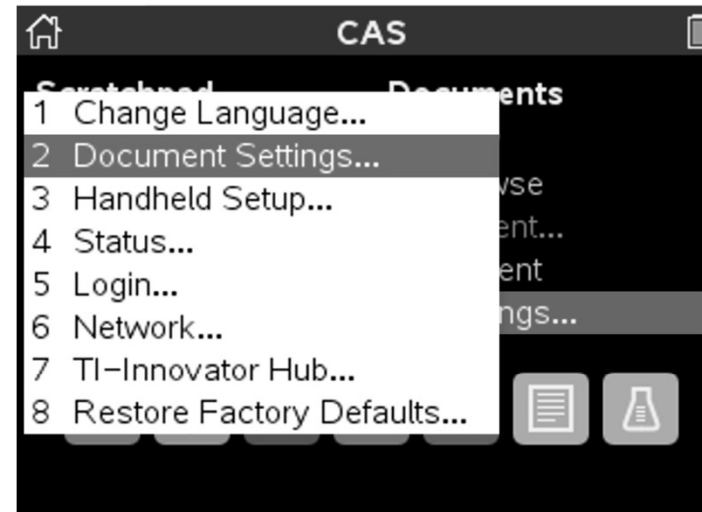
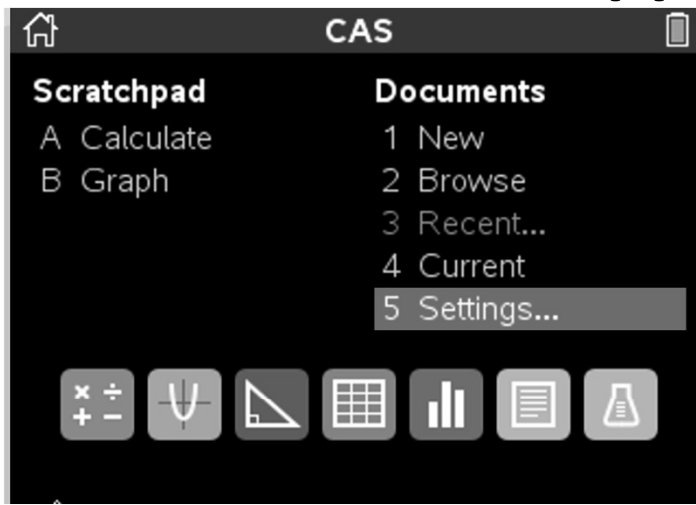


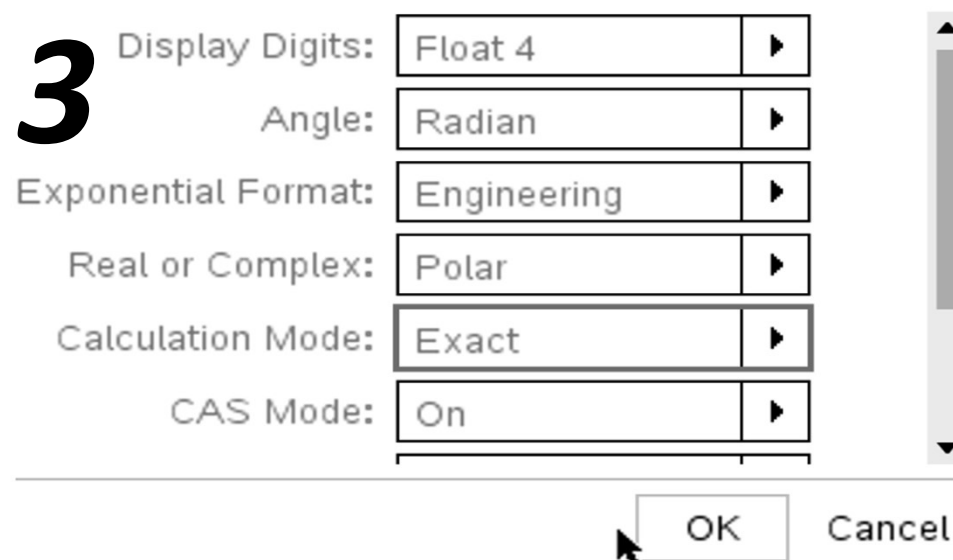
# Calculations with Waveforms

- *DC*
- *Sine*
- *Ramp*
- *Exponentials (2)*
- *plot*
- *derivative*
- *integral*
- *simplify*

