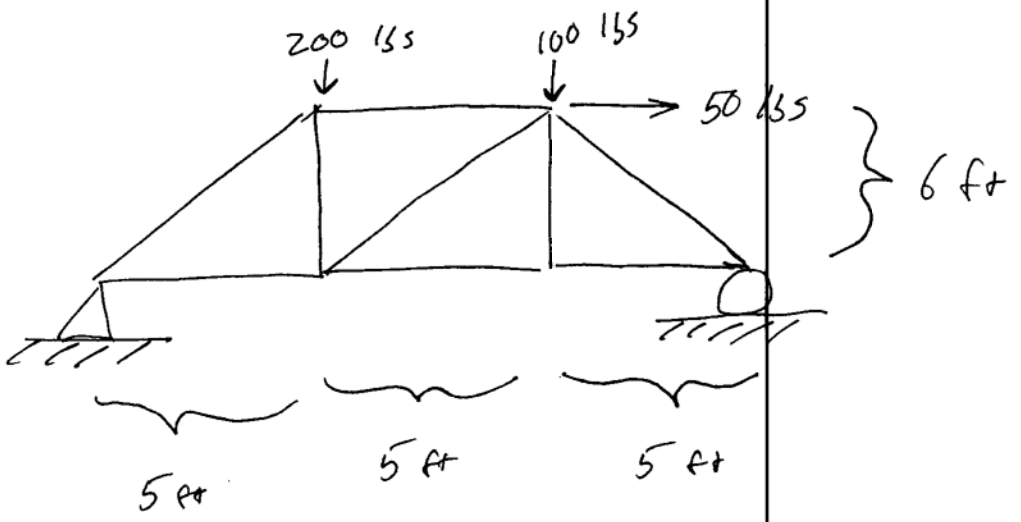
Prin. of Eng.
WEMP

STEP BY STEP TRUSS - CALC.



(1) CHECK FOR STATIC Determinacy

$2J = M + R$

$12 = 9 + 3$

ok!

$J = 6$

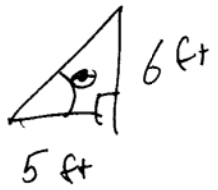
$M = 9$

$R = 3$

Soluable

(2) Find angles

In this truss we have all similar triangles, so we only need to find one angle. Once we know one, we will know them all.



$\tan\theta = \frac{opp}{adj}$

$\tan\theta = \frac{6\ ft}{5\ ft}$

$\theta = \tan^{-1}\left(\frac{6}{5}\right)$

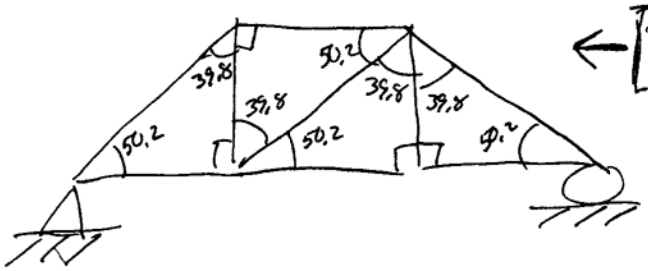
$\theta = 50.2^{\circ}$

SOH
CAH
TOA

Take tangent inverse of both sides

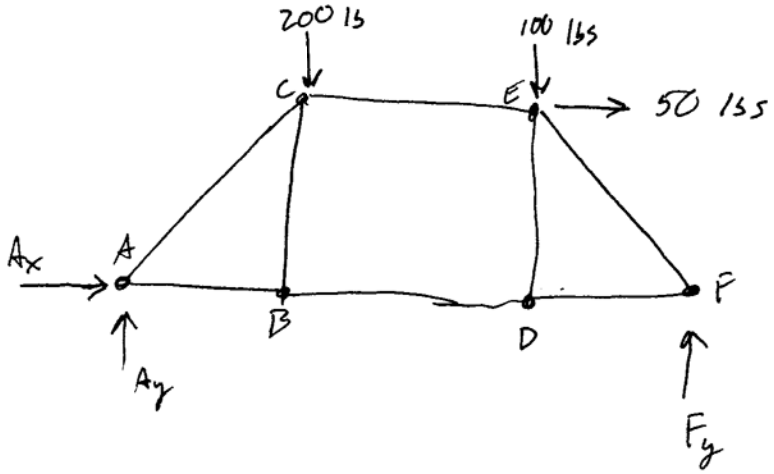
Calculator

SOLVE Angles & add TO Truss



← Redrawn Truss w/ angle dimensions

(3) Sketch truss reaction forces & label the joints



(4) Sum the Moments (Torques) $M = F \times d_{\perp}$

Perpendicular distance to pivot

- Forces that would cause a rotation about a point
- you get to choose the point
- Since the truss is static, The sum of the moments is Zero
- Clockwise rotation = (−) moment

