# EX 5 Arch-Cable Structure

## Task 1   Arch-Cable Structure with Different Support Conditions

Draw the force diagrams for the cases given. Determine the magnitude of A and B and indicate tension forces with red and compression forces with blue.


Form Diagram 1:100
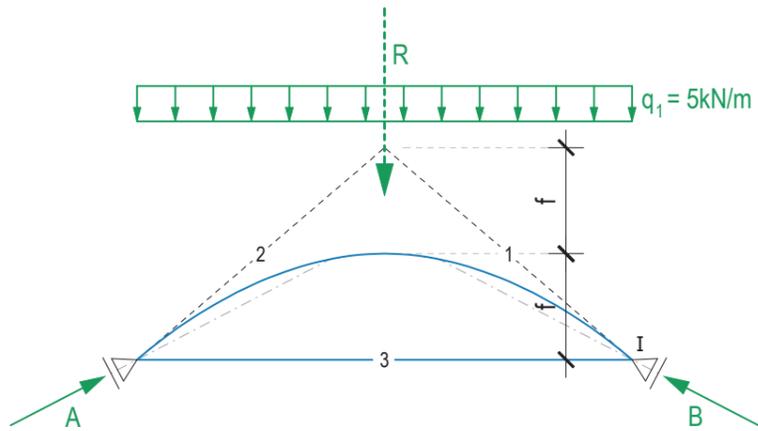
Free Body Diagram
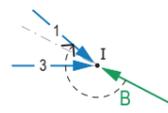
Force Diagram 1cm ≙ 5kN

$q_1 = 5kN/m$
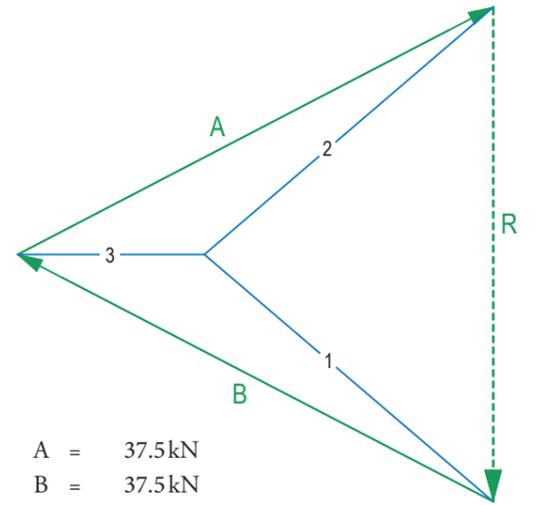
A = 37.5 kN
B = 37.5 kN

Form Diagram 1:100
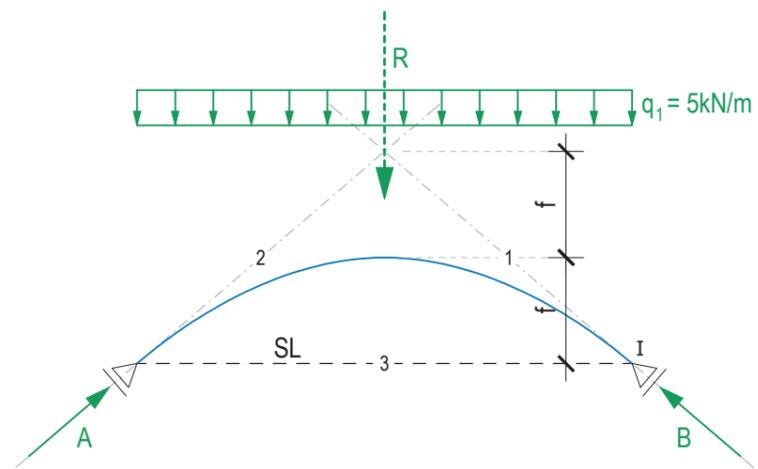
Free Body Diagram
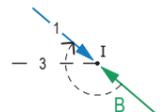
Force Diagram 1cm ≙ 5kN

