If $xy^2-5-y^2=x$, find the equation of the tangent line when $x=3$ in the fourth quadrant.

$3y^2-5-y^2=3$

$2y^2=8$

$y^2=4$

$y=\pm 2$

$(3,-2)$ $(3,2)$

$y+2=\frac{3}{8}(x-3)$

$x\,2y\,dy/dx+y^2-2y\,dy/dx=1$

$2xy\,dy/dx-2y\,dy/dx=1-y^2$

$\frac{dy/dx(2xy-2y)}{2xy-2y}=\frac{1-y^2}{2xy-2y}$

$\frac{1-(-2)^2}{2(3)(-2)-2(-2)}=\frac{-3}{-8}=\frac{3}{8}$

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$-5-x^2y-x^2=5y$

Find the coordinate point on the curve where $x=-2$ and the line tangent to the curve is horizontal.

$0-x^2\,dy/dx-2xy-2x=5\,dy/dx$

$-x^2\,dy/dx-5\,dy/dx=2xy+2x$

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

$2xy+2x=0$

$2(-2)y+2(-2)=0$

$-4y-4=0$

$-4y=4$

$y=-1$

$(-2,-1)$

Plug $(-2,-1)$ into orig equation, check if point exists on the curve

$-5=-5$ ✓

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Given the equation of the curve $x^2+y^2=2x$, find all points on the curve where the line tangent is vertical.

$2x+2y\,dy/dx=2$

$\frac{2y\,dy/dx}{2y}=\frac{2-2x}{2y}=\frac{2(1-x)}{2y}$

$y=0$

$x^2+0=2x$

$x^2-2x=0$

$x(x-2)=0$

$0,2$

$(0,0),(2,0)$

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$x=xy-y^3+4$

Find equations of all tangent lines when $x=4$

$4=4y-y^3+4$

$0=4y-y^3$

$0=y(4-y^2)$

$0=y(2-y)(2+y)$

$y=0 \quad y=2 \quad y=-2$

$(4,0),(4,2)(4,-2)$

$1=x\,dy/dx+y-3y^2\,dy/dx$

$\frac{1-y=dy/dx(x-3y^2)}{x-3y^2}$

$\frac{1-0}{4-3(0)^2}\to 1/4$ Repeat for each coordinate

$y-0=1/4(x-4)$

$y+2=-3/8(x-4)$

$y-2=1/8(x-4)$

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