Differential Equation Classification Exercises

Classify each differential equation as to whether it is exact, linear, separable or homogeneous.

(1) $$(x^4+y^4)dx - 2x^3ydy = 0 \quad \Leftrightarrow \quad \frac{dy}{dx} = \frac{x^4+y^4}{2x^3y}$$

(2) $$2\frac{dy}{dx} - \frac{1}{y} = \frac{2x}{y} \quad \Leftrightarrow \quad \frac{dy}{dx} = \frac{2x+1}{2y} \quad \Leftrightarrow \quad (2x+1)dx - 2ydy = 0$$

(3) $$\frac{dy}{dx} = \frac{xy+3x-y-3}{xy-2x+4y-8} \quad \Leftrightarrow \quad (xy+3x-y-3)dx - (xy-2x+4y-8)dy = 0$$

(4) $$(x+y)^2dx + (2xy+x^2-1)dy = 0 \quad \Leftrightarrow \quad \frac{dy}{dx} = \frac{(x+y)^2}{1-2xy-x^2}$$

(5) $$\frac{dy}{dx} = \frac{y-x}{y+x} \quad \Leftrightarrow \quad (x-y)dx + (x+y)dy = 0$$

(6) $$(5y-2x)\frac{dy}{dx} - 2y = 0 \quad \Leftrightarrow \quad \frac{dy}{dx} = \frac{2y}{5y-2x} \quad \Leftrightarrow \quad 2ydx - (5y-2x)dy = 0$$

(7) $$(x+4y^2)dy + 2ydx = 0 \quad \Leftrightarrow \quad \frac{dy}{dx} = -\frac{2y}{x+4y^2} \quad \Leftrightarrow \quad 2ydx + (x+4y^2)dy = 0$$