Homework #2 Solution

Use this as a study guide for the upcoming test! Pay attention to the footnotes at the end of this document.

1. What does AROC, ROC (or IROC), and PROC stand for?

AROC means average rate of change.
ROC (respectively IROC) means rate of change (respectively instantaneous rate of change).
PROC means percent rate of change.

2. Complete the table below[1]

Types Of Change	Formula	Units
Change	$f(x_2) - f(x_1)$ (or $y_2 - y_1$)	Output Units
Percent Change	$\frac{f(x_2)-f(x_1)}{f(x_1)} \cdot 100$	Percent
AROC	$\frac{f(x_2)-f(x_1)}{x_2-x_1}$	Output units per input units
ROC (or IROC)	$f'(a)$	Output units per input units
PROC	$\frac{f'(a)}{f(a)} \cdot 100$	Percent per input units

3. Write the type of change described in each sentence. Highlight the key phrases in each sentence which led you to your answer.

- In November 2016, the number of Facebook users was increasing by 2 thousand per month. **ROC**

- Between May 2006 and May 2007, the number of Facebook users increased by 89.4%. **Percent Change**

- From May 2006 to May 2007, the number of Facebook users increased on average by 1.048 thousand per month. **AROC**

- Between May 2006 and May 2007, the number of Facebook users increased by 12.58 thousand. **Change**

- In November 2006, the number of Facebook users was increasing by 12.5% per month **PROC**

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[1]On the test, you'll probably need to fill out a table like this. You don't need to worry about filling in the "key phrases" column that I added on the homework. I only added that to help you see what to look out for when determining what type of change a sentence is describing.

4. $v(t)$ meters per second[2] is the velocity of an apple t seconds[3] after it falls from a tree. Suppose $v(0) = 0$, $v(1) = 9.81$ and $v'(1) = 9.81$.

4.a. Give a sentence of interpretation for $v(1) = 9.81$.[4]

Sentence of Interpretation: The apple's velocity is 9.81 meters per second, 1 second after it has fallen from a tree.[5]
What: The apple's velocity.
By how much: 9.81 meters per second.
When: 1 second after is has fallen from a tree.

4.b. Give a sentence of interpretation for $v'(1) = 9.81$[6]

Sentence of Interpretation: The apple's velocity is increasing by 9.81 meters per second per second, 1 second after it has fallen from a tree.
What: The apple's velocity
I/D: Increasing[7]
By how much: by 9.81 meters per second per second[8]
When: 1 second after it has fallen from a tree.

4.c. Give a sentence of interpretation for the percent rate of change of the velocity of the apple 1 second after it falls from the tree (you need to calculate the percent rate of change first).

Sentence of Interpretation: The apple's velocity is increasing by 100% per second, 1 second after it has fallen from a tree.
What: The apple's velocity
I/D: Increasing
By how much: by 100% per second (remember % per input units)
When: 1 second after it has fallen from a tree.

4.d Give a sentence of interpretation for the change of the velocity of the apple between 0 and 1 seconds (you need to calculate the change first).

Sentence of Interpretation: The apple's velocity increased by 9.81 meters per second, between 0 seconds and 1 second after it has fallen from a tree.
What: The apple's velocity
I/D: Increased[9]
By how much: by 100% per second
When: between 0 seconds and 1 second after it has fallen from a tree.

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[2]The output units usually show up right after the function is introduced. In this case, we have "$v(t)$ *meters per second*". Thus, the output units are *meters per second*.

[3]The input units usually show up right after the variable is introduced. In this case, we have "t *seconds*". Thus, the input units are *seconds*.

[4]On the test, you *will* be asked a question like "give a sentence of interpretation for $f(a)$", where $f(a)$ is some function f evaluated at some input a. This means give a sentence of interpretation for the ordered pair $(a, f(a))$.

[5]There is no I/D when interpreting ordered pairs.

[6]On the test, you *will* be asked a question like "give a sentence of interpretation for $f'(a)$", where $f'(a)$ is the *derivative* of some function f at some input a. This means give a sentence of interpretation for the *(instantaneous) rate of change* of the function f at the input a.

[7]We use "ing" at the end because we are talking about one input, namely 1 second after it falls from the tree.

[8]Many people got this part wrong. Remember, the units for rate of change, it's output units per input units. Always identify what your output and input units are. By the way, because the phrase "meters per second per second" is weird, people usually abbreviate it as "meters per second squared" or "m/s^2". However if a problem like this shows up on the exam, don't try to abbreviate. Just write "meters per second per second", as weird as it may sound.

[9]We use "ed" at the end because we are talking about two inputs, namely 0 and 1 seconds after it falls from the tree.