  Counter clockwise = (+) moment

★ I chose point A as my point to sum moments around (outside forces only)

Next page

From p. 2

$$\Sigma M = -(200\ lb)(5\ ft) - (100\ lb)(10\ ft) - (50\ lb)(6\ ft) + F_y(15\ ft)$$

$$0 = -1000 - 1000 - 300 + F_y(15\ ft)$$

$$0 = -2300 + F_y(15\ ft)$$

$$\frac{2300}{15} = \frac{F_y(15\ ft)}{15}$$

$$\boxed{153.33\ lb = F_y}$$

(+) answer means our assumed direction is correct

(5) Sum Forces to get remaining reaction forces. (Outside forces only)

$$\Sigma F_y = 0 = -200\ lb - 100\ lb + F_y + A_y$$

$$0 = -300 + 153.33 + A_y$$

$$0 = -146.67 + A_y$$

$$\boxed{146.67\ lb = A_y}$$

(+) answer means our assumed direction is correct

$$\Sigma F_x = 0 = 50\ lb + A_x$$

$$\boxed{-50\ lb = A_x}$$

(−) answer means our assumed direction is incorrect (change direction of A_x)

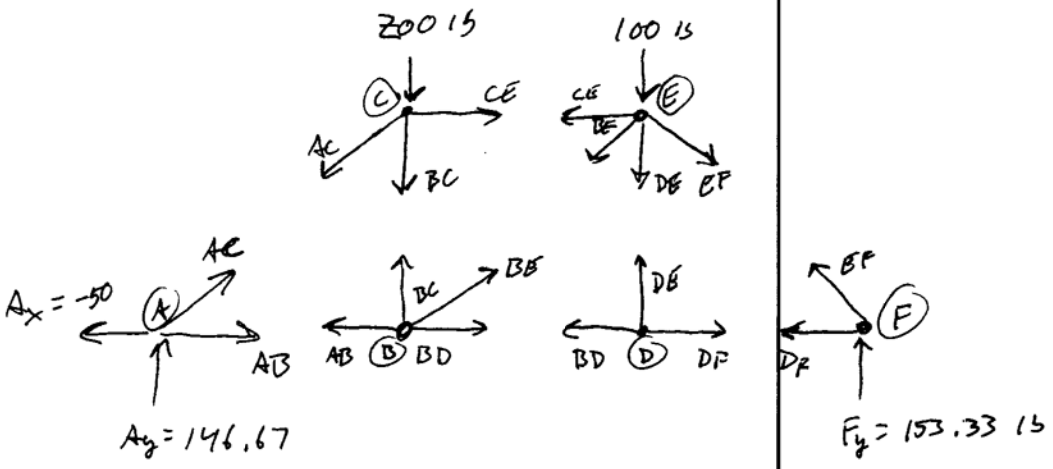
From p.3

All reaction Forces have been found

- $F_y = 153.33$ lb
- $A_y = 146.67$ lb
- $A_x = -50$ lb

All reaction forces have been found. Now we can move on to member Forces

(6) Obtain Force diagrams for each joint assuming tension for all members



(7) Solve the joint you know the most about.

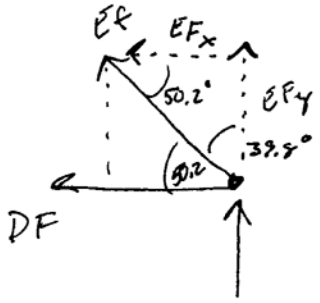
- Usually this is where your anchors are located, but not always
- 90° forces are nice to solve - look for those

- I choose joint (F)

From p.4

Joint F

EF is a vector with x and y components



$F_y = 153,3315$

Sum the forces (y)

