ESC 152: Programming with MATLAB

Computer Lab Exercise[1,2,3,4]

3.1. For the function $y = x^2 - \frac{x}{x+3}$, calculate the value of y for the following values of x using element-by-element operations: 0, 1, 2, 3, 4, 5, 6, 7 .

3.2. For the function $y = x^4 e^{-x}$, calculate the value of y for the following values of x using element-by-element operations: 1.5, 2, 2.5, 3, 3.5, 4 .

3.3. For the function $y = (x + x\sqrt{x+3})(1+2x^2) - x^3$, calculate the value of y for the following values of x using element-by-element operations: –2, –1.5, –1, –0.5, 0, 0.5, 1, 1.5, 2.

3.4. For the function $y = \frac{4 \sin x + 6}{(\cos^2 x + \sin x)^2}$, calculate the value of y for the following values of x using element-by-element operations: 15°, 25°, 35°, 45°, 55°, 65° .

3.5. The radius, r, of a sphere can be calculated from its volume, V, by:

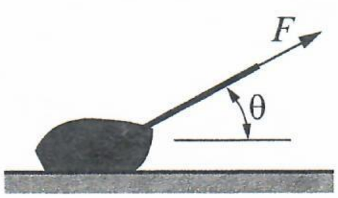
$$r = \sqrt[3]{\frac{3V}{4\pi}}$$

The surface area of a sphere, S, is given by:

$$S = 4\pi r^2$$

Determine the radius and surface area of spheres with volumes of 4,000, 3,500, 3,000, 2,500, 2,000, 1,500, and 1,000 in.^{3}. Display the results in a three-column table where the values of r, V, and S are displayed in the first, second, and third columns, respectively. The values of r and S that are displayed in the table should be rounded to the nearest tenth of an inch.

3.6. A 70 lb-bag of rice is being pulled by a person by applying a force F at an angle θ as shown. The force required to drag the bag is given by:



$$F(\theta) = \frac{70\mu}{\mu \sin\theta + \cos\theta}$$

where $\mu = 0.35$ is the friction coefficient.

(*a*) Determine $F(\theta)$ for θ = 5°, 10°, 15°, 20°, 25°, 30°, and 35° .

(*b*) Determine the angle θ where F is minimum. Do it by creating a vector θ with elements ranging from 5° to 35° and spacing of 0.01. Calculate F for each value of θ and then find the maximum F and associated θ with MATLAB's built-in function `max`.

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[1] Fully understand the problem.
[2] Decide on an algorithm.
[3] Program algorithm in MATLAB.
[4] Debug if necessary.

4.11. Early explorers often estimated altitude by measuring the temperature of boiling water. Use the following two equations to make a table that modern-day hikers could use for the same purpose.

$$p = 29.921(1 - 6.8753 \times 10^{-6} h), \qquad T_b = 49.161 \ln p + 44.932$$

where p is atmospheric pressure in inches of mercury, T_b is boiling temperature in °F, and h is altitude in feet. The table should have two columns, the first altitude and the second boiling temperature. The altitude should range between –500 ft and 10,000 ft at increments of 500 ft.

```
3.1  y =
       0.7500    3.6000    8.5000   15.4286   24.3750
      35.3333   48.3000
```

```
3.2  y =
       1.1296    2.1654    3.2064    4.0328    4.5315
       4.6888
```

```
3.3  y =
     -28.0000  -14.9791   -6.2426   -1.8109
       2.0281    8.0000   22.3759   50.2492
```

```
3.4  y =
       4.9528    4.9694    5.3546    6.0589    7.0372
       8.1775
```

```
3.5  Result =
            9.80       4000.00       1218.60
            9.40       3500.00       1114.80
            8.90       3000.00       1005.90
            8.40       2500.00        890.80
            7.80       2000.00        767.70
            7.10       1500.00        633.70
            6.20       1000.00        483.60
```

```
3.6  F =
          23.86      23.43      23.19      23.13
          23.24      23.53      24.02
     Fmin =
          23.12
     at_Theta =
          19.29
```

4.11

Altitude (ft)	Boiling Temperature (degF)
-500	212.17
0	212.01
500	211.84
1000	211.67
1500	211.5
2000	211.32
2500	211.15
3000	210.98
3500	210.81
4000	210.63
4500	210.46
5000	210.29
5500	210.11
6000	209.93
6500	209.76
7000	209.58
7500	209.4
8000	209.22
8500	209.04
9000	208.87
9500	208.68
10000	208.5