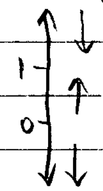
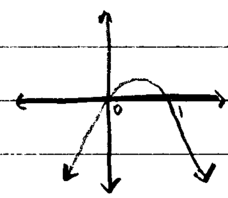
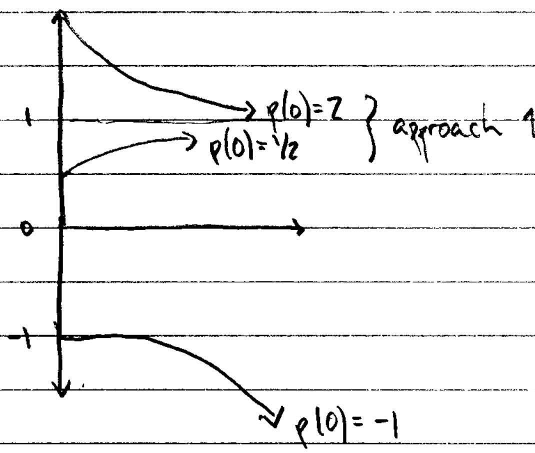
Pages 62, 63 Homework 2

1. Phase diagram



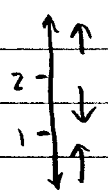
dP/dt vs. P



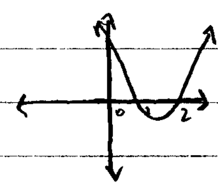


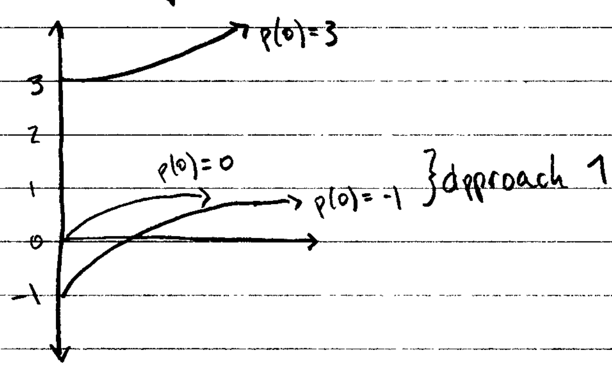
$p(t)$

2. Phase diagram



dP/dt vs. P





Pages 71-72 Homework 2

1. ⓑ $x(0) = 1$ implies $f(x) = dx/dt > 0$ from the graph
Thus $x(t)$ is increasing as $x(t) \to 2$
At $x(t) = 2$, $f(x) = dx/dt = 0$ from the graph
Here $x(t)$ reaches equilibrium.

ⓒ $x(0) = 1$ implies $f(x) = dx/dt < 0$ from the graph
Thus $x(t)$ is decreasing as $x(t) \to -2$
At $x(t) = -2$, $f(x) = dx/dt = 0$ from the graph
Here $x(t)$ reaches eqm.

ⓓ $x(0) = 1$ implies $f(x) = dx/dt > 0$ from the graph
Thus $x(t)$ is increasing as $x(t) \to 3$
At $x(t) = 3$, $f(x) = dx/dt = 0$ from the graph
Here $x(t)$ reaches equilibrium

2. ⓐ $x(0) = -4$ implies $f(x) = dx/dt < 0$ from the graph
As $f(x) = dx/dt \neq 0$ for $x < -4$, $x(t)$ will continue decreasing without bound

ⓒ $x(0) = -4$ implies $f(x) = dx/dt > 0$ from the graph
Thus $x(t)$ is increasing as $x(t) \to -2$
At $x(t) = -2$ $f(x) = dx/dt = 0$ from the graph
Here $x(t)$ reaches equilibrium

6. Note the similarity of this equation to the logistic equation:
$$\frac{dP}{dt} = k(1 - P/n) \cdot P = -\frac{k}{n}P^2 + kP \text{ where } n = \text{carrying capacity}.$$
At low values of $t + P$, $(1 - P/n) \approx 1$. Thus you can solve for k with a normal exponential equation by measuring two population
As P increases, it tends towards n, the carrying capacity allowing you to estimate that quantity by measuring a late-stage
Then; $v = k/n$, $\alpha = k$.