$\Sigma F_y = 0 = F_y + EF_y$

$0 = 153,33 + EF_y$

$-153,33 = EF_y$

use Trig to find EF

$\sin\theta = \frac{opp}{hyp}$

$EF \times \sin 50,2° = \frac{EF_y}{EF} \times EF$

$EF \cdot \frac{\sin 50,2°}{\sin 50,2°} = \frac{EF_y}{\sin 50,2}$

$EF = \frac{EF_y}{\sin 50,2} = \frac{153,33}{\sin 50,2} = 199,57\,15 = EF$

another way to find EF

$\Sigma F_y = 0 = EF(\sin 50,2) + F_y$

$0 = \frac{EF(\sin 50,2)}{\sin 50,2} + \frac{153,33}{\sin 50,2}$

$\frac{-153,33}{\sin 50,2} = \frac{EF(\sin 50,2)}{\sin 50,2}$

$-199,57 = EF$

+EF is the hyp
+EF_y is the opp
+The angle is 50,2°

Sum forces (x)

$\Sigma F_x = 0 = -DF + EF_x$

$DF = EF_x$

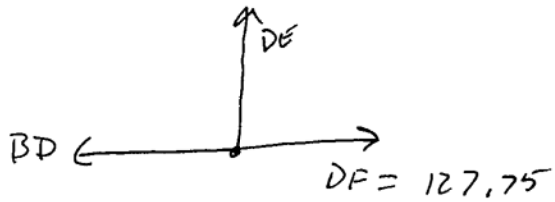
$EF(\cos 50,2)$

$199,57(\cos 50,2) = 127,75\,15 = DF$

From p. 5

(8) Repeat step 7 until all member forces are solved

Point D



$\Sigma F_y = 0 = DE$

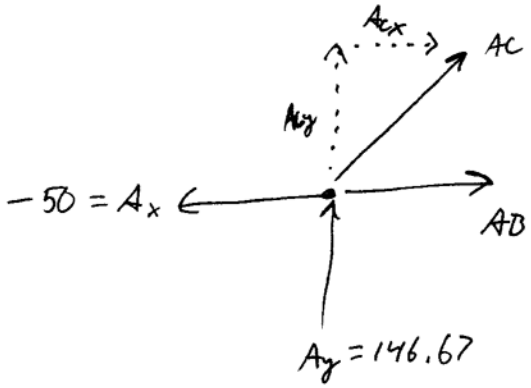
$0 = DE$

$\Sigma F_x = 0 = DF - BD$

$0 = 127.75 - BD$

$BD = 127.75$

Point A



$\Sigma F_y = ACy + Ay = 0$

$0 = ACy + 146.67$

$-146.67 = ACy$

$AC = \frac{ACy}{\sin 50.2} = \frac{146.67}{(\sin) 50.2}$

$AC = 190.91$ lb

$\Sigma F_x = 0 = ACx + AB + Ax$

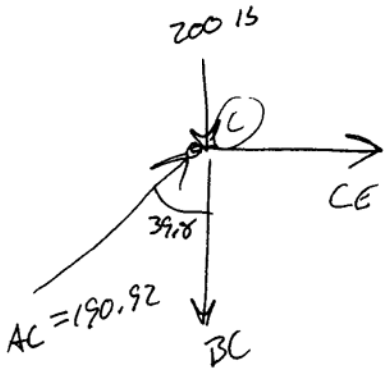
$0 = ACx + AB + (-50)$

$AB = 122.21 + (50)$

$AB = 172.21$ lb

From P. 6

Point C



$\Sigma F_x = 0 = AC_x + CE$

$-AC_x = CE$

$+122.21\ lb = CE$

$\boxed{CE = 122.21\ lb}$

$\Sigma F_y = 0 = AC_y - BC - 200$

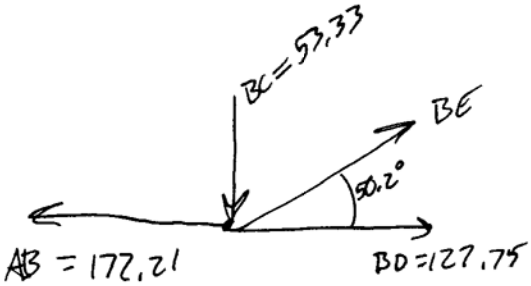
$0 = AC(\cos 39.8) - BC - 200$

$200 = 146.68 - BC$

$\boxed{53.32 = BC}$

+ AC is the -hyp
+ AC_y is the -Adj
+ use Cos of θ

Point B



$\Sigma F_y = BE_y - BC = 0$

$BE_y = BC$

$BE_y = 53.33$

OR

$\Sigma F_y = 0 = BE(\sin 50.2) - BC$

$0 = BE(\sin 50.2) - 53.33$

$\frac{53.33}{\sin 50.2} = \frac{BE(\sin 50.2)}{\sin 50.2}$

$\boxed{69.41 = BE}$

+ BE is the -hyp
+ BE_y is the -opp
+ use sin of θ