



**King Saud University**

**Department of Mathematics**

**Second Semester 1442 H**

**18/04/2021 – 6/9/1441H**

**Actu 483**

**Final Exam**

**Duration: 3 Hours**

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**Sequence Number: 438104503**  
**Section:**

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**Note: The exam consists of 4 pages**

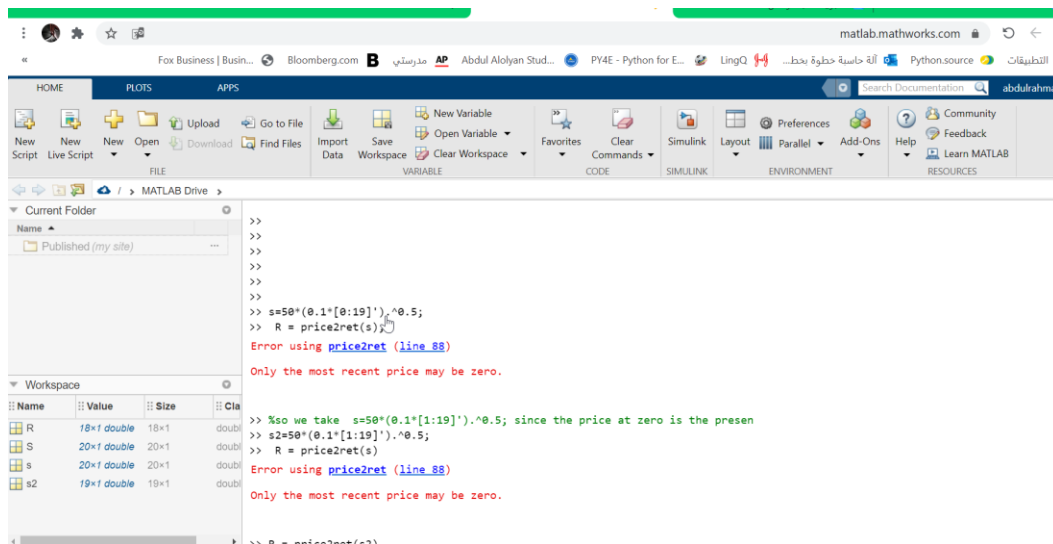
<b><u>Question</u></b>	<b>Mark</b>
<b>Exercise 1</b>	<b>3</b>
<b>Exercise 2</b>	<b>3</b>
<b>Exercise 3</b>	<b>5</b>
<b>Exercise 4</b>	<b>3</b>
<b>Exercise 5</b>	<b>6</b>
<b>Total</b>	

## Instruction for exam ACTU 483:

- 1- The duration of the exam is 2:45 hours
- 2- 15 minutes after the exam , You need to print screen for your answers and copy it in the word file
- 3- Save your file and send it to my e-mail : aalmualem@ksu.edu.sa

## Exercise 1: [3]

- 1) Create stock price process continuously compounded at 10 percent.  
By using the function  
$$S = 50 \sqrt[2]{0.10 t}, t \in [0, 19]$$
- 2) Convert price series to a 10 percent return series.



The screenshot shows the MATLAB R2020a interface. The Command Window displays the following code and error message:

```
>>  
>>  
>>  
>>  
>>  
>>  
>>  
>> s=50*(0.1*[0:19]')^0.5;  
>> R = price2ret(s)  
Error using price2ret (line 88)  
Only the most recent price may be zero.
```

The Workspace panel shows the following variables:

Name	Value	Size	Class
R	18x1 double	18x1	double
S	20x1 double	20x1	double
s	20x1 double	20x1	double
s2	19x1 double	19x1	double

The script continues with the following code:

```
>> %So we take s=50*(0.1*[1:19]')^0.5; since the price at zero is the presen  
>> s2=50*(0.1*[1:19]')^0.5;  
>> R = price2ret(s)  
Error using price2ret (line 88)  
Only the most recent price may be zero.
```

matlab.mathworks.com

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FILE VARIABLE CODE SIMULINK ENVIRONMENT RESOURCES

Current Folder

Published (my site)

