T$? How about $S = D/T$?
	1	1	Formulas	Can you measuring friction using different surfaces?
1			Fractions	Changing fractions to percentage in how far a TekBot is moving on a path.
		1	Fractions	Converting % to fractions and look at the percent grade of a ramp.
1	1	1	Friction	Can you illustrate Newton's Laws with a TekBot?
1		1	Friction	Can you calculate rate of ascent for varying inclines?
1			Friction	Can you use different weights and surfaces to test friction?
			Function of robots in society	What qualifies something as a robot? Can they be made more "human"?
1			Geometric Shapes	Can you create different geometric shapes by attaching yarn to the TekBot and moving it around a grid?
1	1	1	Graphing	Can you represent TekBot movement on a coordinate axis?
1	1	1	Graphing	Can you represent the various components of the TekBot using a Venn Diagram?
1			Graphing	Can you show the results of TekBot speed/change variables on a graph?
1			Graphing	Can you locate the positions of the TekBot based on ordered pairs?
1			Graphing	Can you set up a race track and graph distance vs. time of the TekBot?
1			Graphing	Is it possible to move the TekBot in a truly straight line? (add seconds for segments off the line). Graph segments or average time to travel course.
1			Graphing	Can you plot the diagonal distance of the TekBot using a grid and the distance formula? If the robot picks the points of its own path?
	1		Historical Research	See how robots have changed, compare/contrast robots of the past, present and future.

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		1	Historical Research	Timeline of the invention of silicon chips.
		1	Historical Research	Research the development of motor technology.
	1		iMovie	How to construct the TekBot using step by step directions.
	1		iMovie	Create a tutorial where students show how electronics tools should be used safely.
		1	Innovation vs.. Invention	Are their real world applications of our TekBot?
1	1	1	Inquiry	What if the TekBot could be "super sized"? How could it move better? (e.g. larger wheels, larger batteries.)
1	1		Inquiry	How can robots work to help in today's industry?
	1		Inquiry	Why do you need a resistor? Allow students to demonstrate the answer.
		1	Inquiry	What questions would a person new to robotics have about your TekBot? Give them a TekBot and have them record questions, etc.
1			Integers	Movement on a big number line to use the TekBot to show integers.
1			Integers	Use with coordinate graphs to show negative and positive numbers.
	1		Inventions	How would you change a TekBot. What purpose would it have to help mankind?
		1	Inventions	Design new attachments for the TekBot.
1	1	1	Lab Safety	In what ways could you inadvertently damage the TekBot. How might it damage you inadvertently?
		1	Lab Safety	Why do we need lab safety when working with the TekBot? Examples?
1			Lesson Set	How can a TekBot be used to explain integers to a younger student?
1	1	1	Life	Is the TekBot alive? Why, why not.
	1		Magnetism	Explain how a motor works with a TekBot.
	1		Magnets	Study how magnets work inside a motor with a TekBot.
1			Mass	How much mass can the TekBot transport?
1			Math Facts	Move TekBot on a number line to do basic facts.
1			Mean, Median, Mode	How do different TekBots materials impact its performance?
1			Mean, Median, Mode	What is the average time a TekBot can traverse a maze? Calculate measures of central tendency.
1		1	Mean, Medium, Mode	Calculate and graph central tendency of races, obstacle courses, etc. Record construction times.
1			Mean, Medium, Mode	Navigate maze--determine class mean, median

