Построение фазовых портретов системы с одной степенью свободы // Дорошин А.В., 29.10.2024

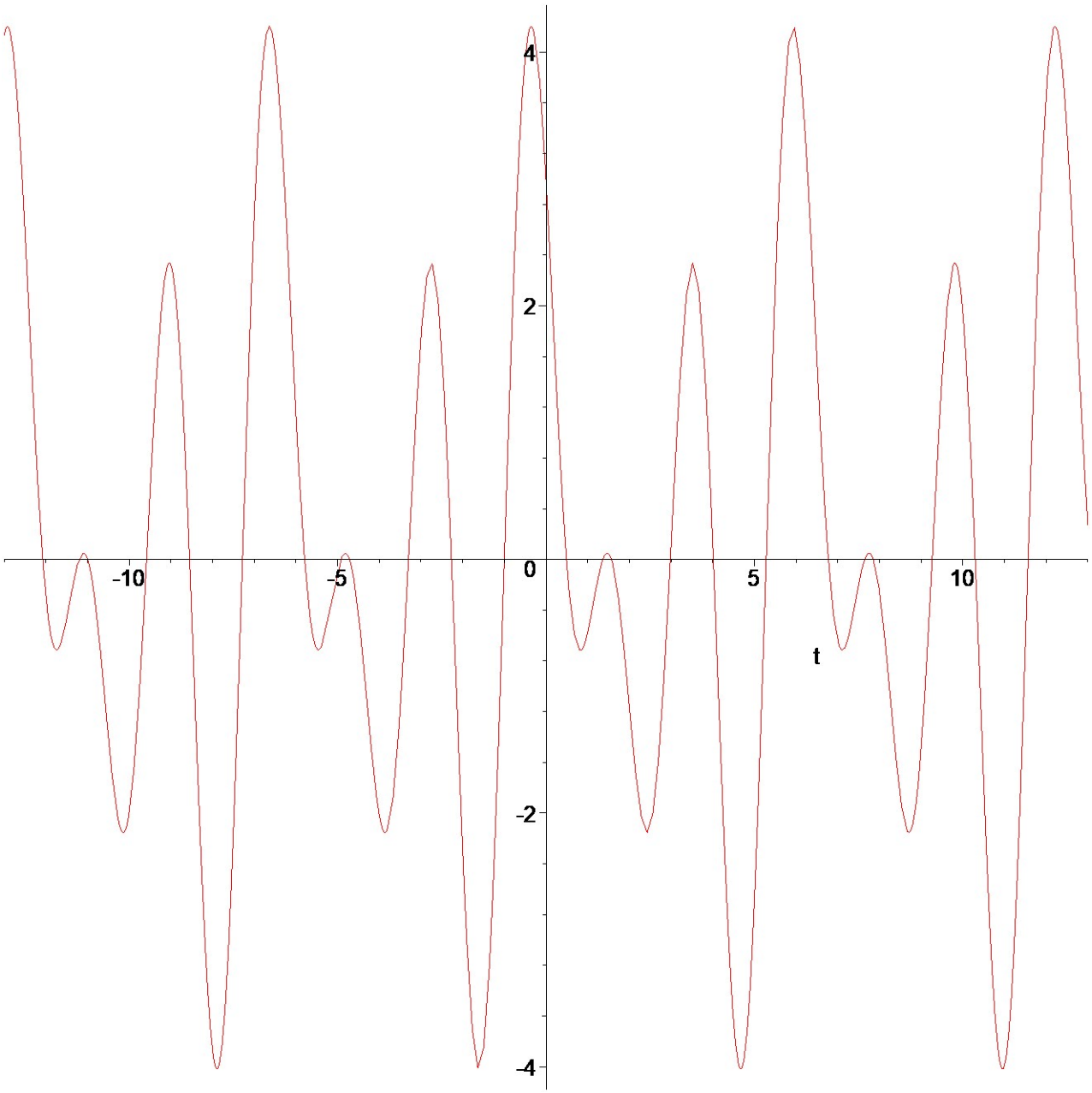
```
>
> restart;
>
```

Функция потенциальной энергии:

```
> P:=xx->cos(xx)+2*cos(2*xx)-2*sin(3*xx);
```

$$P := xx \to \cos(xx) + 2\cos(2\,xx) - 2\sin(3\,xx)$$

```
> plot(P(t),t=-13..13);
```



Потенциальная сила:

```
> f:=-diff(P(xx),xx);
```

$$f := \sin(xx) + 4\sin(2\,xx) + 6\cos(3\,xx)$$

Диф. уравнения для системы с одной степенью свободы с потенциальной

силой:

