In [10]:

```
import matplotlib.pyplot as plt
import math
import numpy as np
```

Question1

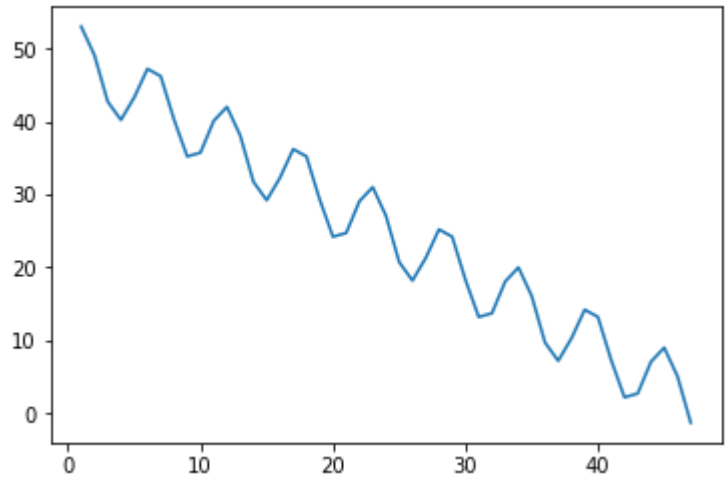
In [57]:

```
t=0
y=np.zeros(47)
while (t<47):

    y[t]=48-t+5*math.cos(2*math.pi*(t/5.5))
    #y[t]=math.cos(2*(t/1.7))

    t+=1
x=np.arange(1,48)
print(y)
plt.plot(x,y)
plt.show()
```

```
[53.         49.07707507 42.72569633 40.20253513 43.28842581 47.20626766
 46.20626766 40.28842581 35.20253513 35.72569633 40.07707507 42.
 38.07707507 31.72569633 29.20253513 32.28842581 36.20626766 35.20626766
 29.28842581 24.20253513 24.72569633 29.07707507 31.         27.07707507
 20.72569633 18.20253513 21.28842581 25.20626766 24.20626766 18.28842581
 13.20253513 13.72569633 18.07707507 20.         16.07707507  9.72569633
  7.20253513 10.28842581 14.20626766 13.20626766  7.28842581  2.20253513
  2.72569633  7.07707507  9.          5.07707507 -1.27430367]
```



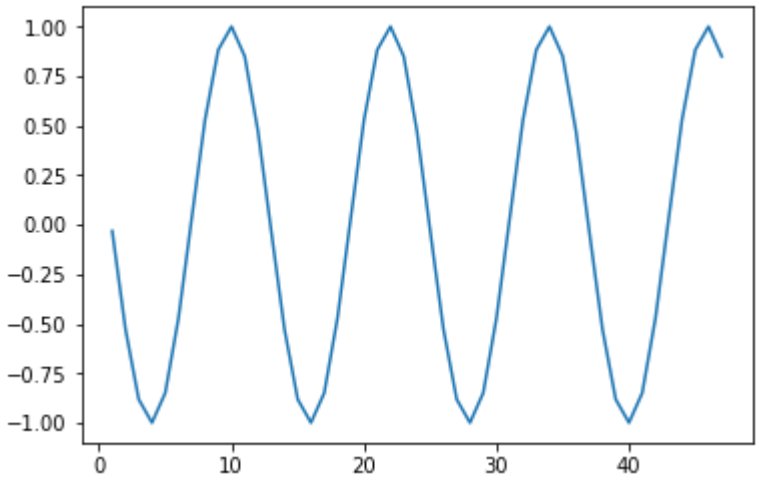
Question2

In [53]:

```
t=0
y=np.zeros(47)
cont_dist=np.random.uniform(low=0.0, high=1.0, size=None)
while (t<47):

    y[t]=math.cos(2*math.pi*(t/12+cont_dist))
    t+=1
x=np.arange(1,48)
print(y)
plt.plot(x,y)
plt.show()
```

```
[-0.03252577 -0.52790359 -0.88183007 -0.9994709  -0.8493043  -0.4715673
  0.03252577  0.52790359  0.88183007  0.9994709   0.8493043   0.4715673
 -0.03252577 -0.52790359 -0.88183007 -0.9994709  -0.8493043  -0.4715673
  0.03252577  0.52790359  0.88183007  0.9994709   0.8493043   0.4715673
 -0.03252577 -0.52790359 -0.88183007 -0.9994709  -0.8493043  -0.4715673
  0.03252577  0.52790359  0.88183007  0.9994709   0.8493043   0.4715673
 -0.03252577 -0.52790359 -0.88183007 -0.9994709  -0.8493043  -0.4715673
  0.03252577  0.52790359  0.88183007  0.9994709   0.8493043 ]
```



In [ ]:

```
Question3

Cov(X+Y, X-Y)=E[(X+Y),(X-Y)]-E[(X+Y)]E[(X-Y)]
Cov(X+Y, X-Y) = E[X^2-XY+YX-Y^2]-[{E(X)+E(Y)}{E(X)-E(Y)}]
= E[X^2-XY+XY-Y^2]-[{E(X)}^2-E(X)E(Y)]+E(X)E(Y)-{E(Y)^2}
= E[X^2-Y^2]-[{E(X)}^2-{E(Y)}^2]
= E(X^2)-E(Y^2)-{E(X)}^2+{E(Y)}^2
= E(X^2)-{E(X)}^2-[E(Y^2)-{E(Y)}^2]
= Var(X)-Var(Y)

Var(x)=Var(Y)
so,Cov(X+Y, X-Y)=0
```

In [ ]:

```

```

In [ ]:

```
Question
4a
corr(x,y) = cov(x,y)/Std(x)Std(y)
0.25=cov(x,y)/sqr(9)*sqr(16)=cov(x,y)/12
cov(x,y)=3
V[x+y] = V[x] + V[y] + 2cov(x,y)
V[x+y]=9+16+2*3=31


4b
https://faculty.math.illinois.edu/~hildebr/461/variance.pdf
cov[x,x+y]=cov(x,x)+cov(x,y)
          =V[x]+cov(x,y)
          =9+3=12


4c
Corr[x+y,x-y]=cov(x+y,x-y)/Std(x+y)Std(x-y)
cov(x+y,x-y)=Var(x)-Var(y)/sqr(V[x+y])*sqr(V[x-y])
            =(9-16)/sqr(31)*sqr(V[x] + V[y] - 2cov(x,y))
            =-7/sqr((31)*(9+16-2*3))=-7/sqr(31*19)
            =-0.2884299752006152
```

In [52]:

```
import math
c=-7/math.sqrt(31*19)
c
```

Out[52]:

```
-0.2884299752006152
```

In [ ]: