Truss Analysis – Method of Sections

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General Procedure for the Analysis of Simple Trusses using the Method of Sections

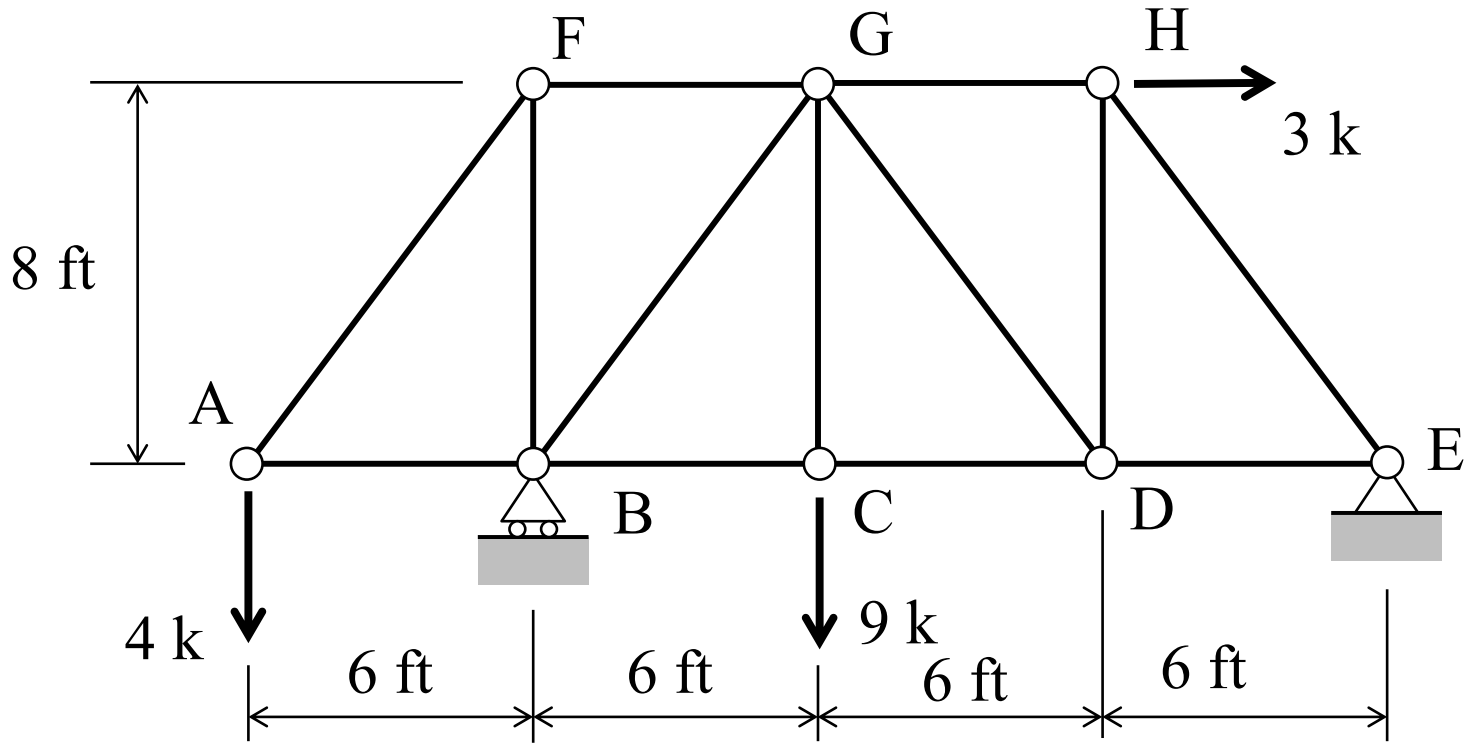
1. Draw a Free Body Diagram (FBD) of the **entire truss** cut loose from its supports and find the **support reactions** using the equations of equilibrium (we will see that for some truss structures this step is not always necessary);

2. Make a cut through the members of the truss that are of interest. The cut must define two separate sections of the truss;

3. Draw a FBD of the section of the truss that is to be analyzed. There are **three equations of equilibrium** available to find unknown truss member forces;

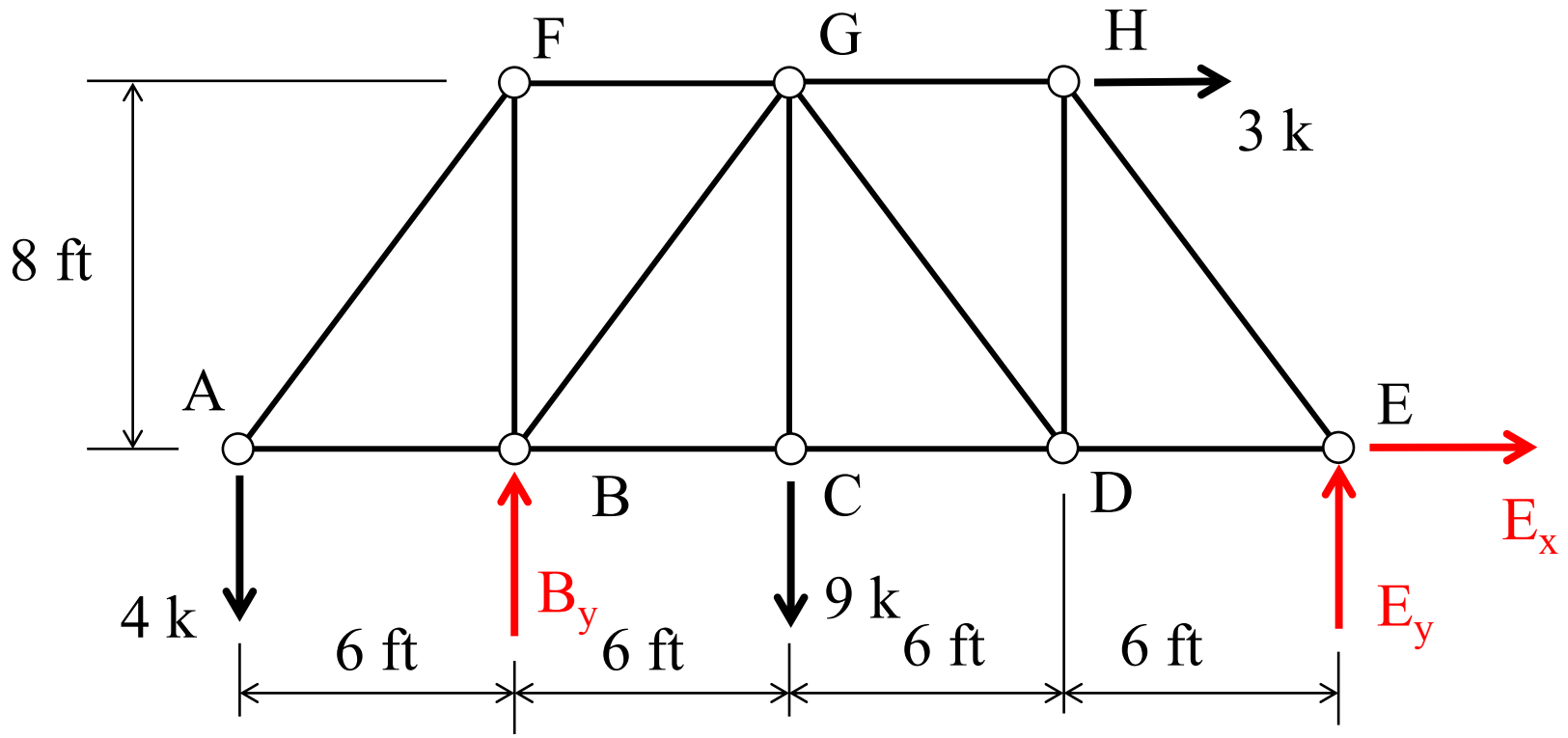
4. Note that due to the geometry of simple trusses, several forces often intersect at a point. These points are often good points to take moment equilibrium about. Often one can isolate one unknown member force with a moment equilibrium equation.

