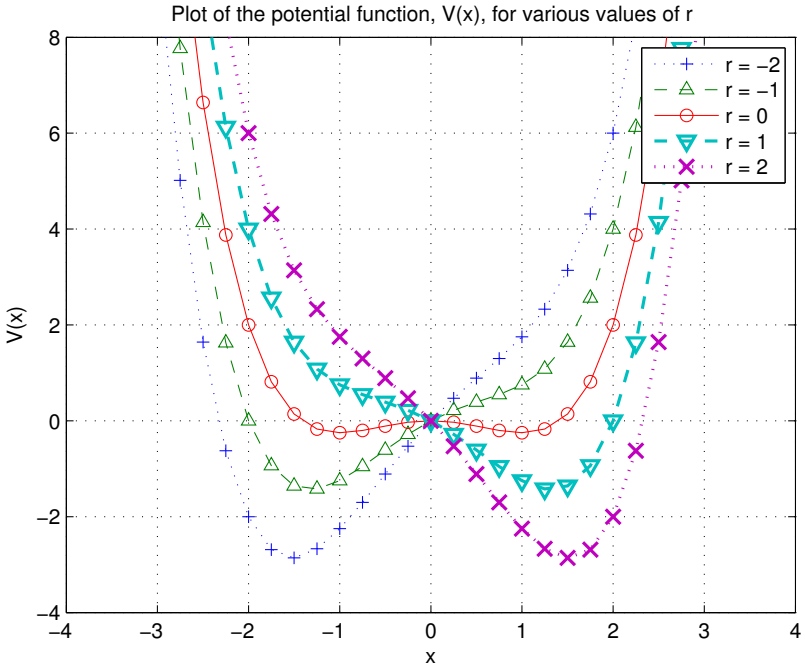
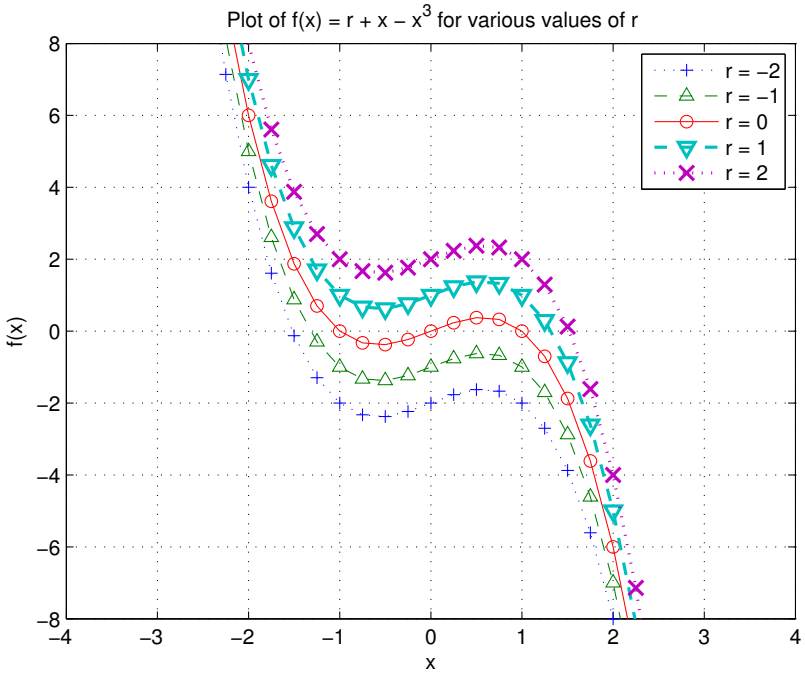
Recitation 2 Handout

