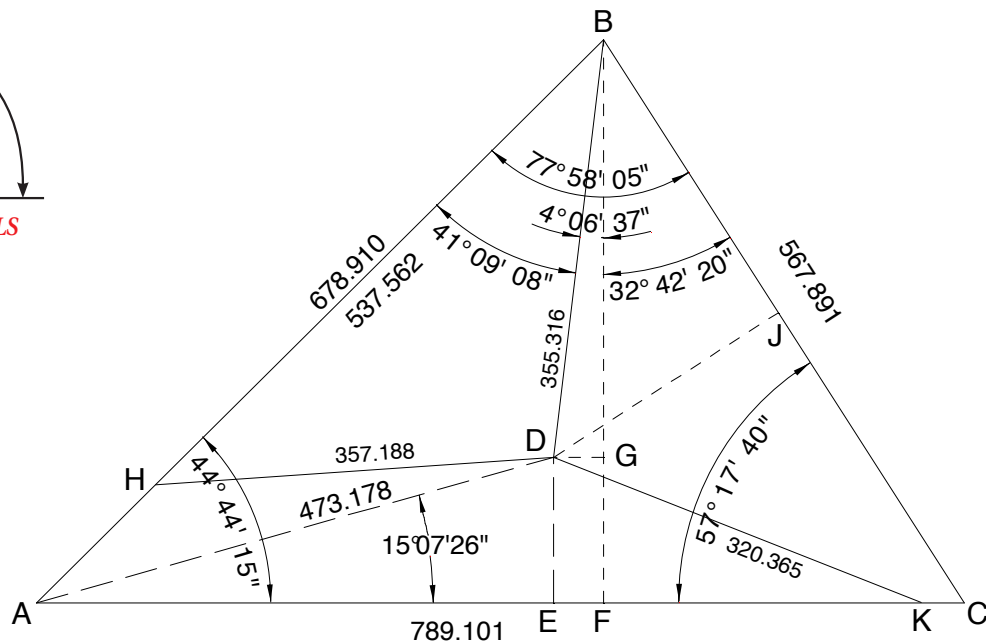


# Solution 216

by David Lindell, LS



Construct DE perpendicular to AC.

$$DE = 473.178(\sin 15^{\circ}07'26'') = 123.455, \quad AE = 473.178(\cos 15^{\circ}07'26'') = 456.789$$

By the Law of Cosines angle CAB =  $44^{\circ}44'15''$ , angle ABC =  $77^{\circ}58'05''$  and angle BCA =  $57^{\circ}17'40''$  (all of which add up to  $180^{\circ}$ ).

Construct BF perpendicular to AC and DG perpendicular to BF.

$$BF = 678.910(\sin 44^{\circ}44'15'') = 477.857, \quad AF = 678.910(\cos 44^{\circ}44'15'') = 482.256$$

$$BG = 477.857 - 123.455 = 354.402, \quad DG = 482.256 - 456.789 = 25.467 \text{ so that}$$

$$BD = \sqrt{25.467^2 + 354.402^2} = 355.316$$

Area of triangle ABC =  $\frac{1}{2}(789.101)(477.857) = 188,539$  sq. units, a third of which is 62,846.3 sq. units.

$$\text{Angle CBF} = 90^{\circ} - 57^{\circ}17'40'' = 32^{\circ}42'20''. \quad \text{Angle DBG} = \arctan \frac{25.4672}{354.4020} = 4^{\circ}06'37''$$

$$\text{Angle ABD} = 77^{\circ}58'05'' - 32^{\circ}42'20'' - 4^{\circ}06'37'' = 41^{\circ}09'08''.$$

The area of triangle BDH = 62,846.3 =  $\frac{1}{2}(355.316)(BH)(\sin 41^{\circ}09'08'')$ , so BH = 537.562.

By the Law of Cosines,

$$HD = \sqrt{537.562^2 + 355.316^2 - 2(537.562)(355.316)\cos 41^{\circ}09'08''} = 357.188$$

Construct DJ perpendicular to BC.  $DJ = 355.316(\sin 36^{\circ}48'57'') = 212.921$ , so that the area of triangle BCD is  $\frac{1}{2}(212.921)(567.891) = 60,458$  sq. units, or 2,388.3 sq. units short of 62,846.3 sq. units. Triangle DCK of height 123.455 and area of 2,388.3 sq. units will have a base of KC = 36.690.

$$EK = 789.101 - 456.798 - 36.690 = 295.622 \text{ and } DK = \sqrt{295.622^2 + 123.455^2} = 320.365$$