37) The difference between degree and order of a differential equation that represents the family of curves given by $y^2 = a\left(x + \frac{\sqrt{a}}{2}\right), a > 0$ is _____. [Main Feb. 26, 2021 (I)]

Solution : (2).

Given that
$$y^2 = a\left(x + \frac{\sqrt{a}}{2}\right)$$

Differentiating it w.r.t. x

$$2y \cdot \frac{dy}{dx} = a$$

From (i) and (ii).

$$y^2 = 2y \frac{dy}{dx}\left(x + \frac{1}{2}\sqrt{2y\frac{dy}{dx}}\right)$$

$$y - 2x\frac{dy}{dx} = \frac{dy}{dx}\sqrt{2y\frac{dy}{dx}}$$

$$\Rightarrow \left(y - 2x\frac{dy}{dx}\right)^2 = 2y^2\left(\frac{dy}{dx}\right)^3$$

$\Rightarrow$ Order 1 and degree 3

So, difference = 2