$q_1 = 5kN/m$
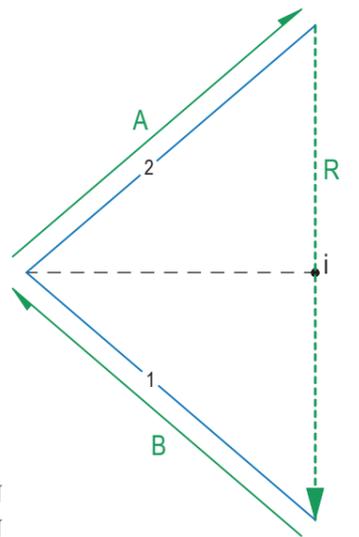
A = 26.8 kN
B = 26.8 kN

Form Diagram 1:100
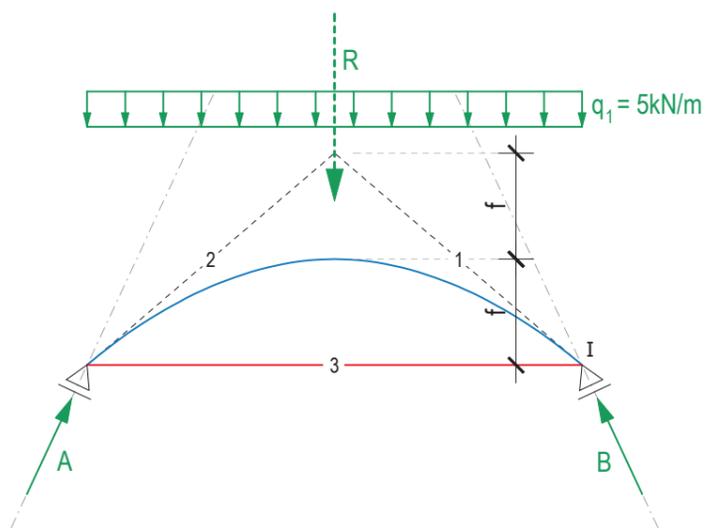
Free Body Diagram
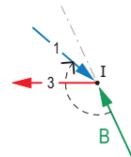
Force Diagram 1cm ≙ 5kN

$q_1 = 5kN/m$

A = 19.3 kN
B = 19.3 kN

Form Diagram 1:100

Free Body Diagram

Force Diagram 1cm ≙ 5kN

$q_1 = 5kN/m$
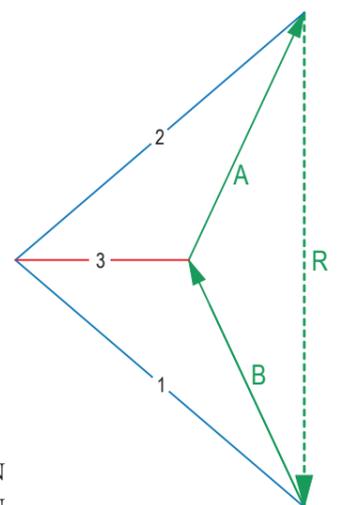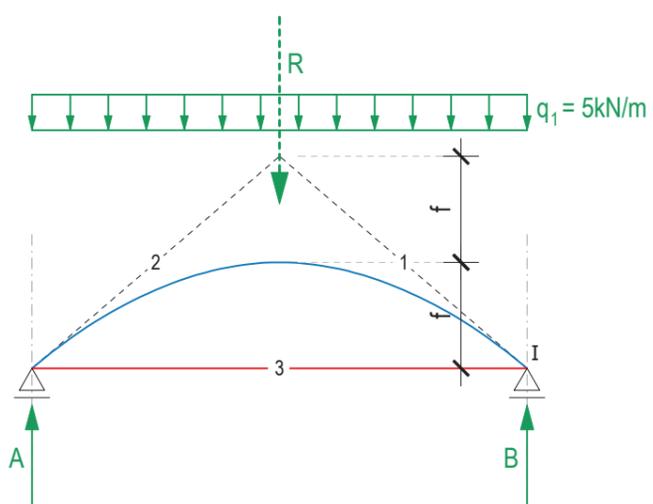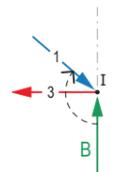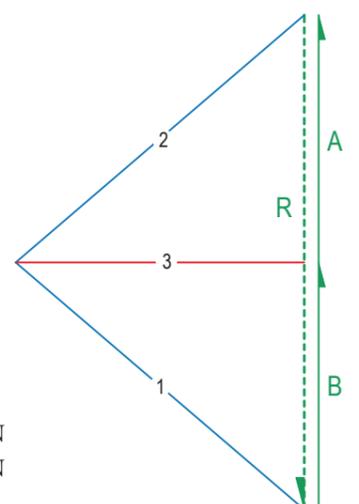
A = 17.5 kN
B = 17.5 kN