Workspace

Name	Value	Size	Class
R	18x1 double	18x1	double
S	20x1 double	20x1	double
s	20x1 double	20x1	double
s2	19x1 double	19x1	double

```

>> %so we take s=50*(0.1*[1:19]')^0.5; since the price at zero is the present
>> s2=50*(0.1*[1:19]')^0.5;
>> R = price2ret(s)
Error using price2ret (line 88)
Only the most recent price may be zero.

>> R = price2ret(s2)
R =
0.3466
0.2027
0.1438
0.1116
0.0912
0.0771

```

Current Folder

Published (my site)

Workspace

	Value	Size	Class
	18x1 double	18x1	double
	20x1 double	20x1	double
	20x1 double	20x1	double
	19x1 double	19x1	double

0.2027

0.1438

0.1116

0.0912

0.0771

0.0668

0.0589

0.0527

0.0477

0.0435

0.0400

0.0371

0.0345

0.0323

0.0303

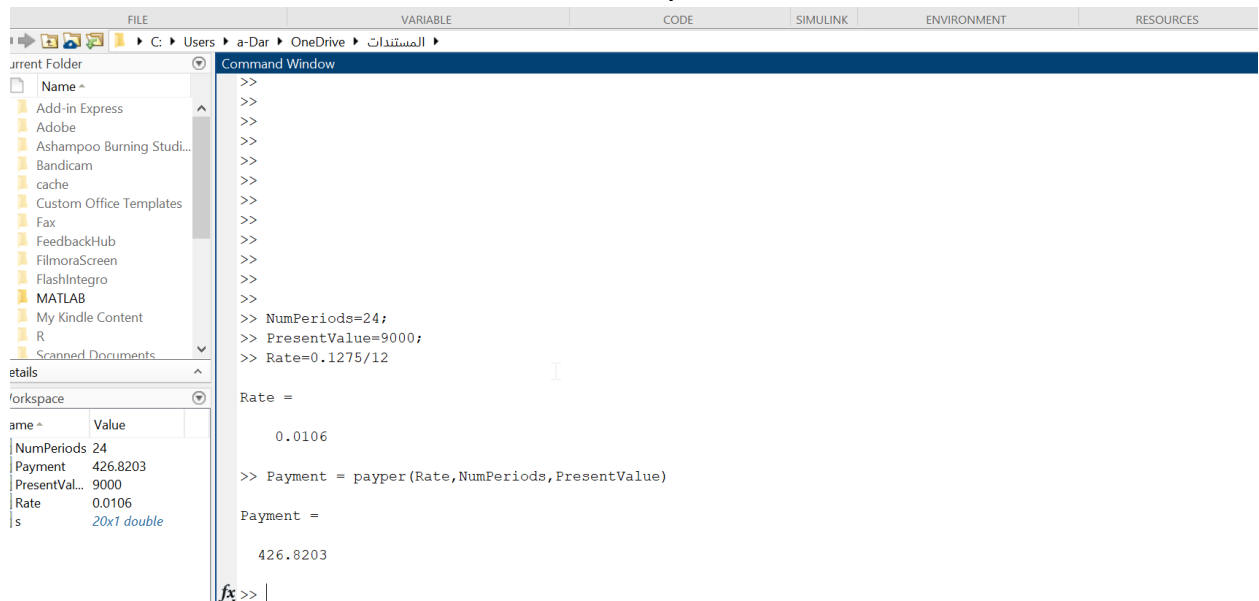
0.0286

0.0270

>>

## Exercise 2: [3]

- 1) Find the monthly payment for 24 payments loan of \$9000 with an annual interest rate of 12.75% convertible monthly.



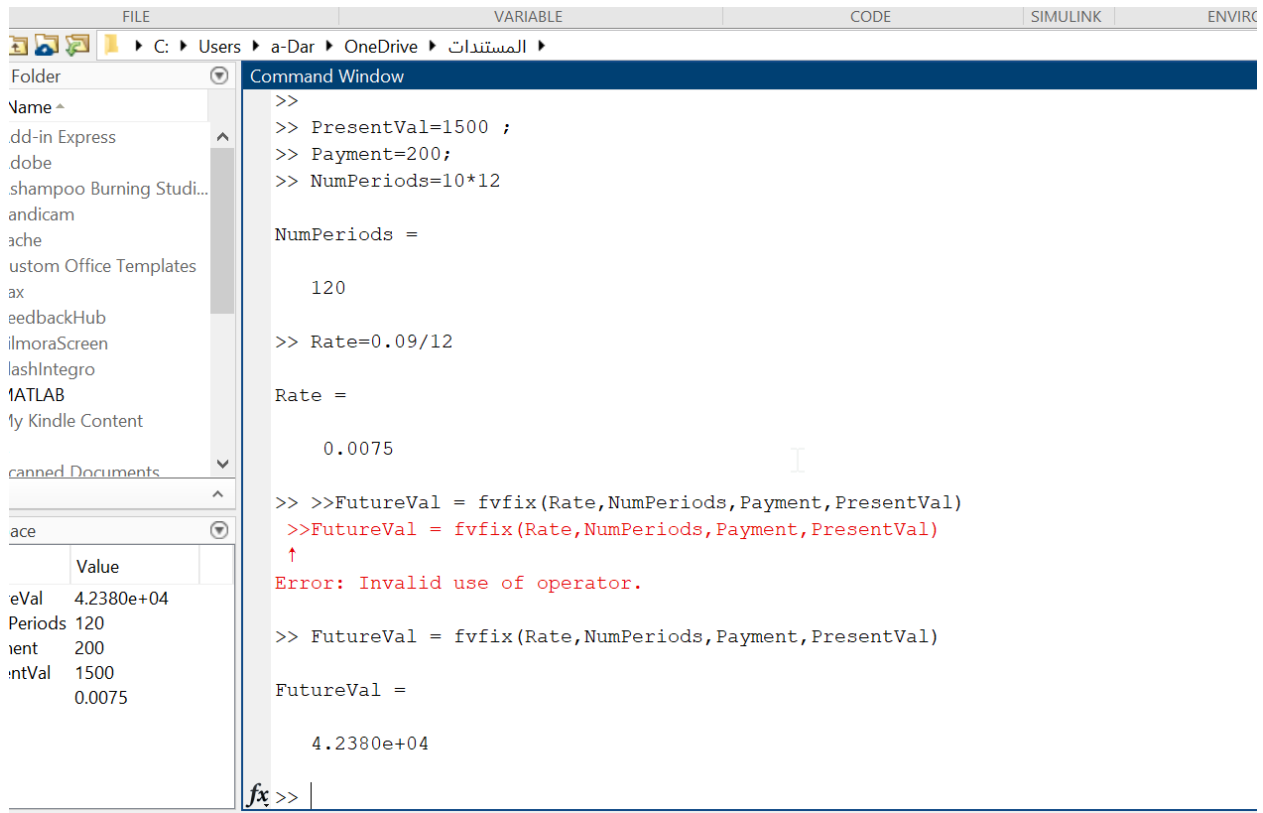
The screenshot shows the MATLAB environment. The Command Window on the right contains the following code and output:

```
>>  
>>  
>>  
>>  
>>  
>>  
>>  
>>  
>>  
>>  
>>  
>>  
>> NumPeriods=24;  
>> PresentValue=9000;  
>> Rate=0.1275/12  
  
Rate =  
  
    0.0106  
  
>> Payment = payper(Rate,NumPeriods,PresentValue)  
  
Payment =  
  
    426.8203  
  
fx >>
```

The Workspace on the left shows the following variables:

Name	Value
NumPeriods	24
Payment	426.8203
PresentVal...	9000
Rate	0.0106
s	20x1 double

- 2) Calculate the future value of a series of equal payments using a saving account that has a starting balance of \$1500. \$200 is added at the end of each month for 10 years and the account pays 9% interest compounded monthly.



