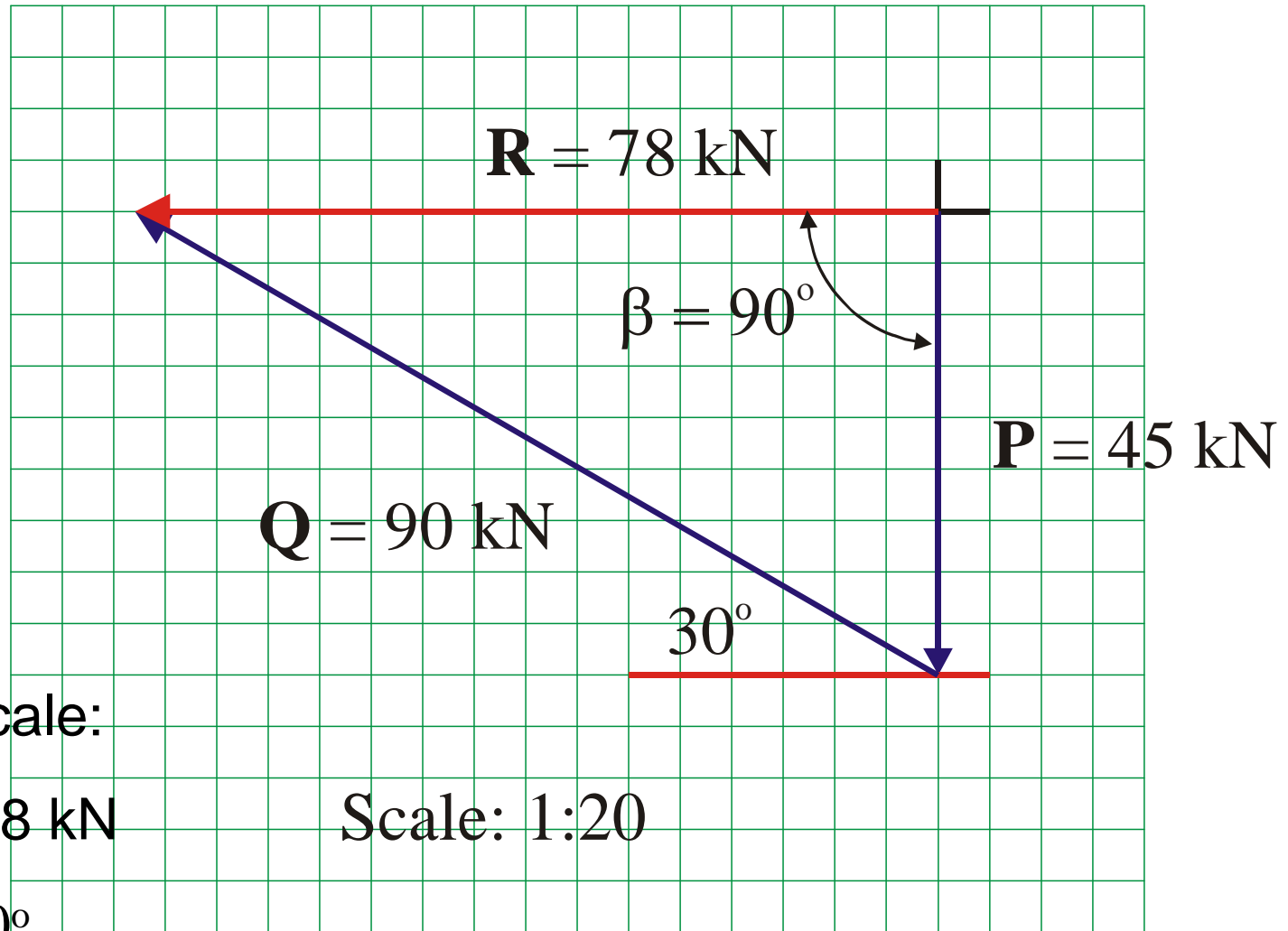# Example 2.1

J. Frye

Example 2.1:

Two structural members B and C forming part of a bridge structure over the Red River in Winnipeg are connected to bracket A. Knowing that member B is in tension and member C is in compression, and that **P** = 45 kN and **Q** = 90 kN, determine

(a) graphically by parallelogram or triangle rule the magnitude and direction of the resultant force exerted on the bracket,
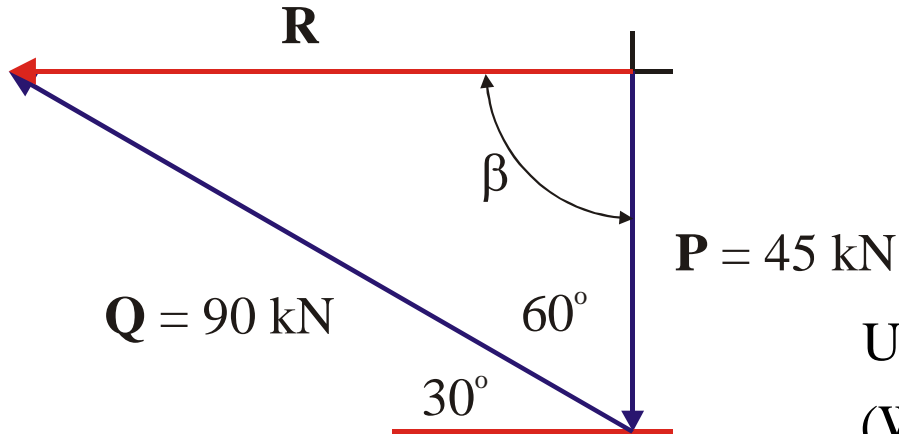(b) using trigonometry (i.e., sine and cosine laws).
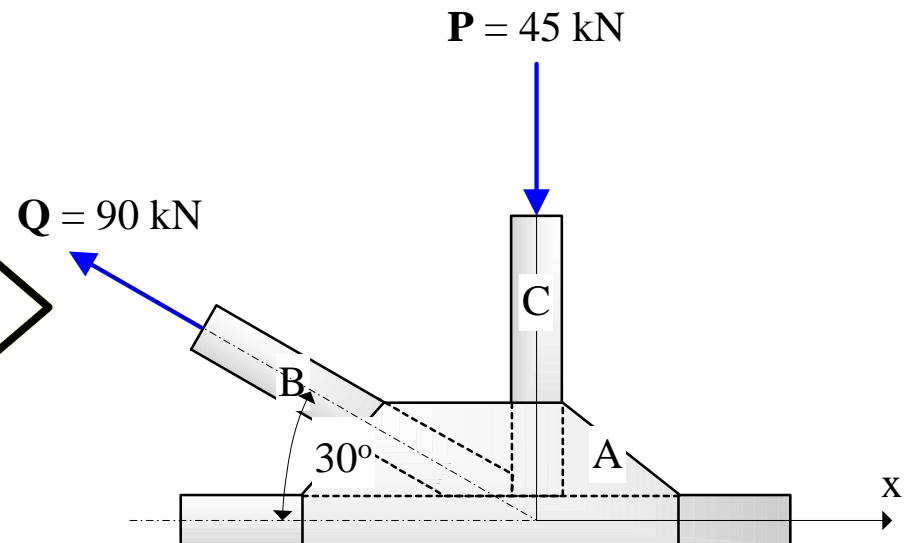
Graphical Solution:
Use the Triangle Rule: Draw **P** and **Q** "Tip-toTail"
Resultant, **R**, goes from "Tail" of **P** to "Tip" of **Q**

$\mathbf{R} = 78 \text{ kN}$

$\beta = 90^{\circ}$

$\mathbf{P} = 45 \text{ kN}$

$\mathbf{Q} = 90 \text{ kN}$

30°

By Scale:

R = 78 kN   Scale: 1:20

$\beta = 90^{\circ}$

Trig Solution:

R

Q $= 90$ kN

β

60°

30°

P $= 45$ kN

Use Cosine Rule :

(We know 2 sides and the included angle)

$$R^2 = 90^2 + 45^2 - 2(90)(45)\cos 60^{\circ}$$

$$R = 77.94\text{kN}$$

Apply the Sine Rule :

$$\frac{77.94}{\sin 60^0} = \frac{90}{\sin \beta}$$

$$\sin \beta = \frac{90(\sin 60^{\circ})}{77.94}$$

$$\beta = 90^{\circ}$$