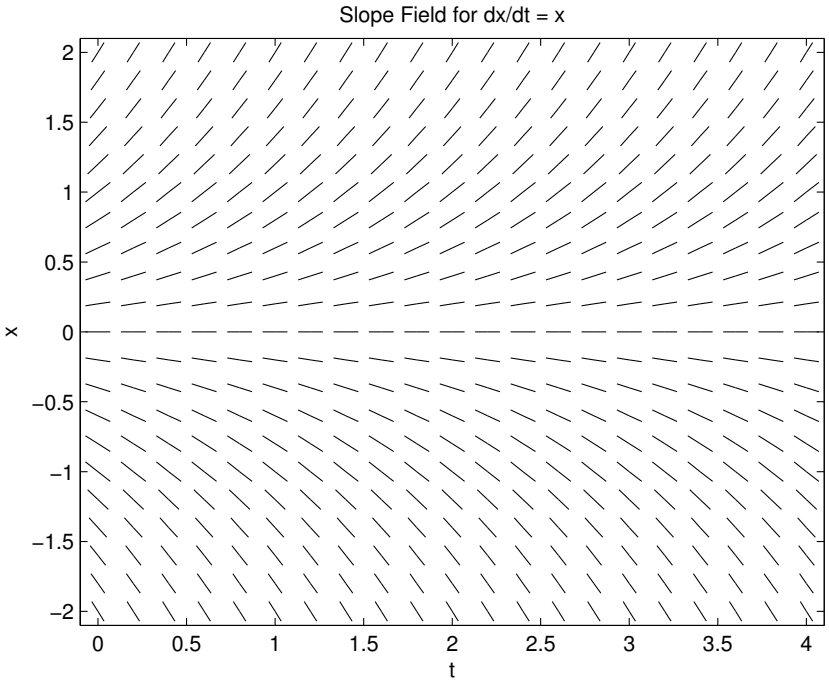
Strogatz 2.7.6



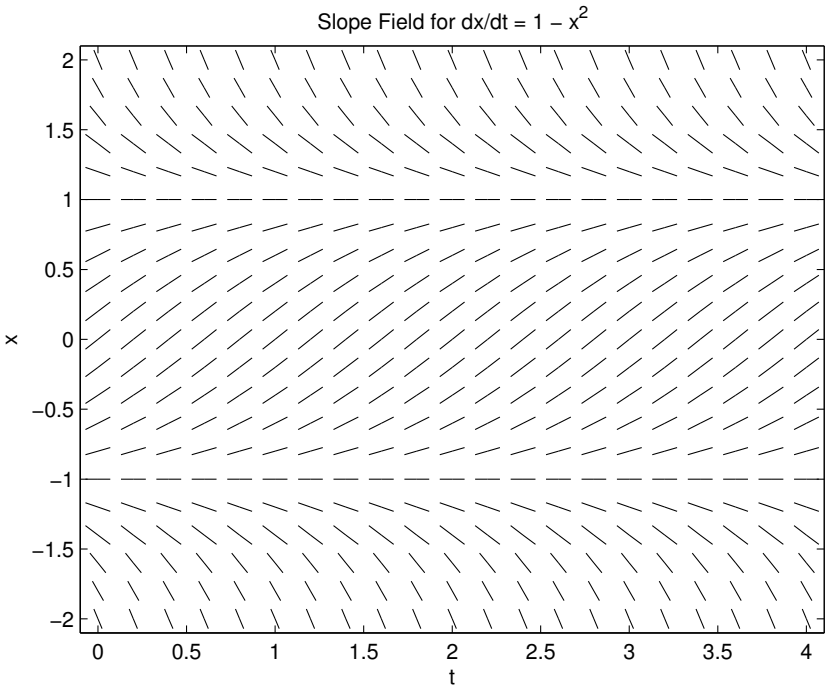


Strogatz 2.8.2 (a-c)

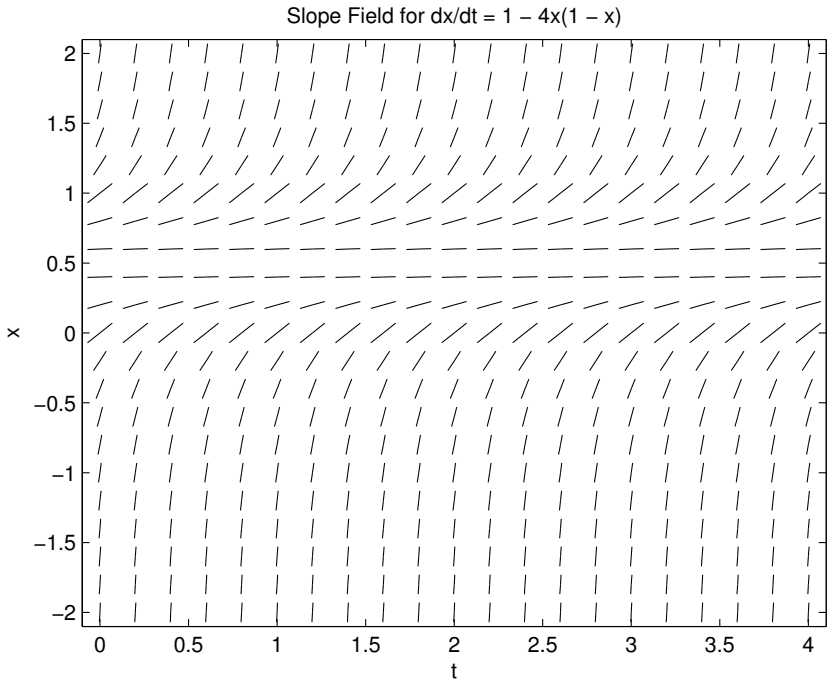
(a) $\dot{x} = x$



(b) $\dot{x} = 1 - x^2$



(c) $\dot{x} = 1 - 4x(1 - x)$



MATLAB Code

```
function hw2_drawvec
% MATLAB file hw2_drawvec.m, for Homework 2
% Katie Byl, April 8, 2013. UCSB. ECE 183 / ME 169 / PHYS 106
figure(1); clf
u = [-.05 .05];
for t = 0:.25:10
for x = pi*(-1:.05:1)
dx = fn(x);
plot(t+u,x+dx*u,'k'); hold on; grid on
end
end
end
function dx = fn(x)
% Below is where you define x'=F(x)
dx = sin(x);
end
```