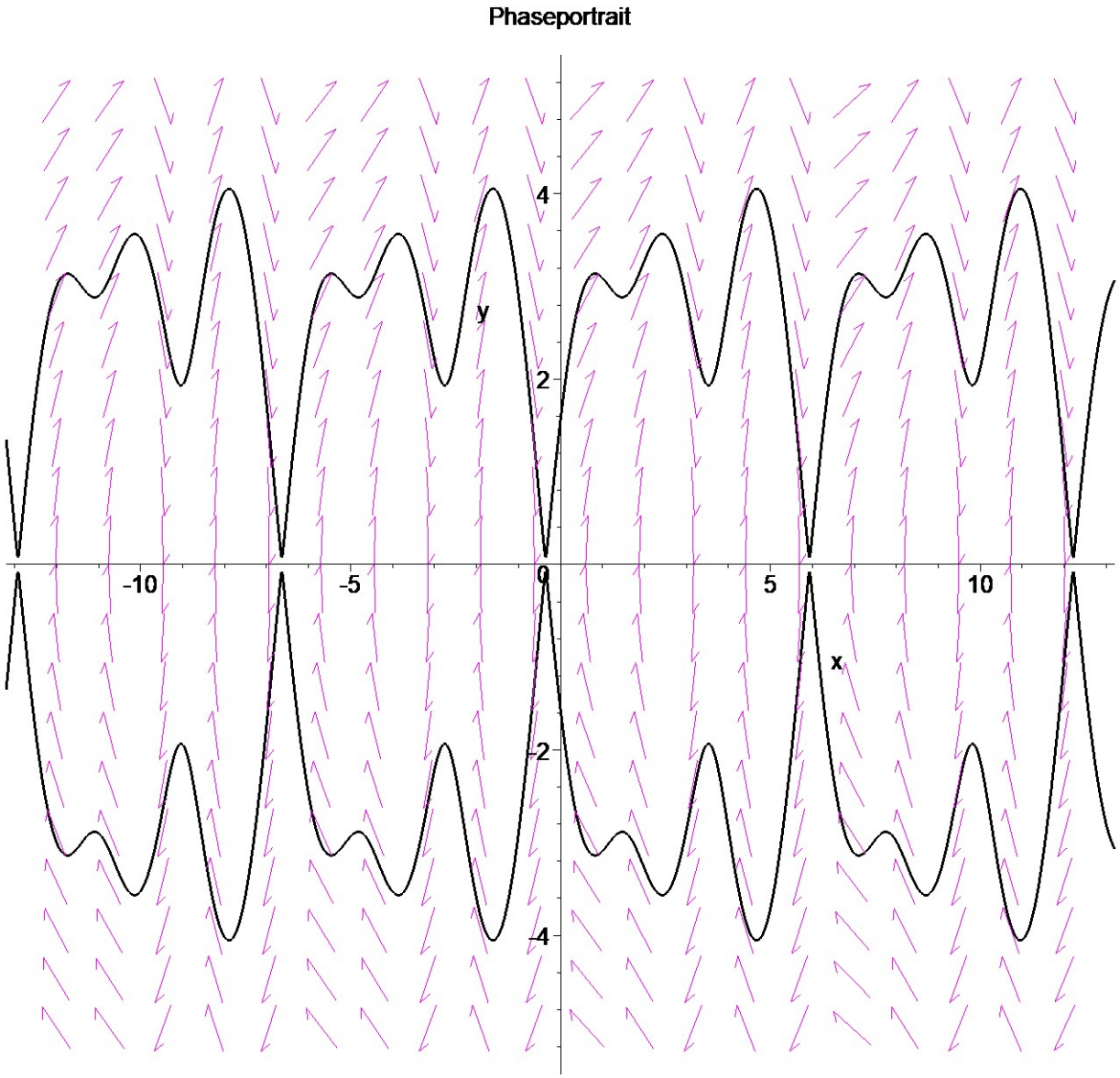
```
> ur1:=diff(x(t),t)=y(t):
> ur2:=diff(y(t),t)=sin(x(t))+4*sin(2*x(t))+6*cos(3*x(t)):
```

Подключение графичческих библиотек:

