

(# 12) d)  $(x^2y^3 + y)^2 = 3x$ , Find  $\frac{dy}{dx}$

expand:  $x^4y^6 + 2x^2y^4 + y^2 = 3x$

$$\frac{d}{dx}(x^4y^6 + 2x^2y^4 + y^2) = \frac{d}{dx}(3x)$$

$$x^4 \cdot 6y^5 \frac{dy}{dx} + y^6 \cdot 4x^3 + 2x^2 \cdot 4y^3 \frac{dy}{dx} + y^4 \cdot 4x + 2y \frac{dy}{dx} = 3$$

$$6x^4y^5 \frac{dy}{dx} + 8x^2y^3 \frac{dy}{dx} + 2y \frac{dy}{dx} = 3 - 4x^3y^6 - 4xy^4$$

$$\frac{dy}{dx}(6x^4y^5 + 8x^2y^3 + 2y) = 3 - 4x^3y^6 - 4xy^4$$

$$\frac{dy}{dx} = \frac{3 - 4x^3y^6 - 4xy^4}{6x^4y^5 + 8x^2y^3 + 2y}$$

e)  $e^{xy} = y^2$

$$\frac{d}{dx}(e^{xy}) = \frac{d}{dx}y^2$$

$$e^{xy} \left( \frac{d}{dx}xy \right) = 2y \frac{dy}{dx}$$

$$e^{xy} \left[ x \frac{dy}{dx} + y \right] = 2y \frac{dy}{dx}$$

$$xe^{xy} \frac{dy}{dx} + ye^{xy} = 2y \frac{dy}{dx}$$

$$ye^{xy} = \frac{dy}{dx}(2y - xe^{xy})$$

$$\frac{dy}{dx} = \frac{ye^{xy}}{2y - xe^{xy}}$$