PLTW GTT FS MATH Frameworks

PLTW Course GTT Flight and Space
Math Strand being addressed Algebra

Math Standard being addressed 7.2.2.2

Overview:

Math Standard and Benchmarks 7.2.2; Recognize proportional relationships in real-world and mathematical situations; represent these and other relationships with tables, verbal descriptions, symbols and graphs; solve problems involving proportional relationships and explain results in the original context.

- 7.2.2.2; Solve multi-step problems involving proportional relationships in numerous contexts. *For example*: Distance-time, percent increase or decrease, discounts, tips, unit pricing, lengths in similar geometric figures, and unit conversion when a conversion factor is given, including conversion between different measurement systems.

Correlation to Common Core Math Standards: MN 7.2.2.2 ≈ CCSSI 7.EE.3

Essential Understandings/Big Ideas:
Students have had prior experience with situations involving a change in one quantity effecting a corresponding change in another. This previous experience has included graphical, tabular, and function rule representations of these relationships. This standard extends the prior understanding to proportional situations. Proportional relationships are a specific linear relationship. When these proportional relationships are graphed, the representation is a line passing through the origin. In other representations of a proportional relationship (tabular, verbal, symbols, or equations), the idea may not be initially evident, but in each representation a constant rate of change can be determined. From translation between these representations, students explore this constant rate of change to determine a unit rate (constant of proportionality or slope). The more connections students can make between these multiple forms of representation, the deeper their understanding of the relationship. With this understanding, students will be able to move to other linear relationships that are not proportional (with a graph that is a line that does not pass through the origin).

What should students know and be able to do [at a mastery level] related to these benchmarks? –

- students should be able to solve multiple-problem types, including missing values, numerical comparison, qualitative comparison, and qualitative prediction;
- assess reasonableness of solutions in the context of the problem.

Work from previous grades that supports this new learning includes:

- Students can fluently translate from percent to decimal;

- Students can assess reasonableness of solutions;
- Students can use proportions (or other strategies) to do measurement conversions;
- Students know the basic metric and standard measurement equivalencies;
- students can solve proportions in a variety of ways (unit rate, factor of change, tabular, graphical, and fraction).

Misconceptions:

Student Misconceptions:

- the difference between 5 % and 105% of an item;
- increasing by 20% is different than increasing by 20;
- forgetting to check the reasonableness of a solution.

Teacher Resources:

Use this website to review Newton's laws as each demonstration is completed:
http://teachertech.rice.edu/Participants/louviere/Newton/

Teacher Notes

When students need to figure out math problems that require multiple steps, student will often get frustrated and look for someone to tell them what numbers to plug in. As a teacher you must guide them to self discover so they will become stronger at solving multiple step problems.

New Vocabulary

proportional. In mathematics, two variable quantities are **proportional** if one of them is always the product of the other by a constant quantity, called the constant of proportionality. In other words, *x* and *y* are proportional if the ratio

Vignette:

Airplane specifications generally include pieces of information about the range, cruise speed, and fuel capacity of a given airplane. These three items make it possible to calculate fuel consumption, range, and cruise speed.
Equations: To find the time it takes to travel a given distance at a given speed, use the following equation: distance/speed = time. To find the airplane's fuel consumption: total fuel/total time = fuel consumed per hour.

Note: Total fuel is considered the total amount of fuel excluding any fuel reserves. Reserves can generally be considered 10% of the total amount of fuel capacity for the airplane. For airplanes that are able to fly by IFR (Instrument Flight Rules), or with instruments, the reserves will be higher. If this is the case, the specifications will show the IFR quantity reserves. Total time is the number that you calculated in Equation 1.

Using the equations above, your calculator, and your ruler if necessary, answer the following questions. Show all your work, and be sure to label your answers.

Additional Instructional Resources   *books/websites that are instructional resources*

Assessment:
Assessment: NM = nautical miles = 1.15 miles = 1.85 kilometers KTS = knots
1 knot = 1.15 miles/hour FPM = feet per minute

Cessna Skylane	
Range	820 NM
Cruise speed	140 KTS
Max speed	145 KTS
Ceiling	18,100 FT
Rate of climb	924 FPM
Fuel capacity	88 US GAL
Extra 300	
Range	462 NM
Cruise speed	178 KTS
Max speed	200 KTS
Ceiling	16,000 FT
Rate of climb	3200 FPM
Fuel capacity	42.3 US GAL
Sopwith Camel	
Range	287.5 NM

Cruise speed	105 KTS
Max speed	115 KTS
Ceiling	19,000 FT
Rate of climb	1,000 FPM
Fuel capacity	30 US GAL

1.   You are an acrobatic pilot preparing for an air show. The air show is being held at an airport 500 nautical miles (NM) away. Given the cruising speed of the Extra 300 that you are flying, how long will it take to fly to the air show?
2.   In the situation above, will you be able to fly to the air show without refueling along the way? Why or why not?
3.   A Cessna Skylane has a range of 820 NM and a cruising speed of 140 KTS. How many hours will it take you to fly 820 NM?
4.   Since the Cessna Skylane has a fuel capacity of 88 US GAL (including 10% in reserve – don't forget to subtract the 10% before figuring your consumption), how many gallons of fuel per hour does it use?
5.   You are flying a Cessna Skylane at a speed of 120 KTS. You are flying on a trip that will take you 520 NM. How long will it take you to get to your destination?

Differentiation:
Gifted and Talented:
Provide the students additional maps and have them plan a trip to a location of there choosing and create a flip plan.

Special Education:

- Provide calculators.
- Simplify word problems to only include relevant information.

English Language Learners

- Provide calculators and graphic organizers
- Rewrite word problems using fewer and easier words so that your ELL students can practice both their math and language skills without being stuck on what a particular phrase or word means as they read the problem. Keep the sentences short and to the point. Take out extra detail that is not needed to convey the gist of the problem.

Parents and Administration:

Administrative/Peer Classroom Observation

Students Are: (descriptive list)	Teachers Are: (descriptive list)
Investigating	Facilitating
Testing	Guiding
Problem solving	Advising
Collaborative groups	Questioning
Using problem solving skill	Monitoring
	Listening
	Redirecting

Professional Learning Communities: *(may not work for PLTW teachers); how many are in a PLC for PLTW?)*
Reflection – Critical Questions regarding the teaching and learning of these benchmarks

Materials – suggest articles and books for book study with PLC

Parent Resources: suggested activities, materials, websites,

References: *list resources you used in the writing of this* ***Framework***