Analysis Example Using the Method of Sections

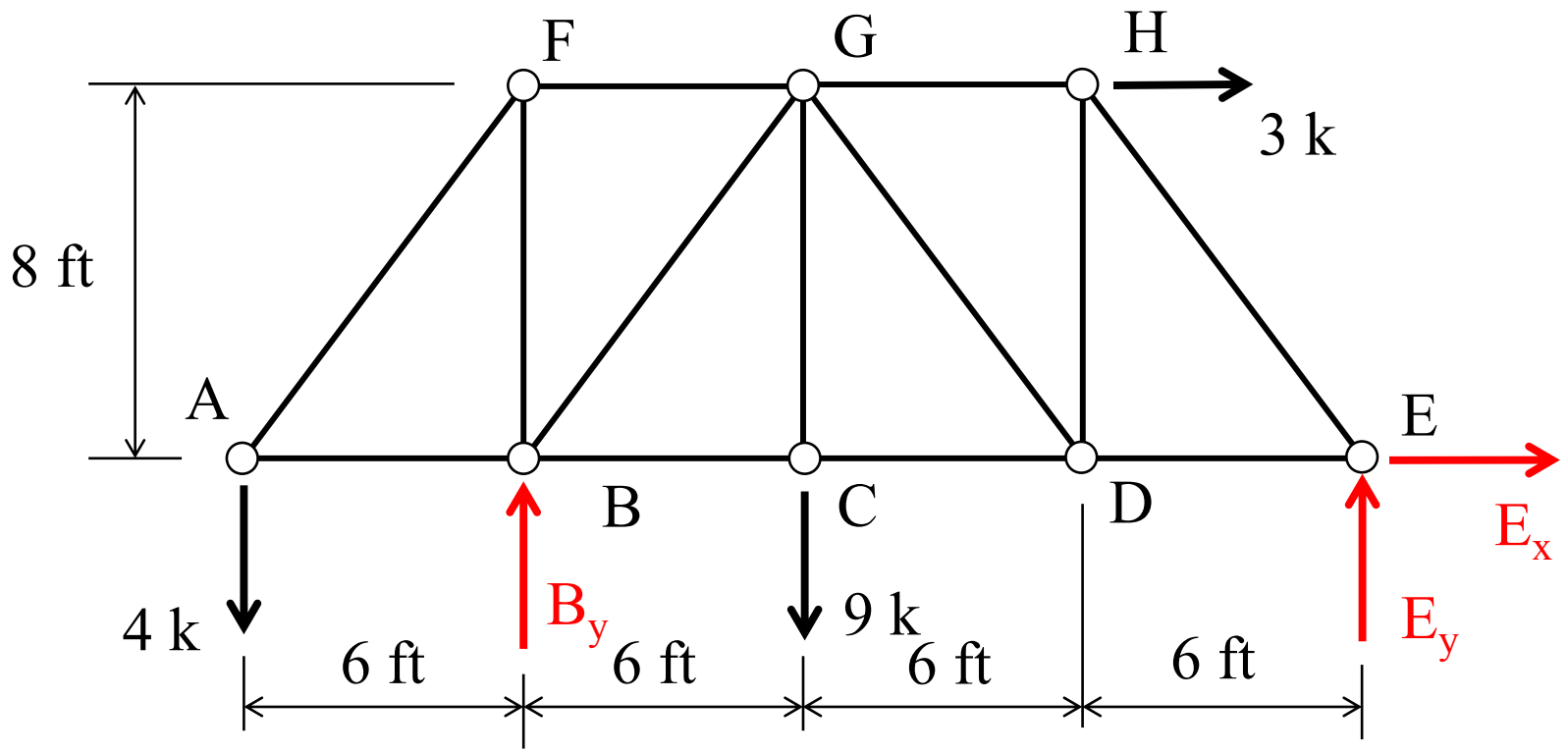


Consider the idealized truss structure with a pin support at E and a roller support at B. The truss is subjected to applied loads at A, C and H. Find the truss member forces FG, BG, and BC

1. Draw a Free Body Diagram (FBD) of the **entire truss** cut loose from its supports and find the **support reactions** using the equations of equilibrium (we will see that for some truss structures this step is not always necessary)



