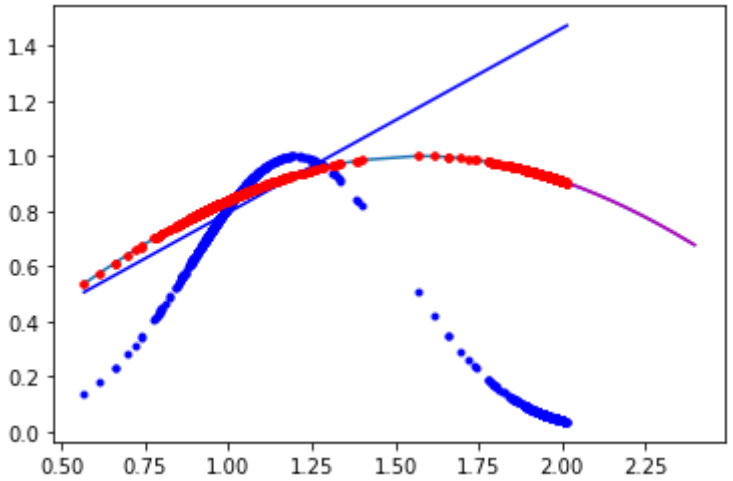
In [4]:

```
import numpy as np
import pandas as pd
from sklearn.datasets import load_boston
import matplotlib.pyplot as plt
%matplotlib inline
import math
boston = load_boston()
features = pd.DataFrame(boston.data, columns=boston.feature_names)
target = pd.DataFrame(boston.target, columns=['target'])
data = pd.concat([features,target],axis=1)
x = data['RM']
X1 = sorted(np.array(x/x.mean()))
X=X1+[i+1 for i in X1]
Y=np.sin(X)
plt.plot(X,Y)
n = int(0.8 * len(X))
x_train=X[:n]
y_train=Y[:n]
x_test=X[n:]
y_test=Y[n:]
w=np.exp([-(1.2-i)**2/(2*0.1)for i in x_train])
plt.plot(x_train, y_train, 'r.')
plt.plot(x_train,w,'b.')
def h(x,a,b):
    return a*x + b
def error(a,x,b,y,w):
    e=0
    m=len(x)
#Apply the weights multiplication for the cost function

    for i in range(m):
        e+=np.power(h(x[i],a,b)-y[i],2)*w[i]

    return(1/(2*m))*e
#Calculating Gradient
def step_gradient(a,x,b,y,learning_rate,w):
    grad_a=0
    grad_b=0
    m=len(x)
    for i in range(m):
        grad_a+=(2/m)*((h(x[i],a,b)-y[i])*x[i])*w[i]
```

```
        grad_b+=(2/m)*(h(x[i],a,b)-y[i])*w[i]
    a=a-(grad_a*learning_rate)
    b=b-(grad_b*learning_rate)

    return a,b
def descend(initial_a,initial_b,x,y,learning_rate,iteration,w):
    a=initial_a
    b=initial_b
    for i in range(iteration):
        e=error(a,x,b,y,w)
        if i%1000==0:
            print(f"Error:{e}-- a:{a},b:{b}")

        a,b=step_gradient(a,x,b,y,learning_rate,w)

    return a,b

a=1.69309840122
b=0.0372197540025
learning_rate=0.3
iteration=100
final_a, final_b = descend(a,b,x_train,y_train, learning_rate, iteration,w)
H=[i*final_a+final_b for i in x_train]
plt.plot(x_train, y_train, 'r.',x_train,H,'b')
print(error(a,x_test,b,y_test,w))
print(error(final_a,x_test,final_b,y_test,w))
plt.plot(x_test,y_test,'m',x_train,y_train,'r.')
```

```
Error:0.28539416725563693-- a:1.69309840122,b:0.0372197540025
2.4755610602936344
0.1549971836535683
```

Out[4]:
```
[<matplotlib.lines.Line2D at 0x246a1139d60>,
 <matplotlib.lines.Line2D at 0x246a1139d90>]
```


1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.50
0.75
1.00
1.25
1.50
1.75
2.00
2.25