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

```
In [2]: month = list(range(1,13))
        interest = [7.43,7.48,8.00,7.75,7.60,
                    7.63,7.68,7.67,7.59,8.07,
                    8.03,8.00]
        data = {'Month':month,'Interest Rate':interest}
```

```
In [3]: df = pd.DataFrame(data)
        df.head()
```

Out[3]:

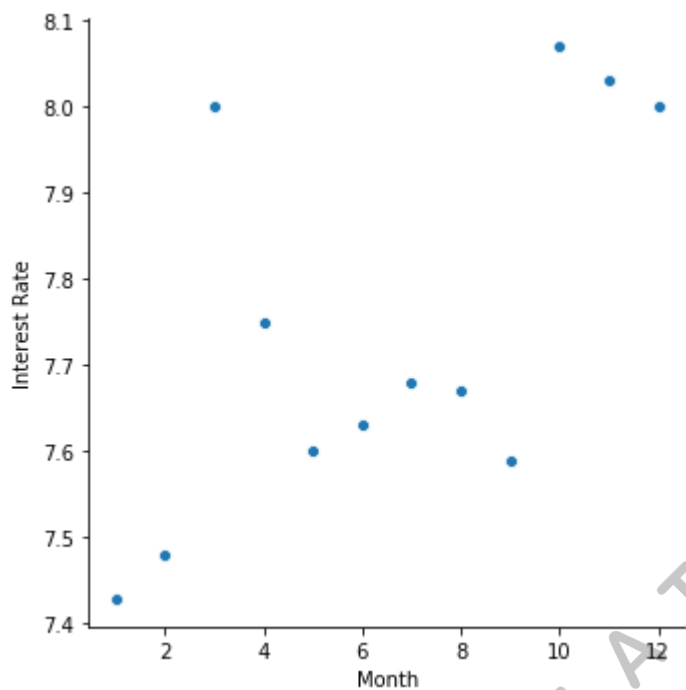|	Month	Interest Rate
0	1	7.43
1	2	7.48
2	3	8.00
3	4	7.75
4	5	7.60

```
In [4]: x_bar, y_bar = df.mean() # mean of all dataset
        x_bar,y_bar
```

Out[4]: (6.5, 7.7441666666666675)

Relationship plot

In [5]:
```python
#plt.scatter(df['Month'],df['Interest Rate'])
sns.relplot(x='Month',y='Interest Rate',kind='scatter',data=df)
```
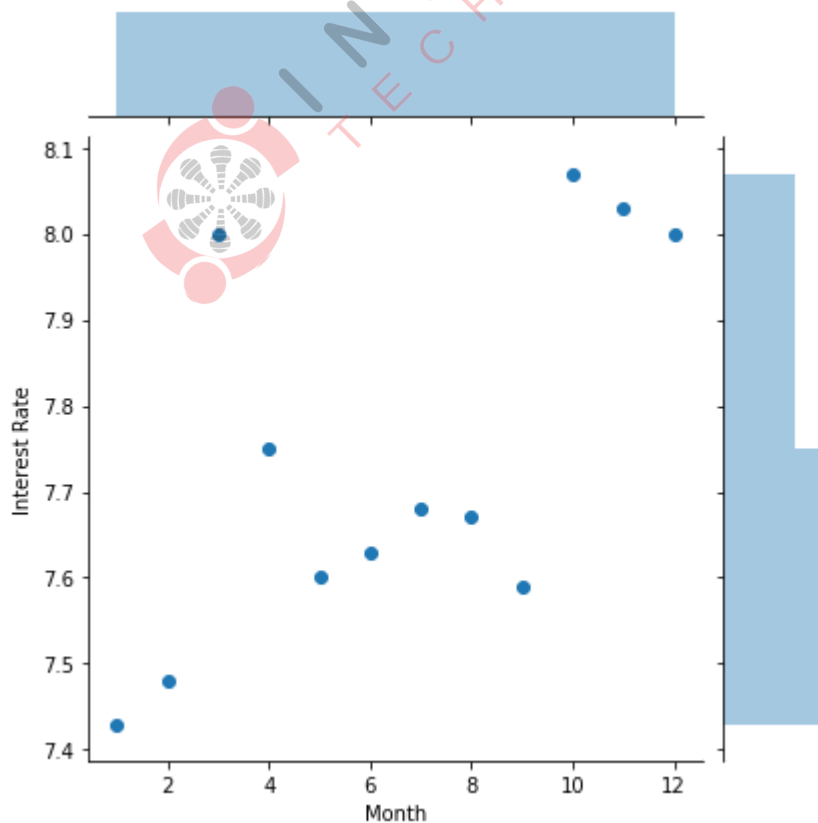
Out[5]: <seaborn.axisgrid.FacetGrid at 0xb1cefc9208>

In [6]:
```python
sns.jointplot(x='Month',y='Interest Rate',data=df)
```

Out[6]: <seaborn.axisgrid.JointGrid at 0xb1cb6686d8>

$$b = \frac{\sum(x-\bar{x})(y-\bar{y})}{\sum(x-\bar{x})^2}$$

- $(x - \bar{x}), (y - \bar{y}), (x - \bar{x})^2$

$$(x - \bar{x})$$

In [7]:
```python
df['x-xbar'] = df['Month'] - x_bar
df['y-ybar'] = df['Interest Rate'] - y_bar
df['(x-xbar)(y-ybar)'] = df['x-xbar']* df['y-ybar']
df['(x-xbar)sqr'] = df['x-xbar']**2
df.head()
```

