TRUE ROBOTICS

INTRODUCTION TO ROBOTICS WITH AXLE

GRADES 6–8

This document lists the Utah learning standards addressed by Introduction to Robotics with Axle, True Robotics' grades 6–8 robotics curriculum. Standards are grouped by subject and grade level, with codes and wording as published by the Utah State Board of Education.

36	14	8	58
MATH	SCIENCE	CS	TOTAL STANDARDS

MATHEMATICS

36 STANDARDS

Based on the Utah state standards

GRADE	CODE	STANDARD
6	6.NS.1	Interpret and compute quotients of fractions.
6	6.NS.8	Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same x-coordinate or the same y-coordinate.
6	6.EE.5	Understand solving an equation or inequality as a process of answering the question: Which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.
6	6.EE.6	Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.
6	6.EE.7	Solve real-world and mathematical problems by writing and solving equations of the form x + a = b and ax = b for cases in which a, b and x are all non-negative rational numbers.
6	6.EE.9	Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.
6	6.G.1	Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing and decomposing into rectangles, triangles and/or other shapes; apply these techniques in the context of solving real-world and mathematical problems.

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GRADE	CODE	STANDARD
6	6.G.2	Find the volume of a right rectangular prism with appropriate unit fraction edge lengths by packing it with cubes of the appropriate unit fraction edge lengths (for example, 3½ x 2 x 6), and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas V = lwh and V = bh to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.
6	6.G.4	Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.
6	6.SP.1	Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers.
6	6.SP.2	Understand that a set of data collected to answer a statistical question has a distribution that can be described by its center, spread/range and overall shape.
6	6.SP.5c	Summarize numerical data sets in relation to their context, such as by: Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations (for example, outliers) from the overall pattern with reference to the context in which the data were gathered.
7	7.RP.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.
7	7.RP.2b	Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
7	7.RP.2c	Represent proportional relationships by equations.
7	7.RP.2d	Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.
7	7.RP.3	Use proportional relationships to solve multi-step ratio and percent problems.
7	7.NS.1c	Understand subtraction of rational numbers as adding the additive inverse, p – q = p + (–q). Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.
7	7.NS.1d	Apply properties of operations as strategies to add and subtract rational numbers.
7	7.NS.2c	Apply properties of operations as strategies to multiply and divide rational numbers.
7	7.NS.3	Solve real-world and mathematical problems involving the four operations with rational numbers.
7	7.EE.4a	Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.
7	7.G.1	Solve problems involving scale drawings of geometric figures, such as computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.
7	7.G.4	Know the formulas for the area and circumference of a circle, and solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

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GRADE	CODE	STANDARD
7	7.G.6	Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.
8	8.NS.1	Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers, show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.
8	8.NS.2	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2).
8	8.EE.5	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.
8	8.EE.8a	Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
8	8.EE.8b	Solve systems of two linear equations in two variables graphically, approximating when solutions are not integers and estimate solutions by graphing the equations. Solve simple cases by inspection.
8	8.EE.8c	Solve real-world and mathematical problems leading to two linear equations in two variables graphically.
8	8.F.3	Interpret the equation y = mx + b as defining a linear function whose graph is a straight line; give examples of functions that are not linear.
8	8.F.4	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
8	8.G.7	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
8	8.G.8	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
8	8.G.9	Know the formulas for the volumes of cones, cylinders, and spheres, and use them to solve real-world and mathematical problems.

SCIENCE WITH ENGINEERING EDUCATION (SEED)

14 STANDARDS

Based on the Utah state standards

GRADE	CODE	STANDARD
6	6.2.2	Develop a model to predict the effect of heat energy on states of matter and density.
6	6.2.4	Design an object, tool, or process that minimizes or maximizes heat energy transfer. Identify criteria and constraints, develop a prototype for iterative testing, analyze data from testing, and propose modifications for optimizing the design solution.

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GRADE	CODE	STANDARD
6	6.4.3	Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
6	6.4.4	Construct an argument supported by evidence that the stability of populations is affected by changes to an ecosystem.
7	7.1.1	Carry out an investigation which provides evidence that a change in an object's motion is dependent on the mass of the object and the sum of the forces acting on it. Various experimental designs should be evaluated to determine how well the investigation measures an object's motion.
7	7.1.2	Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects in a system.
7	7.3.3	Construct an explanation using evidence to explain how body systems have various levels of organization.
7	7.4.4	Obtain, evaluate, and communicate information about the technologies that have changed the way humans affect the inheritance of desired traits in organisms. Analyze data from tests or simulations to determine the best solution to achieve success in cultivating selected desired traits in organisms.
8	8.1.2	Obtain information about various properties of matter, evaluate how different materials' properties allow them to be used for particular functions in society, and communicate your findings.
8	8.1.5	Develop a model that uses computational thinking to illustrate cause and effect relationships in particle motion, temperature, density, and state of a pure substance when heat energy is added or removed.
8	8.2.1	Use computational thinking to analyze data about the relationship between the mass and speed of objects and the relative amount of kinetic energy of the objects.
8	8.2.4	Use computational thinking to describe a simple model for waves that shows the pattern of wave amplitude being related to wave energy.
8	8.2.5	Develop and use a model to describe the structure of waves and how they are reflected, absorbed, or transmitted through various materials.
8	8.2.6	Obtain and evaluate information to communicate the claim that the structure of digital signals are a more reliable way to store or transmit information than analog signals.

COMPUTER SCIENCE

8 STANDARDS

Based on the Utah state standards

GRADE	CODE	STANDARD
6	6.AP.1	Design and illustrate algorithms to efficiently solve complex problems by utilizing pseudocode and/or other descriptive methods.
7	7.NI.1	Model the role of protocols in transmitting data across networks and the Internet.
7	7.AP.1	Design and iteratively develop programs that combine control structures.
7	7.AP.3	Systematically test and refine programs using a range of test cases.

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GRADE	CODE	STANDARD
7	7.IC.1	Compare tradeoffs associated with computing technologies that affect people's everyday activities and career options.
8	8.CS.1	Design a project that combines hardware and software components to collect and exchange data.
8	8.AP.1	Develop a program with iterative protocols that combine control structures and use compound conditions.
8	8.AP.2	Create procedures with or without parameters to organize code and make it easier to reuse.

SOURCES & NOTES

- The official mathematics, science and computer science standards for Utah, as published by the Utah State Board of Education.
- Codes and standard wording are reproduced from the official standards documents. Clarification statements, examples and assessment boundaries are omitted.
- Grade shows the grade level at which True Robotics lessons address each standard. A range (for example K–2) marks a standard written for a grade band.
- Standards text remains the property of its publisher and is reproduced here for alignment reference only.
- A lesson-level crosswalk is available on request at info@truerobotics.org.

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