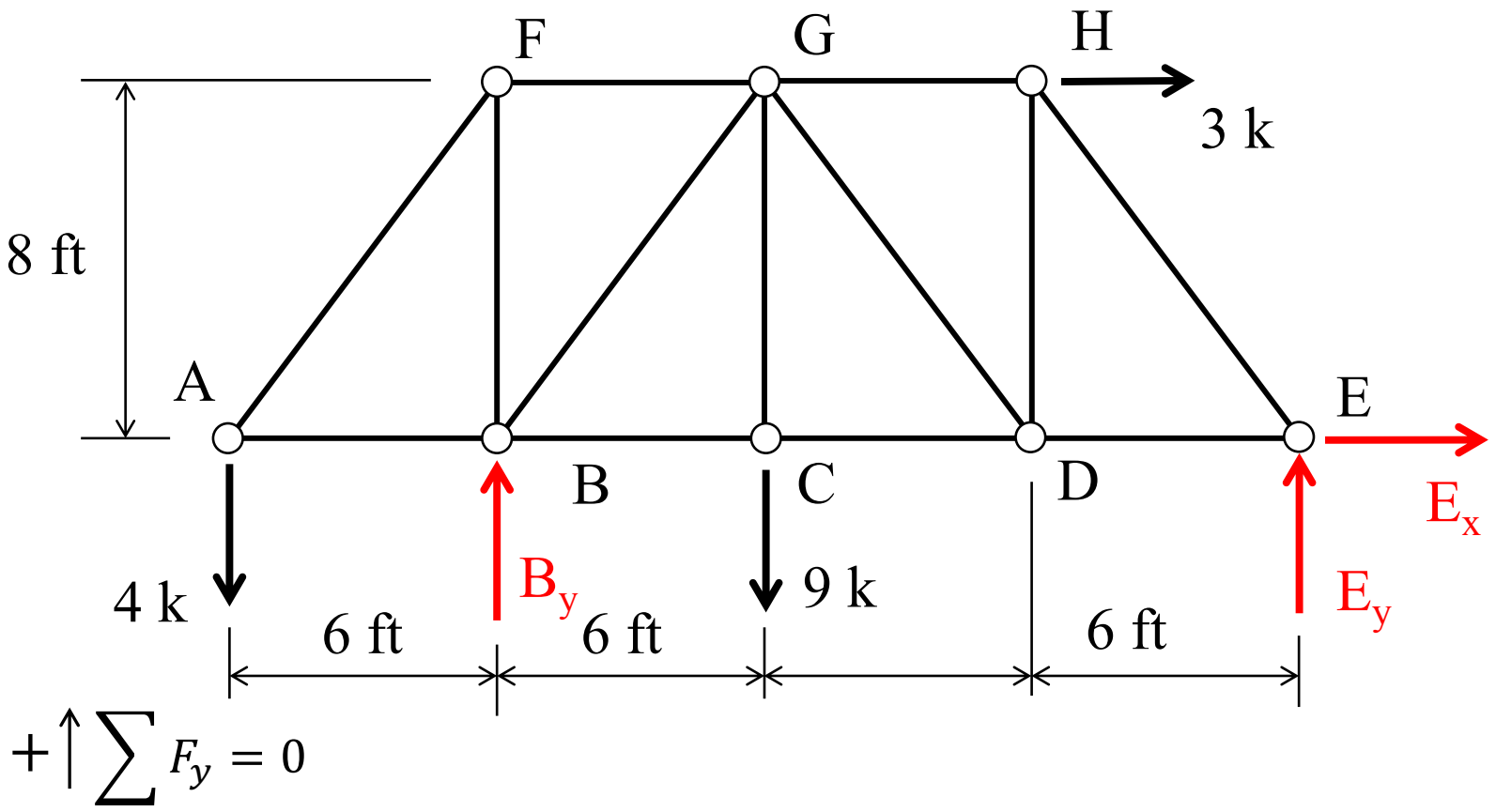
Use Equilibrium to Find Support Reactions



$$\circlearrowleft + \sum M_B = 0$$

$E_y = 3$ k

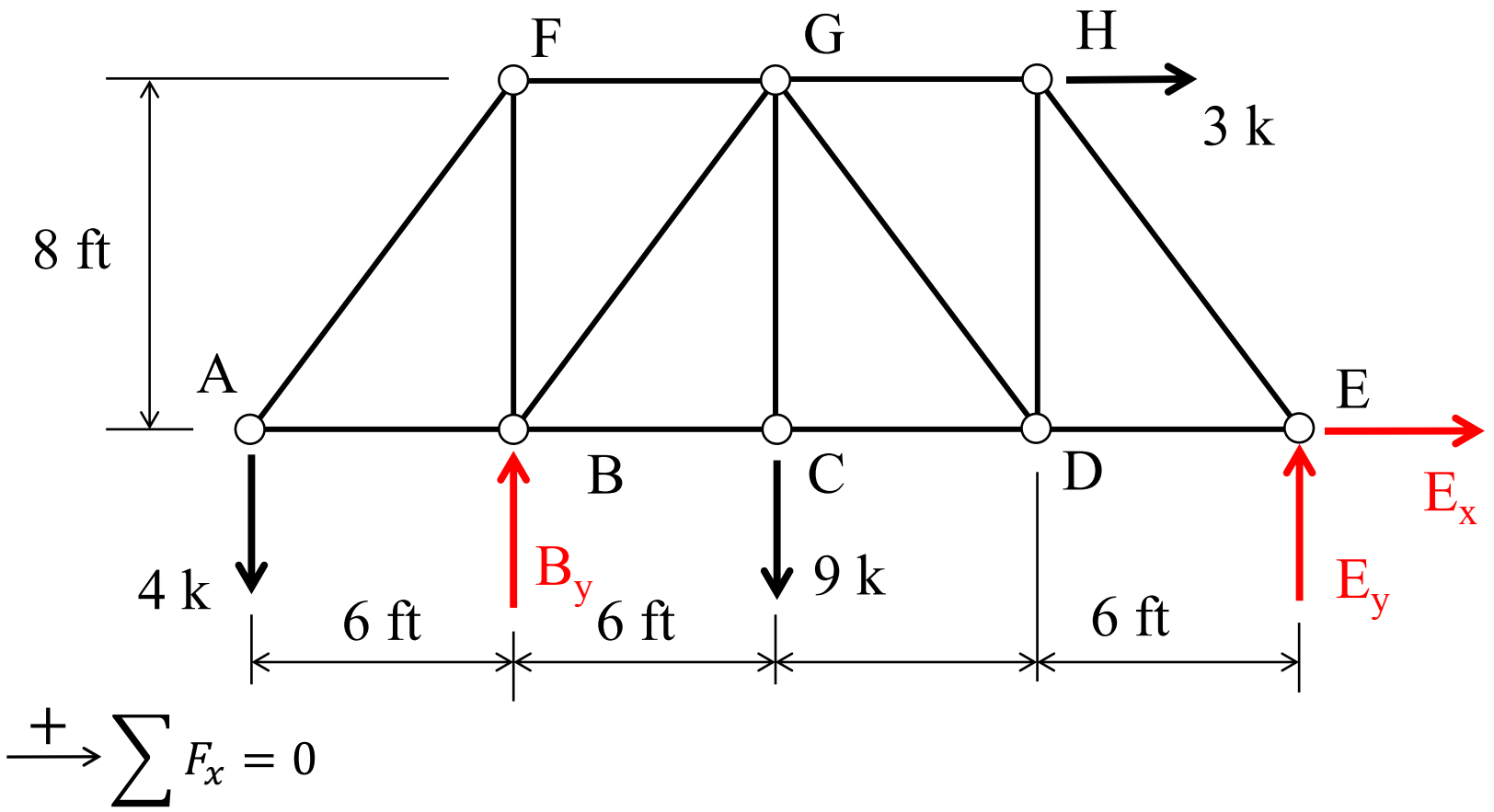
Use Equilibrium to Find Support Reactions



$$+\uparrow \sum F_y = 0$$

$B_y = 10$ k

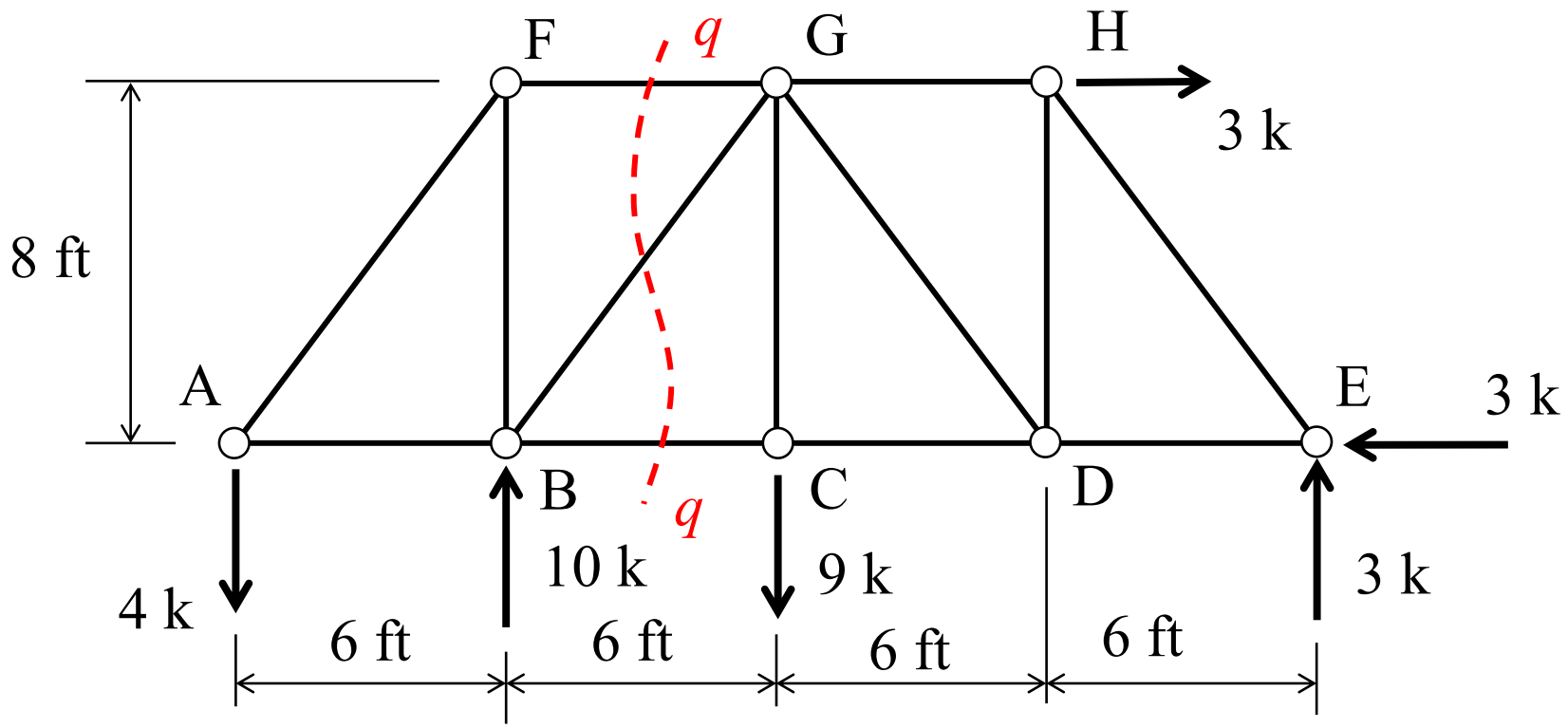
Use Equilibrium to Find Support Reactions



$$\xrightarrow{+} \sum F_x = 0$$

$E_x = -3$ k

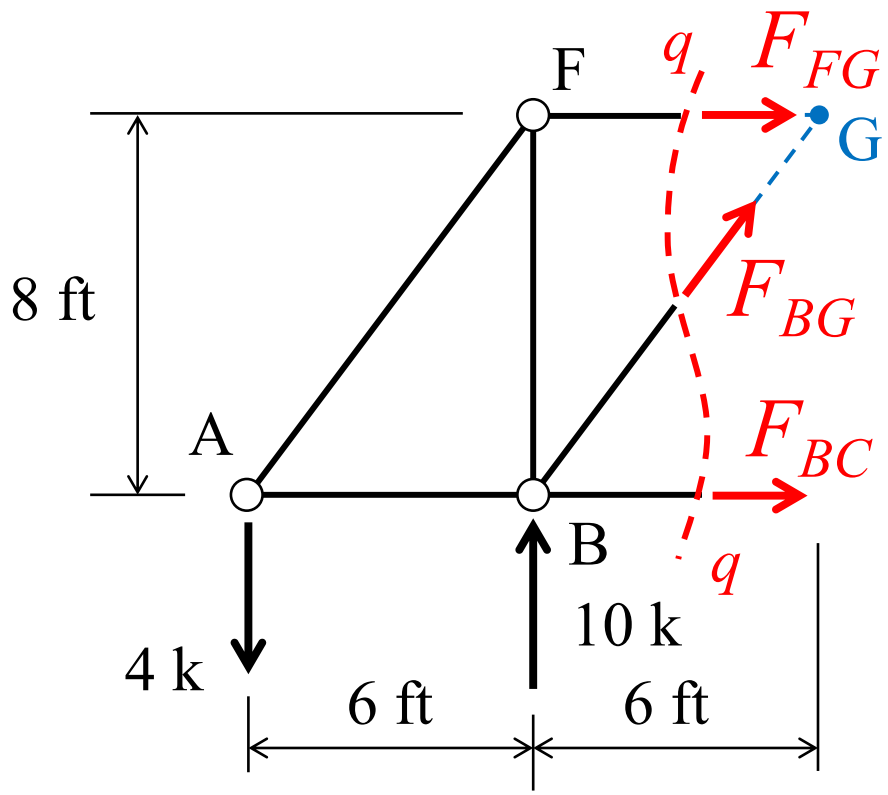
FBD Showing Known Support Reactions



2. Make a cut through the members of the truss that are of interest. The cut must define two separate sections of the truss;

