1. $f(t) = 3t + 12$

$$\mathcal{L}(3t+12) = 3\mathcal{L}(t) + \mathcal{L}(12)$$

$$= 3 \cdot \frac{1!}{s^{1+1}} + \frac{12}{s}$$

$$= \frac{3}{s^2} + \frac{12}{s}$$

2. $f(t) = e^{5t}$

$$\mathcal{L}(e^{5t}) = \frac{1}{s-5}$$

3. $f(t) = e^{-2t}$

$$\mathcal{L}(e^{-2t}) = \frac{1}{s-(-2)}$$

$$= \frac{1}{s+2}$$

4. $f(t) = (a-bt)^2$

$$\mathcal{L}(a-bt)^2 = \mathcal{L}(a^2 - 2abt + b^2t^2)$$

$$= \mathcal{L}(a^2) - 2ab\,\mathcal{L}(t) + b^2\,\mathcal{L}(t^2)$$

$$= \frac{a^2}{s} - 2ab\,\frac{1!}{s^{1+1}} + b^2 \cdot \frac{2!}{s^{2+1}}$$

$$= \frac{a^2}{s} - \frac{2ab}{s^2} + \frac{2b^2}{s^3}$$

5. $f(t) = \cos \pi t$

$$\mathcal{L}(\cos \pi t) = \frac{s}{s^2 + \pi^2}$$

6. $f(t) = \cos^2 \omega t$

$$\mathcal{L}(\cos^2 \omega t) = \mathcal{L}\left\{\frac{1}{2}(2\cos^2 \omega t)\right\}$$

$$= \mathcal{L}\left\{\frac{1}{2}(1+\cos 2\omega t)\right\}$$

$$= \mathcal{L}\left(\frac{1}{2}\right) + \frac{1}{2}\mathcal{L}\{\cos 2\omega t\}$$

$$= \frac{\frac{1}{2}}{s} + \frac{1}{2} \cdot \frac{s}{s^2 + (2\omega)^2}$$

$$= \frac{1}{2s} + \frac{1}{2}\left(\frac{s}{s^2 + 4\omega^2}\right)$$

7. $f(t) = \sin(\omega t + \theta)$

$$\mathcal{L}\{\sin(\omega t + \theta)\} = \mathcal{L}\{\sin \omega t \cos\theta + \cos \omega t \sin\theta\}$$

$= \cos\theta \mathcal{L}\{\sin\omega t\} + \sin\theta \mathcal{L}\{\cos\omega t\}$

$= \cos\theta \left(\frac{\omega}{s^2+\omega^2}\right) + \sin\theta \left(\frac{s}{s^2+\omega^2}\right)$

8. $f(t) = 1.5 \sin(3t - \pi/2)$

$\mathcal{L}\{1.5 \sin(3t - \pi/2)\} = \mathcal{L}\{1.5 \{\sin 3t \cos \pi/2 - \cos 3t \sin \pi/2\}$

$= 1.5 \cos \pi/2 \mathcal{L}\{\sin 3t\} - 1.5 \sin \pi/2 \mathcal{L}\{\cos 3t\}$

$= 1.5 \cos \pi/2 \left(\frac{3}{s^2+9}\right) - 1.5 \sin \pi/2 \left(\frac{s}{s^2+9}\right)$