

- 8.M.8 Solve problems involving scale factors, using ratio and proportion.
- 12.M.1 Make decisions about units and scales that are appropriate for problem situations involving measurement.

4. (PA) Velocity * time = distance I

- 8.A.6 Use symbolic algebra to represent situations and to solve problems, especially those that involve linear relationships.
- 8.M.9 Solve simple problems involving rates and derived measurements for such attributes as velocity and density.

5. Velocity * time = distance II

- 8.A.6 Use symbolic algebra to represent situations and to solve problems, especially those that involve linear relationships.
- 8.A.7 Recognize and generate equivalent forms for simple algebraic expressions and solve linear equations.
- 8.M.9 Solve simple problems involving rates and derived measurements for such attributes as velocity and density.
- 12.A.9 Use symbolic algebra to represent and explain mathematical relationship.

6. Velocity * time = distance III

- 8.A.6 Use symbolic algebra to represent situations and to solve problems, especially those that involve linear relationships.
- 8.A.7 Recognize and generate equivalent forms for simple algebraic expressions and solve linear equations.
- 8.M.9 Solve simple problems involving rates and derived measurements for such attributes as velocity and density.
- 12.A.9 Use symbolic algebra to represent and explain mathematical relationship.

7. Decibel of engine comparison problem

- 8.A.1 Represent, analyze, and generalize a variety of patterns with tables, graphs, words, and, when possible, symbolic rules.
- 8.A.3 Identify functions as linear or nonlinear and contrast their properties from tables, graphs, or equations.
- 12.A.1 Generalize patterns using explicitly defined and recursively defined functions.
- 12.A.5 Understand and compare the properties of classes of functions, including exponential, polynomial, rational, logarithmic, and periodic functions.

8. (PA) Pythagorean theorem -- main route versus detour

- 8.A.6 Use symbolic algebra to represent situations and to solve problems, especially those that involve linear relationships.
- 12.A.9 Use symbolic algebra to represent and explain mathematical relationship.
- 8.G.3 Create and critique inductive and deductive arguments concerning geometric ideas and relationships, such as congruence, similarity, and the Pythagorean relationship.
- 8.G.11 Use geometric models to represent and explain numerical and algebraic relationships.

9. (PA) Slope of ramps vs. lines on graphs I

- 8.A.5 Explore relationships between symbolic expressions and graphs of lines, paying particular attention to the meaning of intercept and slope.

10. Slope of ramps II

- 8.A.5 Explore relationships between symbolic expressions and graphs of lines, paying particular attention to the meaning of intercept and slope.
- 12.A.3 Analyze functions of one variable by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior.

11. Catch up velocity problem -- second place behind first place, how fast to catch up?

- 8.A.1 Represent, analyze, and generalize a variety of patterns with tables, graphs, words, and, when possible, symbolic rules.
- 8.A.6 Use symbolic algebra to represent situations and to solve problems, especially those that involve linear relationships.
- 12.A.9 Use symbolic algebra to represent and explain mathematical relationship.

12. Catch up velocity problem II -- trophy truck

- 8.A.1 Represent, analyze, and generalize a variety of patterns with tables, graphs, words, and, when possible, symbolic rules.
- 8.A.6 Use symbolic algebra to represent situations and to solve problems, especially those that involve linear relationships.
- 12.A.9 Use symbolic algebra to represent and explain mathematical relationship.

13. (PA) GPS coordinates (related to algebra coordinate system)

- 12.G.5 Use Cartesian coordinates and other coordinate systems, such as navigational, polar, or spherical systems, to analyze geometric situations.

14. GPS conversion (fractions to decimal)

- 8.N.1 Work flexibly with fractions, decimals, and percents to solve problems.
- 12.G.5 Use Cartesian coordinates and other coordinate systems, such as navigational, polar, or spherical systems, to analyze geometric situations.
- 12.M.1 Make decisions about units and scales that are appropriate for problem situations involving measurement.

15. GPS distance between points

- 8.N.1 Work flexibly with fractions, decimals, and percents to solve problems.
- 8.N.12 Develop and analyze algorithms for computing with fractions, decimals, and integers and develop fluency in their use.
- 12.G.5 Use Cartesian coordinates and other coordinate systems, such as navigational, polar, or spherical systems, to analyze geometric situations.
- 12.M.1 Make decisions about units and scales that are appropriate for problem situations involving measurement.

16. Percent ratio problem: with a 40 gas:1 oil mix, what percentage of the fuel mixture is gas?

- 8.N.4 Understand and use ratios and proportions to represent quantitative relationships.
- 8.N.14 Develop, analyze, and explain methods for solving problems involving proportions, such as scaling and finding equivalent ratios.

17. (PA) Margin of difference between rider times (subtracting decimals)

- 8.N.1 Work flexibly with fractions, decimals, and percents to solve problems.
- 8.N.8 Understand the meaning and effects of arithmetic operations with fractions, decimals, and integers.

18. (PA) Best, mean, median time over 5 laps

- 8.D.3 Find, use, and interpret measures of center and spread, including mean and interquartile range.

19. (PA) Cumulative angle problem -- given a full circuit and these given angles of turn, what is missing angle?

