

## Free body diagrams and support reactions:

- ~ Equilibrium equations must never be presented without an accompanying FBD. Never.
- ~ Bodies should be OUTLINED only – any internal details detract from the clarity of the diagram – the outline also symbolizes the separation between the body and the rest of the world. Most texts show too much internal detail in their examples.
- ~ To make the body truly “free”, all supports must be completely removed from the FBD. The effects of the supports are then shown in the form of forces and couples. NEVER draw a FBD on the original figure – the body is obviously not free!
- ~ “Stick figures”, as taught in the basic physics courses, should be discouraged – especially when working in pencil, forces, dimension lines and the body all look the same – the body should have some “body” to it, even if it’s just a beam
- ~ Support reactions, in order to be included on a FBD, must meet 2 tests:
  - 1) They must be within the capabilities of the connection.
  - 2) They must be needed to maintain equilibrium – otherwise leave them out.A good example of how this can all go wrong is a simple door with 2 hinges – each of which is capable of 5 reactions. If all are included, the problem becomes statically indeterminate to a high degree. Show only reactions that are needed.
- ~ Support reaction forces with known directions, such as cables, springs, 2 force links, etc. should always be shown as a single unknown (or known) force in the known direction. Never show as 2 or 3 components.
- ~ If the direction of the support reaction force is not known, x, y and z force components should be shown if they are needed to maintain equilibrium. Each one counts as a separate unknown and will be evaluated individually using equilibrium equations. Similarly, couple components about the x, y and z axes should be shown and evaluated separately.
- ~ All forces and couples shown on the FBD should be labeled: known reactions should just be labeled with their values, unknown reactions should be given reasonable names. The names used later in equilibrium equations should be the same as those originally shown on the FBD.