Out[7]:

	Month	Interest Rate	x-xbar	y-ybar	(x-xbar)(y-ybar)	(x-xbar)sqr
0	1	7.43	-5.5	-0.314167	1.727917	30.25
1	2	7.48	-4.5	-0.264167	1.188750	20.25
2	3	8.00	-3.5	0.255833	-0.895417	12.25
3	4	7.75	-2.5	0.005833	-0.014583	6.25
4	5	7.60	-1.5	-0.144167	0.216250	2.25

In [8]:
```python
num = df['(x-xbar)(y-ybar)'].sum()
den = df['(x-xbar)sqr'].sum()
b = num/den
print('Coefficient b = ',b)
```

```
Coefficient b =  0.039055944055944036
```

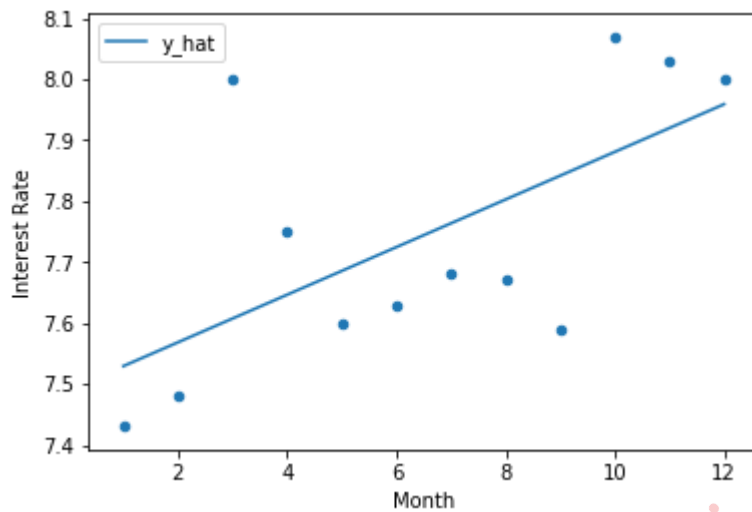$$\hat{y} = a + bx$$

$$a = \bar{y} - b\bar{x}$$

In [9]:
```python
a = y_bar - b * x_bar
print('Intercept a =',a)
```

```
Intercept a = 7.490303030303031
```

In [10]:
```python
df['y_hat'] = a + b * df['Month']
```

In [12]:
```python
fig = df.plot(x='Month',y='y_hat')
df.plot(x='Month',y='Interest Rate',kind='scatter',ax=fig)
```
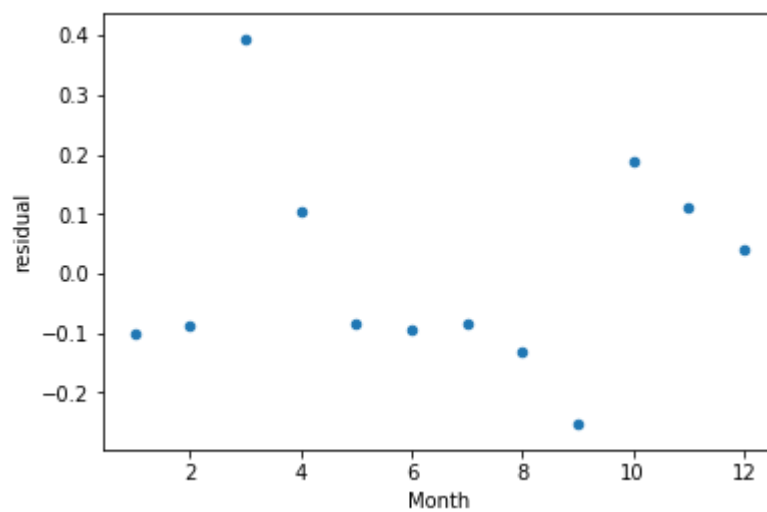
Out[12]: <matplotlib.axes._subplots.AxesSubplot at 0xb1cfdc84a8>

In [17]:
```python
# Residual
df['residual'] = df['Interest Rate']- df['y_hat']
df.head()
```

Out[17]:

	Month	Interest Rate	x-xbar	y-ybar	(x-xbar)(y-ybar)	(x-xbar)sqr	y_hat	residual
0	1	7.43	-5.5	-0.314167	1.727917	30.25	7.529359	-0.099359
1	2	7.48	-4.5	-0.264167	1.188750	20.25	7.568415	-0.088415
2	3	8.00	-3.5	0.255833	-0.895417	12.25	7.607471	0.392529
3	4	7.75	-2.5	0.005833	-0.014583	6.25	7.646527	0.103473
4	5	7.60	-1.5	-0.144167	0.216250	2.25	7.685583	-0.085583

In [19]: `df.plot(kind='scatter',x='Month',y='residual')`

Out[19]: `<matplotlib.axes._subplots.AxesSubplot at 0xb1d024d6d8>`

In [ ]: