First Test of Introduction to Electrical Technology. Professor: Danilo Rairán. Sep/04/2018

Name:____ Code: _____________________ Group:_________

- The symbol "#" is equal to the last digit of your code plus one.
- The grade of each item will be assigned **if and only if** the item is perfect.

1. A student receives $ 1.500x# COP per day during 2017, uses $ 1.500/# COP and saves the rest. Next year, receives and extra (5+#)%, but saves only half of the previous year. Assume that the total amount of money = $ 15.000x# COP in Dec/31/2016. **a**) Compute a function describing the accumulated amount of money that was received monthly during the years 2017 and 2018. **b**) Use Matlab to plot the equation for both years.

2. **a**) Compute the mathematical model of the electric charge in the Fig. 1. **b**) Calculate q(4x#m). **c**) q(t?) = 3x# (µC). **d**) Plot the equation q(t) using Matlab.

3. **a**) How much is 12.345x# k in G? **b**) How much is 6,78 T electrons in Coulombs? **c**) If an electron is a tree, and there are 3.000x# millions of them in the earth, how many planets like earth do we need to have a Coulomb?

4. **a**) Compute i(t) in the Fig. 2, **b**) i(t1?) = 2x# (mA), **c**) i(t2?) = 1,5x#x10^{-3} (A). **d**) plot the equation i(t) using Matlab.

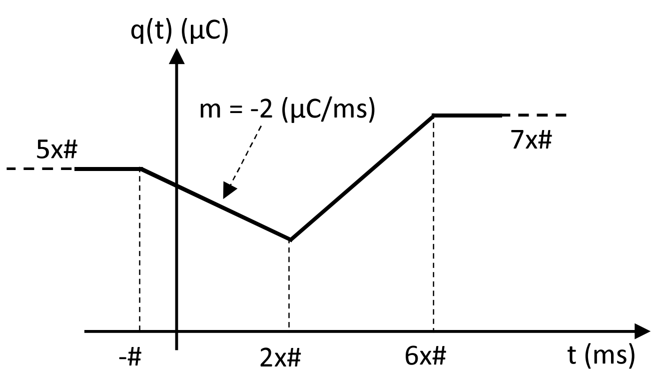

Fig. 1.

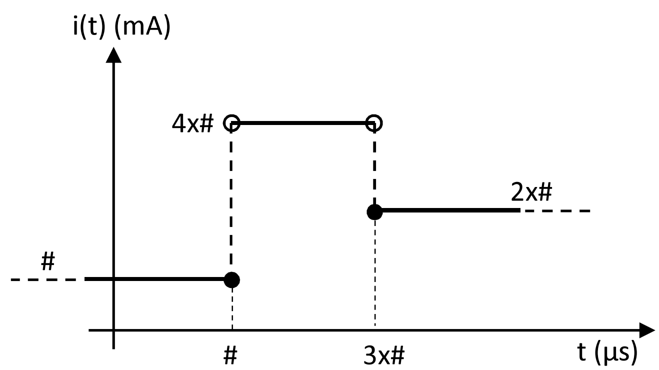

Fig. 2.

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	a = 0,8		a = 0,6	
	b = 0,3	a = 0,2	b = 0,2	
a = 0,7	c = 0,3	b = 0,3	c = 0,2	
b = 0,3	d = 0,4	c = 0,4	d = 0,3	
/1,0	/1,8	/0,9	/1,3	Great Total: /5,0

First Test. Introduction to Electric Technology. Code: __________________________ Group: _________

Danilo Rairán, Mar/06/2018

Note: # is equal to the last digit of your code plus one.

1. Answer each question using scientific notation. Write down the whole mathematical process.

a. How many microseconds are # days? (*0.3 points*)

b. How many electrons make # mC? (*0.3 points*)

c. If the area of an atom is #10^{-12} m^2, how many atoms make 1 mm^2? (*0.6 points*)

2. Compute the value of *k* that makes *q*(*t*) a continuous function. (*0.8 points*)

$$q(t) = \begin{cases} -\#10^{-6}\ (C), & t < -2\ ms \\ t^2 + 4mt + k\ (C), & t \geq -2\ ms \end{cases}$$

3. The electric charge in a circuit is a continuous and piecewise linear function. If the time is given in ms and the charge in mC, then the critical points are (-3#,#), (-#,3#), (3#,-4#), (5#,-2#). Assume *q* = # m*C* if *t* < -3# m*s* and *q* = -2# m*C* if *t* > 5# m*s*.

a. Compute the function that describes the electric charge using a bracket. (*1 point*)

b. Plot the function *q*(*t*) using Matlab. (*0.5 points*)

4. Given the electric charge *q*(*t*), compute and plot the electric current.

$$q(t) = \begin{cases} 0\ C, & t < 0 \\ t^2\ C, & 0 \leq t < \#\ s \\ t(-1-\#) + (\# + 2\ \#^2)\ (C), & \# \leq t < 2\ \#\ s \\ -\#\ \ C, & t \geq 2\ \#\ s \end{cases}$$

a. By hand (*0.7 points*)
b. Using Matlab (*0.8 points*)

The points in each item will be assigned **if and only if** the answer and the process are perfect.

