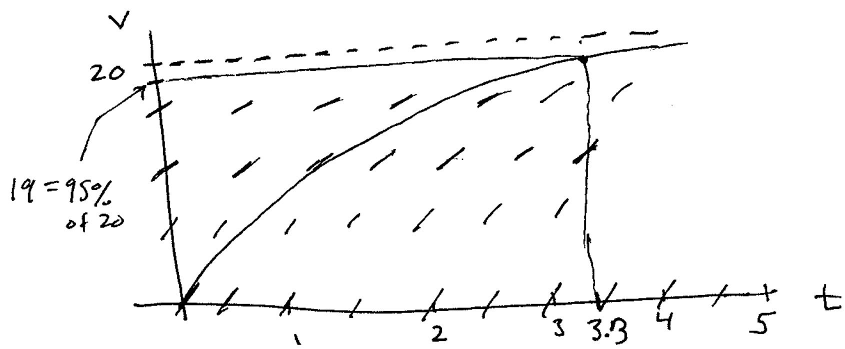
Section 1.3

25

$$\frac{dv}{dt} = 32 - 1.6v$$

$$v(0) = 0$$



limiting velocity $= \lim_{t \to \infty} v(t) = 20$ ft/sec

20 ft/sec = 13.6 mph, can survive with a good haystack

Hit 95% of 20 at $t \approx 3.3$

(actual exact answer is $t = 1.8723$)

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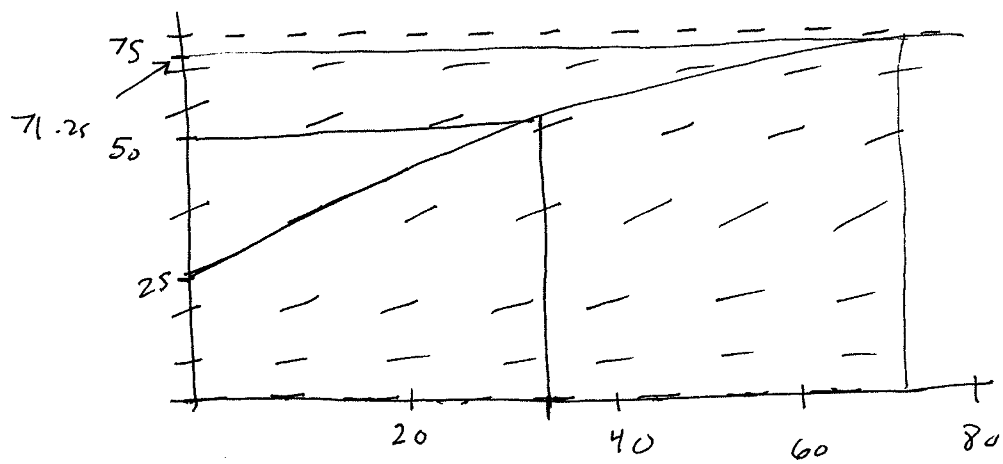
$$\frac{dP}{dt} = .0225P - .0003P^2$$

$.0225P - .0003P^2 = 0$ when $P = 0$ and $P = 75$



take about $t \approx 33$ months to double

take about $t \approx 72$ months to hit 95%

#29

a) $y(x) = \begin{cases} 0 & x \le c \\ (x-c)^3 & x > c \end{cases}$, ODE is $y' = 3y^{2/3}$

For $x \le c$: $y' = 0$, $3y^{2/3} = 0$, so $y' = 3y^{2/3}$

For $x > c$: $y' = 3(x-c)^2$, $3y^{2/3} = 3(x-c)^{3 \cdot 2/3} = 3(x-c)^2$

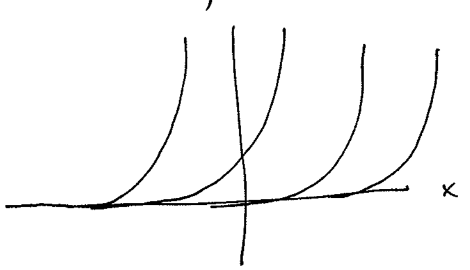
so $y' = 3y^{2/3}$

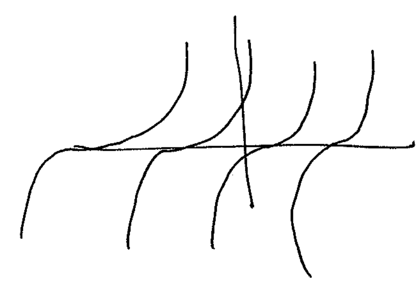
So y satisfies ODE.

Also, $y = (x-c)^3$ (for all x) satisfies ODE

(basically by previous calculation)

b) Sketch of piecewise solutions: $y = (x-c)^3$ (for all x) solutions





d) Thm. 1 does not apply:

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

$\frac{\partial f}{\partial y} = 2y^{-1/3}$

is not cont. at $y = 0$

c) Uniqueness fails for any (a,b)