Can use a FBD of either section to find unknown member forces

FBD of the Section to the Left of Cut *q-q*

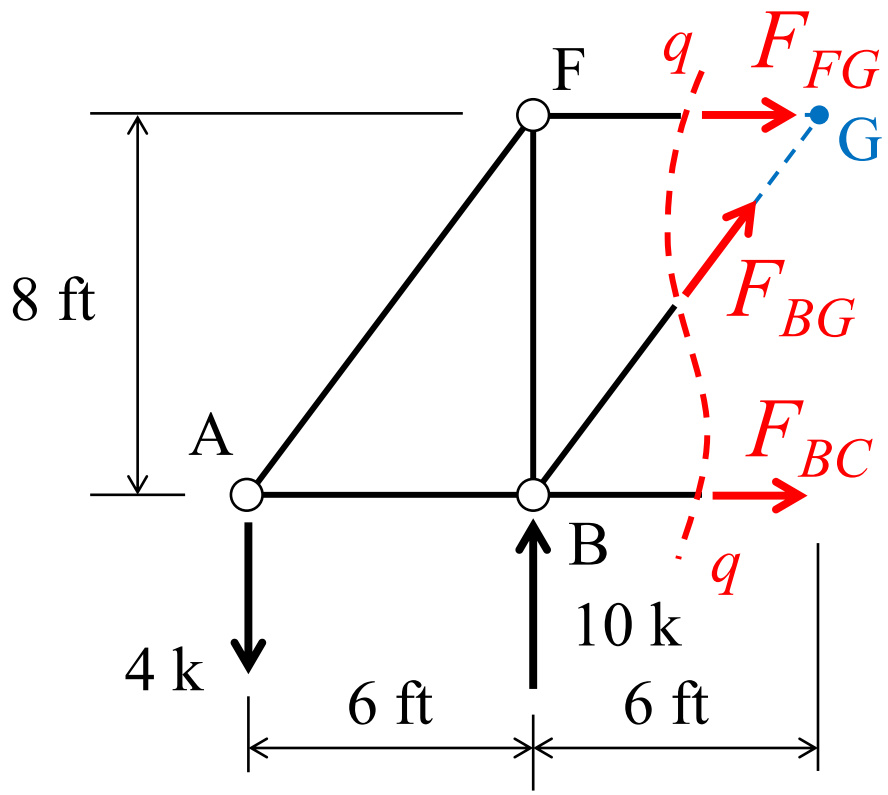


Notes:

- Unknown truss member forces are assumed to act in tension (pulling away form the joint);
- Members FG and BG intersect at G;
- Members BG and BC intersect at B.

3. Draw a FBD of the section of the truss that is to be analyzed. There are **three equations of equilibrium** available to find unknown truss member forces;

FBD of the Section to the Left of Cut *q-q*



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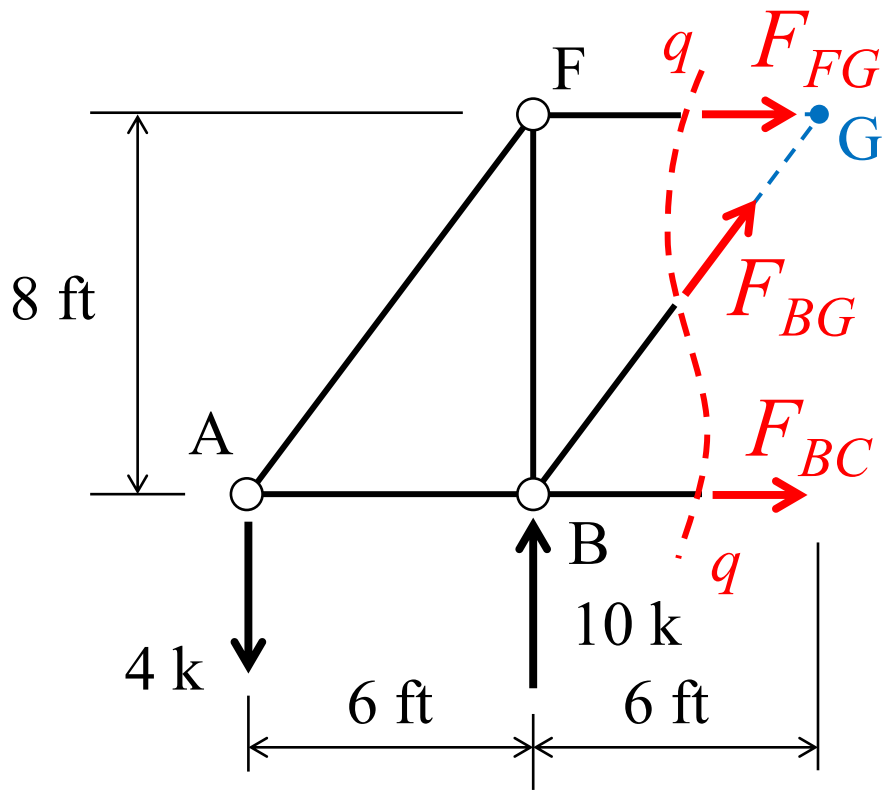
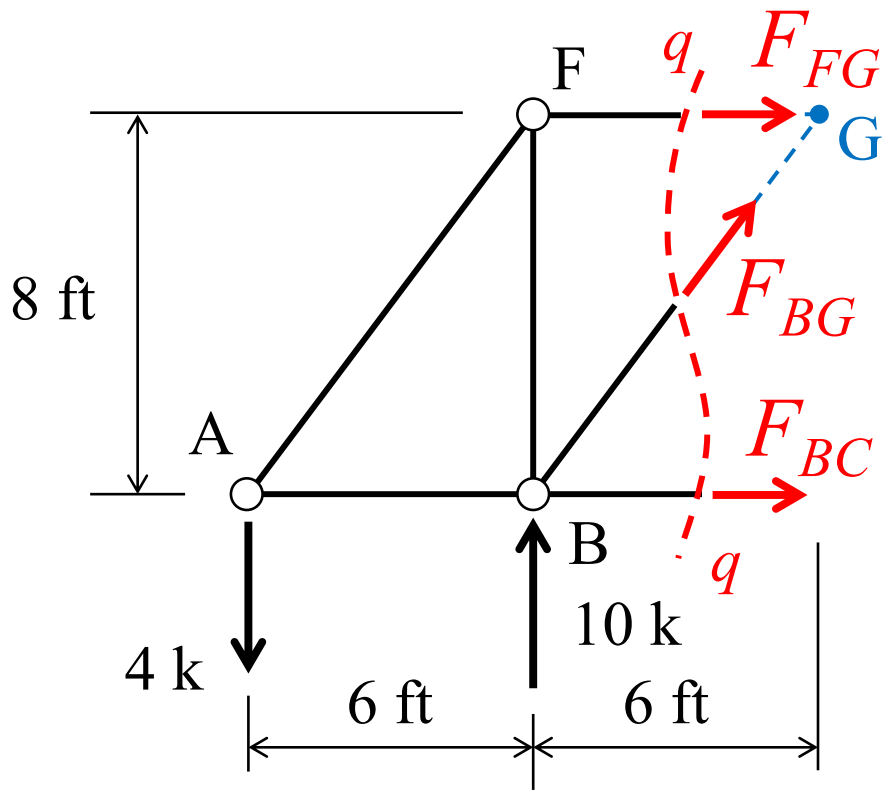
Equilibrium of Truss Section to Find Unknown Member Forces