Task 2 Reaction Forces

Draw the support reactions in the force and form diagram and determine their magnitude using graphic statics.
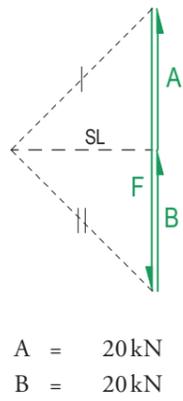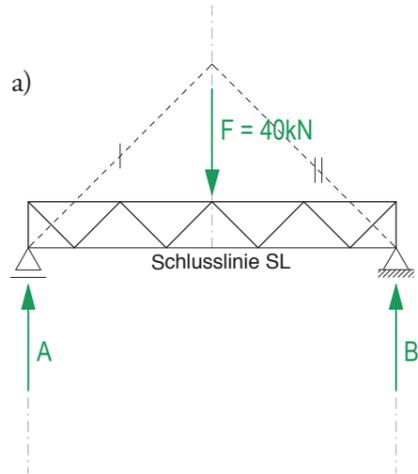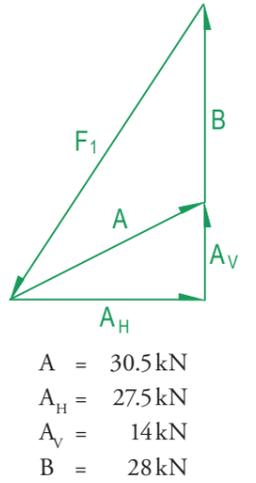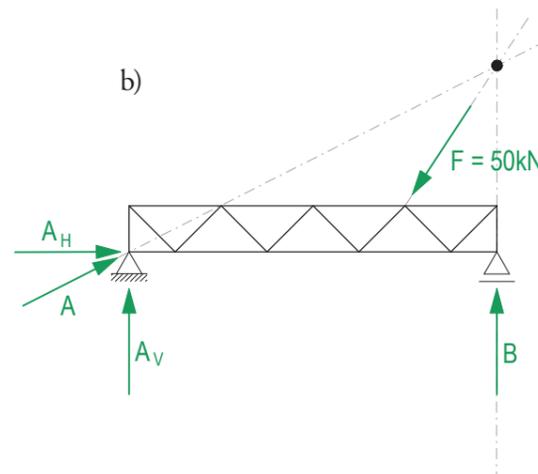
a)

$F = 40\,kN$

Schlusslinie SL

A   B

SL

F

A   B

$\begin{aligned} A &= 20\,kN \\ B &= 20\,kN \end{aligned}$

form diagram 1:100   *force diagram 1cm ≙ 10kN*

b)

A_H

A

$F = 50\,kN$

A_V B

F_1 B

A

A_V

A_H

$\begin{aligned} A &= 30.5\,kN \\ A_H &= 27.5\,kN \\ A_V &= 14\,kN \\ B &= 28\,kN \end{aligned}$

form diagram 1:100   *force diagram 1cm ≙ 10kN*

c)

