Assignment-3

Problem:

Write a program (any program language) to show the
(a) idealized variation of annual-average temperature with latitude at sea leve
l.
    Also overly this plot with that variation of annual-average temperature at a
level of z=8 km
(b) meridional temperature gradient with latitude at z=0 and z=8 km.

In [1]:

```
# Importing  required modules
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
print('Modules are imported.')
```

```
Modules are imported.
```

In [2]:

```
# Intialization
a0 = -12
b0 = 40

a8 = a0 -(3.14*8)
b8 = b0*(1-(8/11))

c = 0.00118
```

In [3]:

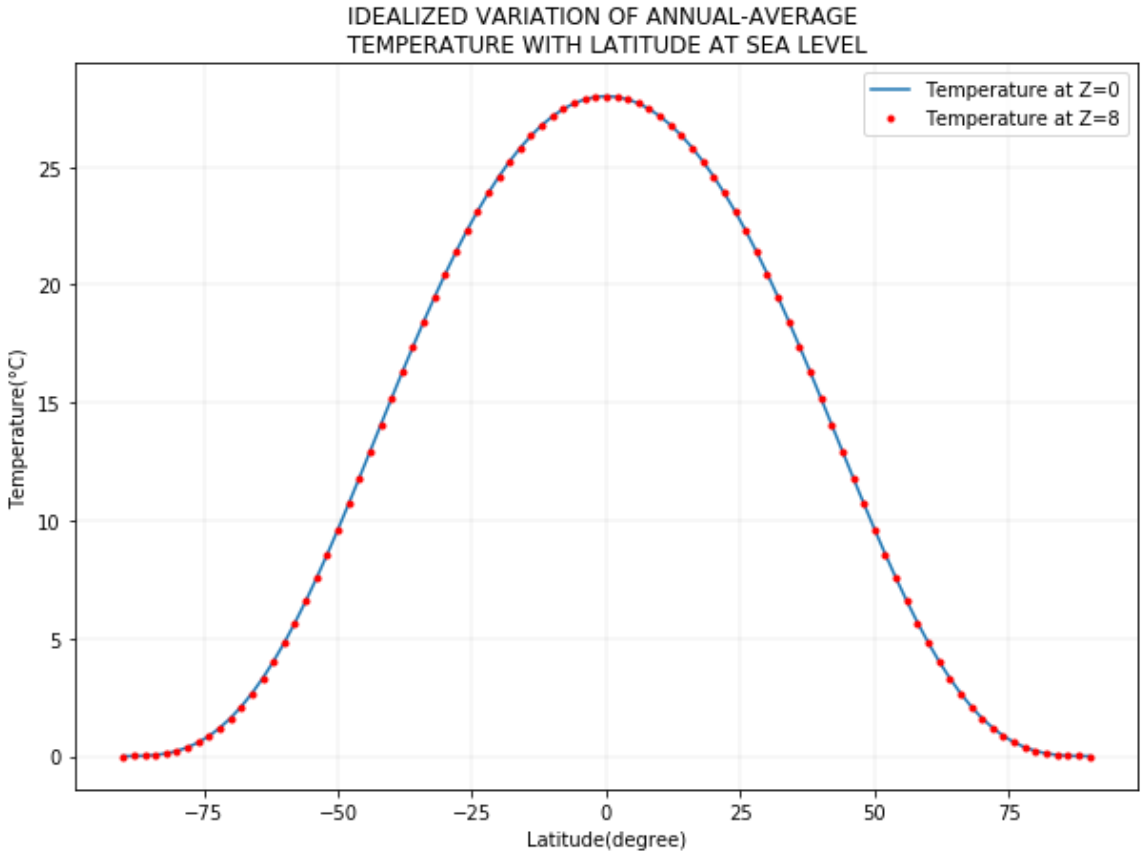
```
# For computing data
t_1list = list()
t_2list = list()
tg_1 , tg_2 = list(),list()

d_list = list(range(-90,91,2))

for i in d_list:
    i = (np.pi/180) * i
    t_1list.append((a0+b0)*np.power(np.cos(i),3)*(1+0.5*np.power(np.sin(i),2)))
    t_2list.append((a0+b0)*np.power(np.cos(i),3)*(1+0.5*np.power(np.sin(i),2)))

    tg_1.append(-1*b0*c*np.power(np.cos(i),2)*np.power(np.sin(i),3))
    tg_2.append(-1*b8*c*np.power(np.cos(i),2)*np.power(np.sin(i),3))
```

In [4]:

```
# Converting data to data frame
data = {'Degree':d_list,'T(z=0)':t_1list,'T(z=8)':t_2list,'T_gradient(z=0)':tg_1,'T_gra
dient(z=8)':tg_2}
dataset = pd.DataFrame(data)
```

