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Speed, Time, Distance  
Plotting a Course

Lesson: Distance = Rate x Time  
Grade Level: 6th Grade General Math

Lesson Overview:  
This lesson will be used following lesson 7-1 “The Rate Model for Division” (Pre-Transition Mathematics) in order to show real life application of concept involving distance/rate/time.

In this lesson the students will use the formula “distance = rate x time” in a variety of activities. The lesson will culminate with the students using the navigation chart (from the previous lesson plan) to determine how long it will take to navigate a boat from point A to point B.

Sources Consulted:  
This lesson came out of all of our activities on calculating distance during the institute. I have taken all of these skills and sculpted them into activities 6th graders can understand. Activity #3 of the institute was the main activity used to create this lesson.

Books:  

Materials Needed:  
Navigation Charts (from previous lesson plan)  
Rulers (1 / student)  
Calculators (1 / student)  
Stop watch (2)  
Measuring Tape (Surveyor tape of at least 100 feet, if possible)  
Paper/pencil/eraser (all students)  
Clipboard (1 / student)  
Dividers (1 / group of 3-4 students)

New Vocabulary:  
Dead Reckoning – A method used to calculate the location of an object (boat, etc.) based on where it was at one point. Knowing the speed, direction and how much time has passed can help find the current location.  
Nautical Chart – A special map used to navigate on bodies of water  
Knot – A unit of speed equal to one nautical mile/hour (approx. 1.15 statute miles/hour)
Nautical Mile – A unit or length approximately equal to one minute or arc of latitude. It is equal to about 1,852 meters (6,076 feet). Often called a sea mile.
Divider - An instrument that looks sort of like a standard drawing compass. Used for dividing lines and transferring measurements.

Focus Question(s) – Introducing the Lesson (5 minutes)

Think of a time when you asked the question, “Are we there yet? Or How much longer until we get there?” In order to answer the second question, what do you need to know? Keep a record (on the board, or have a student scribe take notes) of student responses. These will be discussed in the lesson.

Learning Objectives:
Students will experience the relationship between time/speed/distance through a variety of activities.
Students will measure distances (nautical miles) on a nautical chart using dividers and the scales.
Students will convert hours to minutes.
Students will use the formula distance=rate x time in a variety of circumstances

State Standards: Illinois
Number Sense - 6.C.3a Select computational procedures and solve real world problems using whole numbers, fractions, decimals.

Estimation and Measurement - 7.A.4b Apply formulas in a variety of practical real world measurement applications involving time, speed, distance

Estimation and Measurement - 7.B.3 Select and apply a variety of instruments to the degree of accuracy required

Estimation and Measurement - 7.C.4c Convert within and between and within measurement systems

Classroom Activities:
Getting a Feel for Speed, Time, Distance – activity 1 (25 minutes)
Find an open space outside and using a tape measure (or other tool) mark off a distance of 100 feet. Be sure to draw a straight line. The PE department may be able to help you with this! To save time, this is best done before class!

Students should bring a clipboard, paper, pencil, and calculator. A copy of the worksheet for this activity should be distributed to each student. They will turn this in, with all of their work shown, at the end of class.
Select three students. Tell them one of them is a tortoise and the other a hare. The third
will be the stopwatch operator. The tortoise moves slowly and the hare moves fast. Tell
them that they will both travel for 15 seconds. **Who traveled the longest distance?**
[hare] **Why did the hare go further?** [it went faster] Measure how far each has gone.
**If D = R x T, and if you know the distance and the time, how can you determine the
rate?** [distance/time=rate] What units were used in this activity? Be sure students are
always mindful of the units being used!

This time select four students. Again, one is the tortoise and another the hare. The third
and fourth students are both stopwatch operators. Tell them they will both travel the
entire 100 feet. Each of them will be timed. This time the distance is the same. **Who
arrived first?** [hare –because (s)he went faster] Use the same formula as last time. **Are
the rates similar to the previous tortoise and hare?** [they should be close]

Extension questions:

**If two people are running at the same rate, but one runs ten minutes longer than the
other, who will go further?** [the one who runs for a longer time]

**If two runners both run for 30 minutes and one covers a distance of 3 miles and
other covers a distance of 3.5 miles, who has the greater speed?** [the one who ran 3.5
miles]

After these activities the students should have a better idea of the relationships between
speed, time and distance

**Plotting a Course – activity 2**
Students should return to the classroom and get into the same groups they were in when
they used the nautical chart to determine a bearing. Hand each group their nautical chart
along with the worksheet for this activity.

Introduce the term, “nautical mile”. Students should understand that 1 nautical mile is
the same as one minute of latitude. (Quickly review latitude and longitude if need be.)
The difference between 46 degrees and 47 degrees is one degree, NOT one minute. The
difference between 46° 10’ and 46° 11’ is one MINUTE.

Have students tell you the general latitude and longitude values of their charts. Point out
the marking on the side of the nautical chart. [the black and white bars on the sides, top,
and bottom] How long is one minute [one nautical mile] on your chart? Each group
should open their dividers to show that length. Measure this out on your own divider and
then circulate around the class and compare your divider to each group’s divider.

Once each group has their nautical mile measured, have them determine the distance
between point A and point B on their charts. (These were marked on their charts in the
lesson on the compass rose.) Tell them to work as though they were on the Price is
Right. They will first find out how many full nautical miles they will travel (without going over!) They will make a small tick mark on their course line showing this distance (1, 2, 3, nautical miles, etc.) They will then reposition their dividers for the distance that remains. This, of course, is now less than one nautical mile. Once again, students will use the markings on the side of their nautical charts to determine what portion of a nautical mile remains. They should be accurate to the nearest one sixth of a nautical mile. The final distance should be represented as a decimal rounded to the nearest tenth (or hundredth for the more advanced 6th grader). [ie 2.7 or 2.67 nautical miles]

Next discuss the meaning of the word “knot” - A unit of speed equal to one nautical mile/hour (approx. 1.15 statute miles/hour) Boat speed is measured in knots.

Students now know the distance they need to travel. Ask: If you know your distance and your rate (speed) what formula will you use to determine the time it will take you to get there? [distance/rate = time] What is the unit of your answer? [hours] In order to convert this to minutes you need to know how many minutes there are in an hour. [60 minutes = 1 hour] What do you have to do change hours to minutes? [multiply by 60].

Knowing this, determine how long it will take (in hours and in minutes!) to reach your destination if you travel at a rate of 8 knots. ...12 knots.

If you wanted to reach your destination in two hours, how fast would you have to go? Is this reasonable? Why or why not?

Extra Credit: Look carefully at your nautical chart. Are there any symbols or numbers on or near your course line? Can you figure out what these might mean? Take a computer and search for how to read a nautical chart. You may also use the book Navigation for the Rest of Us as a tool to help you out. Are there any hazards near the course you plotted?

If time permits, draw a course line to another destination. What is your bearing? Distance? How long will it take you get there if you travel at a rate of 8 knots? 12 knots? Are there any hazards near your course?