$$8^x - 9 \cdot 4^x + 26 \cdot 2^x - 24 = 0$$

Solution.

Transform the expression:

$$2^{3x} - 9 \cdot 2^{2x} + 26 \cdot 2^x - 24 = 0$$

Then make the substitution: $2^{\chi} = t$

We have the cubic equation:

$$t^3 - 9t^2 + 26t - 24 = 0$$

Then transform the expression:

$$t^3 - 3 \cdot 3t^2 + 3 \cdot 9t - 27 - t + 3 = 0$$

We know that $t^3 - 3 \cdot 3t^2 + 3 \cdot 9t - 27 = (t - 3)^3$. Then

$$(t-3)^3 - (t-3) = 0$$
$$(t-3)(t-2)(t-4) = 0$$

We have three solutions:

 $t = 3, \quad t = 2, \quad t = 4$

Make the substitution again : $t = 2^x$:

$$2^x = 3$$
, $2^x = 2$, $2^x = 4$

Solve these equations:

$$x = \log_2 3$$
, $x = 1$, $x = 2$

Answer:

$$x = \log_2 3$$
, $x = 1$, $x = 2$