- 8.G.2 Understand relationships among the angles, side lengths, perimeters, areas, and volumes of similar objects.
- 8.G.12 Recognize and apply geometric ideas and relationships in areas outside the mathematics classroom, such as art, science, and everyday life.

20. Wheel distance – number of revolutions of a wheel

- 8.M.6 Develop and use formulas to determine the circumference of circles and the area of triangles, parallelograms, trapezoids, and circles and develop strategies to find the area of more-complex shapes.
- 8.G.11 Use geometric models to represent and explain numerical and algebraic relationships.
- 8.G.12 Recognize and apply geometric ideas and relationships in areas outside the mathematics classroom, such as art, science, and everyday life.

21. Wheel distance II -- comparing a spot on the inside of a tire to the outside

- 8.M.6 Develop and use formulas to determine the circumference of circles and the area of triangles, parallelograms, trapezoids, and circles and develop strategies to find the area of more-complex shapes.
- 8.G.11 Use geometric models to represent and explain numerical and algebraic relationships.
- 8.G.12 Recognize and apply geometric ideas and relationships in areas outside the mathematics classroom, such as art, science, and everyday life.

22. (PA) Taking multiple races at same track and comparing conditions of weather -- should use mean, median, or mode as a comparison? Can include discussion of outlier (e.g. racer who underperformed due to mechanical problem)

- 8.D.3 Find, use, and interpret measures of center and spread, including mean and interquartile range.

23. Volume comparison problem (comparing two cc engines)

- 8.G.2 Understand relationships among the angles, side lengths, perimeters, areas, and volumes of similar objects.
12.G.1 Analyze properties and determine attributes of two- and three-dimensional objects.
12.M.3 Understand and use formulas for the area, surface area, and volume of geometric figures, including cones, spheres, and cylinders.

24. Volume change problem (changing a dimension of an engine, what happens to the cc?)

- 8.G.2 Understand relationships among the angles, side lengths, perimeters, areas, and volumes of similar objects.
12.G.1 Analyze properties and determine attributes of two- and three-dimensional objects.
12.M.3 Understand and use formulas for the area, surface area, and volume of geometric figures, including cones, spheres, and cylinders.

25. Domain and range -- open ended problem involving a particular scene that can be graphed multiple ways with different choices of axis

- 8.A.3 Identify functions as linear or nonlinear and contrast their properties from tables, graphs, or equations.
8.A.9 Use graphs to analyze the nature of changes in quantities in linear relationships.
12.A.12 Identify essential quantitative relationships in a situation and determine the class or classes of functions that might model the relationships.
12.A.14 Draw reasonable conclusions about a situation being modeled.
12.A.15 Approximate and interpret rates of change from graphical and numerical data.

26. Acceleration (quadratic vs. linear) I

- 8.A.1 Represent, analyze, and generalize a variety of patterns with tables, graphs, words, and, when possible, symbolic rules.
8.A.3 Identify functions as linear or nonlinear and contrast their properties from tables, graphs, or equations.
8.A.6 Use symbolic algebra to represent situations and to solve problems, especially those that involve linear relationships.
8.M.9 Solve simple problems involving rates and derived measurements for such attributes as velocity and density.
12.A.5 Understand and compare the properties of classes of functions, including exponential, polynomial, rational, logarithmic, and periodic functions.

27. Acceleration (quadratic vs. linear) II

- 8.A.1 Represent, analyze, and generalize a variety of patterns with tables, graphs, words, and, when

- possible, symbolic rules.
- 8.A.3 Identify functions as linear or nonlinear and contrast their properties from tables, graphs, or equations.
 - 8.A.6 Use symbolic algebra to represent situations and to solve problems, especially those that involve linear relationships.
 - 8.M.9 Solve simple problems involving rates and derived measurements for such attributes as velocity and density.
 - 12.A.5 Understand and compare the properties of classes of functions, including exponential, polynomial, rational, logarithmic, and periodic functions.

28. Acceleration (quadratic vs. linear) III

- 8.A.1 Represent, analyze, and generalize a variety of patterns with tables, graphs, words, and, when possible, symbolic rules.
- 8.A.3 Identify functions as linear or nonlinear and contrast their properties from tables, graphs, or equations.
- 8.A.6 Use symbolic algebra to represent situations and to solve problems, especially those that involve linear relationships.
- 8.A.8 Model and solve contextualized problems using various representations, such as graphs, tables, and equations.
- 8.M.9 Solve simple problems involving rates and derived measurements for such attributes as velocity and density.
- 12.A.5 Understand and compare the properties of classes of functions, including exponential, polynomial, rational, logarithmic, and periodic functions.

29. Tire pressure – contact patch – using formula including area

- 8.G.2 Understand relationships among the angles, side lengths, perimeters, areas, and volumes of similar objects.
- 8.A.6 Use symbolic algebra to represent situations and to solve problems, especially those that involve linear relationships.

30. Tire size problem – Using aspect ratio to convert width to height

- 8.M.8 Solve problems involving scale factors, using ratio and proportion.
- 8.N.3 Develop meaning for percents greater than 100 and less than 1.