Building Trusses

Names: _____

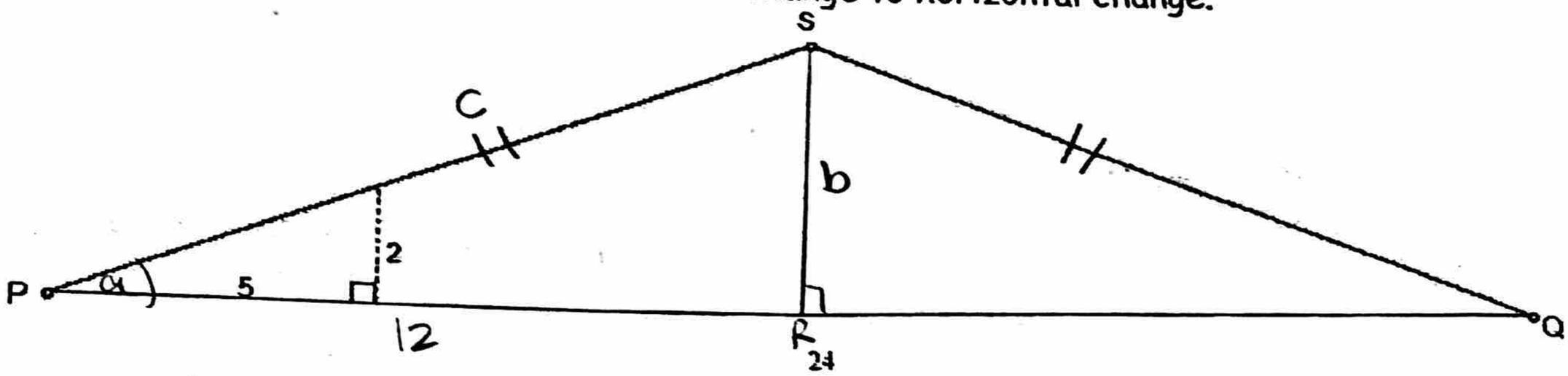
_____

_____

_____

Triangles are the simplest polygons and are the most useful polygons. This activity will examine how triangles are used in building roof trusses.

1. Below is a diagram of a roof with a $\frac{2}{5}$ pitch spanning 24 feet. (PS=QS) The pitch of a roof is defined as the ratio of vertical change to horizontal change.



a. Calculate the measure of $\angle SPQ$.

$\tan a = \frac{2}{5}$ 21.8°

b. Draw the altitude from point S to $\overline{PQ}$ and label the intersection R. Find SR.

$\overline{PR} = 12$ $\tan 21.8° = \frac{b}{12}$ 4.8 ft

c. Find PS. Express your answer in terms of feet and inches.

$\frac{9}{10} = \frac{x}{12}$ $(12)^2 + (4.8)^2 = c^2$ 12.9 ft → 12ft 10.8 in

d. Make a scale drawing of the roof on grid paper.

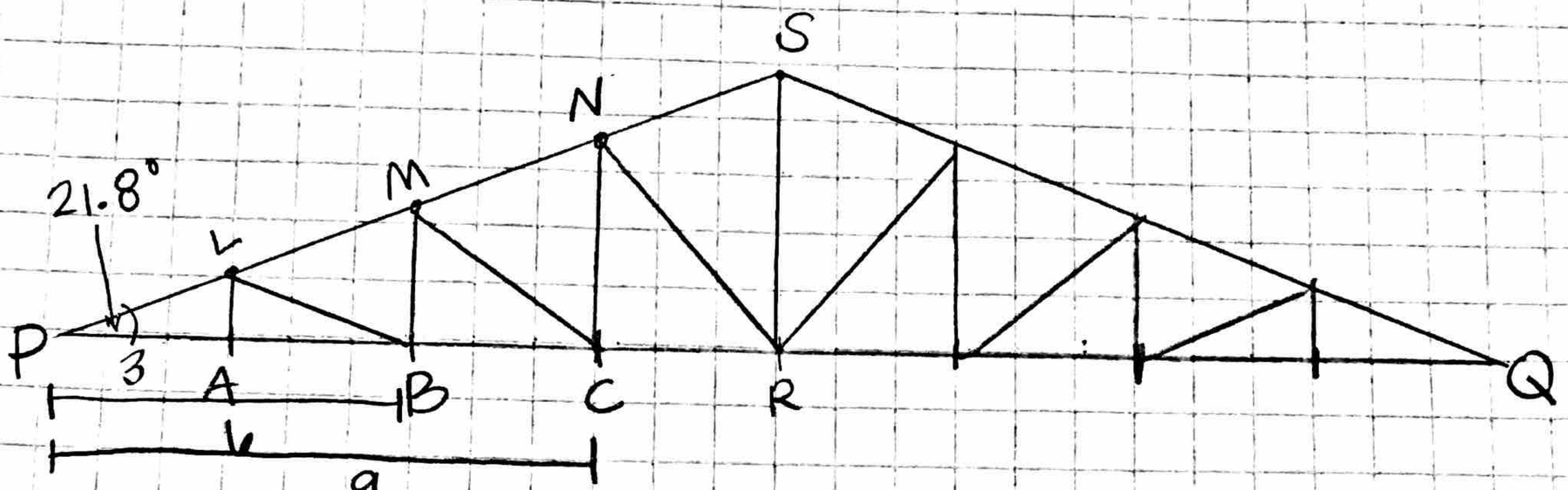
e. Subdivide $\overline{PR}$ into four equal segments. Label each subdivision point from left to right A, B, and C. At each subdivision point draw a perpendicular to $\overline{PR}$. Label the intersection of each perpendicular with $\overline{PS}$ from left to right L, M and N. Find LA, MB and NC.

see grid paper

f. Draw segments LB, MC, and NR. Find these lengths.

g. To complete the truss, reflect the figure across $\overline{SR}$.

