Plotting $\sin(x^2 + y^2)$ for a regular grid with a total of 40,000 points or 20,000 points and on 20,000 random points

We create (x,y) points first and plot a scatter plot on them with gray level given by $\sin(x^2 + y^2)$

Importing vector and plotting libraries. %matplotlib inline to see plots in notebook

In [1]:
```
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
```

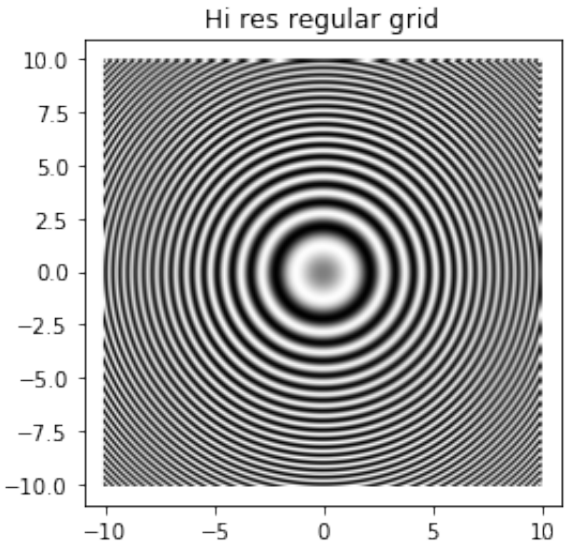
First we show the case of a regular grid with a total of 40,000 points

We plot the function between -10 and 10, so for a total of 40,000 points we need a spacing of $0.1 = 20/\sqrt{(40000)}$ in a regular grid

In [20]:
```
xlist = np.arange(-10.0, 10.0, 0.1) # vector of x values
ylist = np.arange(-10.0, 10.0, 0.1) # vector of y values
X, Y = np.meshgrid(xlist, ylist) # regular mesh from x and y values

Z = np.sin(X**2 + Y**2) # function to plot

fig, axes = plt.subplots(figsize=(4,4)) # Making fig square
plt.title('Hi res regular grid')
plt.scatter(X, Y, c=Z, s=1) # Scatter plot
plt.gray()
```

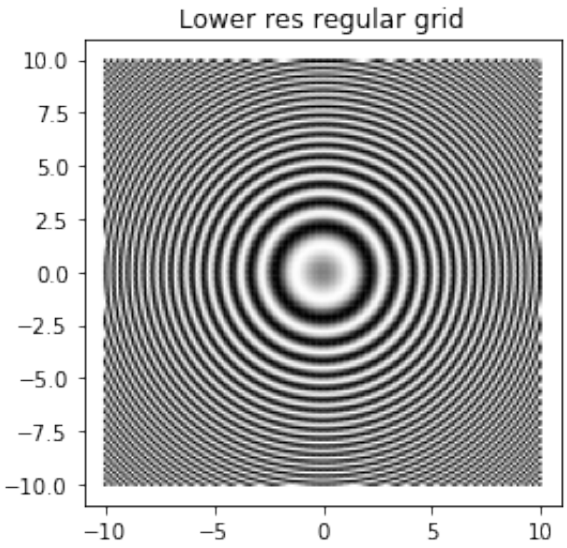


Already at this resolution above one can interference patterns. These patterns are more clear when using less points in the grid, below for 20,000 points, for which the spacing is $0.1414 = 20/\sqrt{(20000)}$

In [21]:
```
xlist = np.arange(-10.0, 10.0, 0.1414) # vector of x values
ylist = np.arange(-10.0, 10.0, 0.1414) # vector of y values
X, Y = np.meshgrid(xlist, ylist) # regular mesh from x and y values

Z = np.sin(X**2 + Y**2) # function to plot

fig, axes = plt.subplots(figsize=(4,4)) # Making fig square
plt.title('Lower res regular grid')
plt.scatter(X, Y, c=Z, s=1) # Scatter plot
plt.gray()
```

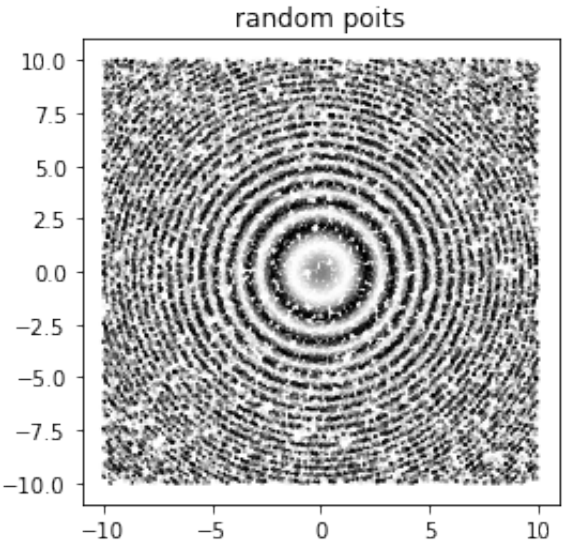


Now for 20,000 random points

In [7]:
```
X = np.random.uniform(low=-10, high=10, size=(20000,))
Y= np.random.uniform(low=-10, high=10, size=(20000,))
Z = np.sin(X**2 + Y**2)
plt.figure()

fig, axes = plt.subplots(figsize=(4,4)) # Making fig square
plt.title('random points')
plt.scatter(X, Y, c=Z, s=1)
plt.gray()
```

```
<matplotlib.figure.Figure at 0x1062e6940>
```



For random points, there are no interference patterns