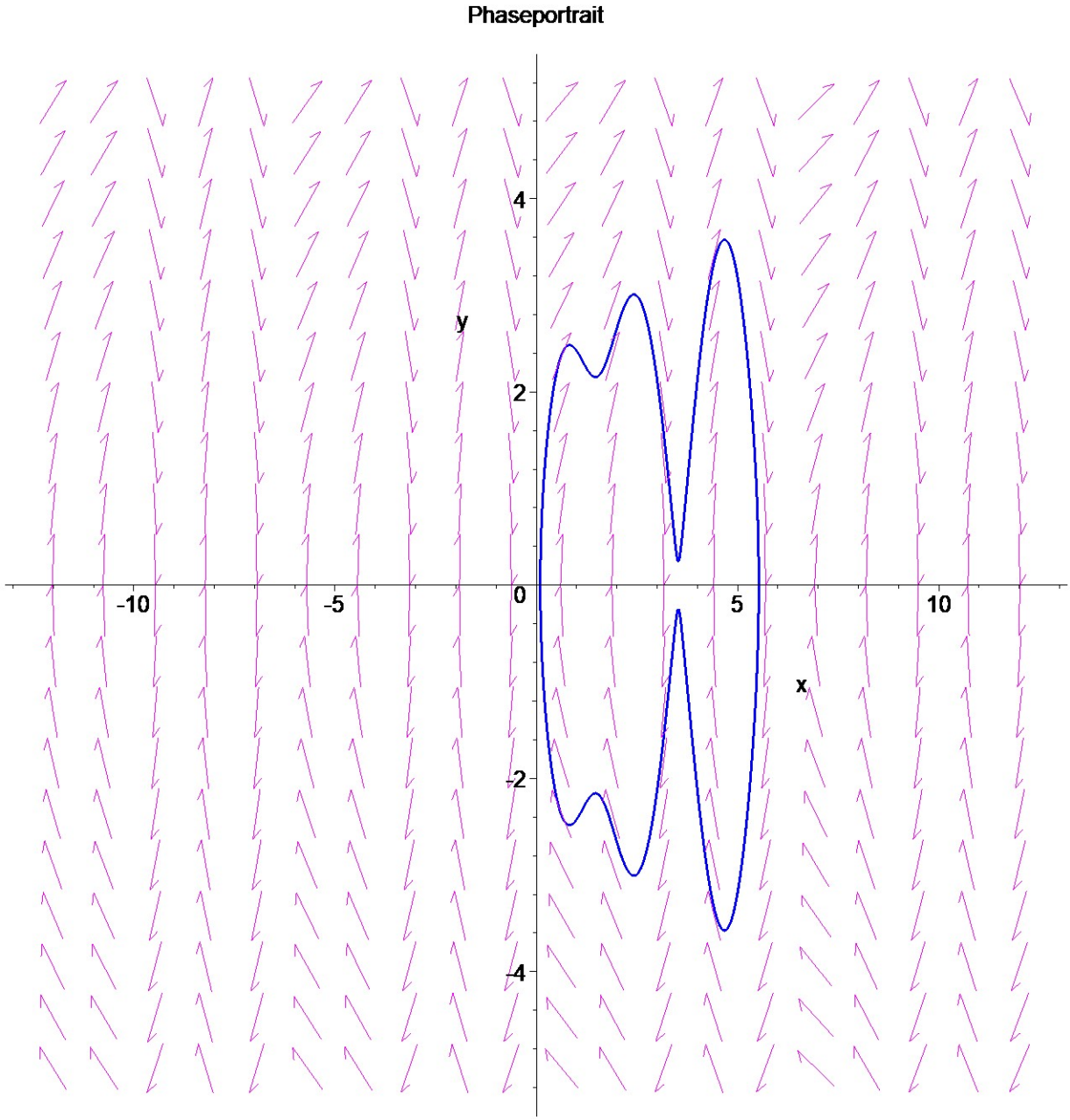
```
> with(plots):with(DEtools):
Warning, the name changecoords has been redefined
```

Построение фазовых портретов:

