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One of the following is exact. Solve it with initial condition $y(1) = 1$.

1. $(2x - y) dx + (y + x) dy = 0$

2. $(2x - y) dx + (y - 2x) dy = 0$

3. $(2x - y) dx + (2 - x) dy = 0$

1. $M_y = -1$, $N_x = +1$ not exact

2. $M_y = -1$, $N_x = -2$ not exact

3. $M_y = -1$, $N_x = -1$ exact

$$\begin{aligned} F(x,y) &= \int M dx + c(y) \\ &= \int (2x - y) dx + c(y) \\ &= x^2 - xy + c(y) \end{aligned}$$

$$F_y = -x + c'(y) \text{ should } = 2 - x$$

so $c'(y) = 2$, hence $c(y) = 2y$.

$$F(x,y) = x^2 - xy + 2y = C \quad (\text{general solution})$$

To pass through $(1,1)$ $C = 1^2 - 1 + 2 = 2$ so

$$x^2 - xy + 2y = 2 \quad (\text{specific solution})$$

$$x^2 + y(2-x) = 2$$

$$y(2-x) = 2-x^2$$

$$y = \frac{2-x^2}{2-x}$$

