1. (21 pts) Find the values below.  
   Show your work.

   a) $R_5 = ?$
   b) $V_S = ?$
   c) $P_S = ?$

2. (22 pts) Use the method of superposition to find the readings of the two ideal meters.  
   Be sure to redraw the circuit as needed and to clearly show and circle your intermediate results.

3. (22 pts) a) Find and draw the Thévenin equivalent of the circuit shown.  The load resistor is $R_L$.

   b) Find the load current using your Thévenin equivalent circuit.

   c) Find and draw the Norton equivalent of the same circuit.

   d) Find the load voltage using your Norton equivalent circuit.
4. (19 pts) Use nodal analysis to find the voltage across \( R_4 \) \( (V_{R4}) \) and the current through \( R_1 \) \( (I_{R1}) \).

You **MUST** show all the steps of nodal analysis work to get credit, including drawing appropriate symbols and labels on the circuit shown.

\[ R_1 = 100\,\Omega \]
\[ R_2 = 200\,\Omega \]
\[ R_3 = 300\,\Omega \]
\[ R_4 = 400\,\Omega \]
\[ V_S = 8\,V \]
\[ I_S = 50\,mA \]

\[ V_{R4} = \frac{400\,\Omega}{8\,V} \]
\[ I_{R1} = \frac{50\,mA}{100\,\Omega} \]

5. (16 pts) For the waveform shown, find:

**INCLUDE UNITS IN YOUR ANSWERS**

a) peak-to-peak current, \( I_{pp} \)

b) amplitude, \( A \)

c) period, \( T \)

d) frequency \( f \) in cycles/sec or Hz

e) frequency \( \omega \) in radians/sec

f) the phase angle in degrees

g) a complete expression for \( i(t) \), include numbers and units

**Answers**

1. a) 600\,\Omega  
   b) 9\,V  
   c) 149\,mW

2. 0.5\,mA  
   12.8\,V

3. a) 20\,\Omega  
   b) 300\,mA  
   c) 450\,mA  
   d) 3\,V

4. a) 4\,V  
   b) 40\,mA

5 a) 6\,mA  
   b) 3\,mA  
   c) 40\,\mu s  
   d) 25-kHz  
   e) \( 1.57 \times 10^5 \,\text{rad/ sec} \)

f) 90°  
   g) 3\,mA \cos \left( 1.57 \times 10^5 \,\text{rad/ sec} \cdot t + 90\,\text{deg} \right) + 1\,mA