

Prefix	Abbreviation	Value
Giga	G	10^9
Mega	M	10^6
Kilo	k	10^3
milli	m	10^{-3}
micro	μ	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}

	Forced Response Solution for $\tau = RC = \frac{L}{R}$	
Step	$v_F(t) = K e^{-\frac{t}{\tau}}$	
Sinusoid	$v_F(t) = a \cos(\omega t) + b \sin(\omega t)$ where $a = \frac{V_A}{1+\omega\tau}$ $b = \frac{\omega\tau V_A}{1+\omega\tau}$	
Exp	$v_F(t) = A e^{-\alpha t}$ where $A = \frac{V_A}{1-\tau\alpha}$	

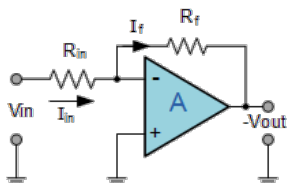
		Eqn	Units
Voltage	V	$v = \frac{dw}{dq}$	$Volts = \frac{Joules}{Coulomb}$
Current	I	$i = \frac{dq}{dt}$	$Amps = \frac{Coulomb}{seconds}$
Power	P	$p = \frac{dw}{dt} = \frac{dw}{dq} \frac{dq}{dt} = vi$	$Watts = \frac{Joules}{Seconds}$

	Series	Parallel
Resistor	$R_{eq} = \sum_{i=1}^n R_i$	$\frac{1}{R_{eq}} = \sum_{i=1}^n \frac{1}{R_i}$
Capacitor	$\frac{1}{C_{eq}} = \sum_{i=1}^n \frac{1}{C_i}$	$C_{eq} = \sum_{i=1}^n C_i$
Inductor	$L_{eq} = \sum_{i=1}^n L_i$	$\frac{1}{L_{eq}} = \sum_{i=1}^n \frac{1}{L_i}$

Part	Transient	Steady State
Capacitor	short	open
Inductor	open	short

Part	Transient	RX Circuit Solution
Capacitor	$i(t) = -C \frac{\partial v}{\partial t}$	$v(t) = [(V_o - V_A) e^{-\frac{t}{R_T C}} + V_A] u(t)$
Inductor	$v(t) = L \frac{\partial i}{\partial t}$	$i(t) = [(I_o - I_A) e^{-\frac{R_T t}{L}} + I_A] u(t)$

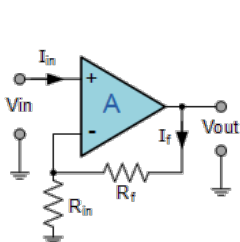
Inverting Op-amp



$$A = \frac{V_{out}}{V_{in}} = -\frac{R_f}{R_{in}}$$

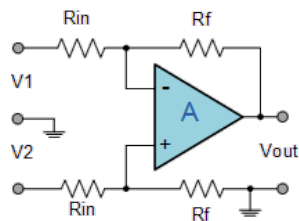
(a) 1

Non-inverting Op-amp



$$A = \frac{V_{out}}{V_{in}} = 1 + \frac{R_f}{R_{in}}$$

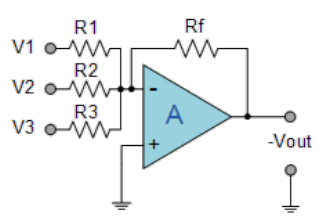
Differential Op-amp



$$V_{out} = \frac{R_f}{R_{in}} (V_2 - V_1)$$

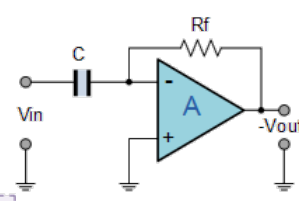
(b) 2

Summing Op-amp



$$V_{out} = -\left(\frac{R_f}{R_1} V_1 + \frac{R_f}{R_2} V_2 + \frac{R_f}{R_3} V_3\right)$$

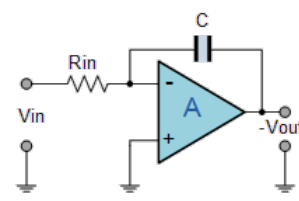
Differentiator Op-amp



$$V_{out} = -R_f C \frac{dV_{in}}{dt}$$

(c) 3

Integrator Op-amp



$$V_{out} = -\frac{1}{j\omega R_{in} C} V_{in}$$