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1		1	Measurement and Unit conversions	Is mph appropriate unit of measure? What's a better unit? Create chart of different units. (convert weight unites)
1	1	1	Metric Measurement	Distance measurement size of TekBot, parts sizes documentation of sizes
1			Metric Measurement	Have TekBot navigate maze measuring metric, and mass-grams.
1			Metric measurement	Measure mass of different parts of the TekBot. Measuring distance traveled on track.
	1		Metric Measurement	Unit conversions while building
1			Metric System	Converting and measuring in metric a TekBot moves across the floor.
1			Metric System	Measuring distance and compare metric to standard measurements.
1			Metric System	Measure distance around room as TekBot travels.
	1		Metric System	Measuring weighted components of the TekBot.
1			Microbiology	Using a moving TekBot to simulate the spread of viruses or bacteria.
		1	Microbiology	Compare and contrast a TekBot with a cell, could lead to other cells.
1		1	Mode, Median, Mean	Using TekBot to make trial runs of distance and time and record the results. Discuss mean, median, mode.
	1		Motors-How They Work	How do motors work, parts, functions.
1			Newton's Law of Motion	Have different weighted objects in front of TekBot to illustrate Laws of Motion.
1			Newton's Law of Motion	Find Newton's 2nd law of Motion by placing different masses on the TekBots and measuring speed.
1		1	Newton's Laws	
1		1	Newton's Laws	$F=ma$ Add weight to the TekBot to find change in velocity and acceleration.
1		1	Newton's Laws	Moving-gravity; Notebook-definitions processes of Newton's Laws
1			Newton's Laws	What happens when we change the direction of a wheel--what happens when an object disturbs the laws of motion.
1			Newton's Laws	Explore $F=ma$ Add mass to TekBot and measure speed and acceleration.
1		1	Newton's Laws (Part A)	Definitions and formulas along with drawings in the notebook. Simulation tests.
1			Newton's Laws (Part B)	use the actual TekBot to experiment and incorporate these formulas. Record findings in notebook.

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1			Newton's Laws of Motion	Inertia (First Law) use and object with and without a seatbelt. F=MA (2nd Law)--play with the mass to see the effect. (3rd Law) Action/Reaction--more vs. less mass--run TekBot into things.
1			Newton's Laws of Motion	Looking at how there must be an energy source to run something, including TekBots.
1			Note taking Documentation	Learning how important note taking is. Teaching combination note taking.
1	1	1	Operations	If you have x dollars and you need to get y number of parts to fix your TekBot, how and what could you purchase to complete your task?
		1	Outline Notes	Document procedure in outline form.
	1		Parts of a Circle	Calculate ratios of different types of wheels. Different calculations of diameter, radius, pi
1	1	1	Percent	Efficiency, drag. Hypothesis-engineering changes create percent of change in performance
1	1		Percent	Track percentage completion. Mass percentages of components.
1			Percent	Analyze percent difference, percent change.
1			Percent	Use for a completion of a maze (% finished).
1			Percentage	Find the percentage of total distance traveled. Find the percentage of ramps used with slope.
1		1	Podcasting Technology	Give oral directions for another to follow around an obstacle course.
1			Polygon	Move in the shape of a polygon and see if TekBot turn radius is sufficient.
1			Polygons	Creating shapes with the TekBot movement and recording with marker.
		1	Polynomials	Solving formulas of the TekBot as it moves in parabolic paths.
		1	Polynomials	Use with algebra and find resistance and describe paths of the TekBot.
1	1		Positive-Negative	Moving TekBot simulating number line. Positive, negative--electricity lesson
1			Positive-Negative	"Mobile counter" -- number line along baseboard with TekBot
	1	1	Positive-Negative	Conduction-Positive/Negative junctions, resistors, Forward Advancement--reverse for +/- number calculations. Documentation of connections
	1		Positive-Negative	Show what happens if you change the battery, balancing of protons/neutrons
		1	Positive-Negative	Use the diode to show the positive flow.
1	1	1	Problem Solving	"Your job is to get the TekBot to do this..." Generate a list of inquiry--"I wonder what would happen if..."
1	1	1	Problem Solving	How can you document and why. Quality control., trouble shooting. What mathematical knowledge required to build/operate TekBot?