# TI Nspire setup

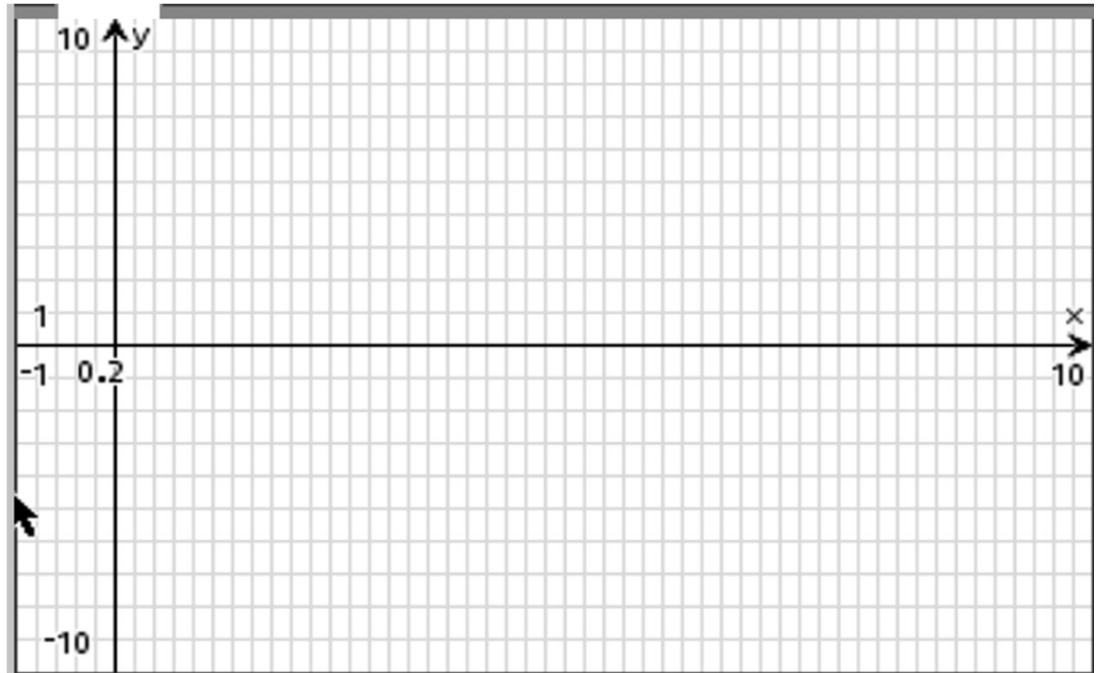


## Document Settings



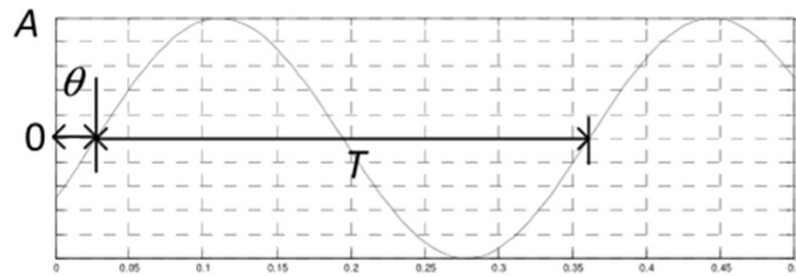
# DC

- $A$
- $A = \text{your age}/4$
- Sketch:  $x \ 0 \Rightarrow 7 \text{ s}$



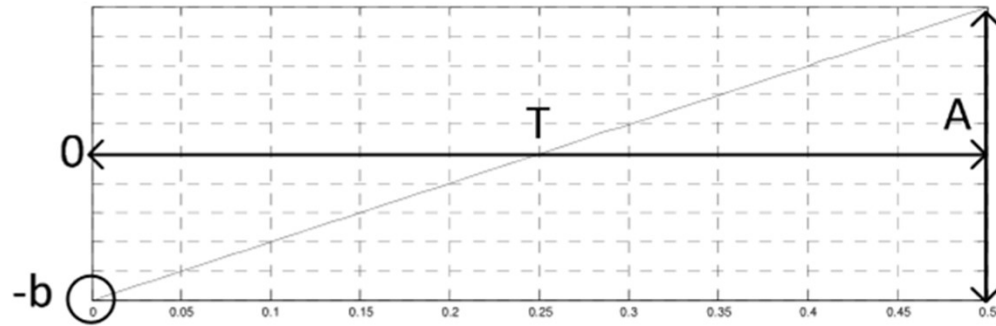
- $\frac{d}{dt} A = ?$
- $\int A \, dt = ?$

# Sine



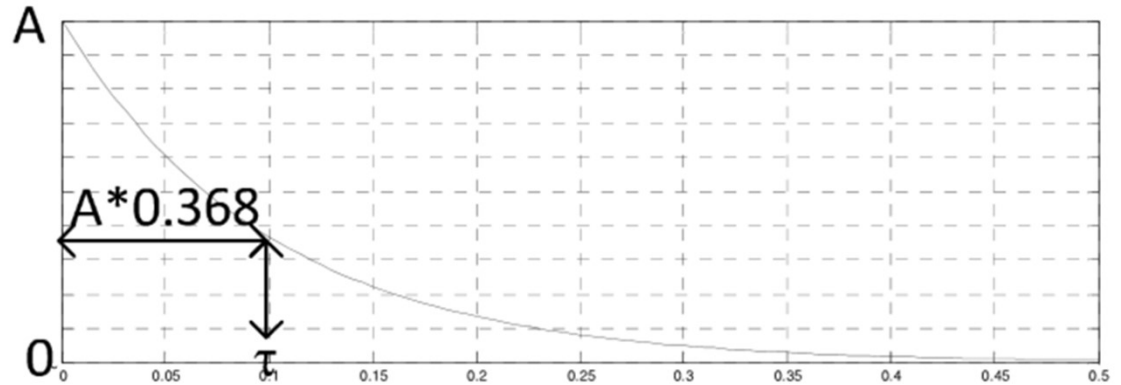
- $A \sin(2\pi f t - \theta) \quad f = \frac{1}{T}$
- $A = \underline{\hspace{2cm}}$
- $T = \underline{\hspace{2cm}} \mu\text{sec} \quad f = \underline{\hspace{2cm}} \quad \theta = \underline{\hspace{2cm}} \text{deg}$
- Write the equation  $\quad = \underline{\hspace{2cm}} \text{rad}$