### **Exercise 3: [5]**

**A-** The price of treasury for bond at three different yield values

Where

yield rate 0.04,0.05,0.06

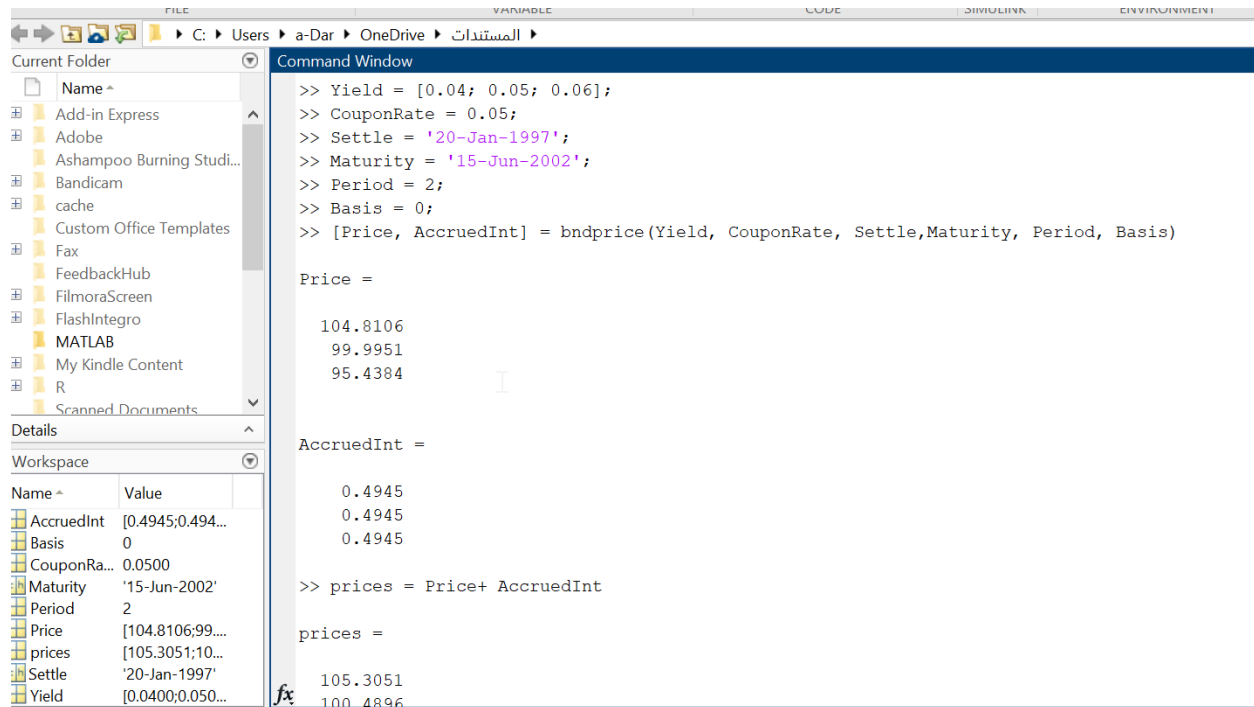
coupon rate= 0.05 ,

Settle 20/January/1997 ,

maturity 15/jun/2002,

period =2,

Basis=0.



The screenshot shows the MATLAB Command Window and Workspace. The Command Window contains the following code and output:

```

>> Yield = [0.04; 0.05; 0.06];
>> CouponRate = 0.05;
>> Settle = '20-Jan-1997';
>> Maturity = '15-Jun-2002';
>> Period = 2;
>> Basis = 0;
>> [Price, AccruedInt] = bndprice(Yield, CouponRate, Settle, Maturity, Period, Basis)

Price =

    104.8106
     99.9951
     95.4384

AccruedInt =

     0.4945
     0.4945
     0.4945

>> prices = Price + AccruedInt

prices =

    105.3051
    100.4896

```

The Workspace shows the following variables:

Name	Value
AccruedInt	[0.4945; 0.4945; 0.4945]
Basis	0
CouponRate	0.0500
Maturity	'15-Jun-2002'
Period	2
Price	[104.8106; 99.9951; 95.4384]
prices	[105.3051; 100.4896]
Settle	'20-Jan-1997'
Yield	[0.0400; 0.0500; 0.0600]

