SHEET 1

PENANG SANGAM HIGH SCHOOL

P. O. BOX 44, RAKIRAKI

LESSON NOTES - 16

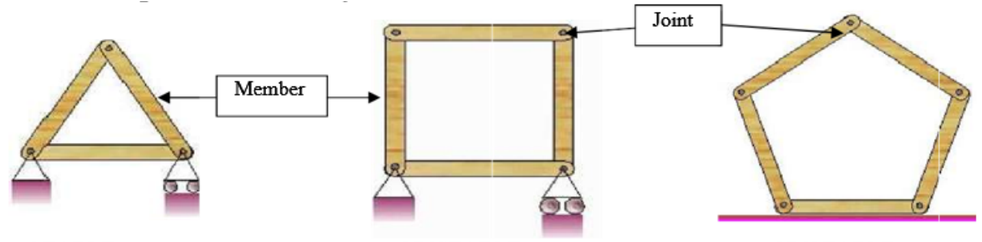
SCHOOL: PENANG SANGAM HIGH **SUBJECT: TECHNICAL DRAWING** **YEAR/ LEVEL: 13 A/B**

Strand	Applied Mechanics
Sub - Strand	Truss
Content Learning Outcome	Analyze the force systems acting on different structures.

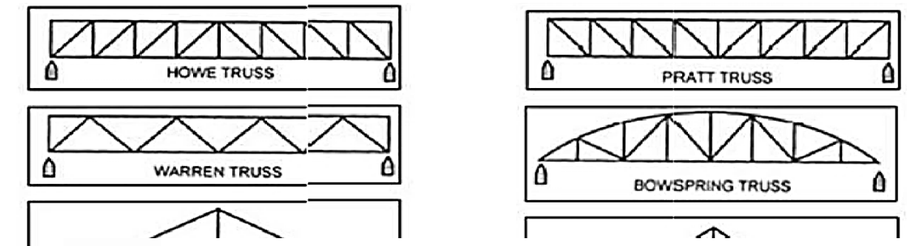
Newton's 3rd Law: states that when two bodies interact, they apply forces to one another that are equal in magnitude and opposite in direction. The third law is also known as the law of action and

Truss Analysis

There is an important characteristic of a useful truss: it must be stable, which is to say that it should not move freely in any direction. The triangle is basic unit of any truss structure. Three dimensions.



Types of Trusses



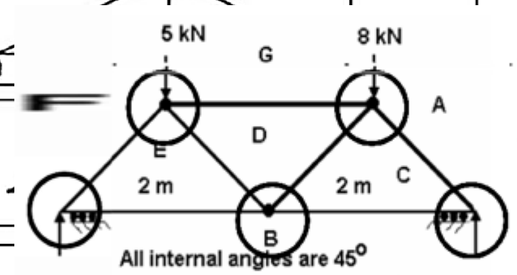
Calculating stability of Trusses

Use the Formula m=2j-3 where
m= number of members in the structure
j= number of joints or nodes in the structure

Example: Given is a Truss with all members labeled. Prove that the truss is stable.

There are 7 members and 5 joints in this frame. All joints are shown by circles.

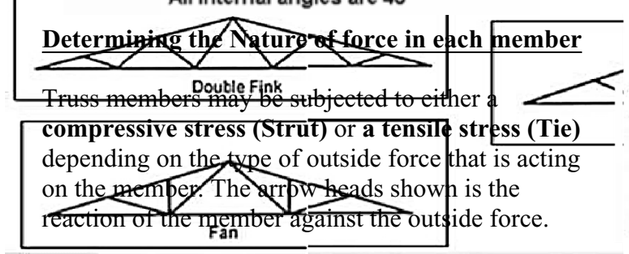
The two sides of the equation is EQUAL, therefore a stable structure.



· List of members

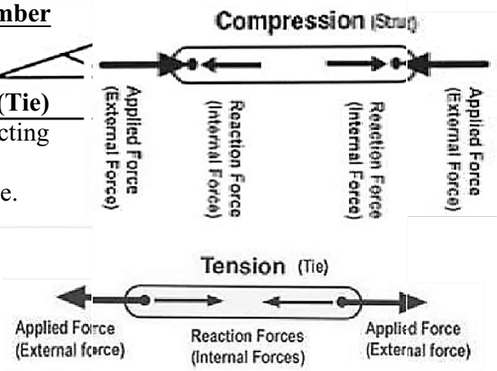
AC BC
CD DE
BE EF
DG

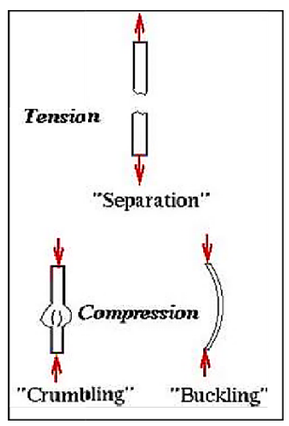
M = 2j – 3
7 = 2 (5) – 3
7 = 10 – 3
7 = 7



