Exploration Class_____ Name_____

1. Suppose you travel 20 miles in 1 hour; describe how to find your average speed and then calculate it. (Include the correct units in your answer.)

_____ _____

2. If you ran 100 feet in 4 seconds, describe how to find your average speed and then evaluate it. (Include the correct units in your answer.)

_____ _____

3. If you move your pencil from any starting position to a point 4 inches away in 2 seconds, describe how to find how fast the pencil is moving and then find it. (Include the correct units in your answer.)

_____ _____

4. If you change the position of your body by 12 feet in 1 minute, describe how to find your average speed and then find the value of the speed. (Include the correct units in your answer.)

_____ _____

5. As you move 160 feet, your watch changes from 1:01 PM to 1:03 PM, describe how to find how fast you are moving and then calculate it. ALSO, if we choose to let Δ symbolize "change," what is Δ *time*? (Include the correct units in your answer.)

_____ _____ _____

6. A football player changes his position from the 15 yard line to the 24 yard line, while the scoreboard clock changes from 9 minutes and 15 seconds to 9 minutes and 13 seconds remaining. If we choose to let Δ symbolize "change," what is Δ *time*? Using Δ to symbolize "change," what is Δ *distance traveled*? Calculate how fast he is moving. (Include the correct units in your answer.)

_____ _____ _____

7. An airplane passenger changes her position from row 10 to row 25 as her watch changes from 1:15 to 1:17 PM. If we choose to let Δ symbolize "change," what is Δ *time*? Using Δ to symbolize "change," what is Δ *distance traveled*? Calculate how fast she is moving. (Include the correct units in your answer.)

_____ _____ _____

8. Using the symbol Δ to represent the concept of change, describe how to calculate how fast an object is moving.

_____

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Below you will find other uses of "how fast" expressed as a rate.

9. If you mow grass at a rate of 250 square feet per minute, how fast are you mowing?_____

10. If you mow 750 square feet of grass in 3 minutes, how fast are you mowing?_____

11. If you paint a wall at a rate of 20 square feet per minute, how fast are you painting?_____

12. If you paint a wall at a rate of 100 square feet in 5 minutes, how fast are you painting?_____

13. If an I.V. drip bag is set to release 2.5 *ml* of fluid per minute, at what rate is the fluid being released?

_____

14. If an I.V. drip bag is set to release 12.5 *ml* of fluid per 5 minutes, at what rate is the fluid being released?

_____

15. At what rate could you mow a 5,000 square foot lawn in 10 minutes?_____

16. At what rate could you paint a 200 square foot wall in 2 hours? _____

17. Suppose you spend money compared to earning money at a rate of \$2 spent for each dollar earned. With a monthly income of x, what is your monthly debt?_____

18. If your car consumes 12.8 gallons of gasoline for 384 miles driven, what is the rate at which it is using gasoline?_____

19. An author writes 78,000 words and uses 120 pages. What is the rate at which he is writing in words per page?_____

20. Describe a calculation used to find a "rate."_____

_____

Teacher Notes:

This exploration is used in Chapters Two, Three, and/or Five. It is assigned the day before the concept of a constant rate of change is "taught" by the teacher. Students must have a graphing calculator for all activities, but in this case it just requires some home screen calculations.

The concept behind this and many other types of activities is pattern building, embedded within a guided discovery activity to best minimize incorrect generalizations. Pattern recognition is a basic function found in all brains. We capitalize on this basic brain functioning in the activity. Once students recognize a pattern, the brain will generalize automatically. We try to minimize any incorrect generalizations through guided discovery. But even if a student makes an incorrect generalization, the teacher has a great opportunity to correct it in class. In mathematics, we have the opportunity to correct miss-generalizations due to the nature of the field, and we can use the graphing calculator to convince them their conjecture is incorrect. At the same time, the graphing calculator (and the teacher or activity) will lead the student to the correct generalization. As a point of interest, when a student generalizes from a pattern, the process forms a memory by the brain. This memory is much more robust than one created by "memorization." Because of the robustness of the memory, it is easier, and more likely, to be able to be recalled.

Like with all pattern-building activities, we start with a situation that most students recognize. In this case it is the concept of velocity, or speed. We also capitalize on the use of units to make sense of the concept we are teaching. This activity uses miles per hour to suggest to the brain − division of miles by hours. We then use a wristwatch to develop the idea of change, or Δ. And then use a wide variety of contexts that suggest to the brain the connection to division as a rate, or how fast.