**B- From following information**

Settle: 12/Jan/2000

Maturity= 1/Oct/2001

Issue date=1/Jan/2000

, First Coupon Date=15/Jan/2000,

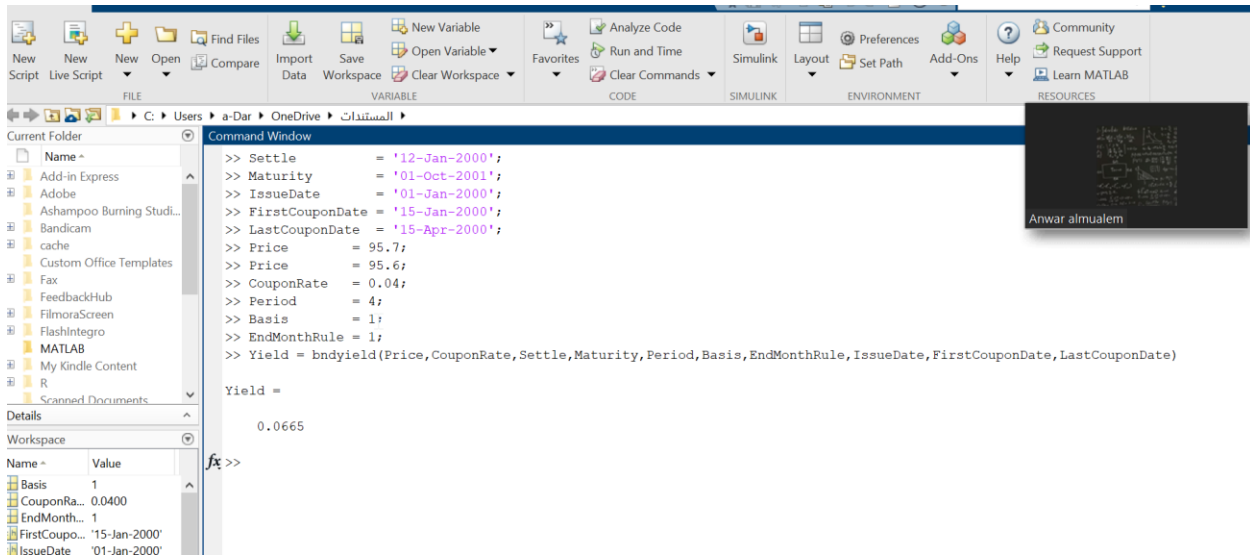
, Last CouponDate=15/Apr/2000,

Face value= \$100, specify a purchase price of \$95.60, a coupon rate of 4% quarterly coupon payments, and a 30/360 day-count convention (Basis=1).

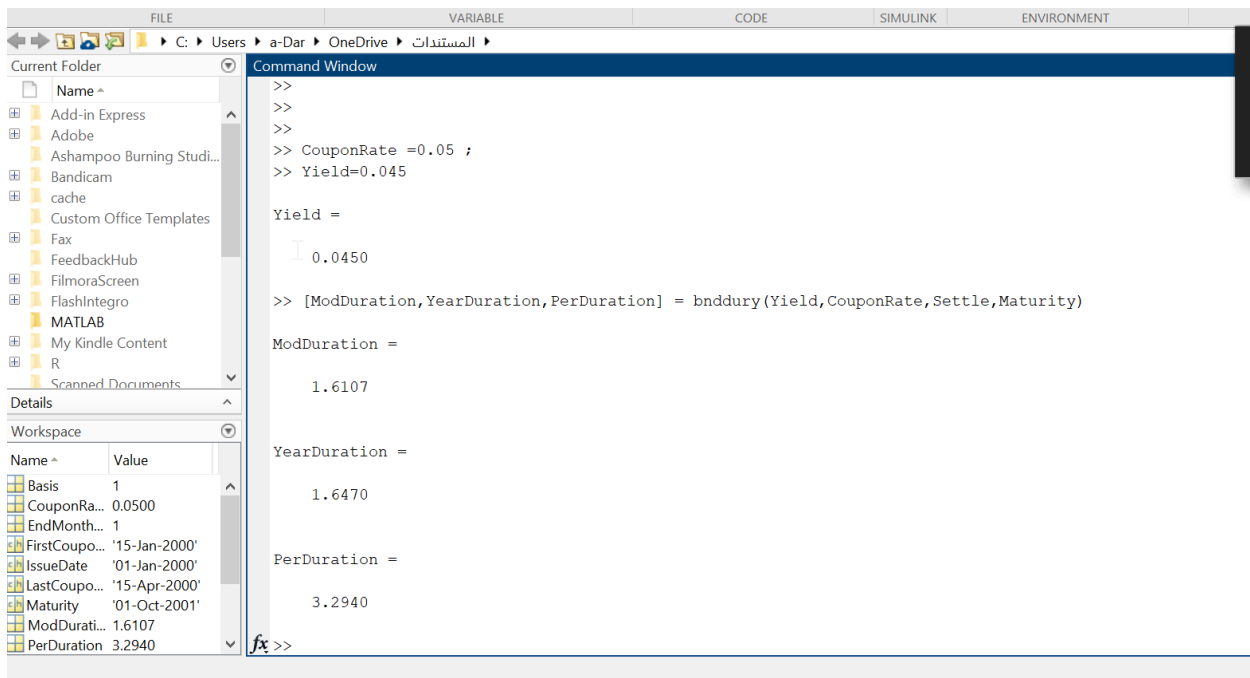
**1) Calculate yield by using the function**

**2) if you change the coupon Rate =0.05 and Yield= 0.045,**

Calculate ModDuration, YearDuration, and PerDuration .



