(2) $e^{ax}\sin(bx+c)$

let $y = e^{ax}\sin(bx+c)$

$\therefore y_1 = e^{ax}\, b\cos(bx+c) + a e^{ax}\sin(bx+c)$

$= e^{ax}\{b\cos(bx+c) + a\sin(bx+c)\}$

Putting $a = r\cos\theta$ and $b = r\sin\theta$ we have

$r = \sqrt{a^2+b^2}$ & $\theta = \tan^{-1} b/a$ where r & θ are constant.

$\therefore y_1 = e^{ax} r\{\sin\theta\cos(bx+c) + \cos\theta\sin(bx+c)\}$

$= re^{ax}\sin(bx+c+\theta)$

$y_2 = re^{ax}\, b\cos(bx+c+\theta) + re^{ax} a\sin(bx+c+\theta)$

$= re^{ax}\, r\sin\theta\cos(bx+c+\theta) + re^{ax} r\cos\theta\sin(bx+c+\theta)$

$= r^2 e^{ax}\sin(bx+c+2\theta)$

. . . .

$y_n = r^n e^{ax}\sin(bx+c+n\theta)$

$\therefore y_n = (a^2+b^2)^{n/2} e^{ax}\sin\left[bx+c+n\tan^{-1} b/a\right]$

$D^n\left[e^{ax}\sin(bx+c)\right] = (a^2+b^2)^{n/2} e^{ax}\sin(bx+c+n\tan^{-1}(b/a))$

If $a=1$, $b=1$ and $c=0$, then

$y = e^x\sin x$ & $y_n = 2^{n/2} e^x\sin\left[x+\frac{n\pi}{4}\right]$.

$\left[\because r=\sqrt{2} \quad \theta = \pi/4\right]$