Issues with homework?

p76 #1ace, 4, 7, 9, 12

Sep 23-10:45 AM

Sec 2.2
Instantaneous Rates of Change

When a rate is needed at a single point, we are not able to use the slope formula.

Need 2 points for $m = \frac{\Delta y}{\Delta x}$

Delta x would be zero if we used the same point twice, undefined.

Sep 24-12:33 PM

INVESTIGATE the Math

A small pebble was dropped into a 3.0 m tall cylindrical tube filled with thick glycerine. A motion detector recorded the time and the total distance that the pebble fell after its release. The table below shows some of the measurements between 6.0 s and 7.0 s after the initial drop.

Time, t (s)	6.0	6.2	6.4	6.6	6.8	7.0
Distance, $d(t)$ (cm)	208.39	221.76	235.41	249.31	263.46	277.84

How can you estimate the rate of change in the distance that the pebble fell at exactly $t = 6.4$ s?

A. Calculate the average rate of change in the distance that the pebble fell during each of the following time intervals.

i) $6.0 \le t \le 6.4$ iii) $6.4 \le t \le 7.0$ v) $6.4 \le t \le 6.6$

ii) $6.2 \le t \le 6.4$ iv) $6.4 \le t \le 6.8$

B. Use your results for part A to estimate the instantaneous rate of change in the distance that the pebble fell at exactly $t = 6.4$ s. Explain how you determined your estimate.

C. Calculate the average rate of change in the distance that the pebble fell during the time interval $6.2 \le t \le 6.6$. How does your calculation compare with your estimate?

instantaneous rate of change
the exact rate of change of a function $y = f(x)$ at a specific value of the independent variable $x = a$; estimated using average rates of change for small intervals of the independent variable very close to the value $x = a$

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We have several ways to solve:

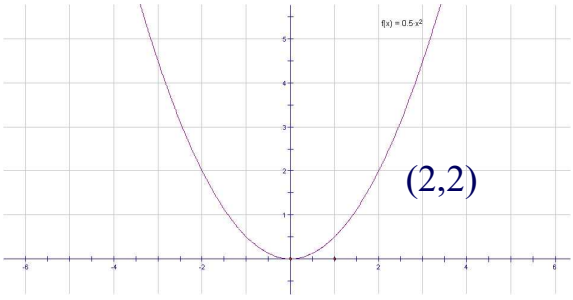
1/ Preceding intervals (left of point)

Def^n p80

Find the ARC for points before x=2 and the point at x=2
Have the first point get closer and closer to 2.

Find the ROC at x=2

X	Y
1	
1.5	
1.9	
1.99	



$(1,0.5) \to (2,2)$ $ARC = \dfrac{2-0.5}{2-1} = 1.5$

$(1.5,1.125) \to (2,2)$ $ARC = \dfrac{2-1.125}{2-1.5} = 1.75$

$(1.9,1.805) \to (2,2)$ $ARC = \dfrac{2-1.805}{2-1.9} = 1.95$

$(1.99,1.98005) \to (2,2)$ $ARC = \dfrac{2-1.98005}{2-1.99} = 1.995$

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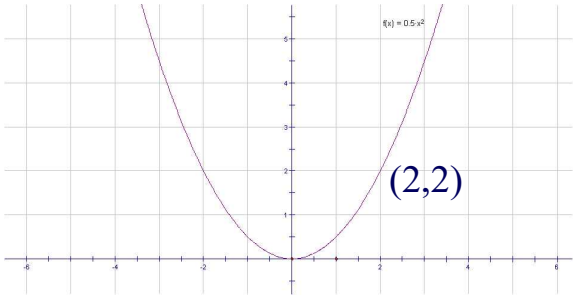
2/ Following intervals (right of point)

Def^{n} p80

Find the ARC for points after x=2 and the point at x=2
Have the second point get closer and closer to 2.

Find the ROC at x=2

X	Y
3	
2.5	
2.1	
2.01	



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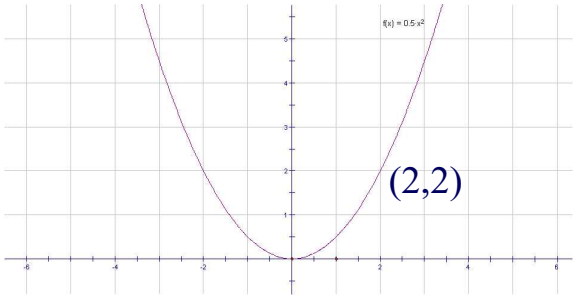
3/ Centred interval (both sides of point)

Def^{n} p81

Find the ARC for points before and after the point at x=2
Have the two points get closer and closer to 2.

Find the ROC at x=2

X	Y
3	
2.1	
1.9	
1	



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Example

A cubic crystal is growing in a laboratory, where its volume is $V(x)=x^3$, where x is the side length.

Find the instantaneous rate of change of volume wrt side length x, when the crystal has side length 4 cm.

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Differential Quotient

Fancy formula for slope between two points but... written in a way to show the difference between the two x values.

$$\frac{\Delta y}{\Delta x} = \frac{f(a+h)-f(a)}{h}$$, where h is a small #

Sep 24-1:00 PM

Homework

p86 #1,2,4ac, 5, 6, 9

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