

# How can I perform exponential regression in Python, step-by-step?

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## RECOMMENDED CITATION

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Exponential regression is a statistical method used to model data that shows an exponential relationship between the independent and dependent variables. In Python, this can be performed using the Statsmodels library. The following are the steps to perform exponential regression in Python:

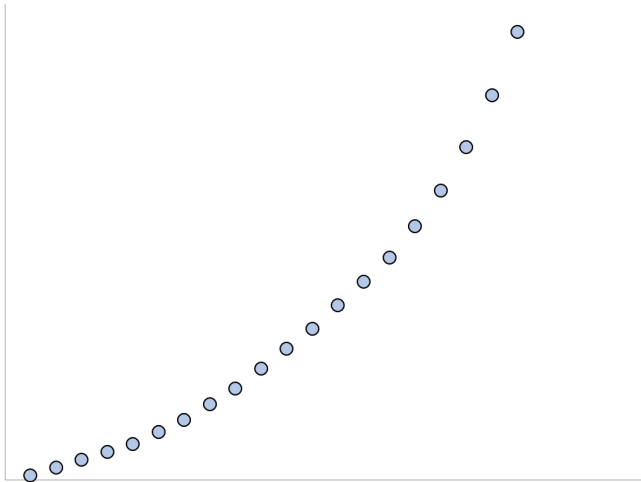
1. Import the necessary libraries: Start by importing the Statsmodels library, as well as any other libraries that may be required for data manipulation and visualization.
2. Prepare the data: Ensure that your data is in a format that can be used by the Statsmodels library. This may involve converting data types, removing missing values, and splitting the data into independent and dependent variables.
3. Fit the model: Use the Statsmodels OLS (Ordinary Least Squares) function to fit an exponential regression model to your data. This can be done by specifying the formula for the model, which includes the dependent and independent variables.
4. Check the model summary: Once the model is fitted, use the summary function to obtain important information about the model, such as the R-squared value, coefficients, and p-values.
5. Make predictions: Use the predict function to make predictions using the fitted model. This will return a set of predicted values based on the input data.
6. Visualize the results: Plot the actual data points and the predicted values on a graph to visualize the fit of the model.
7. Evaluate the model: Use various metrics such as mean squared error and root mean squared error to evaluate the performance of the model.

By following these steps, you can perform exponential regression in Python and gain insights into the relationship between your variables.

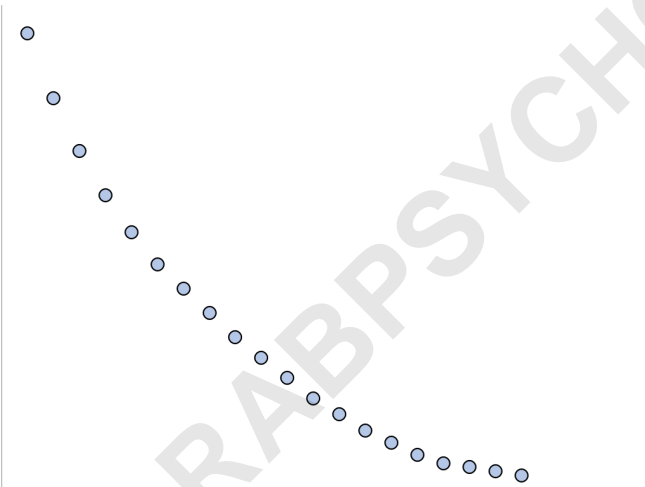
## Exponential Regression in Python (Step-by-Step)

**Exponential regression is a type of regression that can be used to model the following situations:**

- 1. Exponential growth: Growth begins slowly and then accelerates rapidly without bound.**



**2. Exponential decay: Decay begins rapidly and then slows down to get closer and closer to zero.**



**The equation of an exponential regression model takes the following form:**

$$y = ab^x$$

**where:**

**y:** The response variable  
**x:** The predictor variable  
**a, b:** The regression coefficients that describe the relationship between  $x$  and  $y$

The following step-by-step example shows how to perform exponential regression in Python.

**Step 1: Create the Data**

First, let's create some fake data for two variables:  $x$  and  $y$ :

```
import numpy as np
```

```
x = np.arange(1, 21, 1)
```

```
y = np.array()
```

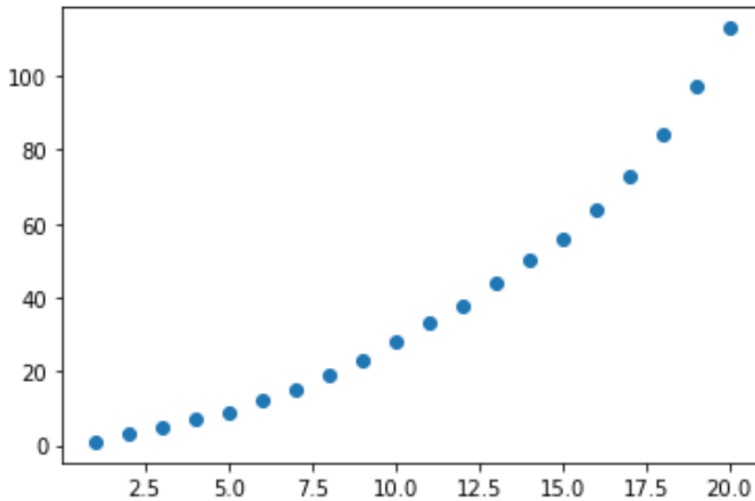
**Step 2: Visualize the Data**

Next, let's create a quick scatterplot to visualize the relationship between  $x$  and  $y$ :

```
import matplotlib.pyplot as plt
```

```
plt.scatter(x, y)
```

## plt.show()



Thus, it seems like a good idea to fit an exponential regression equation to describe the relationship between the variables as opposed to a linear regression model.

### Step 3: Fit the Exponential Regression Model

Next, we'll use the `polyfit()` function to fit an exponential regression model, using the natural log of  $y$  as the response variable and  $x$  as the predictor variable:

```
#fit the model
```

```
fit = np.polyfit(x, np.log(y), 1)
```

```
#view the output of the model
```

```
print(fit)
```

Based on the output, the fitted exponential regression equation can be written as:

$$\ln(y) = 0.9817 + 0.2041(x)$$

Applying  $e$  to both sides, we can rewrite the equation as:

$$y = 2.6689 * 1.2264^x$$

We can use this equation to predict the response variable,  $y$ , based on the value of the predictor variable,  $x$ . For example, if  $x = 12$ , then we would predict that  $y$  would be 30.897:

$$y = 2.6689 * 1.2264^{12} = 30.897$$

**Bonus:** Feel free to use this online to automatically compute the exponential regression equation for a given predictor and response variable.