$$\mathcal{L}^{-1}\left(\frac{1}{p-a}\right)$$
$$= \frac{1}{2\pi i}\int_{c-i\infty}^{c+i\infty} \frac{e^{px}}{p-a}\,dp\ ,\ c > \mathrm{Re}(a)$$
$$= \text{ residue at } p = a \text{ for } x > 0$$
$$= e^{ax}$$

$$\mathcal{L}^{-1}\left(\frac{1}{(p+1)(p-2)^2}\right)$$
$$= \frac{1}{2\pi i}\int_{c-i\infty}^{c+i\infty} \frac{e^{px}}{(p+1)(p-2)^2}\,dp\ ,\ c > 2$$
$$= \sum \text{ residues at } \ p = -1 \text{ and } \ p = 2 \ \text{ for } \ x > 0$$

At $p = -1$, the residue is given by

$$\lim_{p\to -1} \frac{e^{px}}{(p-2)^2} = \frac{1}{9}e^{-x}$$

At $p = 2$, the residue is given by

$$\lim_{p\to 2} \frac{d}{dp}\left(\frac{e^{px}}{p+1}\right)$$
$$= \lim_{p\to 2}\left(\frac{xe^{px}}{p+1} - \frac{e^{px}}{(p+1)^2}\right)$$
$$= \frac{1}{3}xe^{2x} - \frac{1}{9}e^{2x}$$

$$\mathcal{L}^{-1}\left(\frac{1}{(p+1)(p-2)^2}\right) = \frac{1}{9}(e^{-x} + (3x-1)e^{2x})$$

$$\mathcal{L}^{-1}\left(\frac{p}{(p+1)^3(p-1)^2}\right)$$
$$= \frac{1}{2\pi i}\int_{c-i\infty}^{c+i\infty} \frac{pe^{px}}{(p+1)^3(p-1)^2}\,dp\ ,\ c > 1$$
$$= \sum \text{residues at } p = 1 \ \text{ and } \ p = -1 \ \text{ for } \ x > 0\ .$$

At $p = 1$, the residue is given by

$$\lim_{p\to 1} \frac{d}{dp}\left(\frac{pe^{px}}{(p+1)^3}\right)$$
$$= \lim_{p\to 1}\left(\frac{e^{px} + xpe^{px}}{(p+1)^3} - \frac{3e^{px}}{(p+1)^4}\right)$$
$$= \frac{1}{8}(x+1)e^{x} - \frac{3}{16}e^{x} = \frac{1}{16}(2x-1)e^{x}$$

At $p = -1$, the residue is given by

$$
\begin{aligned}
&\frac{1}{2}\lim_{p\to -1}\frac{d^2}{dp^2}\left(\frac{pe^{px}}{(p-1)^2}\right)\\
&= \frac{1}{2}\lim_{p\to -1}\frac{d}{dp}\left(\frac{e^{px}+pxe^{px}}{(p-1)^2} - \frac{2pe^{px}}{(p-1)^3}\right)\\
&= \frac{1}{2}\left(\frac{2xe^{px}+px^2e^{px}}{(p-1)^2} - \frac{4(1+px)e^{px}}{(p-1)^3} + \frac{6pe^{px}}{(p-1)^4}\right)\\
&= \frac{1}{8}(2x-x^2)e^{-x} + \frac{1}{4}(1-x)e^{-x} - \frac{3}{16}e^{-x}\\
&= \frac{1}{16}(1-2x^2)e^{-x}
\end{aligned}
$$

$$
\mathcal{L}^{-1}\left(\frac{p}{(p+1)^3(p-1)^2}\right) = \frac{1}{16}(2x-1)e^{x} + \frac{1}{16}(1-2x^2)e^{-x}
$$