Programming Assignment 3 Solutions

Problem 1: (a) Phase portrait plot:
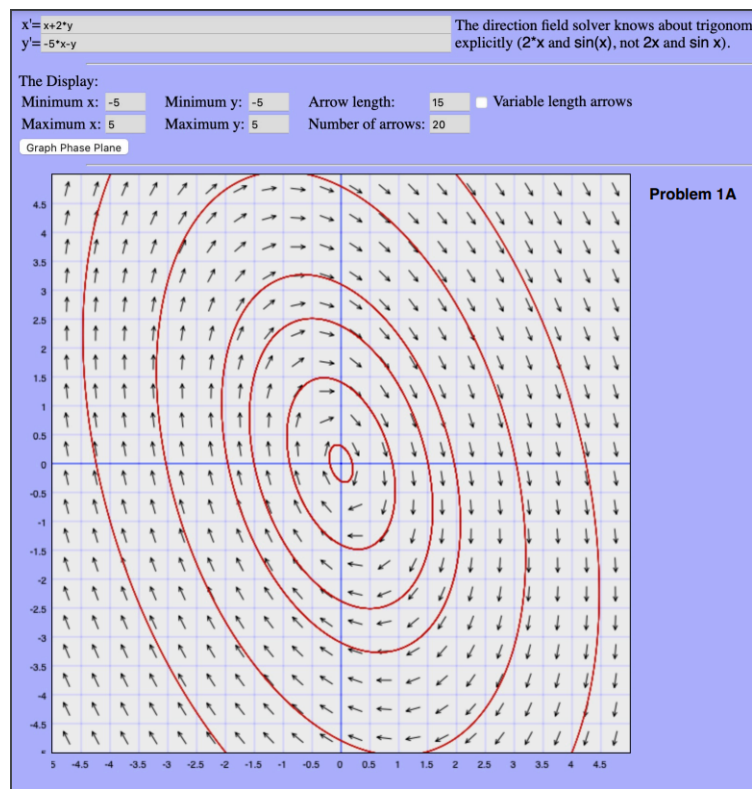
(b) Phase portrait plot:

The direction field solver:

x'= x+y
y'= 4*x-2*y

The direction field solver knows about trig
explicitly (2*x and sin(x), not 2x and sin x)

The Display:
Minimum x: -5   Minimum y: -5   Arrow length: 15   ☐ Variable length arrows
Maximum x: 5   Maximum y: 5   Number of arrows: 20

Graph Phase Plane
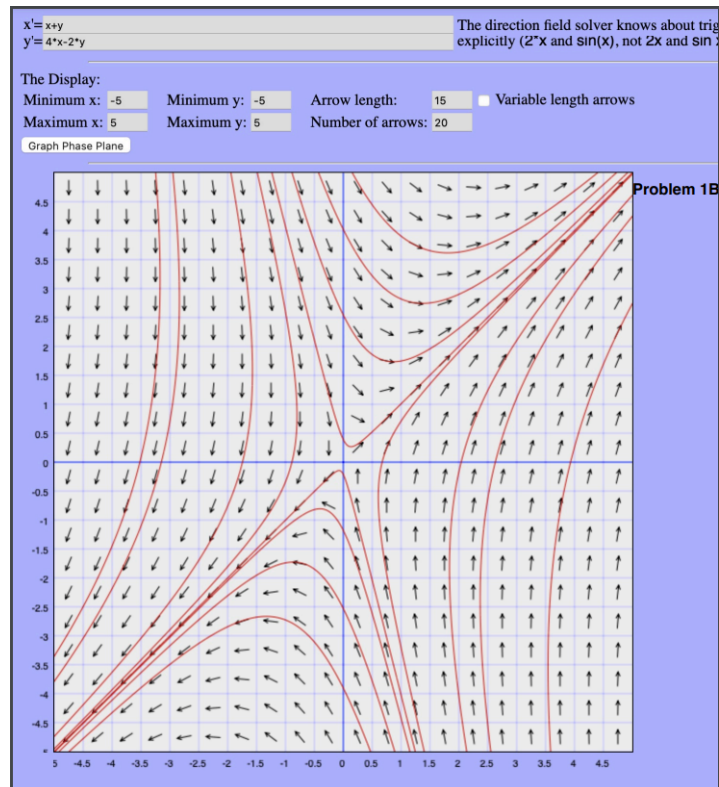
Problem 1B

Problem 2:   (a) Code:

```python
from sympy import *

t = symbols('t')
x1 = Function('x1')
x2 = Function('x2')
deq1 = diff(x1(t),t) - 5*x1(t)+x2(t)
deq2 = diff(x2(t),t) - 3*x1(t)-x2(t)
print(dsolve([deq1,deq2]))
```

Solution:

```
[Eq(x1(t), C1*exp(2*t)/3 + C2*exp(4*t)), Eq(x2(t), C1*exp(2*t) + C2*exp(4*t))]
```

(b) Code:

```
from sympy import *

t = symbols('t')
x1 = Function('x1')
x2 = Function('x2')
deq1 = diff(x1(t),t) - x1(t)+4*x2(t)
deq2 = diff(x2(t),t) - 4*x1(t)+7*x2(t)
print(dsolve([deq1,deq2],ics=({x1(0):3,x2(0):2})))
```

Solution:

```
[Eq(x1(t), 4*t*exp(-3*t) + 3*exp(-3*t)), Eq(x2(t), 4*t*exp(-3*t) + 2*exp(-3*t))]
```