1 Fill out your own Laplace-Transform Cheat Sheet here.

<table>
<thead>
<tr>
<th>$f(t)$</th>
<th>$F(s)$</th>
<th>$f(t)$</th>
<th>$F(s)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>$t^n$</td>
<td></td>
</tr>
<tr>
<td>$e^{At}$</td>
<td></td>
<td>$H(t - A)$</td>
<td></td>
</tr>
<tr>
<td>$\cos(At)$</td>
<td></td>
<td>$\sin(At)$</td>
<td></td>
</tr>
<tr>
<td>$f'(t)$</td>
<td></td>
<td>$\sinh(At)$</td>
<td></td>
</tr>
<tr>
<td>$H(t - A)f(t - A)$</td>
<td></td>
<td>$tf(t)$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$\frac{1}{s}$</td>
<td>$\frac{1}{s^n}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$\frac{1}{s - A}$</td>
<td></td>
<td>$e^{-sA}F(s)$</td>
</tr>
<tr>
<td></td>
<td>$F(s - A)$</td>
<td>$F'(s)$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$\frac{12}{(s + 1)^2 + 9}$</td>
<td></td>
<td>$\frac{7s}{(s + 1)^2 + 9}$</td>
</tr>
</tbody>
</table>

2 State the basic definition of the Laplace Transform of $f$. 
3 Let $F(s)$ be the Laplace Transform of $f(t)$, where $F(s) = \frac{6s^2 + s - 6}{s^2(s + 2)}$. Find $f(t)$.

4 Find the Laplace transform of the function $g$ whose graph is shown. The coordinate squares are one unit on a side, and the graph of $g$ coincides with the $x$-axis for $x \in (2, \infty)$. 
5 Show steps in using the Laplace-Transform method to solve the initial-value problem:

\[ y' = -2y + e^{2t} \quad y(0) = 3/4 \]

6 Let \( g(t) = e^{At} f(t) \). State and prove the relation between \( F(s) \) and \( G(s) \).
7. Use the Laplace-Transform technique to solve the initial-value problem

\[ y' + 2y = E(t) \quad y(0) = 0, \]

where \( E(t) = \begin{cases} 
0 & \text{if } 0 \leq t < 2 \\
4 & \text{if } t \geq 2 
\end{cases} \).

Give an answer in form \( y(t) = \begin{cases} 
\text{ } & \text{if } 0 < t < 2 \\
\text{ } & \text{if } t \geq 2 
\end{cases} \).
8. Here’s a list of second-order linear differential equations.

(A) $2y'' + 2y' + 81y = 0$

(B) $2y'' - 2y' + 81 = 0$

(C) $y'' - 4y = 0$

(D) $y'' + 4y = 0$

(E) $y'' + 4y = \cos(2.25t)$

(F) $y'' + 4y = \cos(2t)$

Each of the figures below shows a portion of a composite plot of a solution of one of the above differential equations. This means that we have plotted the parametric equations

(i) $x = y(t)$, where $y(t)$ is the solution,

(ii) $y = v(t)$, where $v = y'$, and

(iii) $z = t$, on the vertical as shown.

Match graph with differential equation by entering the letter of the appropriate differential equation from the above list in the box in the lower-right part of each figure.