2-

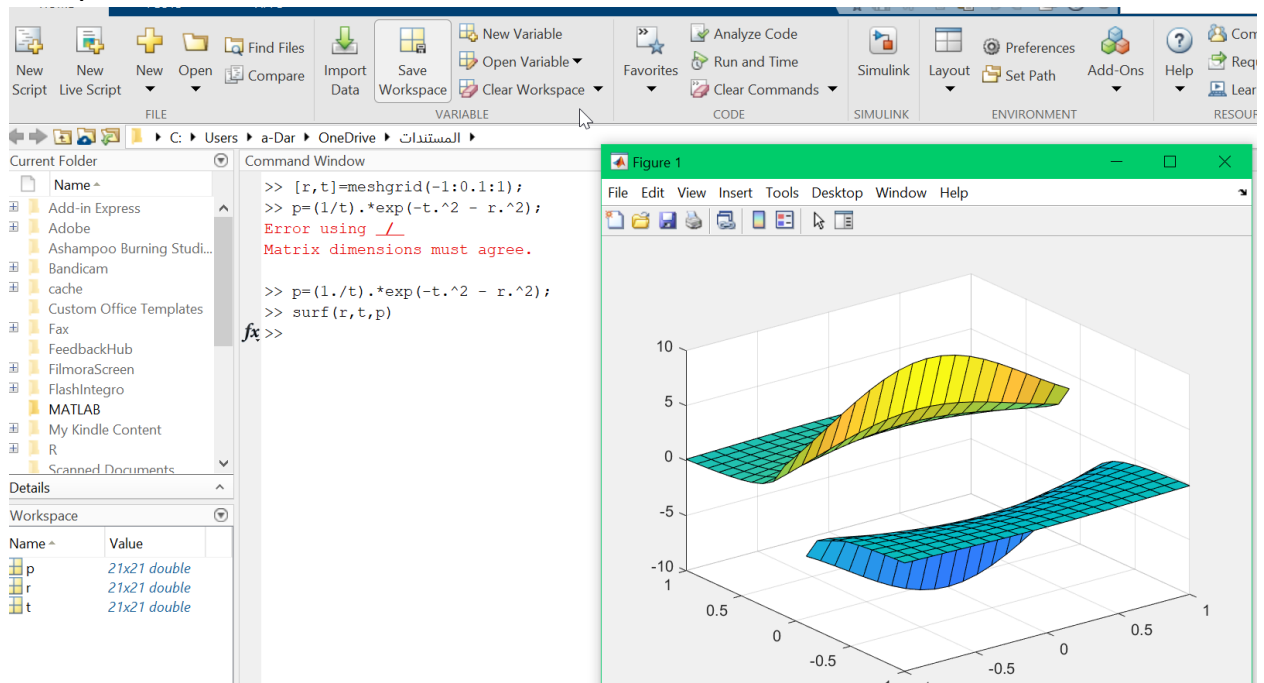


## Exercise 4: [3]

Let the price function define as follows

$$P = \frac{1}{t} e^{(-t^2 - r^2)}$$
, where  $t, r \in (-1, 1)$  where the length of period is 0.1, and  $t$  represent the time and  $r$  represent the interest rate

## 1- Plot p,t,r in 3D.



## Exercise 5: [6]

Suppose you have the following information of a European option

The asset price is \$110.00, the exercise price is \$95.00, the risk-free interest rate is 15%, the time to maturity is 3 months in a year, the volatility is 0.50, and the dividend rate is 0

**Calculate :**

**call and put prices** of a European option and its **delta, gamma, lambda,** and implied **volatility**.



Script Live Script FILE VARIABLE CODE SIMULINK ENVIRONMENT

C:\Users\A-Dar\OneDrive\المستندات

Current Folder

Name
Add-in Express
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Bandicam
cache
Custom Office Templates
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FilmoraScreen
FlashIntegro
MATLAB
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R
Scanned Documents

Details

Workspace

Name	Value
Call	21.8493
CallDelta	0.8055
p	21x21 double
Price	110
Put	3.3527
PutDelta	-0.1945
r	21x21 double
Rate	0.1500
Strike	95