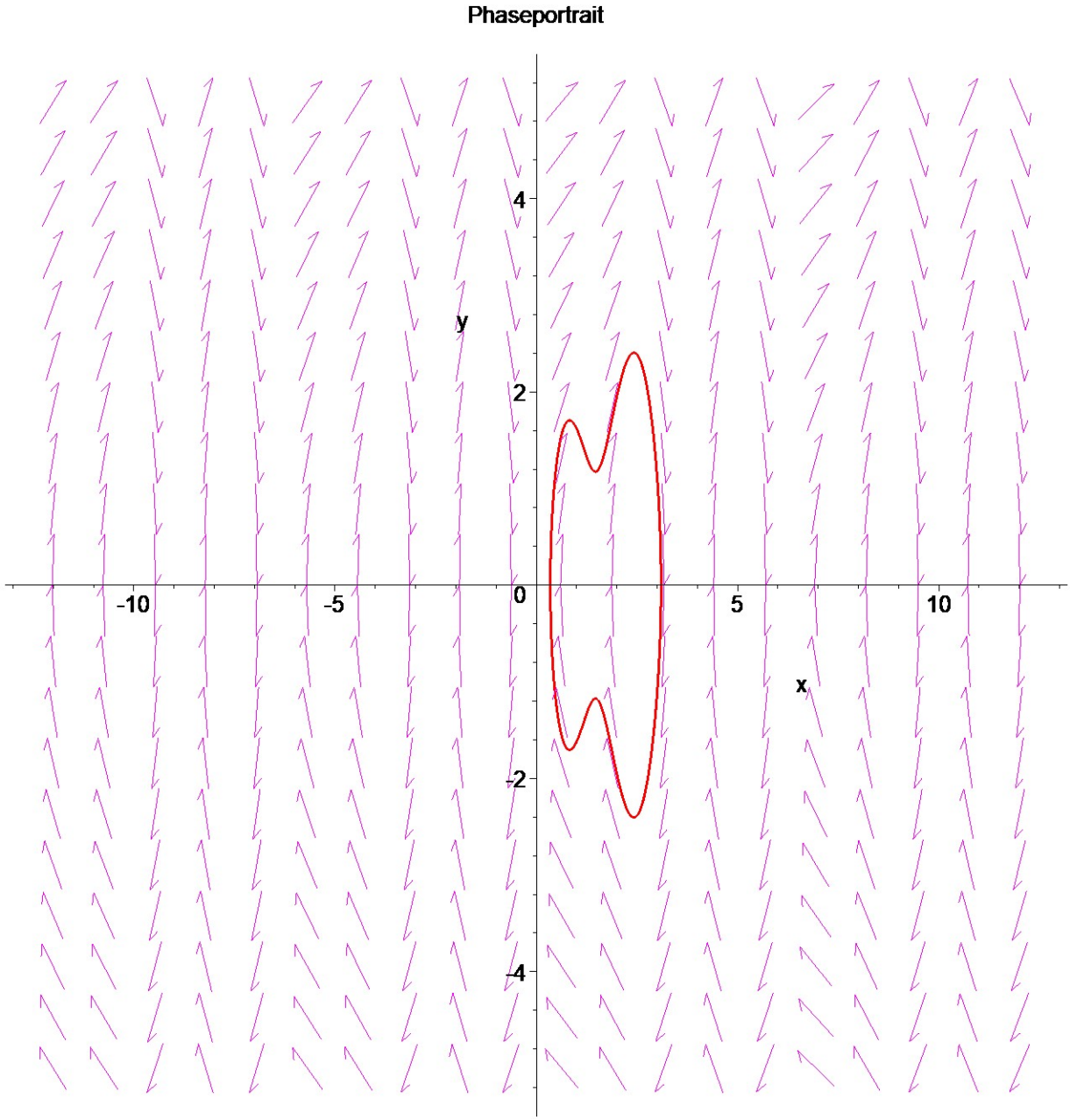
```
> pic1:=phaseportrait([ur1,ur2],[x(t),y(t)],t=-45..45,[[x(0)=-0.34
  ,y(0)=0.1],[x(0)=-0.34,y(0)=-0.10]],x=-12..12,y=-5..5,stepsize=.
  01,title=`Phaseportrait`,colour=magenta,linecolor=black):display
  (pic1);
```



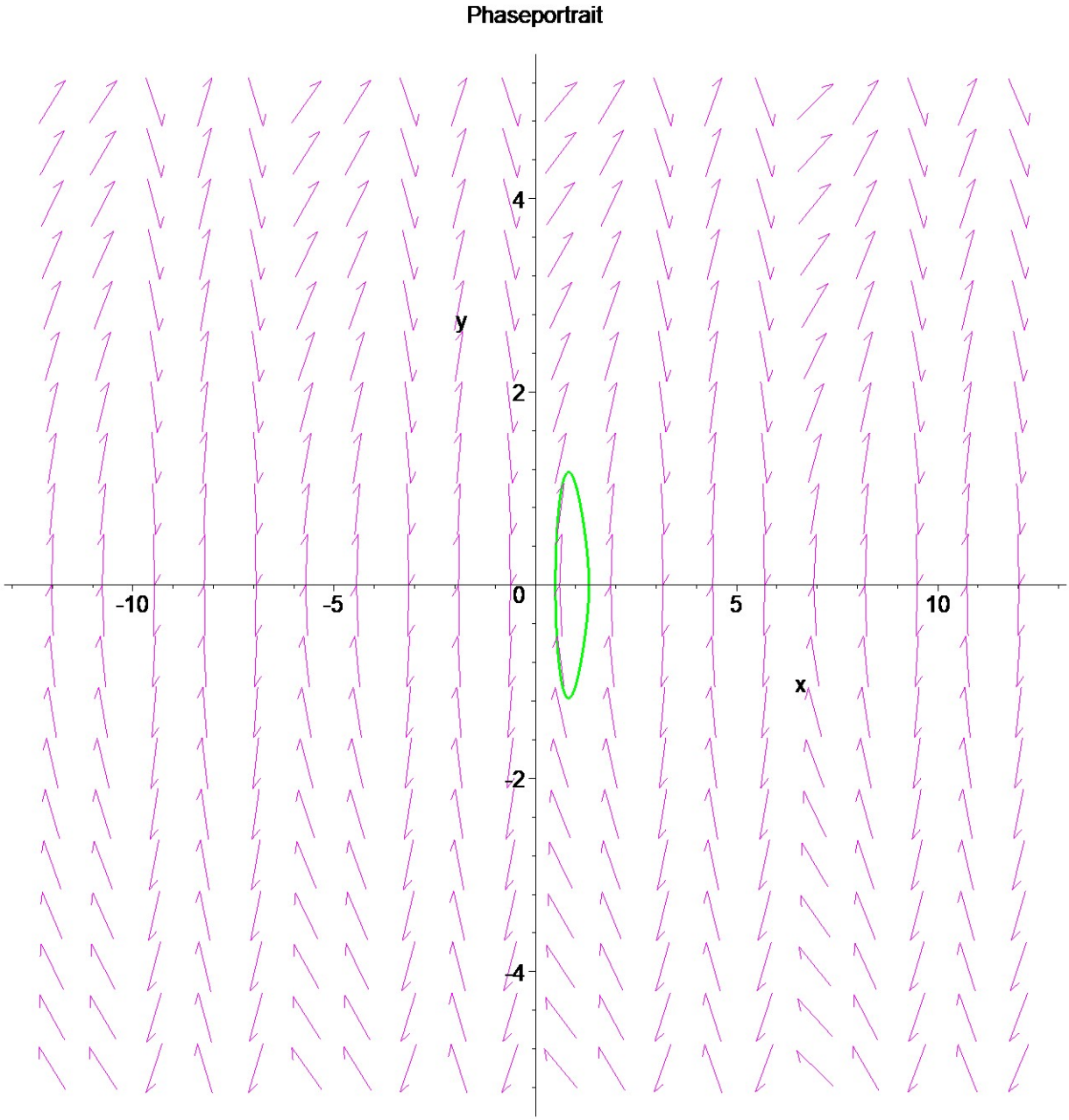

```
> pic2:=phaseportrait([ur1,ur2],[x(t),y(t)],t=-45..45,[[x(0)=0.1,y
  (0)=0.1],[x(0)=0.1,y(0)=-0.10]],x=-12..12,y=-5..5,stepsize=.01,t
  itle=`Phaseportrait`,colour=magenta,linecolor=blue):display(pic2
  );
```