- $\frac{d}{dt} A \sin(2\pi f t - \theta) = ?$
- $\int A \sin(2\pi f t - \theta) dt = ?$

# Ramp



- $A = \underline{\hspace{2cm}}$        $b = \underline{\hspace{2cm}}$
- Write the equation
- $mt + b = \frac{A}{T}t + b$
- $\frac{d}{dt} \left( \frac{A}{T}t + b \right) = \underline{\hspace{2cm}}$
- $\int \left( \frac{A}{T}t + b \right) dt = \underline{\hspace{2cm}}$

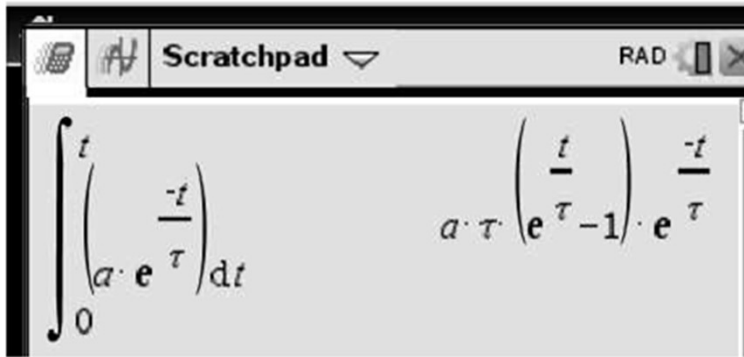
# Exponential Spike



- $Ae^{\frac{-t}{\tau}}$
- $A = \underline{\hspace{2cm}}$                        $\tau = \underline{\hspace{2cm}}$  msec
- Write the equation
- Plot is for  $0 \Rightarrow 0.5$  ms
  
