Calc 4 Life

Section 3.3

May 13-10:02 PM

Rates of Change

You travel to the hair salon from your house in 14 minutes. The salon is $4\frac{1}{2}$ miles from your house. What was your average speed?

$\frac{4.5}{14} \approx .32$ miles/min

≈ 19 miles/hr

Nov 16-12:27 PM

Rates of Change: Change in one variable

Ex: mph or $^{km}/_{s}$

**Δx means the change in the variable x.

Why Δ?

$\Delta x = x_2 - x_1$ $\Delta y = y_2 - y_1$

$\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} = m$

Aug 27-8:33 AM

Average Rate of Change

How can we write the average rate of change in terms of function notation?

**It is between two points*

$f(x)$

$\frac{\Delta f(x)}{\Delta x} = \frac{f(x_2) - f(x_1)}{x_2 - x_1} = \frac{f(x) - f(a)}{x - a} = \frac{f(x+h) - f(x)}{h}$

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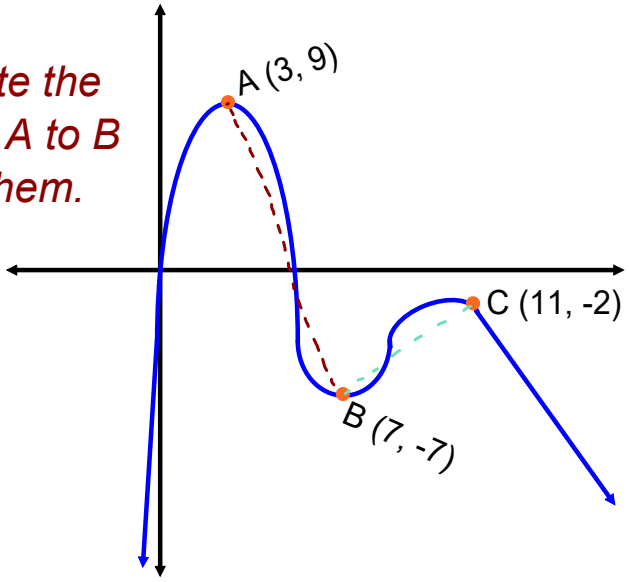
Instantaneous and Average

Can we algebraically calculate the average rate of change from A to B and B to C? If so, calculate them.



$m_{AB} = \frac{-7-9}{7-3} = \frac{-16}{4} = -4$

$m_{BC} = \frac{-2+7}{11-7} = \frac{5}{4}$

Aug 27-8:33 AM

Researchers from the Moose Research Center in Soldotna, Alaska, have developed a mathematical relationship between the age of a captive female moose and its mass. The function is:

$$M(t) = 369t^{0.36}(0.93)^t$$

where M is the mass of the moose (in kg) and t is the age (in years) of the moose. Find the average rate of change in the mass of a female moose between the ages of two and three years.

$$\frac{M(3)-M(2)}{3-2} = \frac{369 \cdot 3^{.36}(.93)^3 - 369 \cdot 2^{.36}(.93)^2}{1}$$

$\frac{\text{Kg}}{\text{Years}}$

Nov 16-12:27 PM

Instantaneous Rate of Change

$$\lim_{h \to 0} \frac{f(a+h) - f(a)}{a+h-a}$$

"instantaneous rate of change or slope at $x=a$"

Sep 25-8:07 AM

Instantaneous vs. Average

An object is launched straight up in the air. It's height in feet is given by the function $f(t) = 12t - 2t^2$, where t is the time in seconds. What is the average speed of the object during the first three seconds?

0 to 3

$$\text{avg ROC} = \frac{f(3)-f(0)}{3-0} = \frac{[12\cdot 3 - 2\cdot 3^2] - [12\cdot 0 - 2\cdot 0^2]}{3}$$

$$\frac{36-18}{3} = 6 \text{ ft/s}$$

Aug 27-8:33 AM

Instantaneous vs. Average

An object is launched straight up in the air. It's height in feet is given by the function $f(t) = 12t - 2t^2$, where t is the time in seconds. What is the instantaneous speed of the object at three seconds?

$a=3$

$$\lim_{h\to 0} \frac{f(3+h)-f(3)}{h}$$

$$\lim_{h\to 0} \frac{12(3+h)-2(3+h)^2-18}{h}$$

$$\frac{36+12h-2(9+6h+h^2)-18}{h}$$

$$\frac{36+12h-18-12h-2h^2-18}{h}$$

$$\lim_{h\to 0} \frac{-2h^2}{h} = -2(0) = 0 \text{ ft/s}$$

Aug 27-8:33 AM

Researchers have determined that the body mass of yearling bighorn sheep on Ram Mountain in Alberta, Canada, can be estimated by:

$$M(t) = 27.5 + 0.3t - 0.001t^2$$

where M(t) is the mass of the sheep (in kg) and t is the number of days since May 25. a) Find the average rate of change of the mass of a bighorn yearling between 70 and 75 days.

$$\frac{M(75)-M(70)}{75-70}$$

Nov 16-12:27 PM

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where M(t) is the mass of the sheep (in kg) and t is the number of days since May 25. b) Find the instantaneous rate of change of mass for a yearling sheep whose age is 70 days past May 25.

$$\lim_{h\to 0} \frac{M(70+h) - M(70)}{h}$$

$$\lim_{h\to 0} \frac{27.5 + .3(70+h) - .001(70+h)^2 - (27.5 + .3\cdot 70 - .001\cdot 70^2)}{h}$$

$$\lim_{h\to 0} \frac{21 + .3h - 4.9 - .14h - .001h^2 - 21 + 4.9}{h} = \lim_{h\to 0} \frac{-.11h - .001h^2}{h}$$

$$= \lim_{h\to 0} -.11 - .001h = -.11 \text{ Kg/day}$$

Nov 16-12:27 PM

Homework

Page 164 - 165

1 - 21 all, 35a and 35b (not c)

May 13-10:02 PM