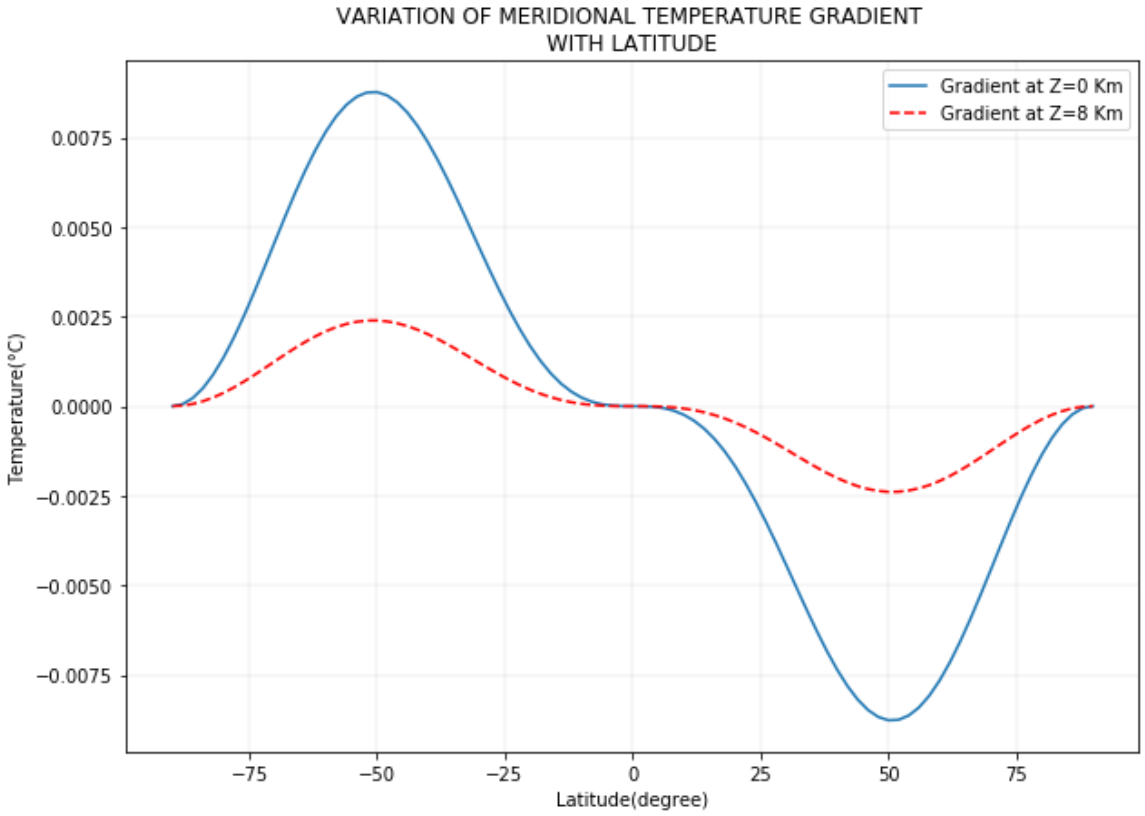
In [5]:

```
# Question part(a)
fig, ax = plt.subplots(figsize = (10,7))
ax.set_title('IDEALIZED VARIATION OF ANNUAL-AVERAGE \n TEMPERATURE WITH LATITUDE AT SEA
LEVEL ')
ax.set_xlabel('Latitude(degree)')
ax.set_ylabel('Temperature(\N{DEGREE SIGN}C)')
ax.grid(color = 'grey',linestyle = '-',linewidth = 0.25,alpha = 0.5)
plt.plot(d_list,t_1list,d_list,t_2list,"r.")
plt.legend(['Temperature at Z=0','Temperature at Z=8'])
plt.show()
```



In [6]:

```
# Question part(b)
fig, bx = plt.subplots(figsize = (10,7))
bx.set_title('VARIATION OF MERIDIONAL TEMPERATURE GRADIENT \n WITH LATITUDE ')
bx.set_xlabel('Latitude(degree)')
bx.set_ylabel('Temperature(\N{DEGREE SIGN}C)')
bx.grid(color = 'grey',linestyle = '-',linewidth = 0.25,alpha = 0.5)
plt.plot(d_list,tg_1,d_list,tg_2,'r--')
plt.legend(['Gradient at Z=0 Km','Gradient at Z=8 Km'])
plt.show()
```



