12. A student was asked to give the exact solution to the equation

$$2^{2x+4} - 9(2^x) = 0$$

The student's attempt is shown below:

$$2^{2x+4} - 9(2^x) = 0$$

$$2^{2x} + 2^4 - 9(2^x) = 0 \quad \leftarrow \divideontimes$$

Let $2^x = y$

$\divideontimes \rightarrow \quad y^2 - 9y + 8 = 0$

$$(y - 8)(y - 1) = 0$$

$$y = 8 \text{ or } y = 1$$

So $x = 3$ or $x = 0$

(a) handwritten annotation:

$$2^4 = 16,$$ not 8

(1 mark)

(a) handwritten annotation:

$$2^{2x+4}$$
$$= 2^{2x} \times 2^4$$

(1 mark)

(a) Identify the two errors made by the student.

(2)

(b) Find the exact solution to the equation.

(2)

(b)

$$2^{2x+4} - 9(2^x) = 0$$

$$2^{2x} \times 2^4 - 9(2^x) = 0$$

$$2^4 \times (2^x)^2 - 9(2^x) = 0$$

$$16(2^x)^2 - 9(2^x) = 0$$

$$\Rightarrow \quad 16y^2 - 9y = 0 \quad \text{where } y = 2^x \quad \text{(1 mark)}$$

$$y(16y - 9) = 0$$

$$y = 0, \tfrac{9}{16}$$

so, $2^x \neq 0$ ↑ no solution

$$2^x = \tfrac{9}{16}$$

$$x = \log_2\left(\tfrac{9}{16}\right) \quad \text{(1 mark)}$$