First Test, Introduction to Electricity, September 10, 2019, Group, Professor: ___________________________

Name: ____ Code: _____________________

 # = last digit of your code plus one

1. The electric charge in a circuit increases at 3 + #/10 μC/s before 4 ms, when it reaches 6 + #/10 nC and remains constant for 6 ms. From then on, it increases at 4 + #/10 nC per ms. **a**) plot the behavior of the charge, **b**) compute its equation.

2. Given the numbers a = 0,03*10^{-3}*# and b = $\frac{54 * 10^2}{\#}$ ***show the process*** and compute: **a**) a + b, **b**) a – b, **c**) a*b, **d**) a/b.

3. Given the following equation answer next questions. **a**) $q(3\mu) = ?$ **b**) $t = ?$ If $q = 0\ C$, **c**) $t = ?$ if $\# \times 10^{-3}\ C < q < 3\# \times 10^{-3}\ C$.

$$q(t) = \begin{cases} (10^3 t + 10^{-3})\#\ \ (C), t < 1\ \mu s \\ \left(\frac{5}{4}10^3 t + \frac{3}{4}10^{-3}\right)\#\ \ (C), 1\ \mu s \le t < 5\ \mu s \\ \left(\frac{-7}{2}10^3 t + \frac{49}{2}10^{-3}\right)\#\ \ (C), t \ge 5\ \mu s \end{cases}$$

4. If a cat is equivalent to an electron, and each solar system has $(\# + \#/13) \times 10^{12}$ cats, how many solar systems do we need to have -#/12 C?

1	2	3	4
a. /0,6	a. /0,25	a. /0,4	a. /0,6
b. /1,0	b. /0,25	b. /0,4	
/1,6	c. /0,25	c. /1,0	
	d. /0,25	/1,8	
	/1,0		

Introduction to Electricity, Prof. Danilo Rairán, Apr/22/2021

Name: ____ **Code**: ________________

Group: ________________ # = a number given by the professor during the test

1. An experiment shows an electric charge behavior following next rule:

$$q(t) = \left(1+\frac{\#}{2}\right)\times 10^3 * Log_2\left(\left(1+\frac{\#}{2}\right)*t\right)^8 \quad (C)$$

t (s)	900m	925m	950m	975m	1	1,025	1,050	1,075	1,100
q(t) (C)									

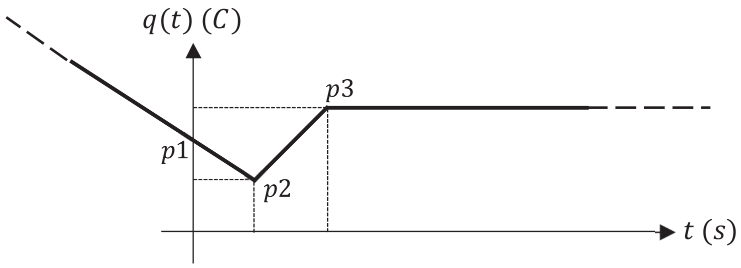
Google it: (1+#/2)*1e3*log2((1+#/2)*t)^8
WolframAlpha: q(t) = (1+#/2)*1e3*log2((1+#/2)*t)^8 t from 0.9 to 1.1

a) Make a linear approximation of the data using two lines (compute their equations)
b) Compute the error using the approximation for one data point.

2. If a virus is an electron and it is known that $\left(\frac{1}{2}+\frac{\#}{8}\right)\times 10^{10}$ new viruses come from a single infected person, and given that the world population is $\left(6+\frac{\#}{2}\right)\times 10^9$ persons, how many planets would be need to make $-\frac{2+\#}{4}\ C$?

3. The global temperature changes as the electric charge in a circuit. The first day, and the last one, of a year it is $18-\frac{\#}{2}\ °C$, and two months later it is $\frac{44+\#}{2}\ °C$. After that the temperature starts to decrease at $\frac{4+\#}{4}\left(\frac{°C}{month}\right)$ for the following four months. That decreasing is followed by an increasing so that four months later we have the same maximum temperature again. Compute the equation to describe the changes in temperature during a whole year.

4. The figure shows the electric charge in a wire. The coordinates for $p1$, $p2$, and $p3$ are $(0\,,1.5\#\times 10^{-6})$, $(\#\times 10^{-3}\,,\ \#\times 10^{-6})$, $(2\#\times 10^{-3}\,,2\#\times 10^{-6})$ respectively. **a**) Evaluate $q(t)$ if $t\ =(\pi/2)\#\ ms$, **b**) Solve for $q(t_?)\ =\ 2\#\ \mu C$.



