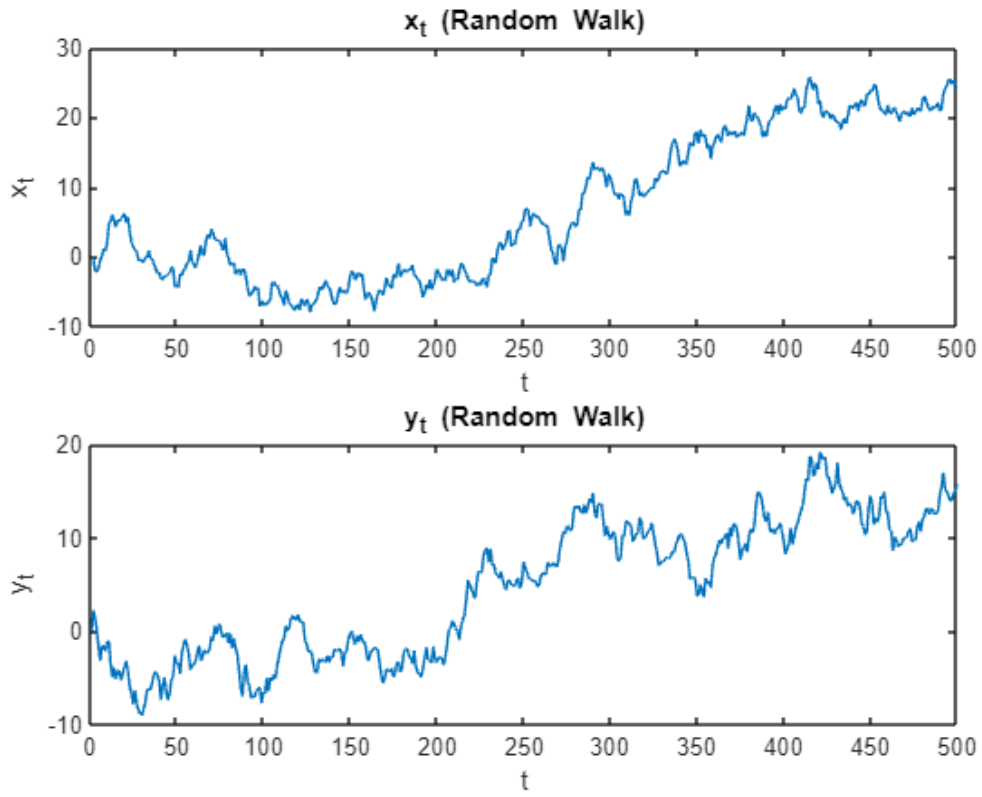
Q4

```
Linear regression model:
    y ~ 1 + x

Estimated Coefficients:
                   Estimate       SE       tStat       pValue
                   ________    ________    ______    __________

    (Intercept)    0.61037      0.21518    2.8366      0.0047462
    x              0.57869     0.017103    33.836    3.5845e-131


Number of observations: 500, Error degrees of freedom: 498
Root Mean Squared Error: 4.02
R-squared: 0.697,  Adjusted R-Squared: 0.696
F-statistic vs. constant model: 1.14e+03, p-value = 3.58e-131
```



Interpretation: We find that the coefficient is higly significant so it may be spurious regression. However, since both x_t and y_t are non-stationary (random walks) but not independent, the regression is not spurious.

Q1(a)

Interpretation of Variables:

Spread1 measures the difference between the 1-year and 3-month Treasury bill rates.

Spread2 measures the difference between the 10-year and 3-month Treasury bill rates.

Corporate refers to the junk bond spread, which is the difference between the interest rates on low-grade and high-grade corporate bonds.

dt3 is the quarterly change in the 3-month Treasury rate, calculated as the difference between the current and previous quarter's 3-month rate.

dt12 is the quarterly change in the 1-year Treasury rate, calculated as the difference between the current and previous quarter's 1-year rate

Q1(b)

```
Granger causality test:
F-stat = 2.5872, p-value = 0.0534
Granger causality test:
F-stat = 3.2960, p-value = 0.0210
Granger causality test:
F-stat = 1.6910, p-value = 0.1692
Granger causality test:
F-stat = 2.5421, p-value = 0.0567
Granger causality test:
F-stat = 3.3993, p-value = 0.0183
```

Interpretation: The results show that both the 1-year interest rate change (dt12) and the corporate credit spread (corporate) significantly predict GDP growth at the 5% level. The 3-month rate (dt3) and the long-term yield curve (spread2) are marginally significant at the 10% level, while the short-term yield curve (spread1) shows no significant effect. These findings are consistent with economic theory: interest rate changes signal monetary policy shifts, and credit spreads reflect market expectations about future conditions and default risks. In particular, corporate spreads widen in downturns, making them a useful leading indicator.

