$$y'' - 2y' + y = 2x e^{x} + e^{x} \sin 2x$$

$$\lambda^2 - 2\lambda + 1 = 0$$

$$(\lambda - 1)^2 = 0$$

$$\lambda = 1$$

$$y = c_1 e^{x}; \quad y = c_2 x e^{x}$$

$$y_{r_1} = x^2 e^{x} (ax + b)$$

$$y_{r_2} = e^{x} (k \cos(2x) + l \sin(2x))$$

$$y_r = e^{x} (a x^3 + b x^2 + k \cos(2x) +$$
$$+ l \sin(2x))$$

$$y_r' = e^{x} (3a x^2 + 2b x - 2k \sin(2x) + 2l \cdot$$
$$\cdot \cos(2x)) + e^{x} (a x^3 + b x^2 + k \cos(2x) +$$
$$+ l \sin(2x))$$

$$y_r'' = 2 e^{x} (3a x^2 + 2b x - 2k \sin(2x) + 2l \cos(2x))$$
$$+ e^{x} (a x^3 + b x^2 + k \cos(2x) + l \sin(2x))$$
$$+ e^{x} (6a x + 2b - 4k \cos(2x) - 4l \sin 2x)$$

$$y_ч'' - 2y_ч' + y_ч = 2e^x(3ax + b - 2k$$

$$\cos(2x) - 2l\sin(2x)) = e^x(2x + \sin(2x))$$

$$6ax + 2b - 4k\cos(2x) - 4l\sin(2x) =$$

$$= 2x + \sin(2x)$$

$$a = \frac{1}{3};\ k = 0;\ l = -\frac{1}{4};\ b = 0$$

$$y_ч = e^x\left(\frac{x^3}{3} - \frac{\sin(2x)}{4}\right)$$

$$y_н = y_ч + c_1 e^x + c_2 x e^x$$

$$\begin{cases} c_1 = 0 \\ c_1 + c_2 = \frac{1}{2} \end{cases};\ c_2 = \frac{1}{2}$$

$$y_н = y_ч + \frac{1}{2}e^x =$$

$$= -\frac{e^x(-4x^3 + 3\sin(2x) - 6)}{12}$$