

BIL108E MIDTERM EXAM II

Duration: 3 hours from 8.30 to 11.30.

Do not copy/cheat or submit “similar” papers.

Do not publish exam questions and do not beg for answers in any social media.

You are not allowed to ask questions to the proctors and instructors during exam.

Do not write any explanations in Turkish.

Please create your .m files as indicated and submit your solutions via ninova. Do not upload .mat files. Use .zip or .rar extension to complete submission once.

Please make sure your files work. Any script files which offer errors when run will be directly graded zero.

Explain your work and discuss your results using % comment operator for all questions.

Best Luck

- 1) (16 Points) Open a new script in the Matlab Editor and save it as `sphericaltank.m`

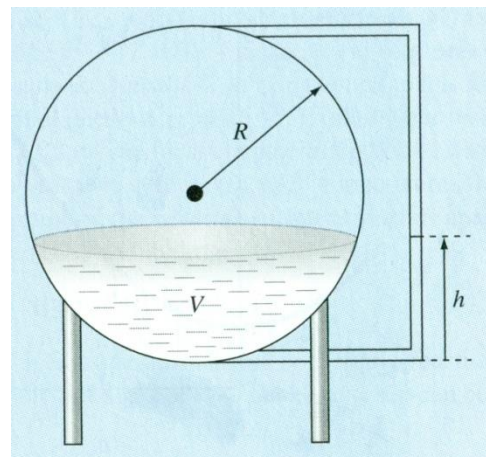
You are designing a spherical tank to hold water for a small village in a developing country. The volume of liquid it can hold can be computed as

$$V = \pi h^2 \frac{[3R - h]}{3}$$

where V = volume (m^3), h = depth of water in tank (m), and R = the tank radius (m).

If $R = 10$ m, determine the depth the tank must be filled to so that it holds 1000 m^3 using

- Bisection Method,
- Newton-Raphson Method,
- Secant Method.
- Using built-in “roots” function; find the actual value of depth of water. Calculate relative error for and comment on approximation accuracy of methods mentioned at a), b), and c). (Three separate relative errors and three comments are needed).



- 2) **(16 Points)** Open a new script in the Matlab Editor and save it as `calendar.m`
The price (in Euros) of a magazine has changed as follows:

Nov.87	Dec.88	Nov.90	Jan.93	Jan.95	Jan.96	Nov.96	Nov.00
4.5	5	6	6.5	7	7.5	8	8

Estimate the price in November 2002 using

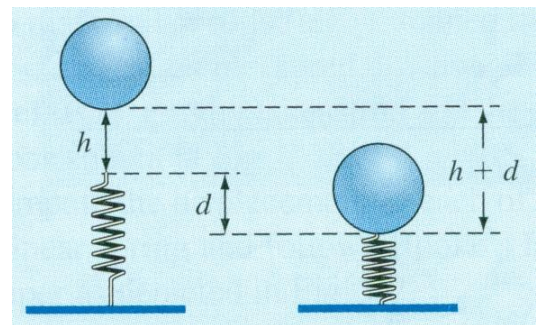
- Curve fitting (*polyfit & polyval*).
- Built-in function *interp1*.

Use comment operator to discuss your answers and your algorithm.

- 3) **(16 Points)** Open a new script in the Matlab Editor and save it as `spring.m`

A block of mass m is released a distance h above a non-linear spring. Conservation of energy states that

$$mg(h + d) = \frac{2k_2 d^{\frac{5}{2}}}{5} + \frac{1}{2}k_1 d^2$$



Solve for d , given the following parameter values:

$k_1 = 40000 \text{ g/s}^2$, $k_2 = 40 \text{ g/(s}^2\text{m}^{0.5}\text{)}$, $m = 95 \text{ g}$, $g = 9.81 \text{ m/s}^2$, and $h = 0.43 \text{ m}$, using

- Bisection Method,
- Newton-Raphson Method
- Secant Method
- Using built-in “roots” function; find the actual value of d . Calculate relative error for and comment on approximation accuracy of methods mentioned at a), b), and c). (Three separate relative errors and three comments are needed).

- 4) **(16 Points)** Open a new script in the Matlab Editor and save it as `surfacearea.m`
On average the surface area A of human beings is related to weight W and height H . Measurements on a number of individuals of height 180 cm and different weights (kg) give values of A (m^2) in the following table.

W (kg)	70	75	77	80	82	84	87	90
A (m^2)	2.10	2.12	2.15	2.20	2.22	2.23	2.26	2.30

Predict the surface area for a 95-kg person using

- Curve fitting (*polyfit & polyval*).
- Built-in function *interp1*.

- 5) **(10 Points)** Please correct the codes given below and save them as `corrected5A.m`, `corrected5B.m` and `corrected5C.m`

a) `x=-34:-1:15;`

```
y=x^5-3*x^4-11*x^3+27*x^2+10*x-24
```

```
dy=diff[y]/diff[x];
```

```
plot(x,y,'o',x,dy)
```

b) `p1 = (1 2 4 3 2 3 6 9 8);`

```
p2 = (9 9 9 9 9 7 8 16 )
```

```
p = p1 + p2
```

c) `p1 = (1 2 4 3 2 3 6 9 8);`

```
p2 = (9 9 9 9 9 7 8 16);
```

```
p3 = (1 2 9 6);
```

```
p4 = conv(p1,p2,p3)
```

Use comment operator (%) to describe your correction or comments.

6. **(26 Points)** Please explain in detail the difference between choosing and using `if` construct, while loop or `for` loop when offering a MatLab-based solution to a problem.

Use your own words!

7. **Bonus (10 Points)** Open a new script in the Matlab Editor and save it as `numberstogrades.m`. With user input, develop an `.m` file that is passed a numeric grade from 0 to 100 and returns a letter grade according to the scheme:

Letter	Criteria
A	$90 \leq \text{numeric grade} \leq 100$
B	$80 \leq \text{numeric grade} < 90$
C	$70 \leq \text{numeric grade} < 80$
D	$60 \leq \text{numeric grade} < 70$
E	$\text{numeric grade} < 60$