- $\frac{d}{dt} Ae^{\frac{-t}{\tau}} = ?$
  
- $\int Ae^{\frac{-t}{\tau}} dt = ?$

# Exponential Spike

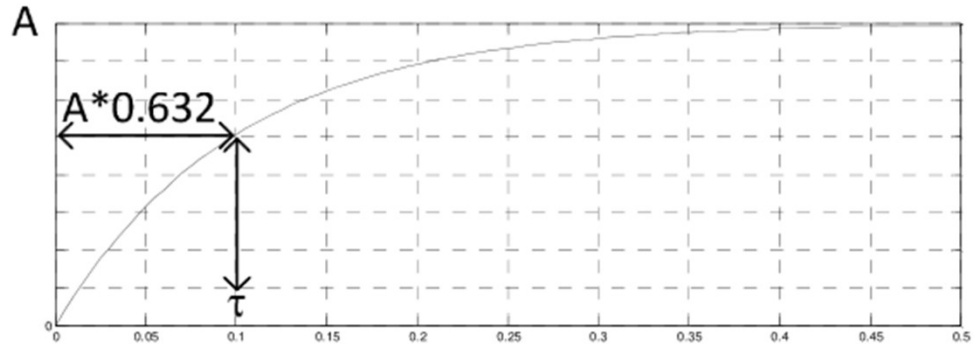
Simplify



A screenshot of a software window titled "Scratchpad" with a "RAD" button and a close icon. The window contains two mathematical expressions. On the left, an integral is shown:  $\int_0^t \left( a \cdot e^{\frac{-t}{\tau}} \right) dt$ . On the right, the simplified result is displayed:  $a \cdot \tau \cdot \left( e^{\frac{t}{\tau}} - 1 \right) \cdot e^{\frac{-t}{\tau}}$ .

$$\int_0^t \left( A e^{\frac{-t}{\tau}} \right) dt = A \tau \left( 1 - e^{\frac{-t}{\tau}} \right)$$

# Exponential Rise

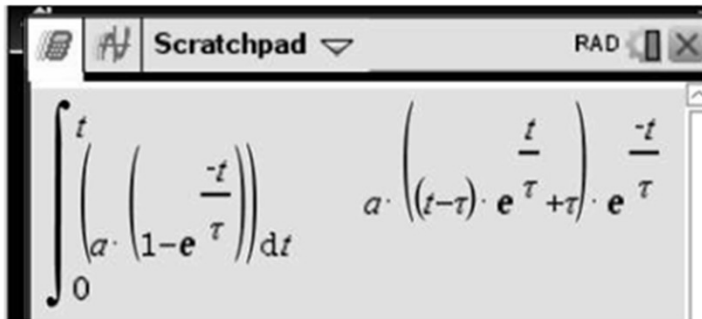


- $A(1 - e^{\frac{-t}{\tau}})$
- $A = \underline{\hspace{2cm}}$        $\tau = \underline{\hspace{2cm}}$  msec
- Write the equation
- Plot is for  $t \ 0 \Rightarrow 0.5 \text{ ms}$
- $\frac{d}{dt} A(1 - e^{\frac{-t}{\tau}}) = ?$
- $\int A(1 - e^{\frac{-t}{\tau}}) dt = ?$



# Exponential Rise

# Simplify



Scratchpad window showing the integral of  $A \left( 1 - e^{-\frac{t}{\tau}} \right)$  from 0 to  $t$ , and the simplified result:

$$\int_0^t A \left( 1 - e^{-\frac{t}{\tau}} \right) dt = A \left( (t - \tau) \cdot e^{\frac{t}{\tau}} + \tau \right) \cdot e^{-\frac{t}{\tau}}$$

$$\int_0^t \left[ A \left( 1 - e^{-\frac{t}{\tau}} \right) \right] dt = A \left[ t - \tau \left( 1 - e^{-\frac{t}{\tau}} \right) \right]$$