

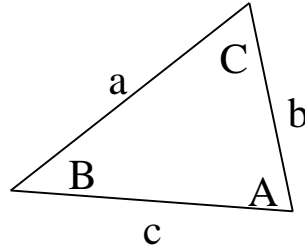
MATLAB Assignment #2

Reading Assignment:

MATLAB Lecture #2
 MATLAB Handout

MATLAB Assignment:

1. Write a MATLAB program to calculate the three angles in a triangle given the three sides using the law of cosines.



Law of Cosines

$$a^2 = b^2 + c^2 - 2 \cdot b \cdot c \cdot \cos(A)$$

Example :

If $a = 20$, $b = 15$, $c = 10$, then

$$20^2 = 15^2 + 10^2 - 2 \cdot (15) \cdot (10) \cdot \cos(A)$$

$$A = \cos^{-1} \left(\frac{15^2 + 10^2 - 20^2}{2 \cdot (15) \cdot (10)} \right)$$

$$A = 104.5^\circ$$

- Include comments in your program, including name, course, filename, description of the assigned problem, and explanations of program features.
- Display a description of the program
- Prompt the user to enter the three sides of the triangle.
- Display the three sides as well as the three angles in degrees (include the unit *degrees*).
- Test the program for the following cases:

Case	a	b	c
1	20	15	10
2	5	12	13
3	200	100	250

- Turn in a printout of the program and a printout of the output for the three cases above.

2. Write a MATLAB program to solve N simultaneous equations.

- Include comments in your program, including name, course, filename, description of the assigned problem, and explanations of program features.
- Display a description of the program.
- Display an example so the user will know how to enter the inputs (using brackets, semicolons, etc).
- Prompt the user to input matrices A and b.
- Test the program with the following simultaneous equations:

Case	Equations
1	$x_1 + 4x_2 + 7x_3 = 10$ $2x_1 + 9x_2 - x_3 = 15$ $12x_2 + 6x_3 = 20$
2	$3x_1 + 4x_2 = 52$ $2x_1 - 3x_2 = -5$
3	$x_1 + 2x_2 + 3x_3 + 4x_4 + 5x_5 = 30$ $10x_1 + 11x_2 + 12x_3 = 40$ $21x_2 + 22x_3 + 23x_4 = 50$ $x_1 - x_2 + x_3 - x_4 + x_5 = 60$ $9x_1 + 8x_2 + 7x_3 + 6x_4 + 5x_5 = 70$

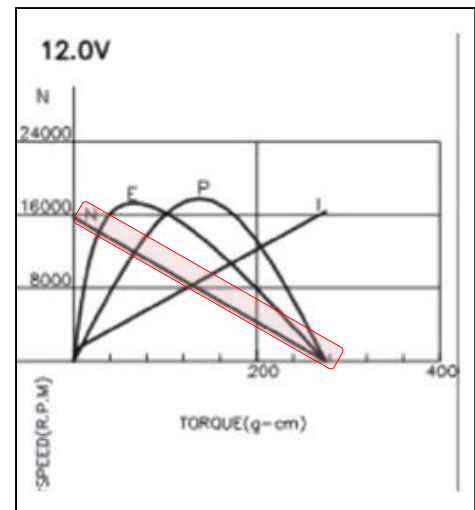
- Turn in a printout of the program and a printout of the output for the three cases above.

3. Write a MATLAB program to calculate the time that a cable car will require to travel the full length of the cable. See the example calculations provided in MATLAB Assignment #1.
- Include comments in your program, including name, course, filename, description of the assigned problem, and explanations of program features.
 - Display a description of the program.
 - Prompt the user to input:
 - a. The speed of the motor in rpm.
 - b. The diameter of the motor pulley in cm
 - c. The diameter of drive pulley in cm
 - d. The length of the cable in m
 - Compute the time to complete the course, based on the input values.
 - Display the four input values (with units) and the time to complete the course (in seconds).
 - Test the program for the following cases:

Case	Motor Speed (rpm)	Motor Pulley Diameter (cm)	Drive Pulley Diameter (cm)	Length of cable (m)	Time to complete course (seconds)
1	3000	1	6	50	
2	3000	1	3	50	
3	5000	1.5	6	50	
4	5000	1.5	3	50	

4. Write a MATLAB program to calculate the torque available at the cable pulley at various motor speeds and pulley ratios. Include comments in your program, including name, course, filename, description of the assigned problem, and explanations of program features.

- Display a description of the program.
- Prompt the user to input:
 - a. The speed of the motor in rpm.
 - b. The diameter of the motor pulley in cm
 - c. The diameter of drive pulley in cm
- Compute the time to complete the course, based on the input values.
- Display the input values (with units) and the torque delivered to the cable pulley in both gram-cm and foot-pounds.
- Test the program for the following cases:



Case	Motor Speed (rpm)	Motor Pulley Diameter (cm)	Drive Pulley Diameter (cm)	Torque delivered to the cable pulley
1	3000	1	6	
2	3000	1	3	
3	5000	1.5	6	
4	5000	1.5	3	

Use the diagram above of motor speed (N) versus motor torque (T) to . By observation we can determine the relationship between these two parameters is linear, and that the motor slows down when the demand for torque increases. Further, it can be approximated this relationship is modeled mathematically as:

$$N = -\frac{15500}{285} * T + 15500 \quad \text{-- OR --} \quad N = -\frac{3100}{57} * T + 15500$$

Solving this equation for T, produces a new equation: $T = 57/3100(15500 - N)$

Use the keyboard entry value of motor speed (N) to find the motor torque at the motor pulley. Then compute the torque delivered to the cable pulley using the following:

$$\text{Cable pulley torque} = \frac{(\text{diameter of cable pulley})}{(\text{diameter of motor pulley})} * \text{motor pulley torque}$$

NOTE: The Torque ratio of a pulley and belt system (as well as a gear set) is the inverse of the speed ratio.

NOTE: your team's design project cable car will perform proportionally less than this diagram indicates, as the motor is powered by only a 9V battery (and the provided graph is based on a 12 volt power to the motor).