Problem 1 (4 points)
Suppose we have entered two row vectors \( x \) and \( y \) given by \( x = [3 \ 6 \ 8 \ 4] \) and \( y = [1 \ 3 \ 2 \ 4] \) into Matlab. Determine the Matlab answers to the following operations:

(a) \( x .* y \)

(b) \( x ./ y \)

(c) \( y' \)

(d) \( x * y' \)

Problem 2 (3 points)
We would like to plot \( x(t) = 5 \sin(2\pi t - \pi/6) \cos(4\pi t + \pi/3) \) over a time interval of \( t = 0 \) to \( t = 2 \) seconds.

(a) Using the Matlab function \( \text{linspace} \), give a Matlab statement to produce a vector \( t \) that has 500 elements over the time interval given above.

(b) Give a Matlab statement to find vector \( x \) from vector \( t \)

Problem 3 (4 points)
We are given the current signal \( i(t) = -4 \sin(20\pi t) \) Amp. Draw a sketch of \( i(t) \) showing \textbf{two cycles}. Include the vertical and horizontal labels and scales for the axes.
Problem 4 (7 points)
We are given the voltage signal \( v(t) = 3 \sin(100\pi t + \pi/6) \) Volts.

(a) What is the amplitude \( A \) of \( v(t) \) in Volts (V)?

(b) What is the angular frequency \( \omega \) of \( v(t) \) in radians/second (rad/s)?

(c) What is the frequency \( f \) of \( v(t) \) in Hertz (Hz)?

(d) What is the phase \( \theta \) of \( v(t) \) in radians (rad)?

(e) What is the phase \( \theta \) of \( v(t) \) in degrees (°)?

(f) What is the period \( T \) of \( v(t) \) in seconds (s)?

(g) If we would like to plot 10 cycles of \( v(t) \), what time range should we use?

Problem 5 (6 points)
You are given the circuit shown below with the dc (constant) voltage source \( V_{in} \) and resistors \( R_1 = 3\Omega \) and \( R_2 = 5\Omega \). Based on measurements, it has been concluded that the current through resistor \( R_2 \) which is marked as \( I_2 = 3A \). Given this information, answer the following questions (using the correct units):

\[
\begin{align*}
&\text{\begin{tikzpicture}[baseline=0cm, node distance=1cm, every node/.style={scale=0.7}]
&\node [circuit] (V) {\text{\textcolor{red}{\textbf{R}} \text{\textcolor{red}{\textbf{1}} = 3\Omega}} \quad \text{\textcolor{red}{\textbf{R}} \text{\textcolor{red}{\textbf{2}} = 5\Omega}}}
&\node [circuit] (V_in) {\text{\textcolor{red}{\textbf{V}_{\text{in}}}}}
&\node (I_1) [right of=V, node distance=2cm] {I_1}
&\node (V_1) [right of=I_1, node distance=1cm] {V_1}
&\node (I_2) [right of=V_1, node distance=1cm] {I_2 = 3A}
&\node (V_2) [right of=I_2, node distance=1cm] {V_2}
&\node (I_3) [below of=V, node distance=1cm] {I_3}
&\node (V_3) [below of=I_3, node distance=1cm] {V_3}
&\node (I_4) [right of=V_3, node distance=1cm] {I_4}
&\node (V_4) [right of=I_4, node distance=1cm] {V_4}
&\end{tikzpicture}}
\end{align*}
\]

(a) What is \( V_1 \)?

(b) What is \( I_1 \)?

(c) What is \( V_1 \)?

(d) Based on your previous results, what should be the value of the voltage source \( V_{in} \)?

(e) What is the power dissipated in resistor \( R_1 \)?

(f) What is the power dissipated in resistor \( R_2 \)?
Problem 6 (6 points)
You are given a partially-completed Matlab script shown below that includes vectors for two time functions $x_1(t)$ and $x_2(t)$.

(a) Complete the following script so that $x_1(t)$, $x_2(t)$ and their product described by $y(t) = x_1(t)x_2(t)$ are all plotted on the same figure. Since $y(t)$ is not defined below, you will have to write that first before plotting. Don’t include any statements for grid, axes labels or title.

```matlab
clear all; clc;
fs=1000; Ts=1/fs; w1=20*pi; w2=4*pi; t=0:Ts:1;
x1=2*sin(w1*t); x2=3*cos(w2*t);
```

(b) How many cycles of $x_1(t)$ will appear in the plot?

(c) How many cycles of $x_2(t)$ will appear in the plot?

Problem 7 (6 points)
You are given the transformer circuit shown below where the number of primary turns is $N_p = 2000$ and the number of secondary turns is $N_s = 100$. Recall that $v_p(t)i_p(t) = v_s(t)i_s(t)$ since the transformer is lossless.

```
+        +
  R = 10Ω  v_s(t)
−        −
```

Suppose we examine the secondary voltage across resistor $R$ and measure $v_s(t) = 20 \sin(120\pi t)$.

(a) Determine the secondary current $i_s(t)$.

(b) Determine the primary voltage $v_p(t)$.

(c) Determine the primary current $i_p(t)$.

(d) Based on the information above, is this a step-up or step-down transformer? Why?
Problem 8 (4 points)
Given the charge $q(t)$ (in Coulombs) versus time $t$ (in seconds) plot shown below, determine and sketch the current $i(t)$ versus time $t$. Be sure to label both axes and indicate the units of $i(t)$.

Bonus Questions (2 points)
These are the bonus questions that will be added to your exam score. The maximum percentage score for the exam will not exceed 100%.

(a) The part time musical director of the Chicago Symphony Orchestra could be referred to as a . . .

(b) Your instructor Vahe has a slight resemblance to what famous movie director?