Determining the Nature of force in each member

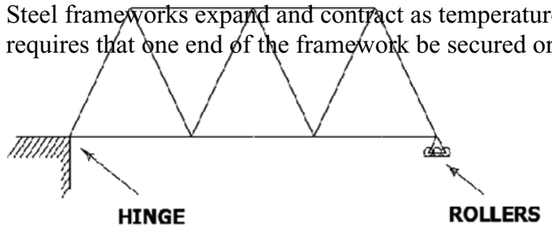
Truss members may be subjected to either a **compressive stress (Strut)** or **a tensile stress (Tie)** depending on the type of outside force that is acting on the member. The arrow heads shown is the reaction of the member against the outside force.





Types of Supports or Reactions: Hinge and roller supports

Steel frameworks expand and contract as temperature changes and due allowance to overcome this phenomena requires that one end of the framework be secured or hinged while the other end is free and 'floats' on rollers.



In determining the line of reaction at the supports, it is assumed that at the roller end the reaction is perpendicular through the centreline of the rollers and at the hinge, the reaction can be in any direction, but it is governed by the conditions required to maintain the whole truss in a **state of equilibrium**. **When external forces to the truss are vertical, the reaction at the hinge is also vertical.**

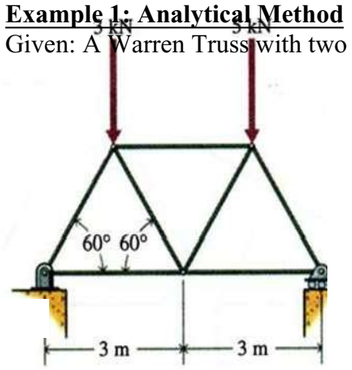
Solving Trusses:

Two methods are used to solve Truss Exercises namely:

1. Analytical Method
2. Graphical Method

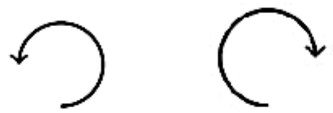
Example 1: Analytical Method

Given: A Warren Truss with two Loads. Calculate the Reactions at the supports RL and RR.



Moment: Turning Effect of Force

Moment: Turning Effect of Force (Torque)



Anti-Clockwise (+) **Clockwise (-)**

(+ and – indicate the direction of moment i.e. clockwise and anticlockwise)

- There are vertical loads acting on the truss therefore the reactions at the hinge end will only have the vertical component similar to the roller end.
- Since the truss is in equilibrium, we will use equation of moments to determine RR.
- ***Moment = Force x perpendicular distance (M= F x d)***
- **Use $+\Sigma M_{RL} = 0$**

(RL x 0) + (-F1 x d1) + (-F2 x d2) + (RR x d) = 0

(RL x 0) + (-3 x 1.5) + (-5 x 4.5) + (RR x 6) = 0

0 □ 4.5 □ 22.5 + 6RR = 0

-27 + 6RR = 0

6RR = 27

RR = 27/6

RR = 4.5 kN

- Next we will use the equation of total forces upwards is equal to total forces downwards.

RL + RR = F1 + F2 **(Sum of Upward force = Sum of downward force)**

↑Σ F = Σ F ↓

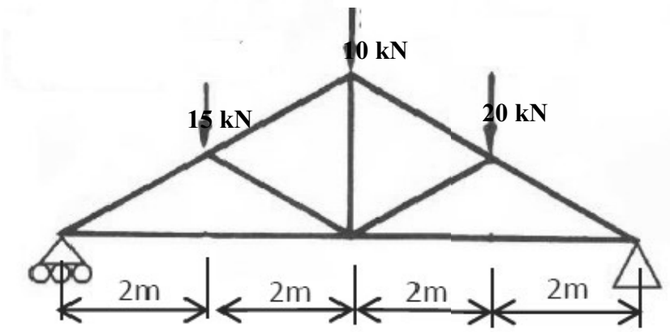
RL + 4.5 = 3 + 5

RL = 3 + 5 – 4.5

RL = 3.5 kN

QUESTION 1

Using Analytical method calculate the Reactions at the supports RL and RR while the other end is free and 'floats' on rollers.



QUESTION 2

Using Analytical method calculate the Reactions at the supports RL and RR while the other end is free and 'floats' on rollers.