$$\circlearrowleft + \sum M_G = 0$$

$F_{BC} = 1.5$ k

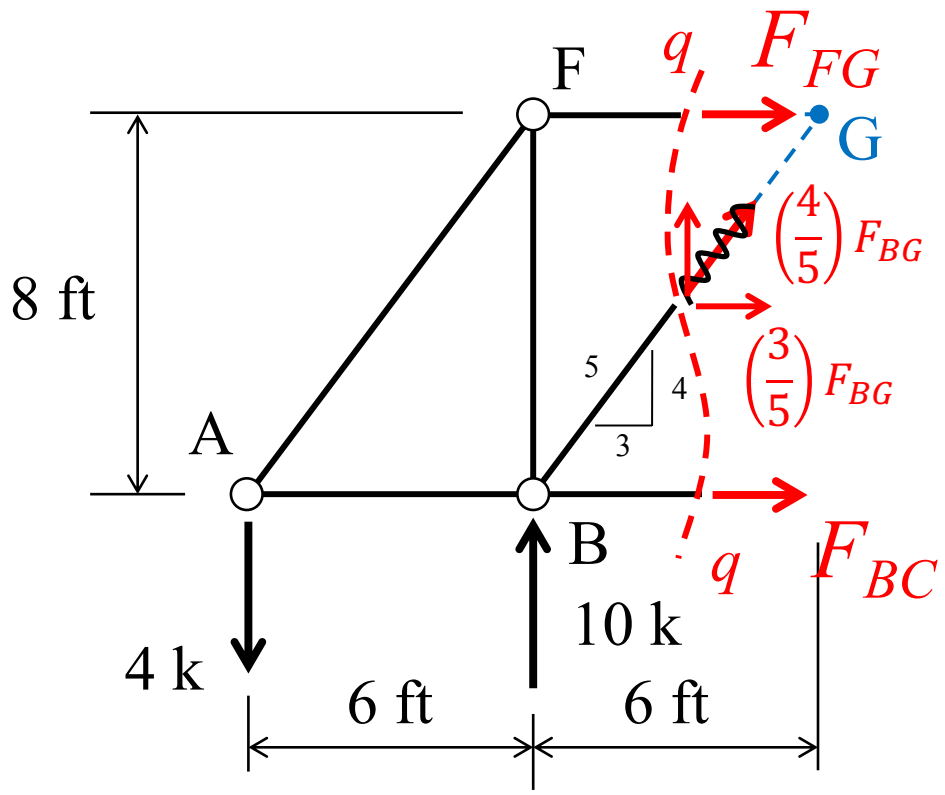
Equilibrium of Truss Section to Find Unknown Member Forces



$$\circlearrowleft + \sum M_B = 0$$

$F_{FG} = 3$ k

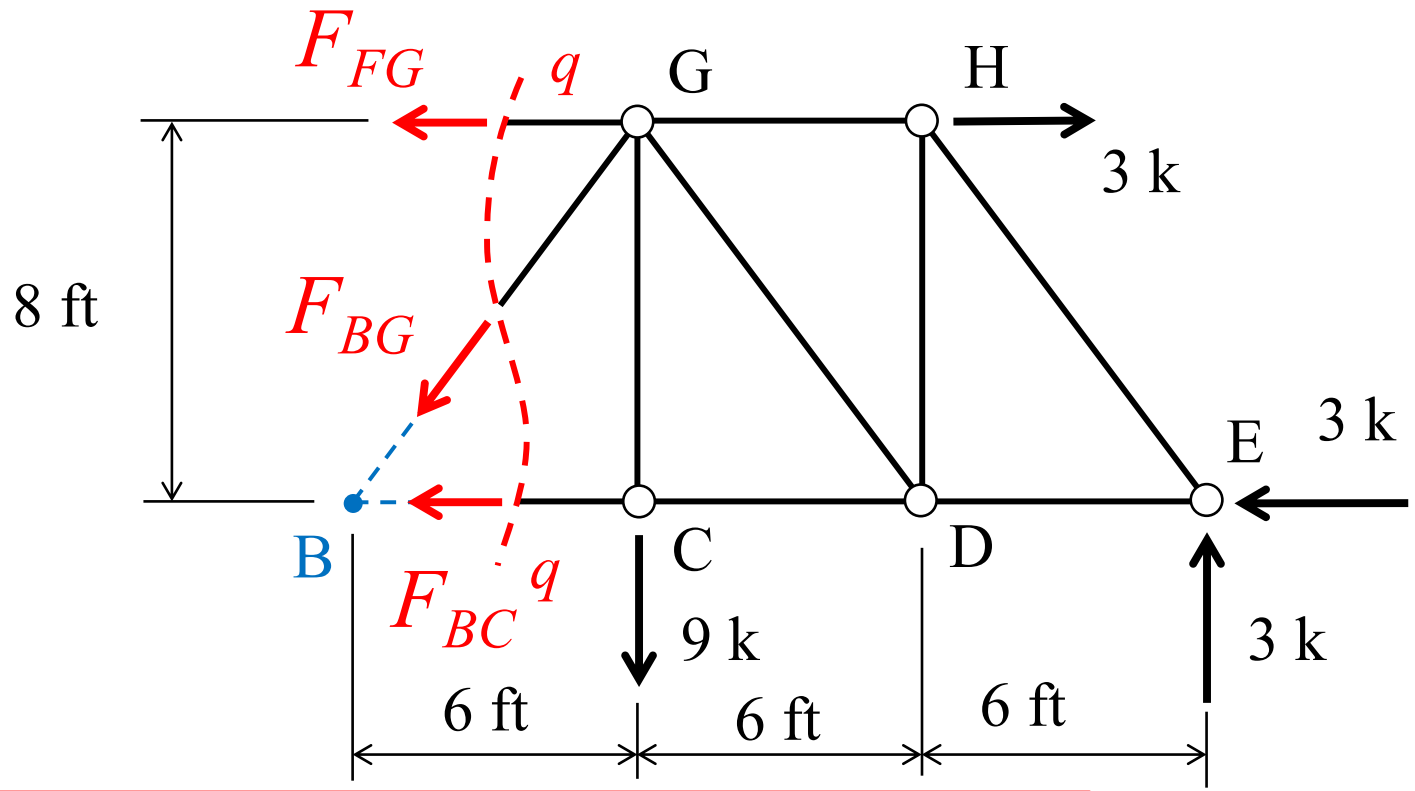
Equilibrium of Truss Section to Find Unknown Member Forces