$F = 40\,kN$

SL

A   B

SL

F

A   B

$\begin{aligned} A &= 20\,kN \\ B &= 20\,kN \end{aligned}$

form diagram 1:100   *force diagram 1cm ≙ 10kN*

d)

$F_1 = 25\,kN$ $F_2 = 10\,kN$

A   R   B

SL

o'   A

SL F_1

F_2 B

$\begin{aligned} R &= 35\,kN \\ A &= 21\,kN \\ B &= 14\,kN \end{aligned}$
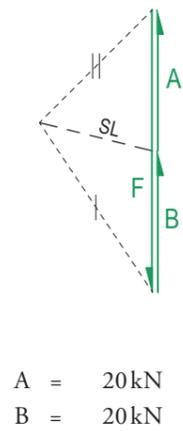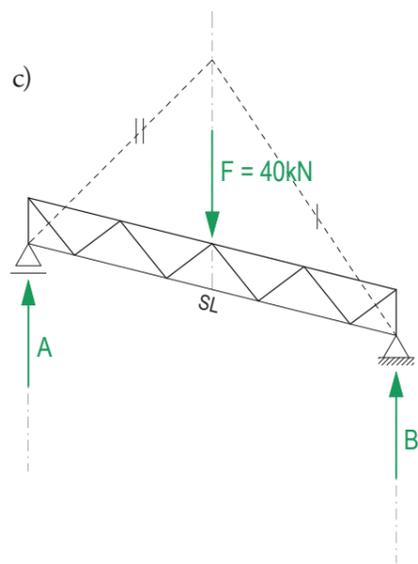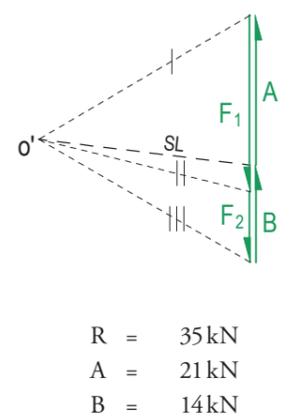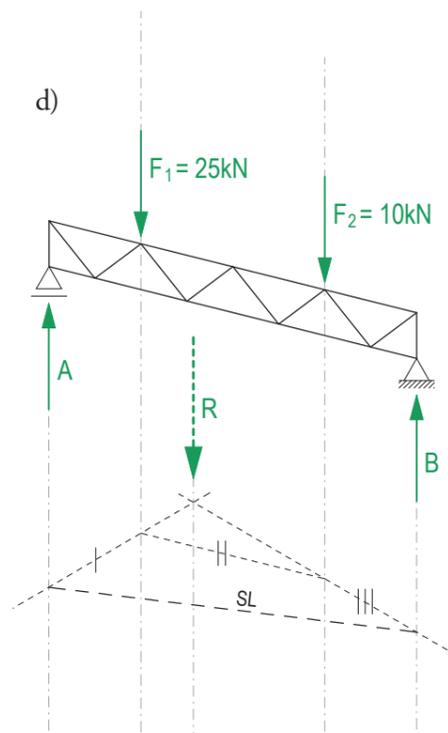
*form diagram 1:100*   *force diagram 1cm ≙ 10kN*