1.	a) 1,1/5	2)	0,8/5	3)	1,4/5	4)	a) 0,4/5
	b) 0,3/5						b) 1,0/5

Introduction to Electricity, Prof. Danilo Rairán, Nov/25/2021

Name: ____ **Code**: _________________

Group: _________________ # = a number given by the professor during the test

1. An experiment shows an electric charge behavior following next rule:

$$q(t) = \left(t - \left(1 - \frac{\#}{5}\right)\right)\left(t + \left(0{,}8 + \frac{\#}{20}\right)\right)t\ (C)$$

$t\ (s)$	$-0{,}2$	0	$0{,}2$	$0{,}4$	$0{,}6$	$0{,}8$	$1{,}0$
$q(t)\ (C)$							

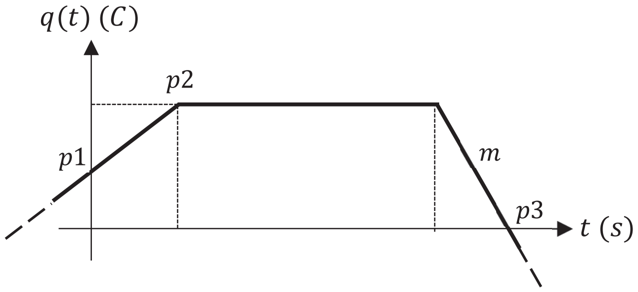
Google it: (t-(1-#/5))*(t+(0.8+#/20))*t, also in *https://www.geogebra.org/graphing*
WolframAlpha: q(t) = (t-(1-#/5))*(t+(0.8+#/20))*t from -0.2 to 1.0

a) Make a linear approximation of the data using two lines (compute their equations)
b) Compute the error using the approximation for one data point.

2. If a grain of sand is an electron and it is known that its volume is $0{,}01\left(0{,}8 + \frac{\#}{10}\right)\ mm^3$, **a**) what is the electric charge of $\left(1 + \frac{\#}{5}\right)\ m^3$ of sand?, **b**) what is the equivalent volume of sand for $-\left(1{,}5 - \frac{\#}{10}\right)\ C$?

3. The number of leaves in a tree changes as the electric charge in a circuit. That number decreased $\left(1 + \frac{\#}{15}\right) \times 10^3$ leaves every day, until two days ago with a minimum of $15\left(0{,}8 + \frac{\#}{10}\right) \times 10^3$ leaves, when the application of a substance immediately started to produce $500\left(1 + \frac{\#}{12}\right)$ new leaves every day. That growing suddenly stopped when the number of leaves reached $55\left(1 - \frac{\#}{5}\right) \times 10^3$, and then remain constant. Compute an equation to describe all the changes in the number of leaves.

4. The figure shows the electric charge in a wire. The coordinates for $p1$, $p2$, and $p3$ are $(0\ ,\ 1{,}5\# \times 10^{-6})$, $(\# \times 10^{-3}\ ,\ 3\# \times 10^{-6})$, $(4\# \times 10^{-3}\ ,\ 0)$ respectively, whereas $m = -3(1 + 0{,}1\#)\ \left(\frac{mC}{s}\right)$. **a**) Evaluate $q(t)$ if $t = (\pi/4)\#\ ms$, **b**) Solve for $q(t_?) = 2\#\ \mu C$.



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1. a) 1,1/5 b) 0,3/5

2) a) 0,8/5 b) 0,4/5

3) 1,4/5

4) a) 0,5/5 b) 0,9/5

Primer parcial, Introducción a la Electricidad, **26 de septiembre de 2022**, Profesor: Danilo Rairán

Nombre: ____ Código:___________________ Grupo: ___________

 # = último dígito del código + 1

1) Si una gota de agua equivale a un electrón, y en un aguacero caen $(1 + \#/5)\times10^{12}$ gotas/hora, ¿cuánto tiempo debe llover para tener un equivalente a -1 Coulomb? Dé el resultado en años.

2) Dados los datos en la tabla siguiente, y mostrando todo el procedimiento:

a) encuentre la ecuación de la mejor aproximación lineal que pueda, usando tres líneas,

b) evalúe el error en la aproximación en uno de los puntos.

t (s)	-2m	-1m	0	1m	2m	3m	4m	5m	6m	7m	8m
q(t) (C)	-196# p	-72# p	0	32# p	36# p	24# p	8# p	0	12# p	56# p	144# p

3) El valor de las acciones de la empresa más importante del país se comporta como el conteo acumulado de carga eléctrica pasando por un conductor. Su valor crecía 150# cop/mes hasta el primero de julio del 2022, cuando llegó a ser $ $\#\times10^3$ cop. Ahora se estima que su precio al final del año será la mitad del valor que tuvo al comienzo del 2022.

a) Suponga un comportamiento lineal, y encuentre el modelo matemático para el valor de las acciones.

b) Si compró 1 millón de pesos en acciones el primero de abril de 2022, ¿cuánto habrá perdido al final de diciembre de 2022?

c) ¿Cuándo el valor de la acción será $ $0.7\#\times10^3$ cop?

