

## Section 5.3. Statically Indeterminate Objects

**Definition.** An object which has more supports than the minimum number needed to maintain equilibrium is said to have *redundant supports*.

**Definition.** If the supports of an object cannot maintain equilibrium under the loads acting on it, the object has *improper supports*.

**Definition.** An object with either redundant supports or improper supports is *statically indeterminate*.

**Example.** An object with either redundant supports or improper supports is *statically indeterminate*. Figure 5.20(a) shows an object with redundant support. The *degree of redundancy* reflects the number of unnecessary supports (one in this system—support  $B$  is unnecessary).

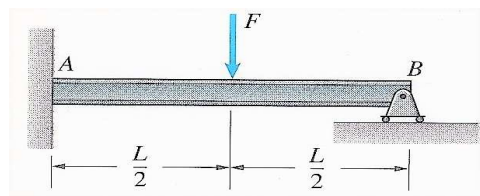


Figure 5.20(a)

**Example.** Figure 5.25(a) shows an object with improper supports. If the supports can only exert parallel forces (as in Figure 5.22) or concurrent forces (see Figures 5.24 and 5.25), then the object has improper supports.

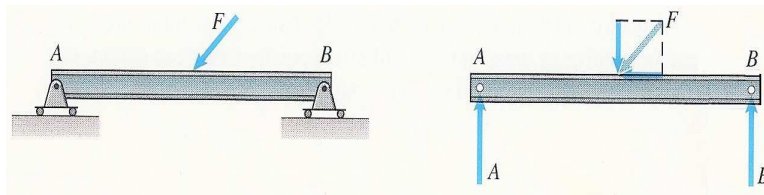


Figure 5.22. (a) A beam with two roller supports is not in equilibrium when subjected to the load shown. (b) The sum of the forces in the horizontal direction is not zero.

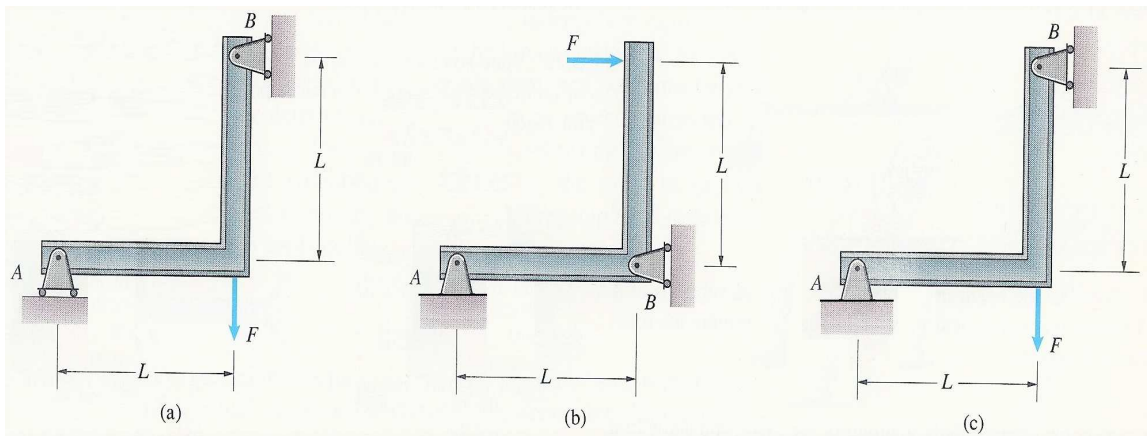


Figure 5.24. Are these properly or improperly supported?

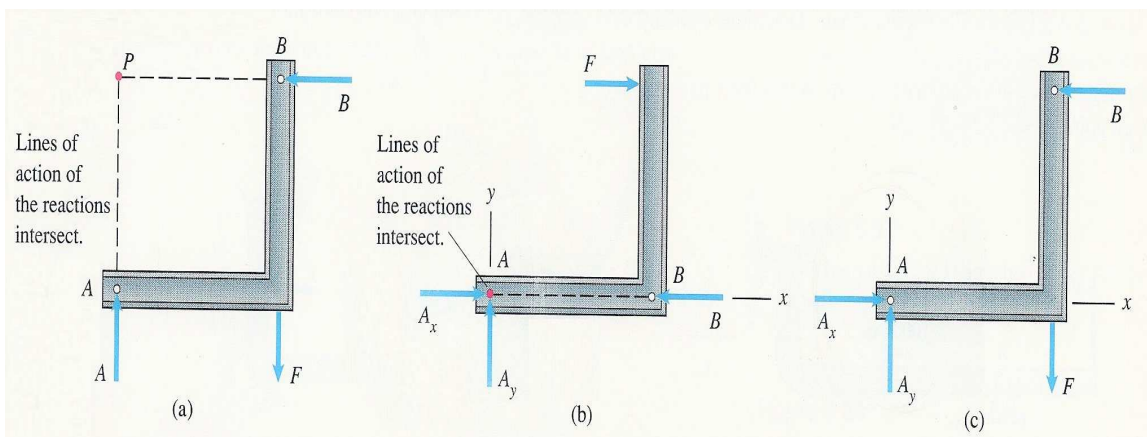


Figure 5.25. Free body diagrams of the three bars in Figure 5.24.

**Example.** Page 236 Number 5.71.

*Revised: 10/8/2018*