Task 3 Reaction Forces

The given structure consists of solid blocks. Finde the resultand due to the given loads. How big are the support reactions A and B?
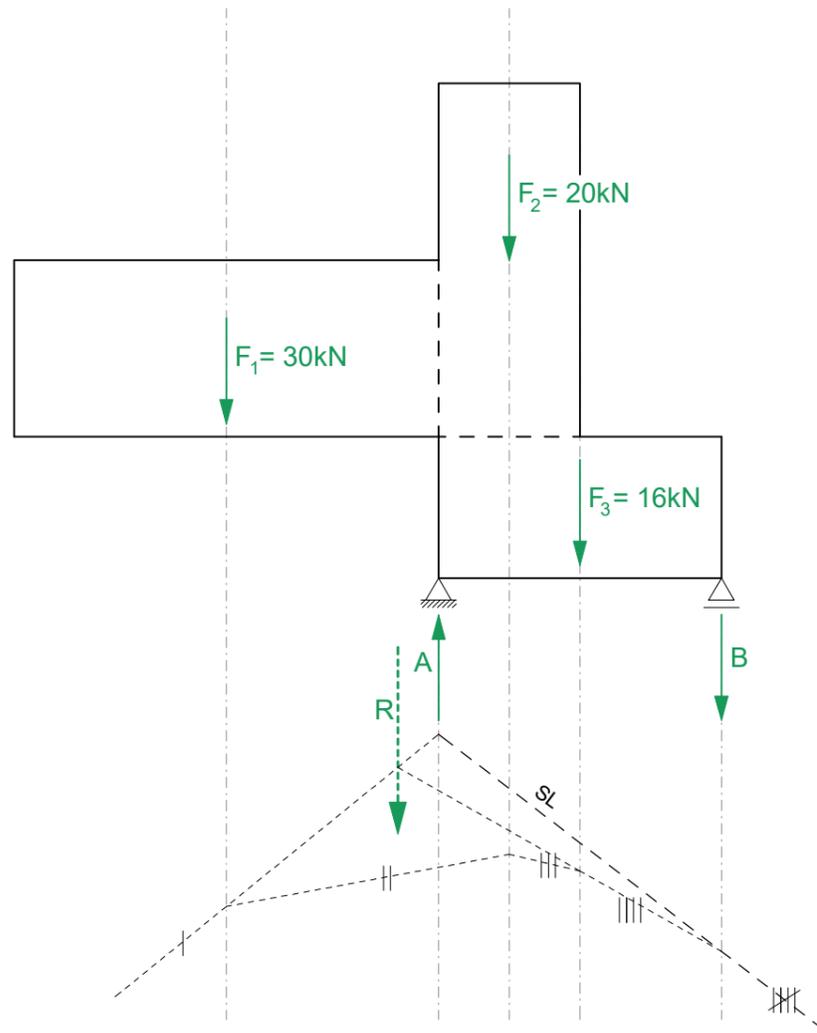