Nota por punto:

1)	1.3	**2**)	a) 1.0	**3**)	a) 1.0
			b) 0.7		b) 0.5
					c) 0.5

Tiempo estimado:

1) 20 minutos, **2**) 40 minutos, **3**) 50 minutos

Introduction to Electricity, Prof. Danilo Rairán, Oct/27/2020

Name: ____ **Code**: ___________________

Group: ___________________ # = a number given by the professor during the test

1. An experiment shows an electric charge behavior following next rule:

$$q(t) = \#\left(t - \left(1 + \frac{\#}{20}\right) * 2{,}5m\right)^2 + 5\mu\ (C)$$

t (s)	0	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m	9 m	10 m
q(t)											

a) Make a linear approximation of the data using two lines (compute their equations)

b) Compute the error using the approximation of a single data point.

2. The total volume of water on Earth is estimated at $1386 * \left(\frac{\#+20}{40}\right) \times 10^9\ km^3$. If $\left(0{,}01 * \left(\frac{\#+20}{40}\right)\right)\ km^3$ of water are a single electron, what is the electric charge of the Earth?

3. A population of ants grows as the changes of electric charge in a circuit. They increase their population at $\# \times 10^3$ ants/month, until six months ago, when they reached a local maximum of $30 * \# \times 10^3$. The winter made their number to decrease to the point that there were only $10 * \# \times 10^3$ a month ago. Then, they started to recover, and they are growing now at the same rate as before. Compute the equation to describe the population of ants.

4. The electric charge in a wire changes as follows:

$$q(t) = \begin{cases} -\#mt + \#(1+\#)\mu\ (C), t < \#\ \ ms \\ 1mt\ (C), \#\ \ ms \le t < 2\#\ \ ms \\ -\#mt + 2\#(1+\#)\mu\ (C), t \ge 2\#\ \ ms \end{cases}$$

a) Plot the electric charge behavior according to the model given by the equation.
b) Solve for $q = 1{,}5\#\mu\ (C)$, in other words, when is the charge equal to $1{,}5\#\mu\ (C)$?
c) Evaluate $q(1{,}5\#m)$.

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1. a) 1,1/5   b) 0,3/5

2) 0,5/5

3) 1,4/5

4) a) 1,1/5   b) 0,4/5   c) 0,2/5

Introduction to Electricity, Prof. Danilo Rairán, May/28/2020

Name: ____ Code: ________________

Group: ______________

= a number given by the professor during the test

1. A device reported two data points corresponding to the counting of electric charge in a wire as a function of time. One data point is (2m,#μ), the other is (#m,9μ). Compute an equation describing that counting as a linear function.

2. Data points in the following table do not describe a linear behavior, but the best we can do now is to define a line that sort of describe them. Compute a linear model that matches the best way possible those points.

t (s)	$2\#\times10^{-6}$	$3\#\times10^{-6}$	$4\#\times10^{-6}$	$5\#\times10^{-6}$	$6\#\times10^{-6}$	$7\#\times10^{-6}$	$8\#\times10^{-6}$
q (C)	1×10^{-3}	0.809×10^{-3}	0.309×10^{-3}	-0.309×10^{-3}	-0.809×10^{-3}	-1×10^{-3}	-0.809×10^{-3}

3. The behavior of the electrical charge in an experiment increases at # (C/s) before 5 μs and then decreases at -# (C/s). Describe the process to plot the behavior and plot it, if the maximum electric charge is # μC.

4. Given the equation for $q(t)$ answer following questions. **a**) $q(4\mu) =?$ **b**) $t =?$ If $q = 0\ C$, **c**) $t =?$ if $\# \times 10^{-3}\ C < q < 2\# \times 10^{-3}\ C$.

$$q(t) = \begin{cases} (10^3 t + 10^{-3})\#\ \ (C), t < 1\ \mu s \\ \left(\frac{5}{4}10^3 t + \frac{3}{4}10^{-3}\right)\#\ \ (C), 1\ \mu s \le t < 5\ \mu s \\ \left(\frac{-7}{2}10^3 t + \frac{49}{2}10^{-3}\right)\#\ \ (C), t \ge 5\ \mu s \end{cases}$$

1) 1/5 → 15 minutes
2) 1/5 → 20 minutes
3) 1/5 → 25 minutes
4.a) 0.5/5 → 5 minutes
4.b) 0.5/5 → 10 minutes
4.c) 1/5 → 30 minutes