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	1	1	Problem Solving	Using the dialectic method for engineering log book
		1	Problem Solving	How do I solve this? What could this be used for? What's the best solution?
		1	Problem Solving	What do you do if it doesn't work. Brainstorm ways to test TekBot.
1			Rational & Real Numbers	Divide the circumference of circular paths by diameter for students to discover the value of Pi.
1			Ratios, torque, Problem Solving, Inquiry	Alter gear ratios and show/test relationships.
		1	Real Numbers	Experiment with different formulas and illustrate the Real number system.
	1		Recognizing Electronic Components	Lesson on resistor colors and their values.
1	1	1	Reflection	What math skills are required to build your TekBot? Can you identify all that you used?
1	1		Scale	Compare original wheels to larger/smaller wheels
1			Scale	Problem solving-changing
	1		Scale	How to scale the parts to fit the construction.
		1	Scale	Compare a TekBot to a real car and include a scale diagram. How does a tire to body scale change between a real car to a TekBot.
		1	Scale	Have students estimate size conversions relative to different payloads.
1	1	1	Science Ethics	What are the ethics of creating. So does the ethics of applications
1	1	1	Scientific Method	Examine how a trailer impacts TekBot performance.
	1		Scientific Method	Order of operations for construction. Trial and errors.
		1	Scientific Method	Compare scientific method to engineering method.
		1	Scientific Method	Give a problem and think of ways we could use the TekBot to help solve that problem.
1	1	1	Simple Machines	What simple machine is used to move the robot, building the robot. Create a Venn diagram of how they are common/different.
	1		Simple Machines	How do simple machines work?
		1	Simple Machines	What are the simple machines? How are these making the TekBot move more easily?
		1	Simple Machines	How things work.
1	1	1	Slope	Capacitors/resistors, linear slope vs. exponential slope
1			Slope	Set up a ramp at different algebraic slopes and observe TekBot movement up the ramp

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1			Slope	Figure out the slope of the a ramp and its impact on TekBot
1			Slope of a line	Using ramp--how slope affects movement of car. (incorporate friction)
1			Sound	Adjust the pitch and volume with differing resistors, etc.
1			Sound	Drive across different materials and compare the sounds they make.
1			Sound	Measuring sound waves, comparing to electrical waves, using the context of the TekBot.
1		1	Sound (Doppler Effect)	Attach a noise maker to TekBot and have students cover their eyes. Students can describe the path of the TekBot as the operator moves it around the room.
1			Speed	Graphing different speeds dragging different weights with TekBots (charts/spreadsheet applicable also)
		1	STEM Careers	S.T.E.M. career research criteria, including salary, education, and daily work load.
1	1		Systems of Equations	Measuring friction
1			Systems of Equations	Use the TekBot to visually demonstrate "solution," to a system by physically showing intersections.
	1	1	Technical Drawing	Drawing a diagram of the TekBot construction process.
		1	Technical Drawing	Design TekBot accessories using technical drawing.
		1	Technical Drawing	Use to CAD-measure components and make a scale drawing.
		1	Technical Drawing	Learning to draw TekBot circuits and how it completes a circuit.
1	1	1	Technology & Society	Brainstorm the ways robots are being used in society.
1			Technology & Society	1. Mars rover 2. Bomb Squad 3. Vacuum cleaner and pool cleaner.
		1	Technology & Society	Have a discussion on how to improve the TekBot to also discuss about engineers.
	1	1	Technology in Society	Have an engineer come and explain the parts of a TekBot.
		1	Technology in society	Discussion about how technology is used in society.
		1	Technology System	Where Robots fit in a system. Mind mapping. Kids Spiration & Inspiration Software
1			Terrains	Varied terrains and observing how the TekBot responds
1			Time	measure time from point A to Point B as TekBot travels.
1			Time	Estimate time for distance traveled with a TekBot.

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1			Time	Drive TekBot around polygons outlined on floor and measure times and compare for shapes.
1			Time	Races--measure the amount of time to travel a race path.
	1	1	Transistor	Demonstrate what it is' give examples outside of TekBot constraints.
	1		Transistor	How does a transistor affect your machine?
	1		Use of electronic components	Using VOM to test components and understand usage for them.
1	1	1	Using Formulas	Solving any physics equation after finding path with the TekBot.
		1	Variables	Solve problems involving circumference, power, velocity, etc.
1			Velocity	run the TekBot and measure number of revolutions per time and how far it goes per time.
		1	Velocity	Velocity of TekBot, math terms in notebook.
1			Velocity, Algebra, Problem Solving	In 60 seconds what is the largest square you can make?
1			Velocity, Distance	Mapping a room.
1			Video Technology	Create a video through the viewpoint of the TekBot. Use garage band, etc. to create feelings, etc. in the film.
1	1	1	Voltage	Use of multimeters
	1		Voltage	Test resistors $V=IxR$ Experiment with multimeter.
	1		Voltage	measuring voltage using batteries--increase voltage
	1		Voltage	How does the TekBot change using different size batteries
1			Weather	Examine road conditions and performance of the TekBots on different roads.
1			Weather	How does weather affect the TekBot?
	1		Weather	Compare TekBot performance at different temperatures.