2. $\dfrac{\partial^2 w}{\partial x^2} + \dfrac{\partial^2 w}{\partial y^2} = aw^n + bw^{2n-1}.$

Solutions:

$$w(x,y) = \left[\frac{a(1-n)^2}{2(n+1)}(x \sin C_1 + y \cos C_1 + C_2)^2 - \frac{b(n+1)}{2an} \right]^{\frac{1}{1-n}},$$

$$w(x,y) = \left\{ \frac{1}{4}a(1-n)^2 \left[(x+C_1)^2 + (y+C_2)^2 \right] - \frac{b}{an} \right\}^{\frac{1}{1-n}},$$

where C_1 and C_2 are arbitrary constants.

Reference

Polyanin, A. D. and Zaitsev, V. F., *Handbook of Nonlinear Partial Differential Equations* , Chapman & Hall/CRC, Boca Raton, 2004.