(1) 解:

$a_2 = 3a_1 - 4 = 5, a_3 = 3a_2 - 8 = 7$

故猜想 $a_n = 2n + 1$

证明:(一般猜想后证明只需证明其正确性, 既满足所给递推式, 但保险起见, 还是从递推式推导出通项, 既是证明, 又是推导)

$$a_{n+1} = 3a_n - 4n$$

$$a_{n+1} - 2(n+1) + 2 = 3a_n - 6n$$

$$a_{n+1} - 2(n+1) - 1 = 3a_n - 6n + 3 = 3(a_n - 2n - 1)$$

故 $\{a_n - 2n - 1\}$ 是公比为 3, 首项为 $a_1 - 2 - 1 = 0$ 的等比数列, 即全为 0 的数列

故 $a_n - 2n - 1 = 0 \Rightarrow a_n = 2n + 1$

(2) 解:

$2^n a_n = 2^n 2n + 2^n$

$S_n = \sum_{i=1}^{n} [2^n (2n + 1)]$

$$\begin{aligned}
2S_n &= \sum_{i=1}^{n} [2^{n+1}(2n+1)] \\
&= \sum_{i=1}^{n} [2^{n+1}(2n+3)] - 2\sum_{i=1}^{n} 2^{n+1} \\
&= S_{n+1} - 2 \times (2+1) - 2(2^{n+2} - 4) \\
&= S_n + 2^{n+1}(2n+3) - 2^{n+3} - 2
\end{aligned}$$

$$\begin{aligned}
S_n &= 2^{n+1} 2n + 3 \times 2^{n+1} - 4 \times 2^{n+1} - 2 \\
&= 2^{n+1} 2n - 2^{n+1} - 2
\end{aligned}$$