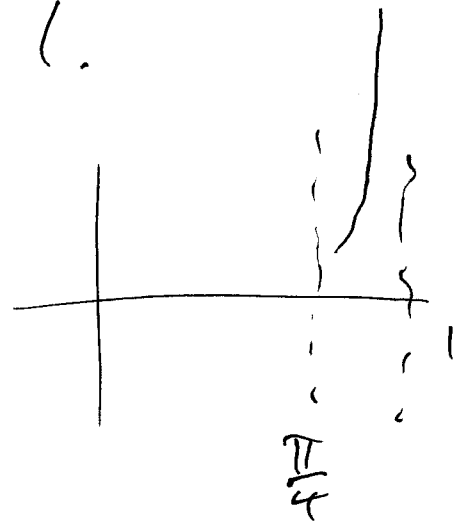


3.4 #1

$x \geq 0$

$$\frac{dy}{dx} = y^2 + x^n, \quad y(0) = 1$$

Show vertical asymptote
between $\frac{\pi}{4}$ and 1.

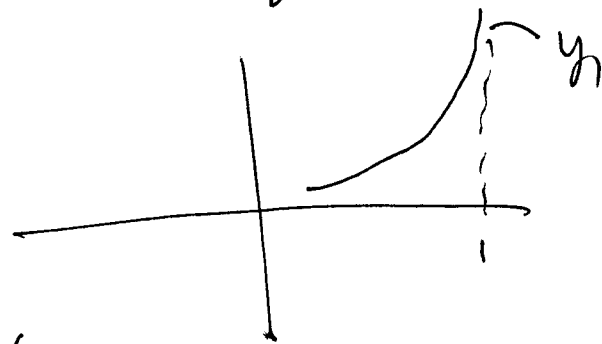


Consider

$$\frac{dy_1}{dx} = y_1^2, \quad y_1(0) = 1$$

Then $y_1 \leq y$ cause $y^2 \leq y^2 + x^n$

$$y_1 = \frac{1}{1-x}$$



$\Rightarrow y$ has vertical asymptote at $x=1$ or before.

$$\frac{dy}{dx} = y^2 + x^n \quad n > 1$$

$$\text{for } 0 \leq x \leq 1, \quad x^n \leq 1$$

$$\frac{dy_2}{dx} = y^2 + 1 \quad y(0) = 1$$

Comp. Thm says

$$y_2 \geq y \quad \text{for } 0 \leq x \leq 1$$

$$\text{Solve } \frac{dy_2}{dx} = y^2 + 1, \quad y(0) = 1$$

$$y = \tan(x + C) = \tan\left(x + \frac{\pi}{4}\right)$$

vertical asympt at $x = \frac{\pi}{4}$.

\Rightarrow vert. asympt at y is

at $x = \frac{\pi}{4}$ or later.

4.3 Modelling

Example Car is going 60 mph.

It starts to a stop.

t (sec)	v (mph)	$\frac{dv}{dt}$ (ft/s)
0	60	
5	52.2	-1.39
10	46.1	-1.08
15	37.5 41.4	-.86
20	37.5	-.71
25	34.3	-.59
30	31.6	

Goal : Find a diff eq. for $v(t)$

~~v(t)~~ $v(t)$ = velocity.

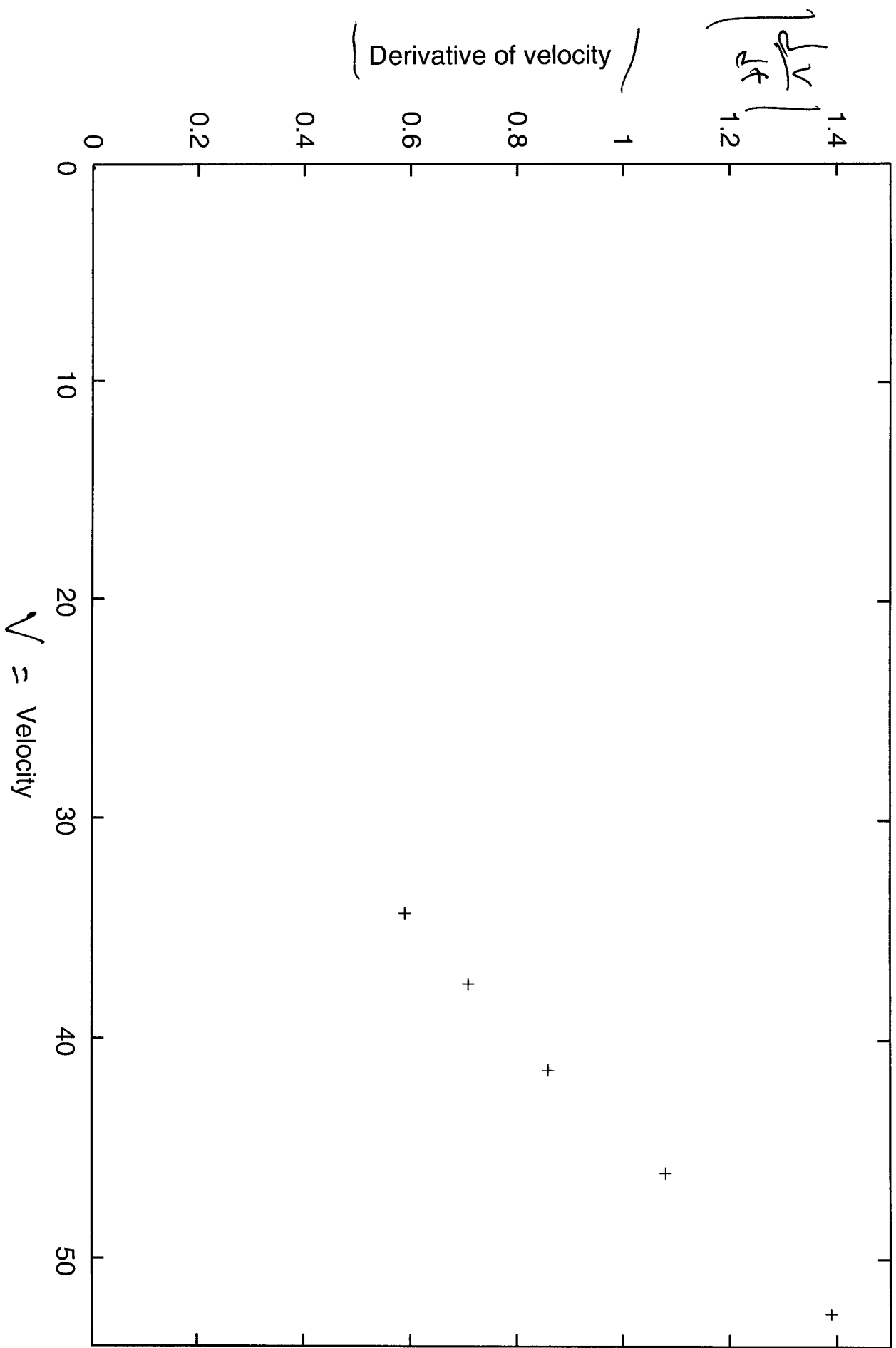
$\frac{dv}{dt}$ depends on v ?

Possibilities $\frac{dv}{dt} = \text{const}$

$$\frac{dv}{dt} = -c v \quad c > 0$$

$$\frac{dv}{dt} = -c v^p$$

Derivative of velocity as function of velocity



Derivative of velocity as function of velocity squared