$$+\uparrow \sum F_y = 0$$

$F_{BG} = -7.5$ k

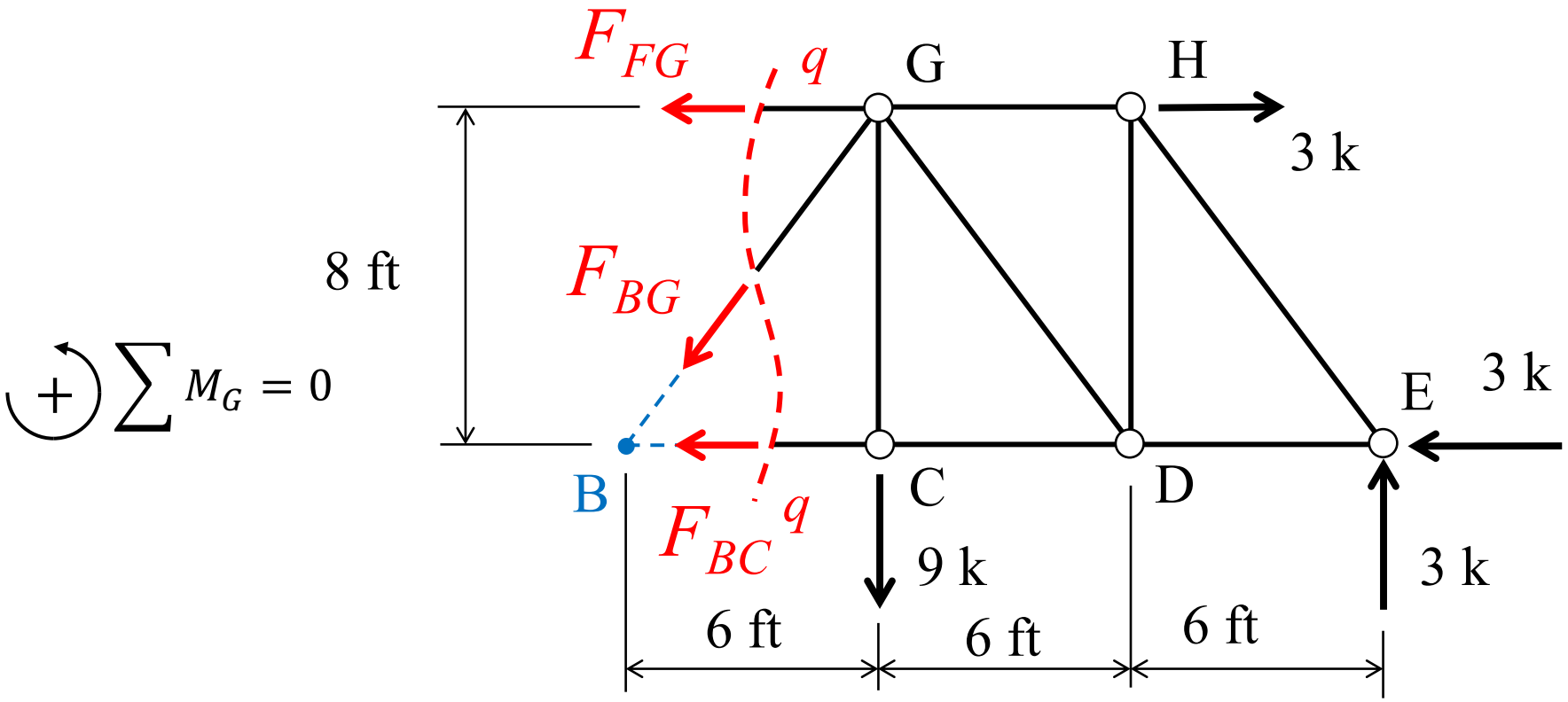
FBD of the Section to the Right of Cut *q-q*



Notes:

