Samples of Math Academic Standards that can be reinforced during Saturday Robotics activities

K

K.G.1.a Describe objects in the environment using names of shapes.

K.G.1.b Describe the relative positions of objects using terms such as above, below, beside, in front of, behind, and next to.

K.G.2. Correctly name shapes regardless of their orientations or overall size.

K.G.3. Identify shapes as two-dimensional (lying in a plane, “flat”) or three-dimensional (“solid”).

K.MD.1. Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.

K.MD.2. Directly compare two objects with a measurable attribute in common, to see which object has “more of”/“less of” the attribute, and describe the difference.

K.MD.3. a) Classify objects into given categories;

K.MD.3. b) count the numbers of objects in each category

K.MD.3. c) sort the categories by count.

[Note: Limit category counts to be less than or equal to 10.]

K.G.4. Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and vertices/“corners”) and other attributes (e.g., having sides of equal length).

K.G.5. Model shapes in the world by building shapes from components and drawing shapes.

K.G.6. Compose simple shapes to form larger shapes.

K.CC.6. Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.

K.CC.5. Count to answer “how many?” questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1–20, count out that many objects.

1.MD.1. Order three objects by length; compare the lengths of two objects indirectly by using a third object.

1.G.1. Distinguish between defining attributes, versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes.

1.G.2. Compose two-dimensional shapes or three-dimensional shapes to create a composite shape and compose new shapes from the composite shape.

1.MD.1. Order three objects by length; compare the lengths of two objects indirectly by using a third object.

1.MD.2. a) Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end;

1.MD.2. b) Understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps.

1.MD.4. Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

2

2.MD.9. a. Generate measurement data by measuring lengths of several objects to the nearest whole unit,

2.MD.9. b. Generate measurement data by making repeated measurements of the same object.

2.MD.10 b) Solve simple put-together, take-apart, and compare problems using information, e.g. information presented in a bar graph.

2.G.1. Recognize and draw shapes having specified attributes.

2.MD.1. Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

2.MD.2. Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen.

2.MD.3. Estimate lengths using units of inches, feet, centimeters, and meters.

2.MD.4. Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard-length unit.

3

3.MD.2. a. Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (e.g. in the Robot Skin activity)

3.MD.2.b Add, subtract, multiply, or divide to solve problems involving masses or volumes that are given in the same units.

3.MD.4. a) Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch.

3.MD.5. Recognize area as an attribute of plane figures and understand concepts of area measurement.

3.MD.6. Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).

3.MD.7. Relate area to the operations of multiplication and addition.

3.MD.7. a) Find the area of a rectangle with whole-number side lengths by tiling it and show that the area is the same as would be found by multiplying the side lengths.

3.MD.7. b) Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real world and mathematical problems and represent whole-number products as rectangular areas in mathematical reasoning.

4

4.G.3. a) Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts.

4.G.3. b) Identify line-symmetric figures

4.G.3. c) Draw lines of symmetry.

4.MD.3. Apply the area and perimeter formulas for rectangles in real world and mathematical problems.

4.MD.2. Use the four operations to solve word problems involving: distances, intervals of time, liquid volumes, masses of objects, money, simple fractions, decimals, and/or problems that require expressing measurements given in a larger unit in terms of a smaller unit.

4.MD.1. a) Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec.

4.MD.1. b) Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit.

4.G.1. Draw points, lines, line segments, rays, angles (right, acute, obtuse), and/or perpendicular and parallel lines. Identify these in two-dimensional figures.

4.G.3. a) Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts.

4.G.3. b) Identify line-symmetric figures

4.G.3. c) Draw lines of symmetry.

5

5.G.4. Classify two-dimensional figures in a hierarchy based on properties.

5.MD.1. a) Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m),

5.MD.1.b) Use these conversions in solving multi-step, real world problems.

5.G.4. Classify two-dimensional figures based on properties.