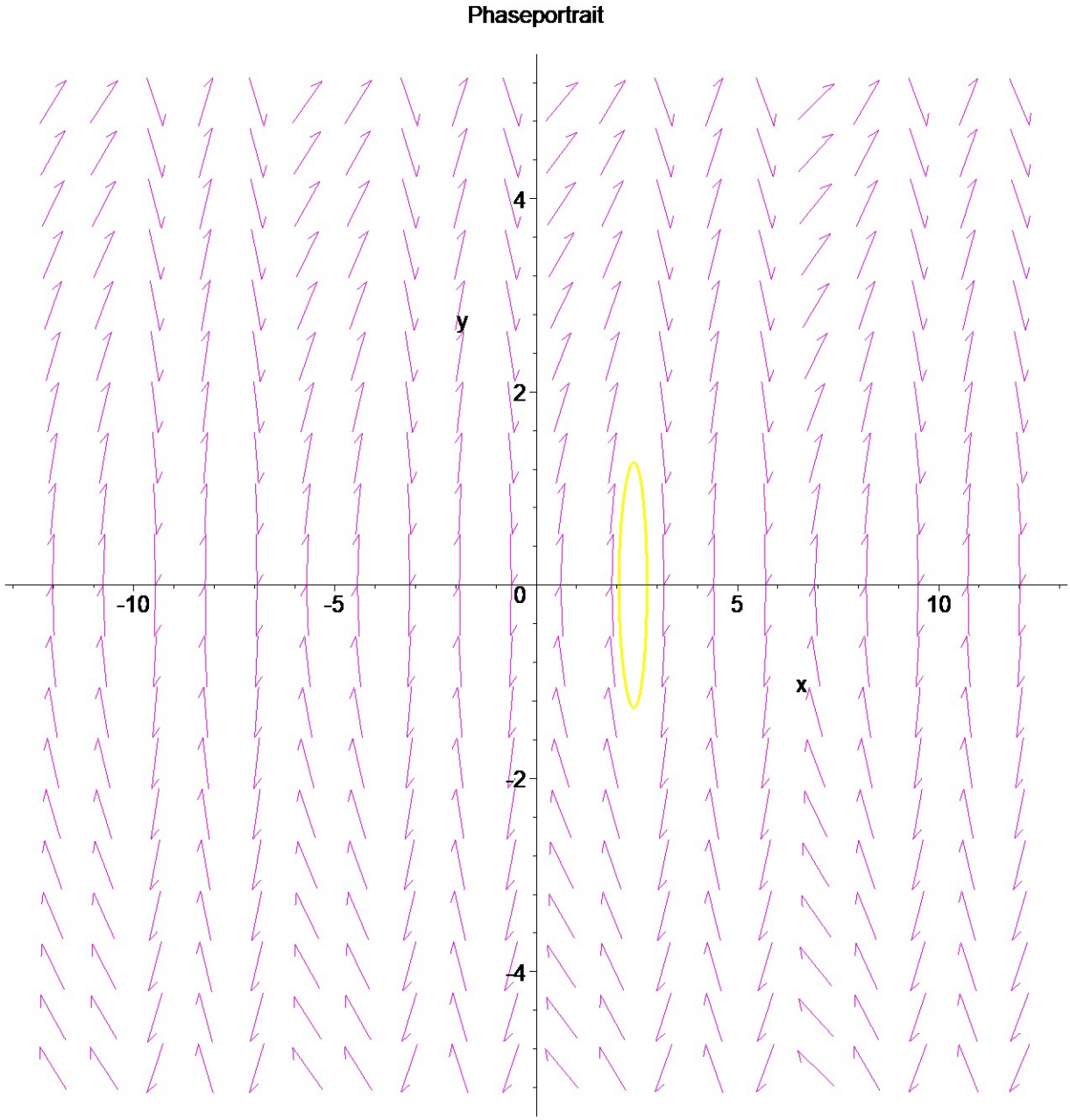

```
> pic3:=phaseportrait([ur1,ur2],[x(t),y(t)],t=-45..45,[[x(0)=0.35,
  y(0)=0.1],[x(0)=0.35,y(0)=-0.10]],x=-12..12,y=-5..5,stepsize=.01
  ,title=`Phaseportrait`,colour=magenta,linecolor=red):display(pic
  3);
```



