Decomposable

$$a, b \in \mathbb{R},$$
$$y'' + \sin(x)y' + \cos(x)y = 0$$
has unique solution $y_{a,b}(x)$ with
$$y_{a,b}(0) = a,\ y'_{a,b}(0) = b$$
Decomposable $\Longrightarrow y_{a,b}(x) = a y_{1,0} + b y_{0,1}$

Non-Decomposable

Need to find $y_{a,b}$ for all $a, b \in \mathbb{R}$

Decomposable

Need to find $y_{a,b}$ for only two $(a, b) \in \mathbb{R}^2$

Linearly independent

$\sin x, \cos x$ ✓

$\sin x \neq 3\cos x$

or any other

$\sin 2x, \sin x \cos x$ ✗

$\sin 2x = 2\sin x \cos x$

$\sin 2x, \sin x$

$\sin 2x = 2\sin x \cos x$ ✓

$$x^2 + 4x - 12 = 0$$

$$x \simeq 2$$

$$w = x - 2 \qquad x = w + 2$$

$$x^2 = (w+2)^2 = w^2 + 4w + 4$$

$$4x = 4w + 8$$

$$-12$$

$$x^2 + 4x - 12 = w^2 + 8w$$

$$w^2 + 8w = 0$$

$$w(w+8) = 0$$

$$w = -8 \Rightarrow x = -6$$