Math-in-CTE Lesson Plan Template

Lesson Title: Calculating Tire Size		Lesson #AT-14		
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Occupational Area: Automotive Technology: Steering and Suspension				
CTE Concept(s): Retaining Tire Rolling Diameter When Changing Rim Size				
Math Concepts: Aspect Ratios, Diameter, Circumference, Algebra, Order of Operation, Percent, Conversions				
Lesson Objective:	Increase Rim Size and Retaining Rolling Diameter			
Supplies Needed:	Calculator, Tire Size off from a vehicle in parking lot, or students car.			

THE "7 ELEMENTS"	TEACHER NOTES (and answer key)
1. Introduce the CTE lesson.	· · · · · · · · · · · · · · · · · · ·
You have just obtained your first vehicle and are eager to dump an exorbitant amount of money into it even though it's a rough running, paint faded/peeling, bondo/spray foam buggy.	
You are concerned with the exterior looks, so you get a couple cans of spray primer grey, then you look into rims. You want the "Rubber-Coated" rim look.	Some items that you might/need to consider: Is my vehicle equipped with ABS? How is my speedometer affected? Will my odometer be affected?
Can you put just any size wheel on your vehicle?	When I turn will the wheels and tires come in contact
Why not?	with the steering or suspension?
What might be some adverse drawbacks to putting huge rims on your vehicle?	When I go over a bump, is there enough clearance so I do not bottom out?
	What are the local and state regulations say on the

What are some things you might affect by changing rim size?



subject?

How much do I want to spend?

What are the price for replacement tires?

Will the tires work in the winter or will I need another set of wheels and tires?

What affect will this have on the overall riding performance? Are we trading comfort, feel and practicality for cool looks?

When manipulating your overall tire size, whether making them smaller or larger, you have to consider that the rolling diameter (circumference) will change. Why does this matter? When installing smaller diameter tires, the travel distance per rotation is reduced and vice versa for larger diameter tires. With smaller diameter, your actual speed may be slower than what your speedometer reads while larger diameter tires will cause your speedometer to show a slower speed than you are actually going. By this, your odometer is affected as well. Your odometer will clock lower miles with your larger diameter wheels than you actually travel. With smaller diameter tires, your odometer will record more miles than you actually travel.

Currently, the Maine Sate regulations, which are in the process of being amended, states the following:

Reject vehicle if it is equipped with tires that are more than 2 sizes larger or smaller than manufacturer's recommended tire sizes, or if any tire change results in more than a two-inch change in overall tire diameter in violation of the size restrictions in Title 29-A Section 1917 (see supplement).





Having these considerations, you find that the best overall compromise is to keep the same height or the same rolling diameter.

Since we now have some direction, what is the largest rim we can put on this vehicle while retaining the same rolling diameter or overall height.

Is there an actual tire manufactured to this size we will calculate or not?



2. Assess students' math awareness as it relates to the CTE	Below, is a website that describes the sidewall information
lesson.	found on a tire; by Car and Driver magazine.
When we see or say the term rolling diameter, this is actually referring to the circumference.	http://www.caranddriver.com/reviews/how-to-read-a-tire- sidewall-feature control-click
Below are examples of Diameter and	Another good site:
Circumference.	http://www.carbibles.com/tyre_bible.html#sizes
	control-click
Concum ference Concum ference Diameter Diameter Rad	Ratio of height to width (espect ratio) Radial Nominal width of the in millimeters Radial Max permissible of an





Note for PEMDAS:

 $\ensuremath{\textbf{P}}\xspace$ - Perform all the operations within the parenthesis () first.

 $\ensuremath{\text{E-Square}}$ roots, squared, cubed, to the $4^{\ensuremath{\text{th}}}$ power, etc.

Notes on conversions used:

The decimal is moved to the left 2 spaces.

The decimal is moved to the right 2 spaces.

Remember that in math there are a different	
number of operation symbols that can be used:	
Multiplication:	
* X · ()	
Division	
/ ÷	
Other items you need to know:	
When calculating for the Aspect Ratio, you will need to round the % figure to the nearest 5, as the sizes increase in increments of 5, ex. 50,55,60,65,70, and so on	
Knowledge Check:	
1. What is 65% of 195mm	<u>Answers</u>
	1. Change 65% into a decimal by dividing by 100:
	65/100 = 0.65
	You can then multiply 0.65 by 195mm:
2. What is 65% of 205mm	0.65 x 195mm = 126.75mm
3. What is 65% of 185mm	2. 0.65 x 205mm = 133.25mm
	3. 0.65 x 185mm = 120.25mm
4. What is 55% of 265mm	Notice that the aspect ratio is dictated by the tires width, even though the 65 is the same number, the actual sidewall height is different.
5. Convert 205mm to inches	4. 0.55 x 265mm = 145.75mm
	5. In order to make this conversion, we need to divide 205 by 25.4.
6. Convert 265mm to inches	205/25.4 = 8.07 "
	6. 265/25.4 = 10.43 "

3. Work through the math example *embedded* in the CTE lesson.



Refer to the following file:

AT_14_HO1

4. Work through *related, contextual* math-in-CTE examples.

Refer to the following file for an answer key: AT_14_HO1_KEY



Refer to the following file:

AT_14_HO2

Refer to the following file for an answer key: AT_14_HO2_KEY

5. Work through <i>traditional math</i> examples.	
Refer to the following file:	Refer to the following file for an answer key:
AT_14_HO3	AT_14_HO3_KEY

6. Students demonstrate their understanding.

Refer to the following file:

AT_14_HO4

Refer to the following file for an answer key: AT_14_HO4_KEY



NOTES:

Build upon this lesson and take it to the next level:

As a teacher, you can take this lesson to another level. Calculate the rolling diameter (circumference) of the stock tires and compare this with the rolling diameter (circumference) a tire whose diameter is 2" larger than that and 2" smaller than that.

This would allow an easy way to implement word problems:

Car "A" has tires that are 2" less in diameter than the factory size, and car "B" has tires that are 2" larger than the factory size.

If both cars leave the same spot at the same time and travel the same speed (60mph) as displayed by their speedometer, who will get to the finish line first, which is 300 miles away. What are the actual speed differences between the two cars? How far does each car's odometer show they traveled?