(1)



e) $\overline{LA} \Rightarrow \tan 21.8 = \frac{x}{3}$

1.2 ft

$\overline{MB} \Rightarrow \tan 21.8 = \frac{x}{6}$

2.4 ft

$\overline{NC} \Rightarrow \tan 21.8 = \frac{x}{9}$

3.6 ft

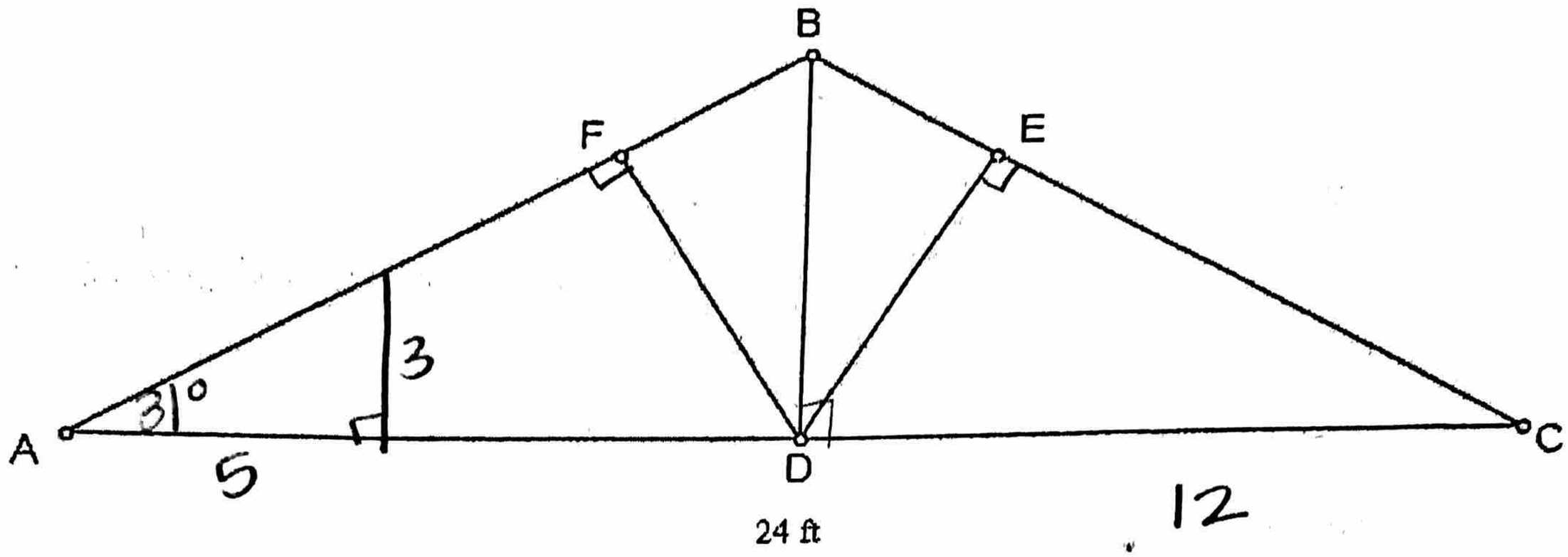
f) $LB \Rightarrow 3^2 + 1.2^2 = x^2$ 3.4 ft

$MC \Rightarrow 3^2 + 2.4^2 = x^2$ 3.8 ft

$NR \Rightarrow 3^2 + 3.6^2 = x^2$ 4.7 ft

g) see above

2. Suppose a roof has a pitch of $\frac{3}{5}$ and spans 24 ft. (AB=BC) BD is an altitude of ΔABD. DF and DE are support beams constructed perpendicular to AB and BC. Find the lengths of each support beam (DF, BD, and DE).



$\tan A = \frac{3}{5}$

$m\angle A = 31°$

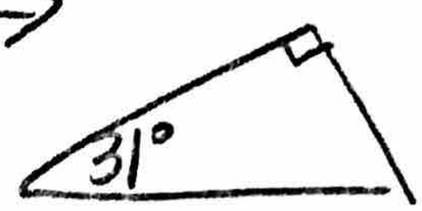
$\overline{AD} = 12$

$\overline{BD}\Rightarrow$

$\tan 31° = \frac{x}{12}$

7.2 ft

$\frac{\overline{DE}}{\overline{DF}}\Rightarrow$



$\sin 31° = \frac{x}{12}$

6.2 ft