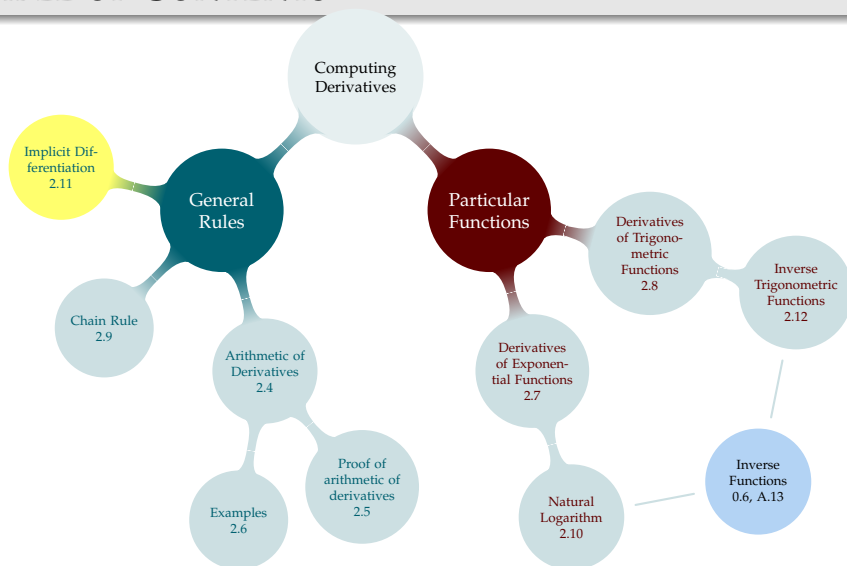


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IMPLICITLY DEFINED FUNCTIONS

$$y^2 + x^2 + xy + x^2y = 1$$

Which of the following points are on the curve?

$(0, 1)$, $(0, -1)$, $(0, 0)$, $(1, 1)$

If $x = -3$, what is y ?

2.11: Implicit Diff

Implicitly Defined Functions

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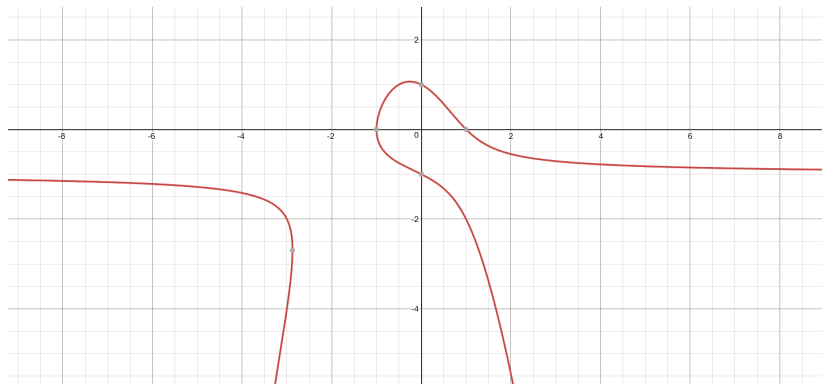
Which of the following points are on the curve?
(0, 1), (0, -1), (0, 0), (1, 1)

If $x = -3$, what is y ?

Things to emphasize:

- One x might have multiple y
- You won't be asked to graph these
- We can solve questions without *needing* to see their graphs
- Locally looks like a function (explain "locally") so all the stuff that worked before still works now if we restrict where we're looking

$$y^2 + x^2 + xy + x^2y = 1$$



Still has a slope: $\frac{\Delta y}{\Delta x}$

Locally, y is still a function of x .

$$y^2 + x^2 + xy + x^2y = 1$$

Consider y as a function of x . Can we find $\frac{dy}{dx}$?

$$\frac{d}{dx}[y] =$$

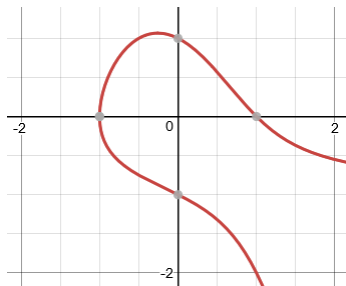
$$\frac{d}{dx}[x] =$$

$$\frac{d}{dx}[1] =$$

$$y^2 + x^2 + xy + x^2y = 1$$

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

Necessarily, $\frac{dy}{dx}$ depends on **both** y and x . Why?




NOW
YOU



Suppose $x^4y + y^4x = 2$. Find $\frac{dy}{dx}$ at the point $(1, 1)$.

2.11: Implicit Diff

NUM
YOU  Suppose $x^3y + y^3x = 2$. Find $\frac{dy}{dx}$ at the point $(1, 1)$.

Students often struggle knowing when to replace variables with constants.

NOW
YOU

Suppose $\frac{3y^2 + 2y + y^3}{x^2 + 1} = x$. Find $\frac{dy}{dx}$ when $x = 0$, and the equations of the associated tangent line(s).

Use implicit differentiation to differentiate $\log(x)$, $x > 0$.

$$\log x = y(x)$$

$$x = e^{y(x)}$$

Use implicit differentiation to differentiate $\log |x|$, $x < 0$.

Use implicit differentiation to differentiate $\log_a(x)$, where $a > 0$ is a constant and $x > 0$.

Use implicit differentiation to differentiate $\log_a |x|$, $a > 0$.

Included Work



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screenshot of graph using Desmos Graphing Calculator,

<https://www.desmos.com/calculator> (accessed 19 October 2017), 6



screenshot of graph using Desmos Graphing Calculator,

<https://www.desmos.com/calculator> (accessed 19 October 2017), 4