form diagram 1:100
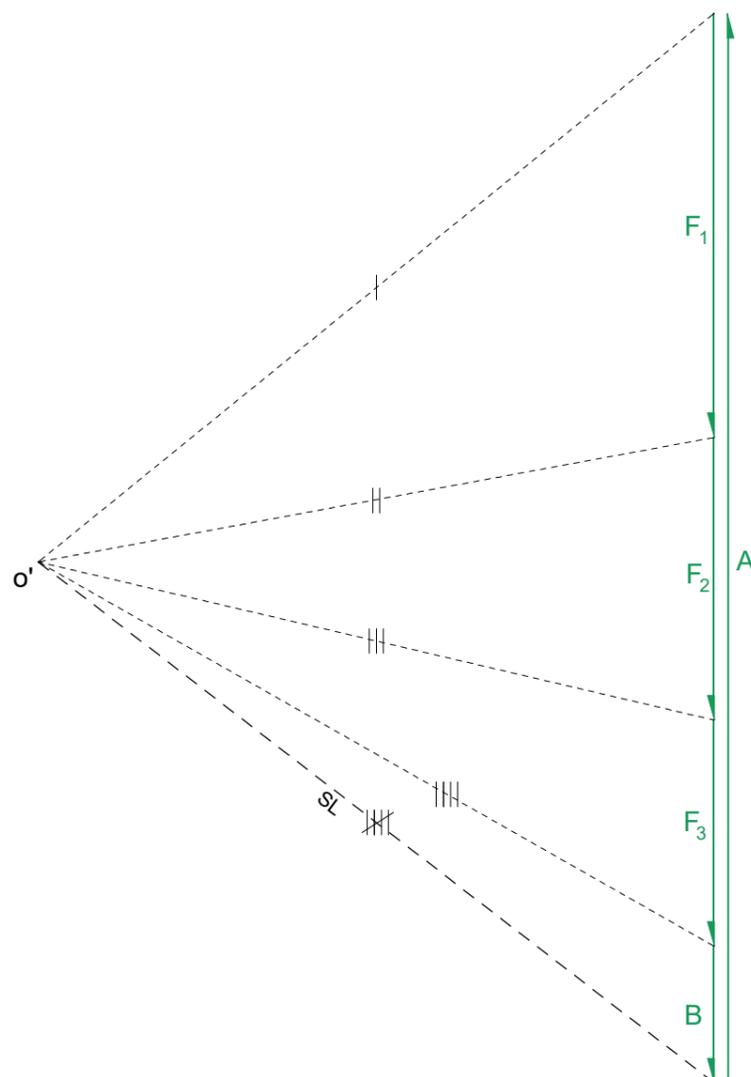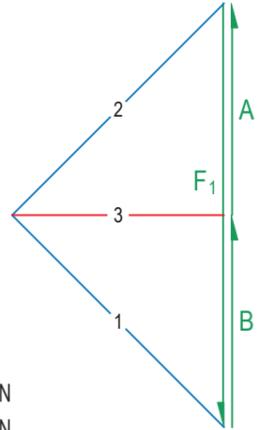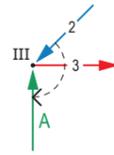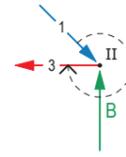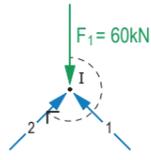
A = 75.7 kN
B = 9.7 kN
R = 66 kN
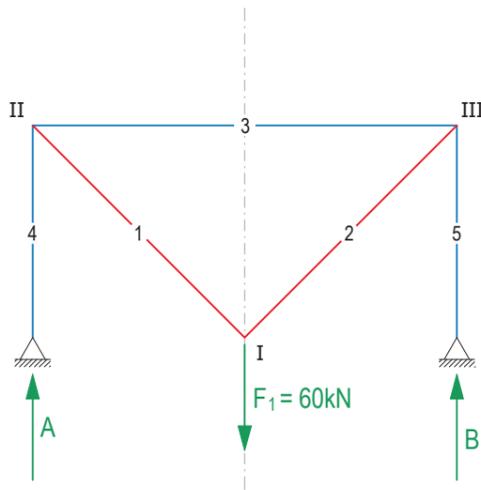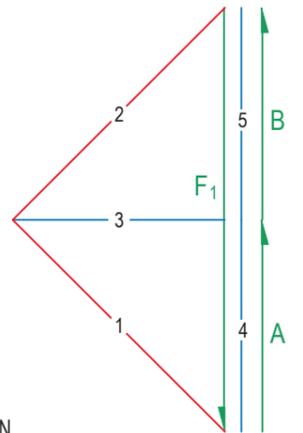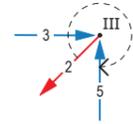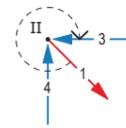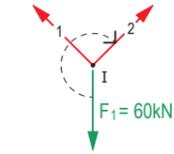
force diagram 1cm ≙ 5kN

Additional Task 1

Determine Forces in Structural Members

Draw the force diagrams for the given cases. Indicate tension forces with red and compression forces with blue. How big are the support reactions A and B?


