Find dy/dx of each equation.

1a) $x^3 - xy + y^2 = 7$

$$3x^2 - xy' - y + 2yy' = 0$$

$$(2y - x)y' = y - 3x^2$$

$$y' = \frac{y - 3x^2}{2y - x}$$

1b) $x^{1/2} + y^{1/2} = 16$

1c) $x^3y^3 - y = x$

1d) $\sin x + 2\cos 2y = 1$

1e) $x^3 - 3x^2y + 2xy^2 = 12$

Evaluate the derivative of the function at the given point.

2a) $y^2 = \dfrac{x^2 - 49}{x^2 + 49}$, $(7, 0)$

2b) $\tan(x + y) = x$, $(0, 0)$

Find the point(s) at which the graph of the equation has a vertical *or* horizontal tangent line.

3a) $25x^2 + 16y^2 + 200x - 160y + 400 = 0$

Find $\frac{d^2y}{dx^2}$ **in terms of *x* and *y*.**

4a) $x^2 - y^2 = 36$

4b) $y^2 = x^3$

$$x^2 - y^2 = 36$$

$$2x - 2y\frac{dy}{dx} = 0$$

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

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

$$\frac{dy}{dx} = \frac{x}{y}$$

$$\frac{dy}{dx} = \frac{x}{y}$$

$$\frac{d^2y}{dx^2} = \frac{y \bullet 1 - x \bullet 1\frac{dy}{dx}}{y^2}$$

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

$$\frac{d^2y}{dx^2} = \frac{y - \frac{x^2}{y}}{y^2} \bullet \frac{y}{y}$$

$$\frac{d^2y}{dx^2} = \frac{y^2 - x^2}{y^3}$$

Write the equation of the NORMAL line(s) to each equation at the given *x*-value.

5a) $y^2 = 2x + 14$ at $x = 1$

When $x = 1$ $y = \pm 4$

Derivative:

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

$$\frac{dy}{dx} = \frac{1}{y}$$

$$\frac{dy}{dx}(1,\ 4) = \frac{1}{4} \text{ and } \frac{dy}{dx}(1,\ \text{-}4) = -\frac{1}{4}$$

Normal line slopes: -4 at $(1,\ 4)$ and 4 at $(1,\ \text{-}4)$

So, equations of NORMAL lines are:

$y = 4(x-1) - 4$ & $y = -4(x-1) + 4$

5b) $3y^2 - 2x^2 - 4 = 0$ at $x = 1$

6) AP MULTIPLE CHOICE EXAMPLES

1) If $x^3 + 3xy + 2y^3 = 17$, then in terms of x and y, $\frac{dy}{dx} =$

(A) $-\frac{x^2 + y}{x + 2y^2}$ (B) $-\frac{x^2 + y}{x + y^2}$ (C) $-\frac{x^2 + y}{x + 2y}$

(D) $-\frac{x^2 + y}{2y^2}$ (E) $\frac{-x^2}{1 + 2y^2}$

2) If $x + 2xy - y^2 = 2$, then at the point $(1,1)$, $\frac{dy}{dx}$ is

(A) $\frac{3}{2}$ (B) $\frac{1}{2}$ (C) 0 (D) $-\frac{3}{2}$ (E) nonexistent

3) If $\tan(xy) = x$, then $\frac{dy}{dx} =$

(A) $\frac{1 - y\tan(xy)\sec(xy)}{x\tan(xy)\sec(xy)}$ (B) $\frac{\sec^2(xy) - y}{x}$ (C) $\cos^2(xy)$

(D) $\frac{\cos^2(xy)}{x}$ (E) $\frac{\cos^2(xy) - y}{x}$