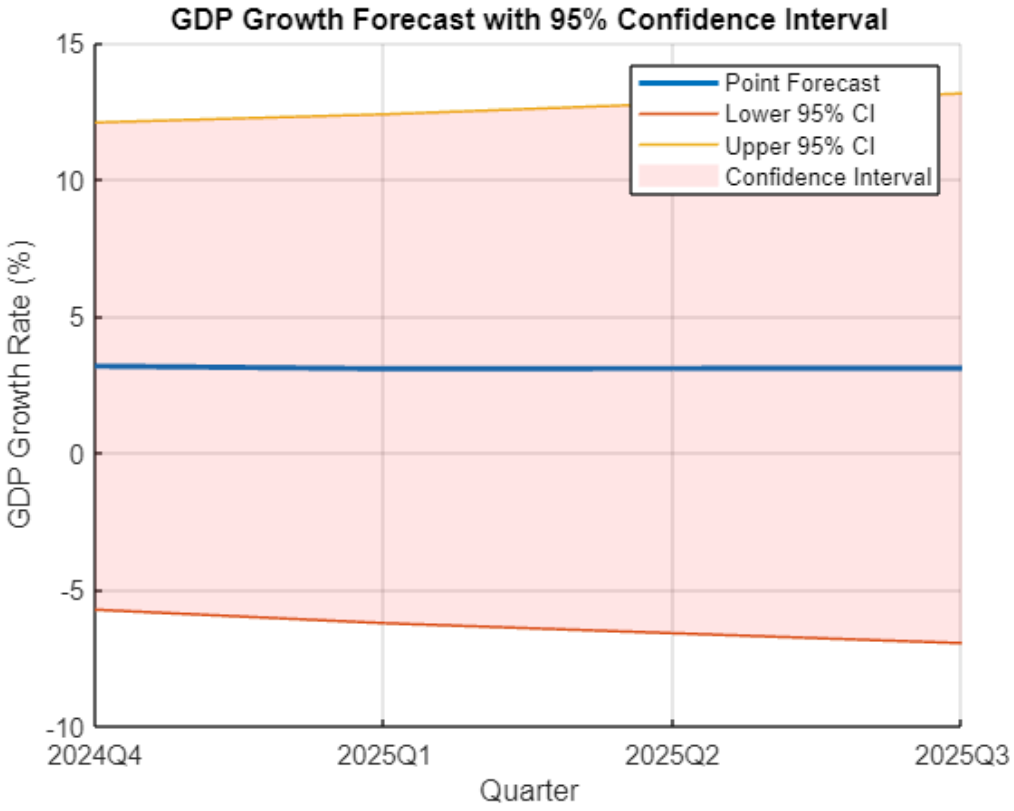
Q1(c)

I would select the corporate for forecasting the futrue GDP because it is the most significant with least p-value. You may also involve dt12 in model since it is also statistically significant. For (d), I will use the most significant variable, the corperate.

Q1(d)

```
GDP Growth Forecasts based on Corporate Spread Model:
```

Quarter	GDP_Growth	Lower_95	Upper_95
{'2024Q4'}	3.1721	-5.728	12.072
{'2025Q1'}	3.0762	-6.2197	12.372
{'2025Q2'}	3.0884	-6.5871	12.764
{'2025Q3'}	3.0911	-6.9496	13.132



Q2

```
ADF Test Results:
AAA Bond Yield:     H = 0, p-value = 0.4172
BAA Bond Yield:     H = 0, p-value = 0.1928
BAA - AAA Spread:   H = 1, p-value = 0.0010
```

By ADF test, we find that there are likely unit roots in AAA and BAA but no unit root in the spread.