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Do Now

1. Given $x^2y - 2y + 5 = 0$

a. Write an equation of the line tangent to the curve when $x = 1$
 $y - y_1 = m(x - x_1)$
 $y - 5 = 10(x - 1)$

b. Find all points where the curve is horizontal, if any.
 c. Find all points where the curve is vertical, if any.

a) To find y: $(1, 5)$ $x^2y - 2y + 5 = 0$
 $(1)y - 2y + 5 = 0$
 $y - 2y + 5 = 0$
 $-y = -5$ $y = 5$

$x^2 dy/dx + 2xy - 2 dy/dx = 0$
 $dy/dx (x^2 - 2) = \frac{-2xy}{x^2 - 2} = \frac{-2(1)(5)}{1^2 - 2}$
 $= \frac{-10}{-1} = 10$

2. Given $x^3 + 6 = 3y$
 a. Write an equation of the line tangent when $y = 2$.
 b. Find all points where the curve is horizontal, if any.
 c. Find all points where the curve is vertical, if any.

b) set numerator of $dy/dx = 0$
 $-2xy = 0$
 $x = 0$ or $y = 0$

$x^2y - 2y + 5 = 0$
 $x^2(0) - 2(0) + 5 = 0$
 $5 = 0$
 NO

$x^2y - 2y + 5 = 0$
 $-2y = -5$
 $y = 5/2$
 Horizontal line at point $(0, 5/2)$

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c) To see where the curve is vertical, set denom of $dy/dx = 0$

$x^2 - 2 = 0$ $x^2y - 2y + 5 = 0$
 $\sqrt{x^2} = \sqrt{2}$ $(\sqrt{2})^2 y - 2y + 5 = 0$
 $x = \pm\sqrt{2}$ $2y - 2y + 5 = 0$
 $5 = 0$
 NO

$(-\sqrt{2})^2 y - 2y + 5 = 0$
 $2y - 2y + 5 = 0$
 $5 = 0$
 NO

There are no points where the curve is vertical

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2a) $y^2 + 6 = xy$
 a) $2 + 6 = x(2)$ $(3, 2)$
 $8 + 6 = 2x$
 $14 = 2x$
 $x = 7$

$3y^2 dy/dx + 0 = x dy/dx + y$
 $3y^2 dy/dx - x dy/dx = y$
 $dy/dx (3y^2 - x) = y$
 $dy/dx = \frac{y}{3y^2 - x} = \frac{2}{3(2)^2 - 7} = \frac{2}{12 - 7} = \frac{2}{5}$

$y - 2 = \frac{2}{5}(x - 7)$

b) $y = 0$
 $0^2 + 6 = 0$
 $6 = 0$
 none

c) $3y^2 - x = 0$
 $3y^2 = x$
 $y^2 + 6 = 3y^2$
 $6 = 2y^2$
 $3 = y^2$
 $y = \pm\sqrt{3}$
 $x = 3y^2$
 $x = 3(\sqrt{3})^2 = 3 \cdot 3 = 9$
 $x = 3(-\sqrt{3})^2 = 3 \cdot 3 = 9$
 $(9, \sqrt{3})$
 $(9, -\sqrt{3})$

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