Therefore,

$$\mathcal{L}\{\cos bt\} + i\mathcal{L}\{\sin bt\} = \frac{s}{s^2+b^2} + i\frac{b}{s^2+b^2}.$$

It follows that

$$\mathcal{L}\{\cos bt\} = \frac{s}{s^2+b^2}, \quad \mathcal{L}\{\sin bt\} = \frac{b}{s^2+b^2}.$$

It can be shown that this is valid for $s>0$.

<u>Linearity of Laplace Transform</u>

(1) $\mathcal{L}\{f_1 + f_2\} = \mathcal{L}\{f_1\} + \mathcal{L}\{f_2\}$

(2) $\mathcal{L}\{cf\} = c\mathcal{L}\{f\}$ if c is a constant.

(3) $\mathcal{L}\{c_1 f_1 + c_2 f_2\} = c_1\mathcal{L}\{f_1\} + c_2\mathcal{L}\{f_2\}$

if c_1, c_2 are constants.

<u>Example</u> (#14) Using Laplace transform table & linearity find

$$\mathcal{L}\{5 - e^{2t} + 6t^2\}.$$

$\mathcal{L}\{5 - e^{2t} + 6t^2\} = \mathcal{L}\{5\} - \mathcal{L}\{e^{2t}\} + 6\mathcal{L}\{t^2\}$ (by linearity)

$= 5\mathcal{L}\{1\} - \mathcal{L}\{e^{2t}\} + 6\mathcal{L}\{t^2\}$

$= \dfrac{5}{s} - \dfrac{1}{s-2} + 6 \cdot \dfrac{2!}{s^3}$ (by 1., 2., 3. in table)

$= \dfrac{5}{s} - \dfrac{1}{s-2} + \dfrac{12}{s^3}$ for $s>2$.