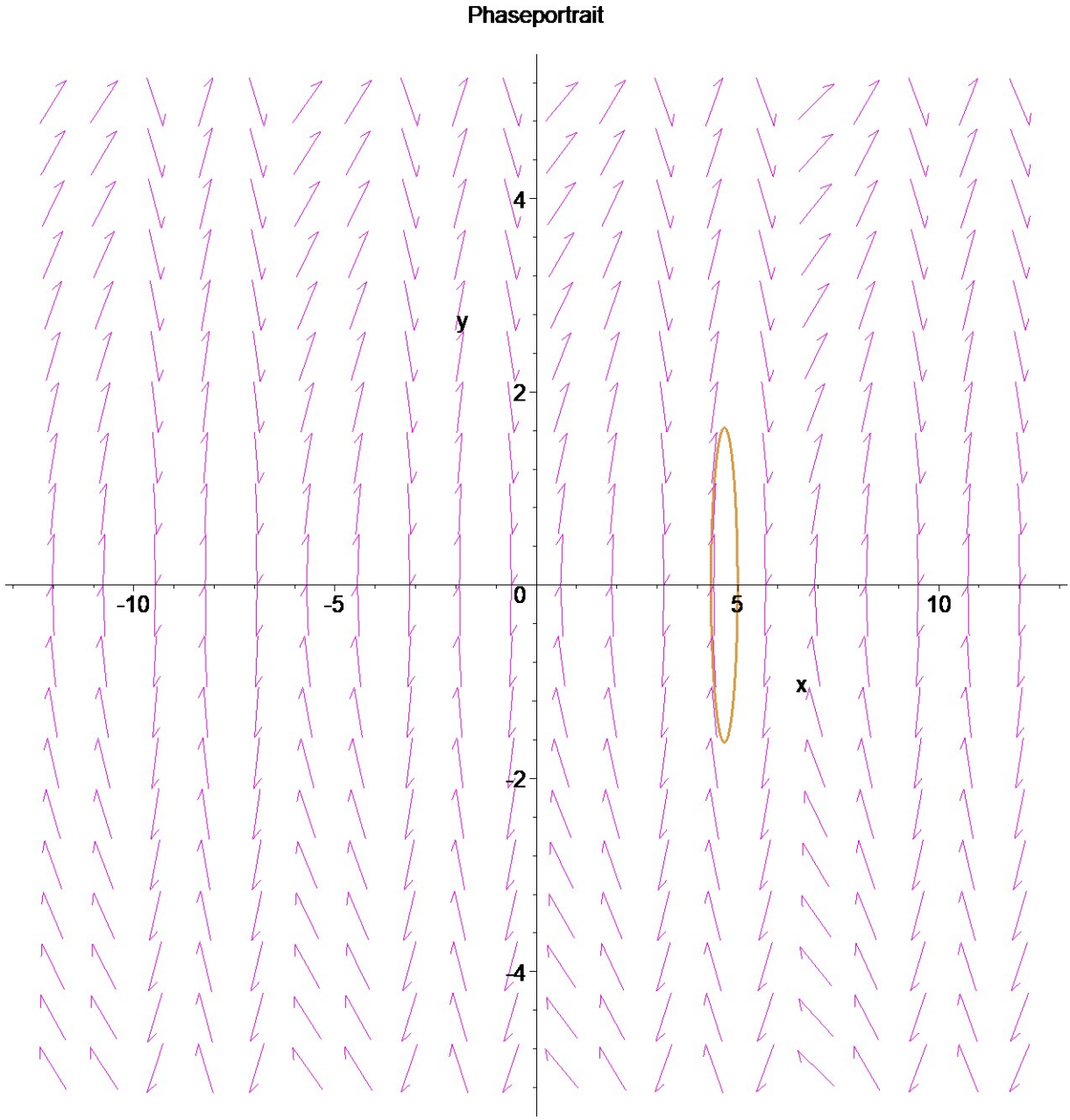

```
> pic4:=phaseportrait([ur1,ur2],[x(t),y(t)],t=-45..45,[[x(0)=0.5,y
  (0)=0.1],[x(0)=0.5,y(0)=-0.10]],x=-12..12,y=-5..5,stepsize=.01,t
  itle=`Phaseportrait`,colour=magenta,linecolor=green):display(pic
  4);
```



