**Math 31**
**Derivative HW #2**

Name Key. 19

1. Find $\frac{dy}{dx}$ by implicit differentiation.

a) $9x^2 - 16y^2 = 144$

$\frac{d}{dx}(9x^2 - 16y^2 = 144)$

$18x - 32y\frac{dy}{dx} = 0$

$\frac{dy}{dx} = \frac{-18x}{-32y}$

$\frac{dy}{dx} = \frac{9x}{16y}$

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b) $x^2y^3 = 10$

$y = fg$
$y' = f'g + fg'$

$\frac{d}{dx}(x^2y^3 = 10)$

$(2x)(y^3) + (x^2)(3y^2)\left(\frac{dy}{dx}\right) = 0$

$2xy^3 + 3x^2y^2\frac{dy}{dx} = 0$

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

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

2. Find the slopes of the tangent(s) to each of the following graphs at the indicated position.

a) $2x^5 + 5y^3 = -38$ when $x = 1$.

$10x^4 + 15y^2\frac{dy}{dx} = 0$

$\frac{dy}{dx} = -\frac{10x^4}{15y^2}$

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$\frac{dy}{dx} = -\frac{2x^4}{3y^2}$

$x=1 \ldots \ 2(1)^5 + 5y^3 = -38$

$5y^3 = -40$

$y^3 = -8$

$y = -2$

Point $(1,-2)$

$y'(1) = -\frac{2(1)^4}{3(-2)^2} = \frac{-2}{12}$

slope at $(1,-2)$ is $-\frac{1}{6}$

b) $(x-1)^2 + (y+3)^2 = 17$, at $(2,1)$.

$2(x-1)(1) + 2(y+3)\left(\frac{dy}{dx}\right) = 0$

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

$\frac{dy}{dx} = -\frac{(x-1)}{(y+3)}$

$y'(2) = -\frac{(2-1)}{(1+3)} = -\frac{1}{4}$

slope at $(2,1)$ is $-\frac{1}{4}$

3. Find the equation of the tangent line to the ellipse $x^2+9y^2=37$ at the point (-1,2).

$2x + 18y\frac{dy}{dx} = 0$

$\frac{dy}{dx} = -\frac{2x}{18y}$ OR $\frac{dy}{dx} = -\frac{x}{9y}$

slope at (-1, 2)

4

$m = -\frac{(-1)}{9(2)}$

$m = \frac{1}{18}$

$\frac{1}{18} = \frac{y-2}{x+1}$

$x+1 = 18y - 36$

$x - 18y + 37 = 0$

4. Find the third order derivative of $g(x)=\frac{x^5}{20}+6x^2-\frac{8}{\sqrt{x}}$. Express your answer as a rational expression with positive exponents.

$y = \frac{1}{20}x^5 + 6x^2 - 8x^{-1/2}$

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$y' = \frac{1}{4}x^4 + 12x + 4x^{-3/2}$

$y'' = x^3 + 12 - 6x^{-5/2}$

$y''' = 3x^2 + 0 + 15x^{-7/2}$

$= 3x^2 + 15x^{-7/2}$

$= 3x^{-7/2}\left[x^{11/2} + 5\right]$

$= \frac{3(x^{11/2} + 5)}{x^{7/2}}$