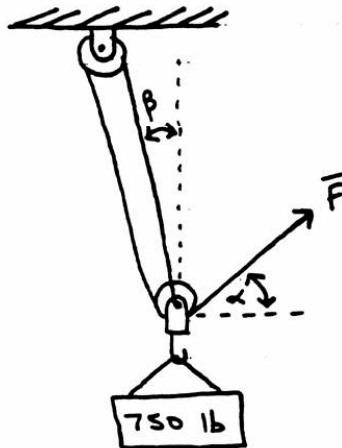


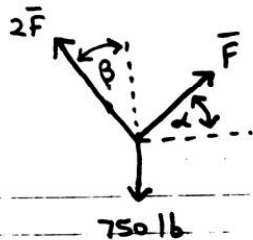
SAMPLE Computer Solution

Problem 2.C2 A 750-lb crate is supported by the rope-and-pulley arrangement shown. Write a computer program which can be used to determine, for a given value of β , the magnitude and direction of the force F which should be exerted on the free end of the rope. Use this program to calculate F and α for values of β from 0 to 30° at 5° intervals.



Solution:

Free Body Diagram: (lower pulley)



$$\Sigma F_x = 0 = F \cos \alpha - 2F \sin \beta$$

$$\cos \alpha = 2 \sin \beta$$

$$\alpha = \cos^{-1}(2 \sin \beta)$$

$$\Sigma F_y = 0 = F \sin \alpha + 2F \cos \beta - 750$$

$$F(\sin \alpha + 2 \cos \beta) = 750$$

$$F = \frac{750}{\sin \alpha + 2 \cos \beta}$$

Now write a computer program to solve the 2 boxed equations above for $\beta = 0$ to 30° in 5° increments.

Sample Computer Solution Using Excel

A B C D E F G H

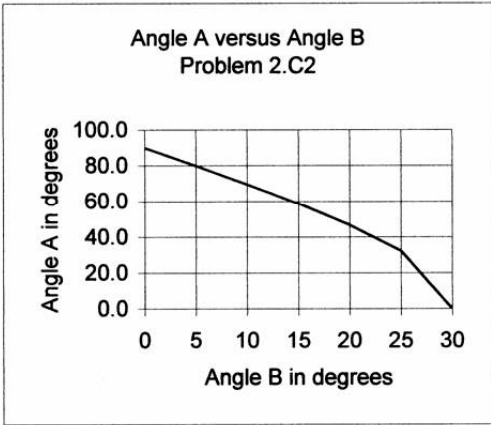
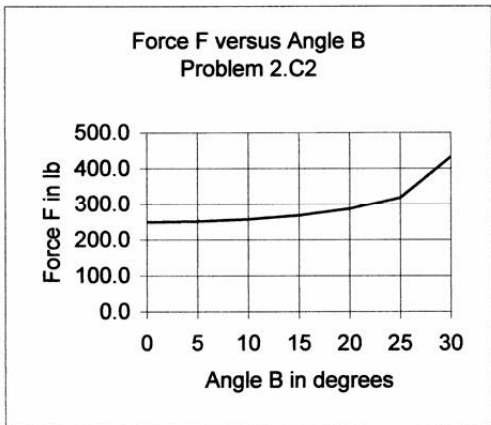
1 John Doe
 2 EGR 140
 3 Statics
 4 Filename: N1402C2.xls
 5
 6 Problem 2.C2

7
 8 A 750-lb crate is supported by the rope-and-pulley arrangement shown. Write a computer program which
 9 can be used to determine, for a given value of B, the magnitude and direction of the force F which should be
 10 exerted on the free end of the rope. Use this program to calculate F and A for values of B from 0 to 30 degrees
 11 in 5 degree increments.

12
 13 Solution: See additional sheet for Free Body Diagram and development of equations.

B (degrees)	A (degrees)	F (lb)
0	90.0	250.0
5	80.0	251.9
10	69.7	258.0
15	58.8	269.1
20	46.8	287.5
25	32.3	319.6
30	0.0	433.0

24 Formula for cell B16: $\text{DEGREES}(\text{ACOS}(2*\text{SIN}(\text{RADIANS}(A16))))$
 25 Formula for cell C16: $750/(2*\text{COS}(\text{RADIANS}(A16))+\text{SIN}(\text{RADIANS}(B16)))$



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