9.21

(b)

Solution. Using Euler's relation, we can write

$$x(t) = \left(e^{-4t} - \frac{j}{2}e^{-(5-5j)t} + \frac{j}{2}e^{-(5+5j)t}\right)u(t).$$

Then the Laplace transform of $x(t)$ can be expressed as

$$X(s) = \int_{-\infty}^{\infty} e^{-4t}u(t)\,\mathrm{d}t - \frac{j}{2}\int_{-\infty}^{\infty} e^{-(5-5j)t}u(t)\,\mathrm{d}t + \frac{j}{2}\int_{-\infty}^{\infty} e^{-(5+5j)t}u(t)\,\mathrm{d}t.$$

Each of these integrals represents a Laplace transform of the type encountered in Example 9.1. It follows that

$$\begin{aligned}
e^{4t}u(t) &\overset{\mathcal{L}}{\longleftrightarrow} \frac{1}{s+4}, \quad \mathcal{Re}\{s\} > -4,\\
e^{-(5-5j)t}u(t) &\overset{\mathcal{L}}{\longleftrightarrow} \frac{1}{s-5+5j}, \quad \mathcal{Re}\{s\} > -5,\\
e^{-(5+5j)t}u(t) &\overset{\mathcal{L}}{\longleftrightarrow} \frac{1}{s-5-5j}, \quad \mathcal{Re}\{s\} > -5.
\end{aligned}$$

For all three Laplace transforms to converge simultaneously, we must have $\mathcal{Re}\{s\} > -4$. Consequently, the Laplace transform of $x(t)$ is

$$X(s) = \frac{1}{s+4} - \frac{j}{2(s-5+5j)} + \frac{j}{2(s-5-5j)}, \quad \mathcal{Re}\{s\} > -4.$$

(i)

Solution.

$$x(t) = \delta(t) + u(t) \overset{\mathcal{L}}{\longleftrightarrow} X(s) = 1 + \frac{1}{s}, \quad \mathcal{Re}\{s\} > 0.$$

(j)

Solution. Note that $\delta(3t) + u(3t) = \delta(t) + u(t)$. Therefore, the Laplace transform is the same as the result of the previous part.

9.22

(e)

9.23

(1)

9.25

(c)

9.26

9.31

9.35

9.40