Command Window

```
>> Price=110;
>> Strike=95;
>> Rate=0.15;
>> Time=0.25;
>> Volatility=0.5;
>> [Call,Put] = blsprice(Price,Strike,Rate,Time,Volatility)

Call =

    21.8493

Put =

    3.3527

>> [CallDelta,PutDelta] = blsdelta(Price,Strike,Rate,Time,Volatility)

CallDelta =

    0.8055

PutDelta =

   -0.1945

>> Gamma = blsgamma(Price,Strike,Rate,Time,Volatility)

Gamma =

    0.0100

>> [CallEl,PutEl] = blslambda(Price,Strike,Rate,Time,Volatility)

CallEl =

    4.0553

PutEl =

   -6.3815

fx>>
```

```
>> Volatility = blsimpv(Price,Strike,Rate,Time,Call)
```

```
Volatility =
```

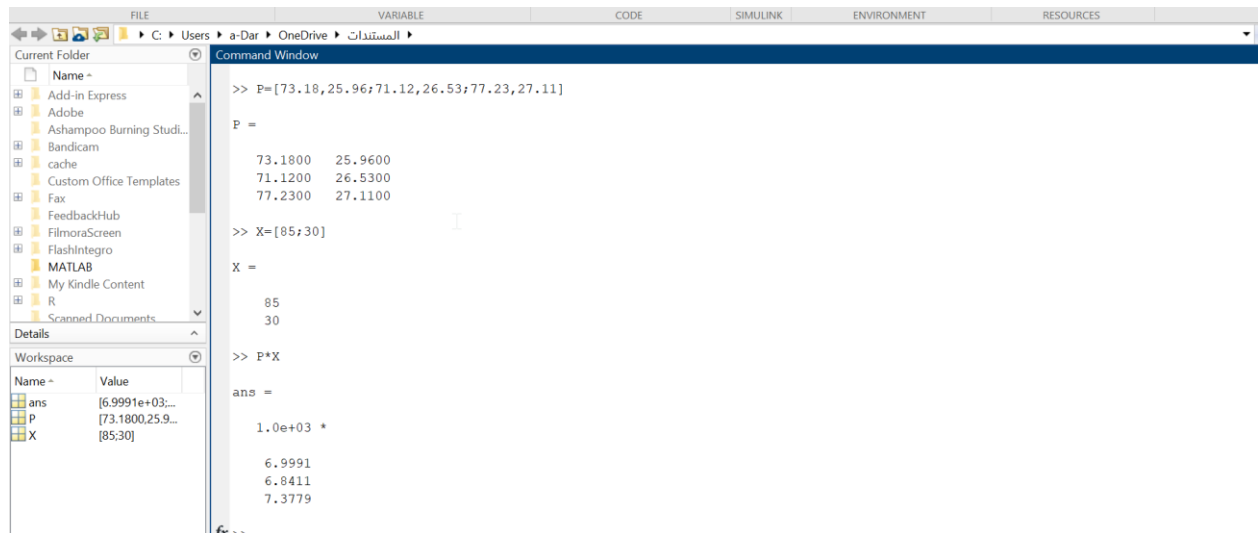
```
    0.5000
```

### And the put is NaN

**B-** If you have the price matrix in three days for risky asset as follows

$$P = \begin{bmatrix} 73.1800 & 25.9600 \\ 71.1200 & 26.5300 \\ 77.2300 & 27.1100 \end{bmatrix}$$

How much do you need to invest in these risky asset in order to get \$ 85 in first risky asset and \$ 30 in second risky asset.



The screenshot shows the MATLAB Command Window and Workspace. The Command Window contains the following code and output:

```
>> P=[73.18,25.96;71.12,26.53;77.23,27.11]
P =
    73.1800    25.9600
    71.1200    26.5300
    77.2300    27.1100

>> X=[85;30]
X =
     85
     30

>> P*X
ans =
    1.0e+03 *
    6.9991
    6.8411
    7.3779
```

The Workspace window shows the following variables:

Name	Value
ans	[6.9991e+03;...]
P	[73.1800,25.9...]
X	[85;30]

6999.1>>>for the first day

6841.1>>> for the second day

7377.9 >>> for the third day

c) load ibm data and then plot the first fourth column vrs time

where y axis represent price and x axis represent the date from earliest day to latest day.

