**ARC and IRC REVIEW!**

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In the previous lesson, you calculated the average rate of change of a function between two points. In this lesson, you will investigate what happens to the average rate of change between two points on a function when those two points get closer and closer together. You will also explore what average rate of change (AROC) tells you about a function.

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**7-94.** Let *d*(*t*) = 10*t*2 feet continue to be the distance function with respect to time of the car from problem [7-80](https://ebooks.cpm.org/bookdb.php?title=pc3&name=7.2.2&type=lesson#7-80).

* 1. Calculate the average velocity of the car on the interval *t* = 5 to *t*= 5 + *h* where *h* is 0.5, 0.1, and 0.01.
	2. What values are the same in each calculation? What values are changing?
	3. What is happening to the value of *h* on this interval?
	4. What is happening to the velocity of the car as the interval becomes smaller and smaller?



**7-95.** In the previous problem, *h* changed while *t*= 5 did not change. This causes repetition in your average velocity calculations. To simplify this process, complete the parts below to calculate the average velocity of the same car from *t*= 5 to *t*= 5 + *h*.

* 1. Write an expression for the average velocity of the car over the interval 5 ≤ *t* ≤ 5 + *h*. Simplify your result as much as possible and compare your result with your team.
	2. Using your result from part (a), evaluate the average velocity of the car over the intervals 5 ≤ *t* ≤ 5.5, 5 ≤ *t* ≤ 5.1, and 5 ≤ *t* ≤ 5.01. How do your answers compare to the results of problem 7-94.
	3. What does your answer from part (a) allow you to calculate?

**7-96.** Use the same distance function as in the previous problems: *d*(*t*) = 10*t*2.

* 1. Write an expression for the average velocity from *t* = 4 to *t* = 4 + *h*.
	2. Use your expression from part (a) to calculate the average velocity from *t* = 4 to *t* = 4.1, *t* = 4 to *t* = 4.01, *t* = 3.99 to *t* = 4, and *t* = 3.999 to *t* = 4.

**7-97.** In problem [7-90](https://ebooks.cpm.org/bookdb.php?title=pc3&name=7.2.2&type=lesson#7-90), the volume of the tube was *V*(*x*) = *x*2(12 − 4*x*). Sketch the graph of *y*= *V*(*x*) and calculate the slope over the following intervals:

* 1. 2 ≤ *x* ≤ 2.5
	2. 2 ≤ *x* ≤ 2.1
	3. 2 ≤ *x* ≤ 2.01
	4. 2 ≤ *x* ≤ 2.001
	5. 1.99 ≤ *x* ≤ 2
	6. 1.999 ≤ *x* ≤ 2
	7. What value is the slope approaching as the intervals in parts (a) through (f) become smaller? What does this value mean in terms of the volume of the tube?

**7-98**. Let *R*(*t*) be the altitude of a rocket *t* seconds after takeoff.

1. Write the expression for the average velocity of the rocket from time *t* = 20 to time *t* = 20 + *h* in terms of *R*(*t*).
2. As *h* gets closer and closer to 0, what happens to the average velocity of the rocket?

***Complete the following problems in your PRACTICE NOTEBOOK, titled, “Day 18 – 7.2.3 Practice”***



**ARC and IRC REVIEW – Part 2**

**TPS-C**



Draw the graph above and draw a line segment between each set of points listed in parts a.) through f.) in problem 103.



**7-109.** In the previous problem you calculated the slopes of the secant lines that passed through the given points. Now focus on the secant lines themselves. Obtain a [Lesson 7.2.4 Resource Page](http://pdfs.cpm.org/stuRes/pc3/ch7/pc3_7.2.4_rp.pdf) and use it to investigate what happens to a secant line when *h* approaches 0.

* 1. On the Lesson 7.2.4 Resource Page use a colored pencil and a straight edge to draw a secant line through the points (2, *f*(2)) and (2 + *h*, *f*(2 *+ h*)) where *h* = 1. Be sure to extend your line well beyond the points. With a different colored pencil draw another secant line through the points (2 − *h*, *f*(2 − *h*)) and (2, *f*(2)) where *h* = 1.
	2. On the separate graphs, repeat the process from part (a) for *h* = 0.5, *h* = 0.25, and *h*= 0.1. Be sure to draw each secant line with the correct color and in the order given.
	3. What is happening to the secant lines as *h* approaches zero?

**7-110.** When the value of *h* approaches zero the secant line approaches a **tangent line**. A tangent line is a line that “grazes” the curve at a single point. When this occurs, the average rate of change approaches an **instantaneous rate of change** (IROC), the exact slope of the function at a point. How are IROC and the tangent line at a point related?

**7-111.** Now, consider the function *r*(*t*) = 2*t*3.

* 1. Show that the average rate of change of *r*(*t*) from *t* = **2** to *t* = **2 + *h*** is 24 + 12*h* + 2*h*2.
	2. Evaluate the limit as *h* → 0 for your expression from part (a).
	3. Write a complete sentence describing what the answer from part (b) represents.
* **7-112.** Given the function *f*(*x*) = 2*x*.
	1. Write an expression for the average rate of change of  *f*  from *x* = 5 to *x* = 5 + *h*.
	2. What happens to this expression when *h* = 0? What does this tell you about the

instantaneous rate of change at *x* = 5?

* 1. Use a graphing calculator to evaluate  for the expression you wrote in part (a).
	2. Do this by examining a table or a graph of the expression at values extremely close to *h* = 0.
	3. What does this value represent?

**7-113.** In homework problem [7-102](https://ebooks.cpm.org/bookdb.php?title=pc3&name=7.2.3&type=lesson#7-102) you showed that the average rate of change for *y* = 3*x* − 5 is 3, no matter what interval is used. What is the average rate of change of any linear function? To investigate this, let *f*(*x*) = *mx* + *b* and complete the parts below.

1. Explain why average rate of change is computed by using the ratio .
2. Evaluate the ratio from part (a) using *f*(*x*) = *mx* + *b*. Why does the result make sense? What have you proved?

***Complete the following problems in your PRACTICE NOTEBOOK, titled, “Day 18 – 7.2.4 Practice”***