MATLAB Basics

- **Troubleshooting**
  `help`, `lookfor`
- **Operators and Special Characters**
  `+, −, /, *, .^, :, ;, =`
  `==, ~=, &&, &`

  Example:

```
>> x = [0 4], y = 2 + 0.5*x.^2
x =
     0     4
y =
     2    10
```

- **Useful commands**
  `sqrt, exp, log, log10`
  `pi, j, i, eye`
  `sin, cos, tan`
  `asin, acos, atan`
  `abs, angle`
  `ones, zeros`

  Example:

```
>> z = sin(pi/4) - sqrt(2)/2
z =
 -1.1102e-16
```

  Example:

```
>> w = abs(3*ones(2,3) - 4*j)
w =
     5     5     5
     5     5     5
```

- **Plotting**
  `plot(X,Y,S)`
  `grid, axis, legend`
  `title, xlabel, ylabel`

- **M-files**
  M-files can either be a list of commands (script) or a function. They have the extensions '.m'.

- **Functions**

```
function [vout] = myfunction(vin)
⋮
end
```

  Example:

```
function dx = fn(x)
  dx = sin(x);
end
```

- **`if` statements**

```
IF expression
  statements
ELSEIF expression
  statements
ELSE
  statements
END
```

  Example:

```
if x > 0
  y = log(x);
end
```

- **`for` loops**

```
FOR variable = expr, statement, ...,
  statement END}
```

  Example:

```
u = zeros(1,5);
for v = 1:5
  if v < 4
    u(v) = v^2 + 1;
  end
end
```

  Note: The above script is equivalent to
  `u = ((1:5).^2 + 1).*(1:5 < 4);`

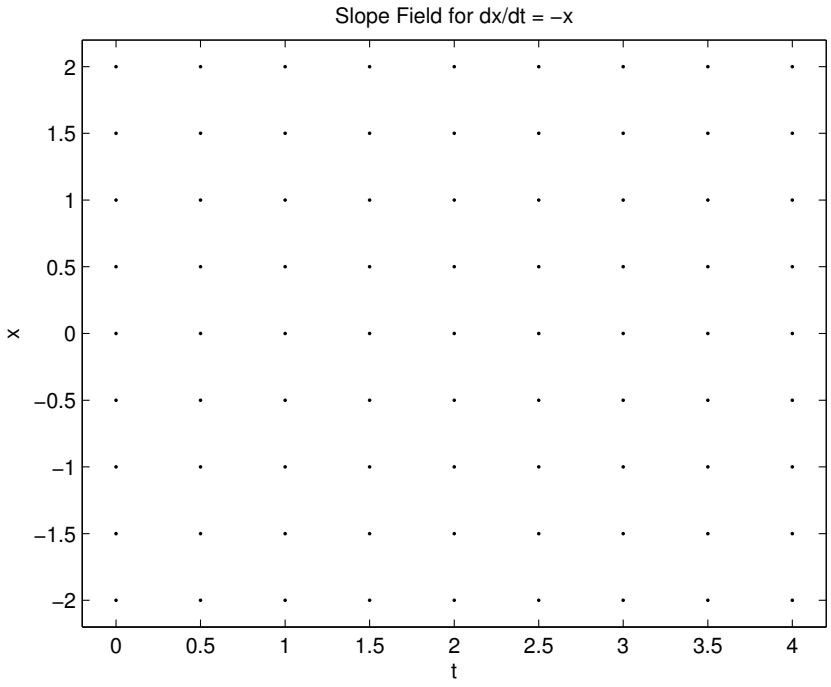
Name(s): _____

Recitation 2: Exercises

Exercise A

Sketch the slope field for the following differential equation on the given set of axes (you only need to draw slope line segments on the dots). Then "integrate" the equation manually by drawing trajectories that are everywhere parallel to the local slope. (Draw trajectories for three different $x(0)$: one positive, one equal to zero, and one negative.)

$$\dot{x} = -x$$



Exercise B

For the following vector field, plot the potential function $V(x)$ on the given set of axes and identify all the equilibrium points and their stability. (Choose the constant of integration '$C = 0$' for convenience.)

$$\dot{x} = \sin(x)$$