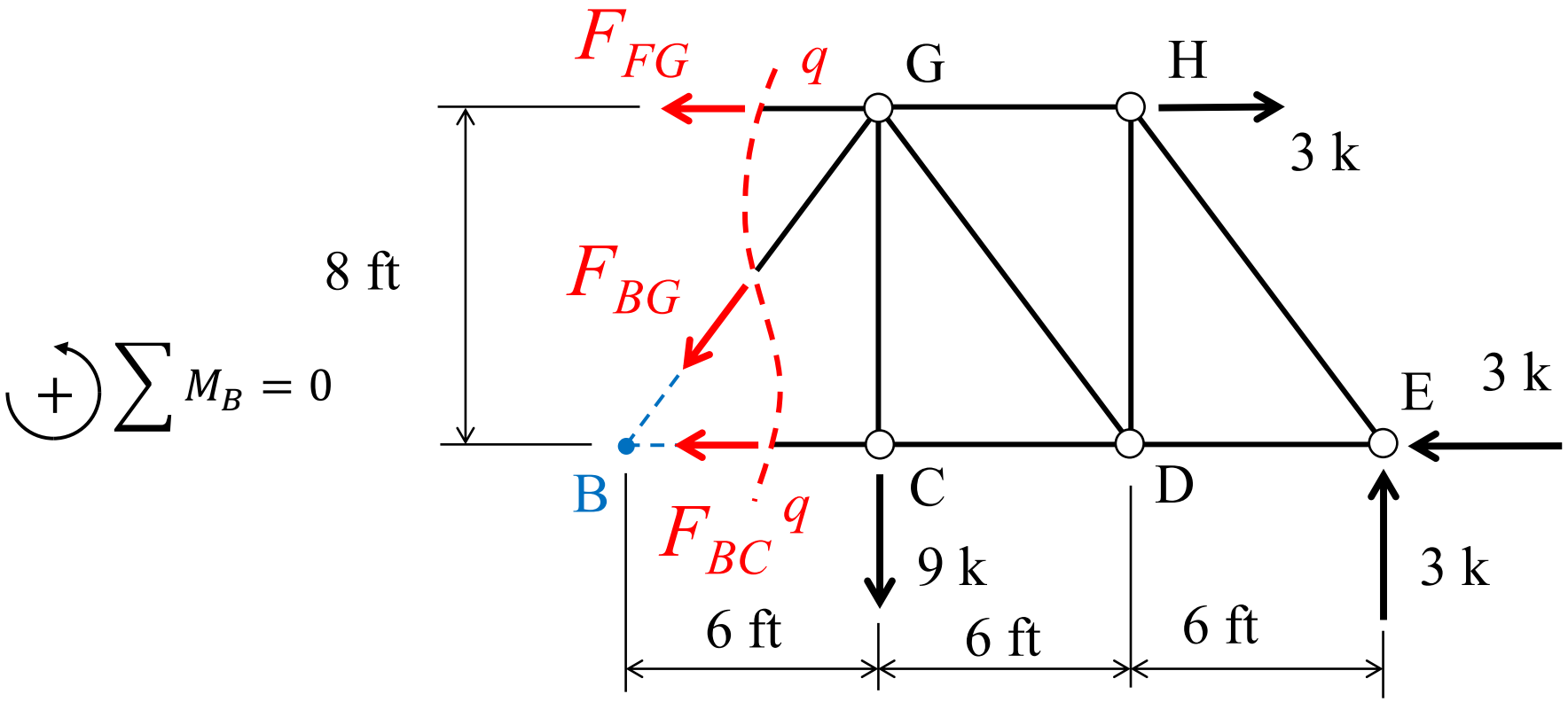
- Unknown truss member forces are assumed to act in tension (pulling away form the joint);
- Members FG and BG intersect at G;
- Members BG and BC intersect at B;
- Analysis yields same results.

FBD of the Section to the Right of Cut *q-q*



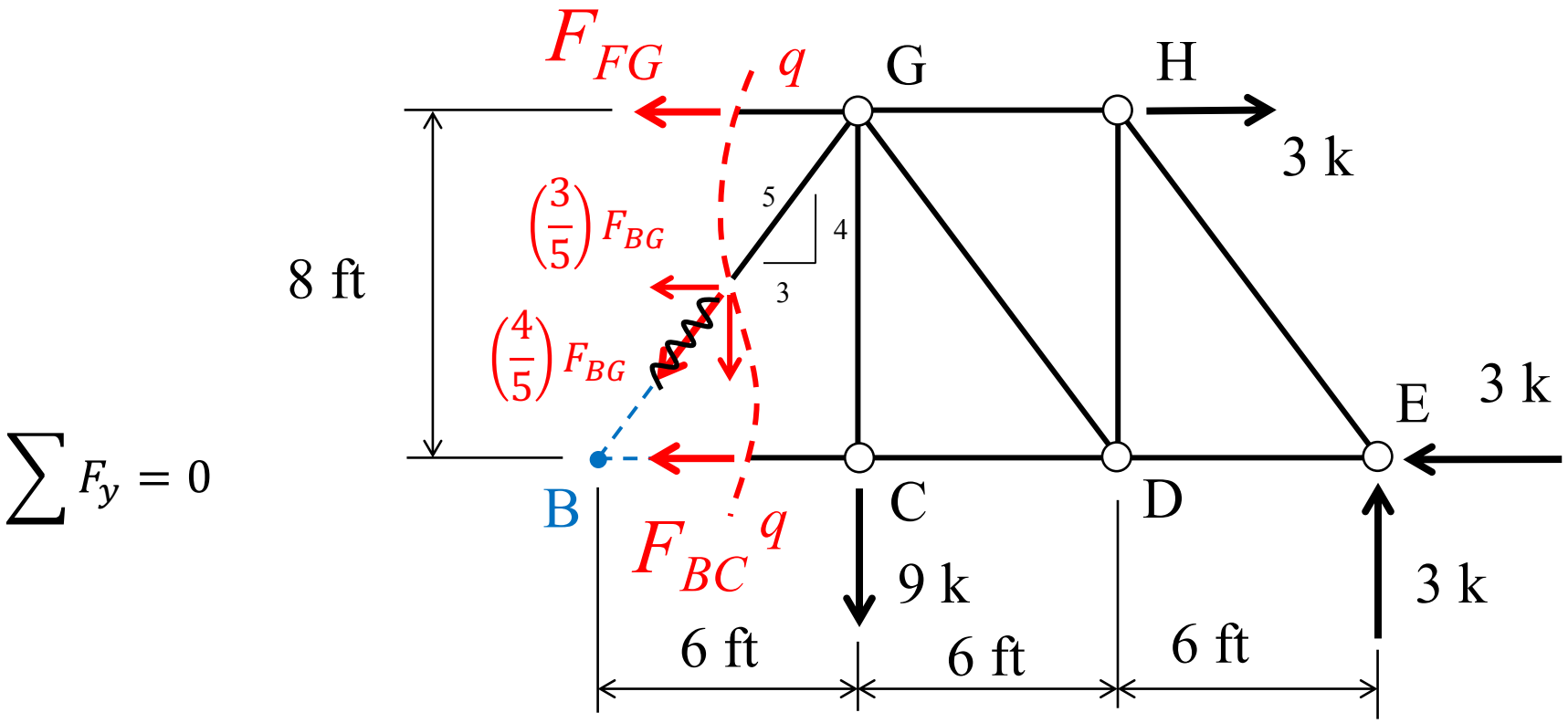
$F_{BC} = 1.5$ k

FBD of the Section to the Right of Cut *q-q*



$F_{FG} = 3$ k

FBD of the Section to the Right of Cut *q-q*



$$\sum F_y = 0$$

$F_{FG} = -7.5$ k