5.MD.3. a) Recognize volume as an attribute of solid figures and understand concepts of volume measurement.

5.MD.5 a) Solve real world and mathematical problems involving volume.

5.G.2. Represent real world and mathematical problems by a) graphing points in the first quadrant of the coordinate plane. *(e.g., Have students create their Cardio Kid on a coordinate plane. Then mark locations of organs on the coordinate plane and track movement and locations of nanobots by the coordinates.)*

5.G.2. b) interpreting coordinate values of points in the context of the situation. *(e.g., Have students create their Cardio Kid on a coordinate plane. Then mark locations of organs on the coordinate plane and track movement and locations of nanobots by the coordinates.)*

5.G.1. a) Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. *(e.g., Have students create their Cardio Kid on a coordinate plane. Then mark locations of organs on the coordinate plane and track movement and locations of nanobots by the coordinates.)*

5.G.1. b) Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate). *(e.g., Have students create their Cardio Kid on a coordinate plane. Then mark locations of organs on the coordinate plane and track movement and locations of nanobots by the coordinates.)*

6

6.G.1 Solve real-world and mathematical problems involving area, surface area, and volume.

6.G.1.a) Find the area of shapes by composing into rectangles or decomposing into triangles and other shapes;

6.G.1.b) apply these techniques in the context of solving real-world and mathematical problems.

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. For example, “How old am I?” is not a statistical question, but “How old are the students in my school?” is a statistical question because one anticipates variability in students’ ages.

6.SP.2. Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

6.SP.5. Summarize numerical data sets in relation to their context, such as by:

6.SP.5. a) Reporting the number of observations.

6.SP.5. b) Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

6.SP.5. c) 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 from the overall pattern with reference to the context in which the data were gathered.

6.SP.5. d) Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

7

7.G.1. Solve problems: a) involving scale drawings, *(e.g., Create scale drawings of the How to Train Your Robot activity obstacle course)*

7.G.1. b) including computing actual lengths and areas from a scale drawing

7.G.1. c) reproducing a scale drawing at a different scale.

7.G.2. a) Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions.

7.SP.5. Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.

7.SP.6. a) Approximate the probability of a chance event by collecting data on the chance process that produces it. *(e.g., with nanobot or skitter robot movements and reaching a specific point.)*

7.SP.6. b) Approximate the probability of a chance event by observing its long-run relative frequency,

7.SP.6. c) Predict the approximate relative frequency given the probability. *(e.g., with nanobot or skitter robot movements and reaching a specific point.)*

7.SP.7. a) Develop a probability model and use it to find probabilities of events.

7.SP.7. b) Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.

7.SP.7. c) Develop a uniform probability model by assigning equal probability to all outcomes and use the model to determine probabilities of events. For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.

7.SP.7. d) Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.

8

8.G.8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system. *(e.g., Have students create their Cardio Kid on a coordinate plane. Then mark locations of organs on the coordinate plane and track movement and locations of nanobots by the coordinates.)*

8.G.7. a) Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world problems in two and three dimensions.

N-VM.3. Solve problems involving velocity and other quantities that can be represented by vectors.

G-MG.1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

S-MD.1. Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space

G-MG.3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost.)

S-MD.7. Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing).

S-MD.6. Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).

Follow the Modeling Cycle (Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards. Choices, assumptions, and approximations are present throughout this cycle.):

(1) Problem: identifying variables in the situation and selecting those that represent essential features,
(2) Formulate: formulating a model by creating and selecting (ex. geometric, graphical, tabular, algebraic, or statistical) representations that describe relationships between the variables,
(3) Compute: analyzing and performing operations on these relationships to draw conclusions,
(4) Interpret: interpreting the results of the mathematics in terms of the original situation,
(5) Validate: validating the conclusions by comparing them with the situation, and then either improving the model or, if it is acceptable,
(6) Report: reporting on the conclusions and the reasoning behind them.