Study 2.5, # 1-17, 21-31, 51, 53

Goal: to find the derivative of a variable that is not expressed explicitly in terms of other variables.

Examples: Find dy/dx

$$xy = 1$$
 $\sin y = x$ $x^2 + y^2 = 25$

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2.5 Implicit Differentiation

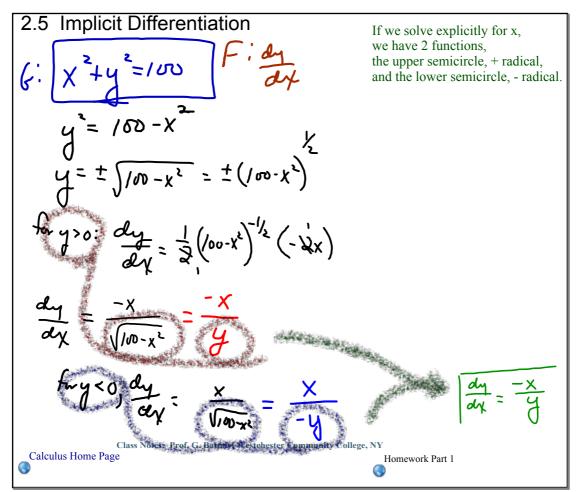
If we solve explicitly for x, we have 2 functions, the upper semicircle, a pos. radical, and the lower semicircle, a neg. radical.

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F: dy

derivative with respect to x

Since $y = \pm \sqrt{\sqrt{n} - x^2}$ treat y^2 as a composite function

Instead of solving explicitly, use the **Chain Rule** on y² to solve implicitly.

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F: dy

derivative with respect to x

Since
$$y = \pm \sqrt{\sqrt{n-x^2}}$$

treat y² as a composite function

Instead of solving explicitly, use the **Chain Rule** on y² to solve implicitly.

$$\frac{dy}{dy} = \frac{-2x}{2y} = \left(-\frac{x}{y}\right)$$

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2.5 Implicit Differentiation

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$$x^{2}-y^{2}=16$$

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

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

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

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2.5 Implicit Differentiation

$$\chi^{3} + \chi^{3} = 8$$

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$$x^{3}+y^{3}=8$$

$$3x^{2}+3y^{2}dy=0$$

$$3y^{2}dy=-3x^{2}$$

$$dy=-x^{2}$$

$$dy=-x^{2}$$

$$y^{2}$$

2.5 Implicit Differentiation

dy = -x y

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

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

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2.5 Implicit Differentiation

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$$x^{2}+y^{2}-4x+6y+9=0 \qquad F: dy$$

$$2x+2y \frac{dy}{dx}-4+6 \frac{dy}{dx}+0=0$$

$$2y \frac{dy}{dx}+6 \frac{dy}{dx}=4-2x$$

$$(2y+6) \frac{dy}{dx}=4-2x$$

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

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2.5 Implicit Differentiation

$$x^{2} + y^{2} - 4x + 6y + 9 = 0$$

$$y^{2} + 6y + 9 = -x^{2} + 4x$$

$$(y + 3)^{2} = -x^{2} + 4x$$

$$y + 3 = \pm \sqrt{-x^{2} + 4x}$$

$$y = -3 \pm \sqrt{-x^{2} + 4x}$$

$$y = -3 \pm \sqrt{-x^{2} + 4x}$$

$$(x + b)^{2} = 0$$

$$x^{2} + 2ab + b^{2}$$

$$x^{3} + 2bx + b^{3}$$

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2.5 Implicit Differentiation

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

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G:
$$\chi^2 + y^2 = 36$$

F: eq. tang line and normal line at (6,0) and at $(5,\sqrt{11})$

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