1. Given the weight $W = 1000$ (lbs), find $F_{AB}$ and $F_{AC}$ the forces in the supporting wires by setting the sum of the forces to zero at $A$. Use Cramer’s rule.

![Diagram of forces](image)

2. For the double-loop DC circuit shown, the currents $I_1$ and $I_2$ can be found by solving the boxed simultaneous equations. Given the resistances $R_1 = 7(\Omega)$, $R_2 = 4(\Omega)$, and $R_3 = 5(\Omega)$, and the voltages $V_1 = 24$ (volts), and $V_2 = 12$ (volts), find the currents $I_1$ and $I_2$ using substitution.

\[
\begin{align*}
(R_1 + R_3)I_1 + (R_3)I_2 &= V_1 \\
(R_3)I_1 + (R_2 + R_3)I_2 &= V_2
\end{align*}
\]

![Diagram of circuit](image)

3. The currents shown in the table were measured in the series RC circuit after the switch was closed. Given that the current is given by an exponential function $i(t) = Be^{\alpha t}$, estimate the decay rate $\alpha$.

<table>
<thead>
<tr>
<th>$t$ (sec)</th>
<th>$i(t)$ (amps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>0.3679</td>
</tr>
<tr>
<td>0.2</td>
<td>0.1353</td>
</tr>
<tr>
<td>0.3</td>
<td>0.04979</td>
</tr>
</tbody>
</table>

![Diagram of RC circuit](image)
4. **Given:** \( m = 2 \text{ (slugs)} \), \( k = 200 \text{ (lb/ft)} \), \( c = 44 \text{ (lb-s/ft)} \)
\( y(t = 0) = -0.25 \text{ (ft)} \), \( v(t = 0) = -10 \text{ (ft/s)} \)

**Find:** \( y(t) \)

5. **Given:** \( m = 2 \text{ (slugs)} \), \( k = 200 \text{ (lb/ft)} \), \( c = 10 \text{ (lb-s/ft)} \)
\( y(t = 0) = -0.5 \text{ (ft)} \), \( v(t = 0) = -5 \text{ (ft/s)} \)

**Find:** \( y(t) \)
Express the result as an exponential function times a single, phase-shifted sine function.

6. A ball is thrown off a tower at a height of 30 (ft) as shown. The path of the ball is given by the function
\( y(x) = 30 + 5x - 0.16 x^2 \text{ (ft)} \).

a) Find \( y'(x) = \frac{dy}{dx}(x) \), \( y''(x) = \frac{d^2y}{dx^2}(x) \)

b) Using the results of part (a), find the \( X \) coordinate of the ball when it reaches its maximum height.

c) Find the equation of the line that is tangent to \( y(x) \) at \( x = 30 \text{ (ft)} \).

7. A spring-mass system with \( m = 2 \text{ (slugs)} \), \( k = 98 \text{ (lb/ft)} \), and no damping is shown in the diagram. The system is given an initial displacement of \( x_0 = 2 \text{ (ft)} \) and initial velocity of \( v_0 = 7 \text{ (ft/s)} \).

a) Find \( x(t) \) as a single, phase-shifted cosine function.

b) Find the time when the mass first reaches its largest displacement.

c) Find \( T \) the period of the oscillation.

d) Find \( v(t) = \frac{dx}{dt} \) the velocity of the mass.

e) Find \( a(t) = \frac{dv}{dt} \) the acceleration of the mass.

f) Find the first time when the velocity \( v(t) \) is maximum or minimum.