

Introduction To Engineering – Assignment 05

#	Student ID	Student Name	Grade (10)
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Delivery Date	
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<p>١. يتم تسليم التمرين محلولا في خلال أسبوع من تاريخ التمرين، و يتم حذف درجتين من التمرين عن كل أسبوع تأخير</p> <p>٢. يتم التسليم لمعيد المقرر مباشرة</p> <p>٣. تتم أجابه التمرين في نفس ورق الأسئلة</p>



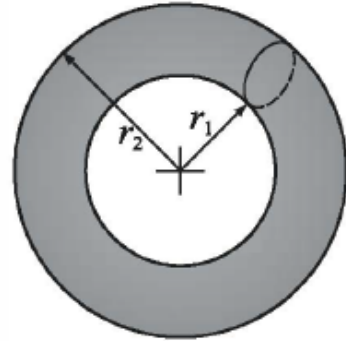
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Q1

The volume V and the surface area S of a torus-shaped water tube are given by:

$$V = \frac{1}{4}\pi^2(r_1 + r_2)(r_2 - r_1)^2 \quad \text{and} \quad S = \pi^2(r_2^2 - r_1^2)$$

If $r_1 = 0.7r_2$, determine V and S for $r_2 = 12, 16, 20, 24,$ and 28 in. Display the results in a four-column table where the first column is r_2 , the second r_1 , the third V , and the fourth S .



Sol 1

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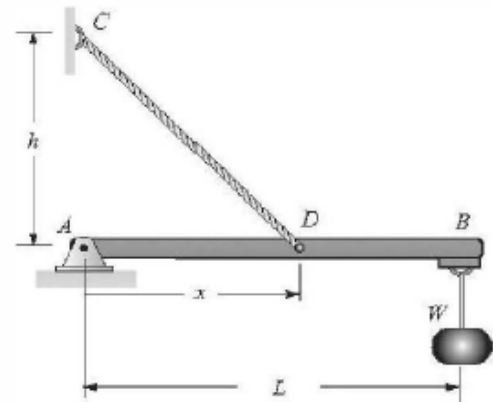
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Q2

A beam with a length L is attached to the wall with a cable as shown. A load $W = 500 \text{ lb}$ is attached to the beam. The tension force, T , in the cable is given by:

$$T = \frac{WL\sqrt{h^2 + x^2}}{hx}$$

For a beam with $L = 120 \text{ in.}$ and $h = 50 \text{ in.}$, calculate T for $x = 10, 30, 50, 70, 90,$ and 110 in.



Sol 2

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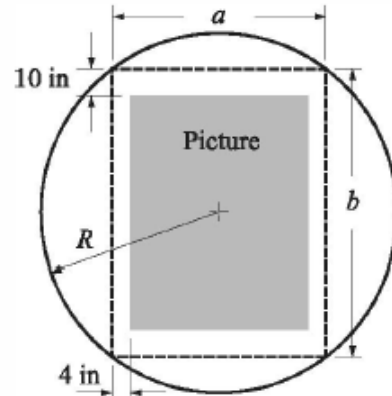
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Q3

A round billboard with radius $R = 55$ in. is designed to have a rectangular picture placed inside a rectangle with sides a and b . The margins between the rectangle and the picture are 10 in. at the top and bottom and 4 in. at each side. Write a MATLAB program that determines the dimensions a and b such that the overall area of the picture will be as large as possible. In the program define a vector a with values ranging from 5 to 100 with increments of 0.25. Use this vector for calculating the corresponding values of b and the overall area of the picture. Then use MATLAB's built-in function `max` to find the dimensions of the largest rectangle.



Sol 3

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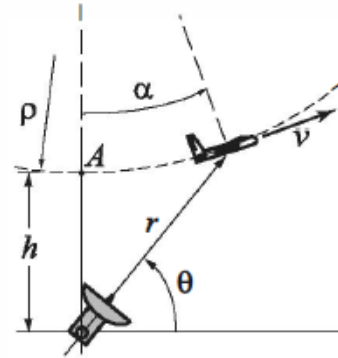
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Q4

The airplane shown is flying at a constant speed of $v = 50$ m/s in a circular path of radius $\rho = 2000$ m and is being tracked by a radar station positioned a distance $h = 500$ m below the bottom of the plane path (point A). The airplane is at point A at $t = 0$, and the angle α as a function of time is given (in radians) by $\alpha = \frac{v}{\rho}t$. Write a MATLAB program that calculates θ and r as functions of time. The program should first determine the time at which $\alpha = 90^\circ$. Then construct a vector t having 15 elements over the interval $0 \leq t \leq t_{90^\circ}$, and calculate θ and r at each time. The program should print the values of ρ , h , and v , followed by a 15×3 table where the first column is t , the second is the angle θ in degrees, and the third is the corresponding value of r .



Sol 4

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