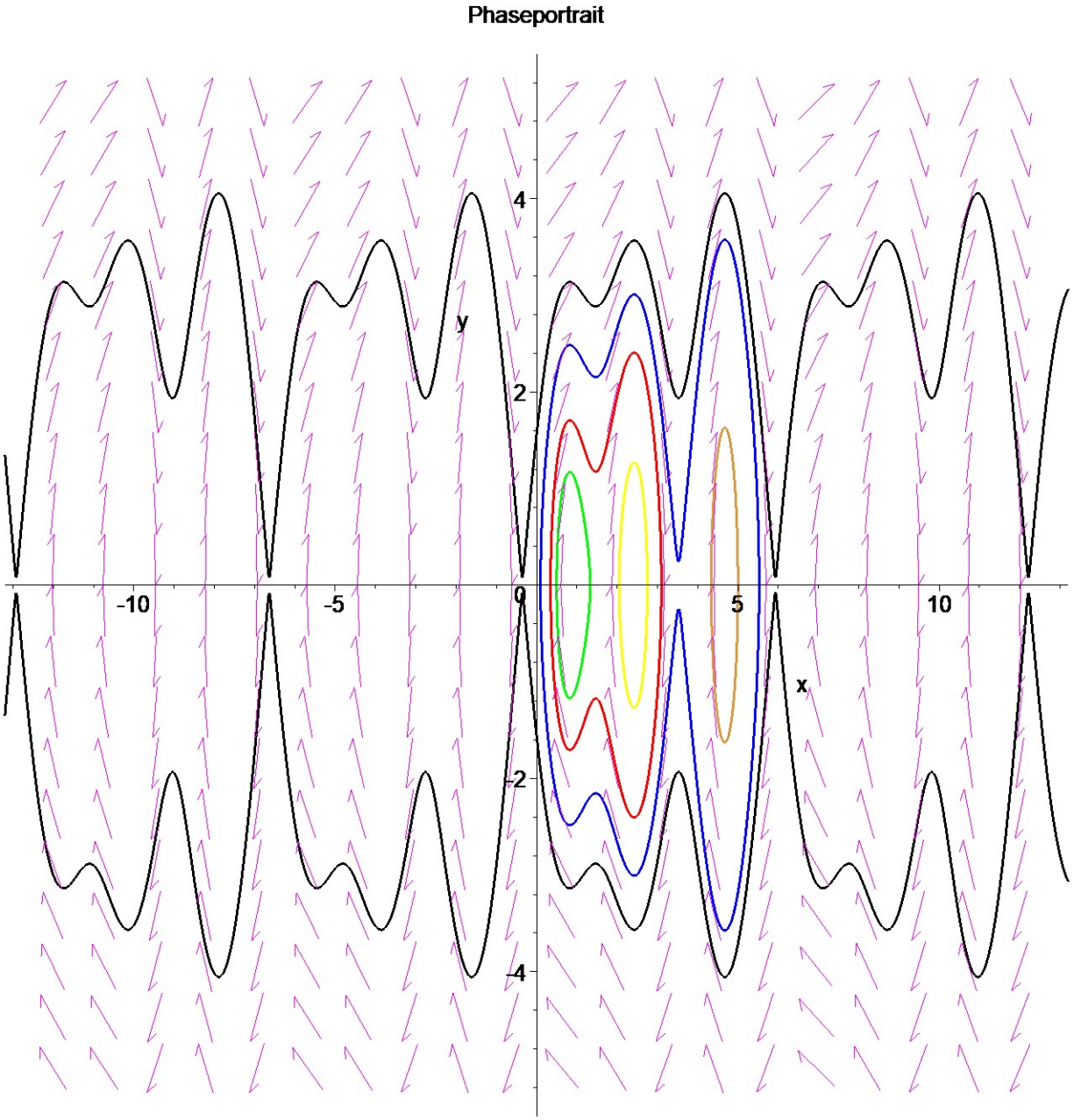

```
> pic5:=phaseportrait([ur1,ur2],[x(t),y(t)],t=-45..45,[[x(0)=2.75,
  y(0)=0.10],[x(0)=2.75,y(0)=-0.10]],x=-12..12,y=-5..5,stepsize=.0
  1,title=`Phaseportrait`,colour=magenta,linecolor=yellow):display
  (pic5);
```




```
> pic6:=phaseportrait([ur1,ur2],[x(t),y(t)],t=-45..45,[[x(0)=5,y(0
  )=0.10],[x(0)=5,y(0)=-0.10]],x=-12..12,y=-5..5,stepsize=.01,titl
  e=`Phaseportrait`,colour=magenta,linecolor=gold):display(pic6);
```