$F_1 = 60kN$

A = 30 kN
B = 30 kN

Form Diagram 1:100   *Free Body Diagram*   *Force Diagram 1cm ≙ 10kN*

$F_1 = 60kN$

A = 30 kN
B = 30 kN

Form Diagram 1:100   *Free Body Diagram*   *Force Diagram 1cm ≙ 10kN*

$F_1 = 30kN$ $F_2 = 30kN$

A = 60 kN

Form Diagram 1:100   *Free Body Diagram*   *Force Diagram 1cm ≙ 10kN*

$F_1 = 30kN$ $F_2 = 30kN$
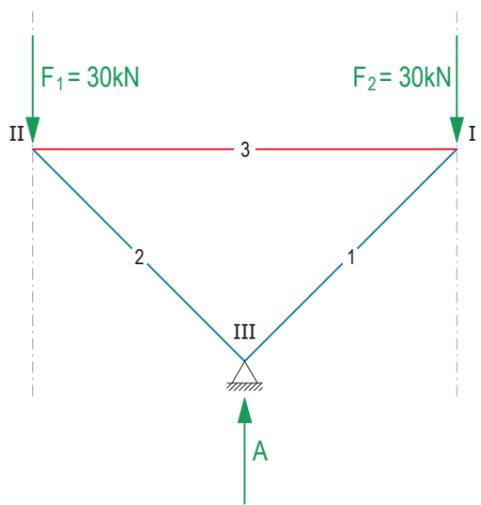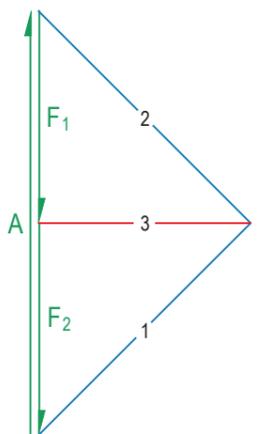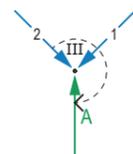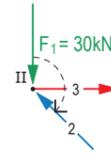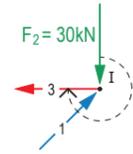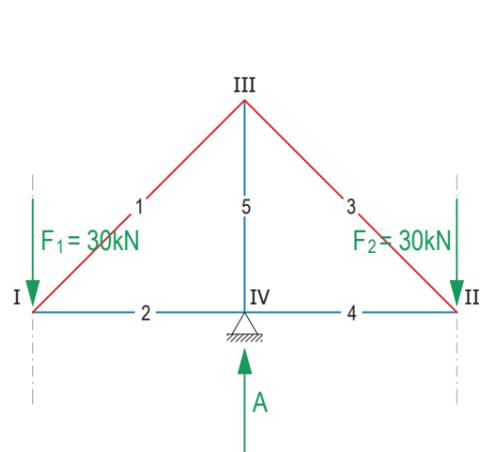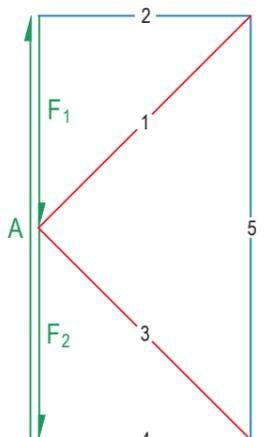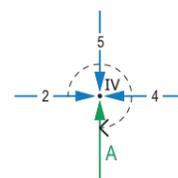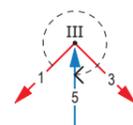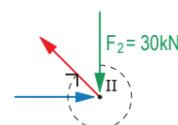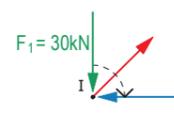
A = 60 kN

*Form Diagram 1:100*   *Free Body Diagram*   *Force Diagram 1cm ≙ 10kN*

Additional Task 2

Roof Structure with Constant Top Chord Force

Given are the supports A and B, the forces F_1 to F_5, and the form of the roof.
Design a structure for the roof, in a way that a constant force of 60 kN acts in the roof slope.

1. Draw the form diagram with the help of the force diagram. Mark in both form and force diagram all tension elements with red and compression elements with blue.
2. How can the structure for the roof be stiffen. Draw a suggestion in the form diagram.

F_1 bis F_5 = F_d = 15kN

A = 37.5kN   B = 37.5kN

Form Diagram 1:100

Force Diagram 1cm ≙ 10kN