

### Question 01.

```
disp("Question 01.")
```

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```
% Defining symbolic variables
```

```
syms x y k
```

```
% Finding critical points
```

```
eqns1 = [(x-4*y) == 0, (-x+y) == 0];  
eqns1
```

```
eqns1 = (x - 4 y = 0  y - x = 0)
```

```
[x1 y1] = solve(eqns1, [x y]);  
[x1 y1]
```

```
ans = (0 0)
```

```
% Finding matrix for eigenvalues
```

```
eqns2 = ((+1-k)*(+1-k))-((-1)*(-4)) == 0;  
eqns2
```

```
eqns2 = (k - 1)2 - 4 = 0
```

```
k = solve(eqns2, k);  
k
```

```
k =
```

```
 $\begin{pmatrix} -1 \\ 3 \end{pmatrix}$ 
```

```
% Critical point is stable spiral point since eigenvalues have negative real part
```

```
% Plotting phase plane trajectories
```

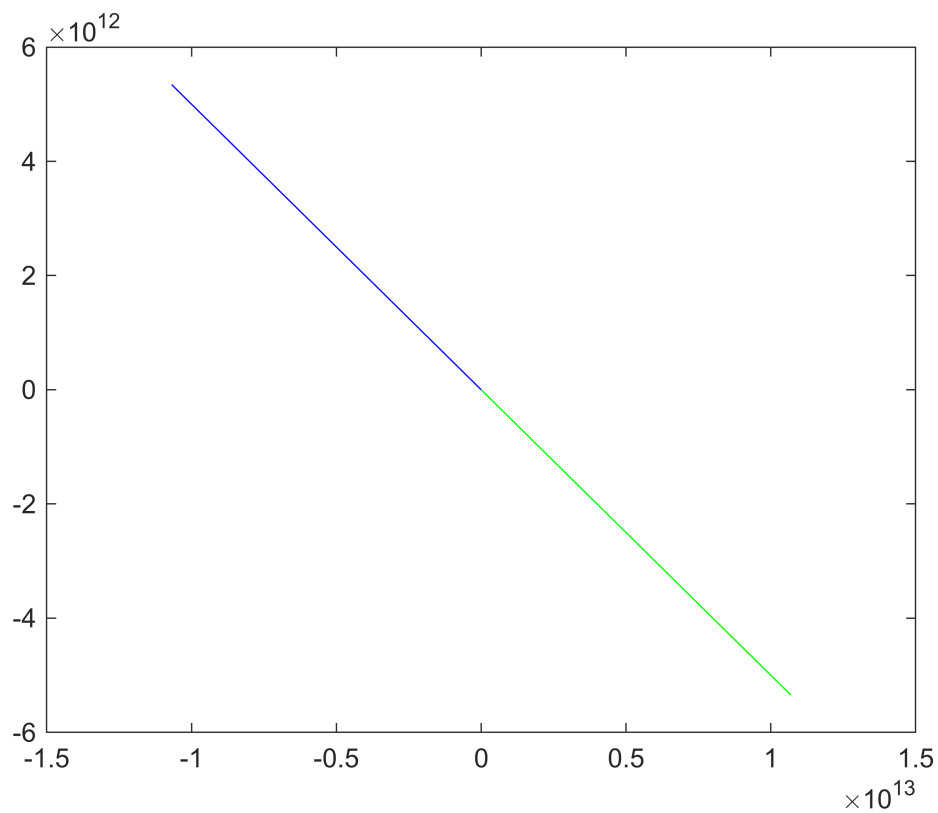
```
for a = -0.5:0.1:0.5  
    Y0 = [-1;a];  
    [T,Y] = ode45(@eqns3,[0 10],Y0);  
    plot(Y(:,1),Y(:,2),'blue -')  
    hold on  
end
```

```
for a = -0.5:0.1:0.5
```

```

Y0 = [1;a];
[T,Y] = ode45(@eqns3,[0 10],Y0);
plot(Y(:,1),Y(:,2),'green -')
hold on
end

```



```

% Defining function for equations

```

```

function F = eqns3(t,y)
    F=[y(1)-4*y(2); -y(1)+y(2)];
end

```