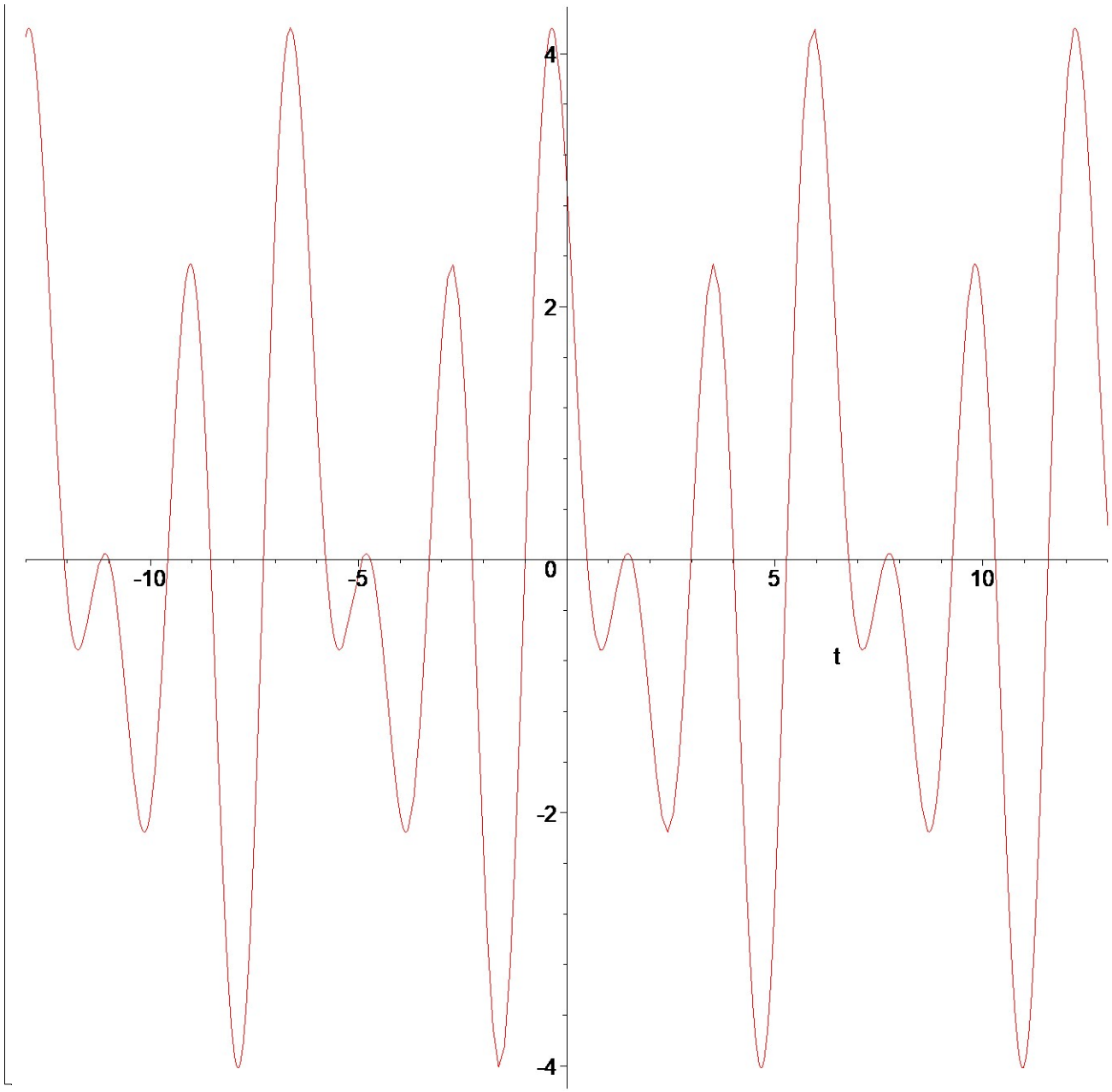



```
> display([pic1,pic2,pic3,pic4,pic5,pic6]);
```



Снова график потенциальной энергии:

```
> plot(P(t),t=-13..13);
```


4
2
0
-2
-4
-10
-5
5
10
t

>

>

>

>