In [7]:

```
# Displaying the dataset used in the program
display(dataset)
```

	Degree	T(z=0)	T(z=8)	T_gradient(z=0)	T_gradient(z=8)
0	-90	9.642549e-48	9.642549e-48	1.769717e-34	4.826500e-35
1	-88	1.784557e-03	1.784557e-03	5.738342e-05	1.565002e-05
2	-86	1.423305e-02	1.423305e-02	2.279992e-04	6.218161e-05
3	-84	4.779345e-02	4.779345e-02	5.072875e-04	1.383511e-04
4	-82	1.124869e-01	1.124869e-01	8.877914e-04	2.421249e-04
5	-80	2.177072e-01	2.177072e-01	1.359367e-03	3.707366e-04
6	-78	3.720341e-01	3.720341e-01	1.909471e-03	5.207647e-04
7	-76	5.830671e-01	5.830671e-01	2.523508e-03	6.882295e-04
8	-74	8.572810e-01	8.572810e-01	3.185247e-03	8.687036e-04
9	-72	1.199908e+00	1.199908e+00	3.877267e-03	1.057436e-03
10	-70	1.614846e+00	1.614846e+00	4.581449e-03	1.249486e-03
11	-68	2.104603e+00	2.104603e+00	5.279471e-03	1.439856e-03
12	-66	2.670265e+00	2.670265e+00	5.953318e-03	1.623632e-03
13	-64	3.311501e+00	3.311501e+00	6.585769e-03	1.796119e-03
14	-62	4.026592e+00	4.026592e+00	7.160863e-03	1.952963e-03
15	-60	4.812500e+00	4.812500e+00	7.664325e-03	2.090270e-03
16	-58	5.664949e+00	5.664949e+00	8.083936e-03	2.204710e-03
17	-56	6.578542e+00	6.578542e+00	8.409844e-03	2.293594e-03
18	-54	7.546893e+00	7.546893e+00	8.634800e-03	2.354946e-03
19	-52	8.562775e+00	8.562775e+00	8.754319e-03	2.387542e-03
20	-50	9.618280e+00	9.618280e+00	8.766755e-03	2.390933e-03
21	-48	1.070499e+01	1.070499e+01	8.673296e-03	2.365444e-03
22	-46	1.181416e+01	1.181416e+01	8.477871e-03	2.312147e-03
23	-44	1.293684e+01	1.293684e+01	8.186985e-03	2.232814e-03
24	-42	1.406413e+01	1.406413e+01	7.809471e-03	2.129856e-03
25	-40	1.518724e+01	1.518724e+01	7.356181e-03	2.006231e-03
26	-38	1.629769e+01	1.629769e+01	6.839624e-03	1.865352e-03
27	-36	1.738741e+01	1.738741e+01	6.273550e-03	1.710968e-03
28	-34	1.844885e+01	1.844885e+01	5.672511e-03	1.547049e-03
29	-32	1.947509e+01	1.947509e+01	5.051404e-03	1.377656e-03
...	...	...	...	...	...
61	32	1.947509e+01	1.947509e+01	-5.051404e-03	-1.377656e-03
62	34	1.844885e+01	1.844885e+01	-5.672511e-03	-1.547049e-03
63	36	1.738741e+01	1.738741e+01	-6.273550e-03	-1.710968e-03
64	38	1.629769e+01	1.629769e+01	-6.839624e-03	-1.865352e-03
65	40	1.518724e+01	1.518724e+01	-7.356181e-03	-2.006231e-03
66	42	1.406413e+01	1.406413e+01	-7.809471e-03	-2.129856e-03
67	44	1.293684e+01	1.293684e+01	-8.186985e-03	-2.232814e-03

	Degree	T(z=0)	T(z=8)	T_gradient(z=0)	T_gradient(z=8)
68	46	1.181416e+01	1.181416e+01	-8.477871e-03	-2.312147e-03
69	48	1.070499e+01	1.070499e+01	-8.673296e-03	-2.365444e-03
70	50	9.618280e+00	9.618280e+00	-8.766755e-03	-2.390933e-03
71	52	8.562775e+00	8.562775e+00	-8.754319e-03	-2.387542e-03
72	54	7.546893e+00	7.546893e+00	-8.634800e-03	-2.354946e-03
73	56	6.578542e+00	6.578542e+00	-8.409844e-03	-2.293594e-03
74	58	5.664949e+00	5.664949e+00	-8.083936e-03	-2.204710e-03
75	60	4.812500e+00	4.812500e+00	-7.664325e-03	-2.090270e-03
76	62	4.026592e+00	4.026592e+00	-7.160863e-03	-1.952963e-03
77	64	3.311501e+00	3.311501e+00	-6.585769e-03	-1.796119e-03
78	66	2.670265e+00	2.670265e+00	-5.953318e-03	-1.623632e-03
79	68	2.104603e+00	2.104603e+00	-5.279471e-03	-1.439856e-03
80	70	1.614846e+00	1.614846e+00	-4.581449e-03	-1.249486e-03
81	72	1.199908e+00	1.199908e+00	-3.877267e-03	-1.057436e-03
82	74	8.572810e-01	8.572810e-01	-3.185247e-03	-8.687036e-04
83	76	5.830671e-01	5.830671e-01	-2.523508e-03	-6.882295e-04
84	78	3.720341e-01	3.720341e-01	-1.909471e-03	-5.207647e-04
85	80	2.177072e-01	2.177072e-01	-1.359367e-03	-3.707366e-04
86	82	1.124869e-01	1.124869e-01	-8.877914e-04	-2.421249e-04
87	84	4.779345e-02	4.779345e-02	-5.072875e-04	-1.383511e-04
88	86	1.423305e-02	1.423305e-02	-2.279992e-04	-6.218161e-05
89	88	1.784557e-03	1.784557e-03	-5.738342e-05	-1.565002e-05
90	90	9.642549e-48	9.642549e-48	-1.769717e-34	-4.826500e-35

91 rows × 5 columns

In [ ]: