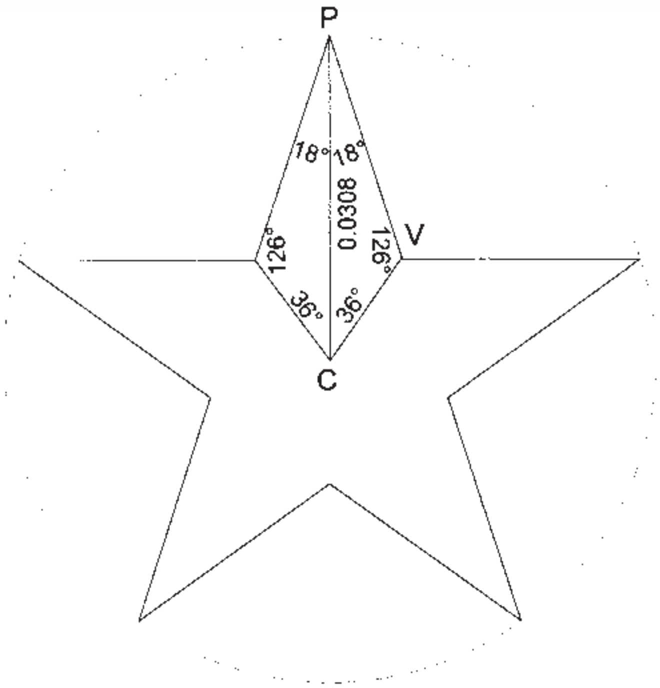
Solution to Problem 101



EACH STAR IS COMPRISED OF TEN EQUAL PARTS, EACH A TRIANGLE WITH ONE SIDE EQUAL TO 0.0308 AND ANGLES OF 18°, 36° AND 124°.

BY THE LAW OF SINES: $\dfrac{PC}{\sin 126°} = \dfrac{PV}{\sin 36°} = \dfrac{VC}{\sin 18°}$

SO THAT PV = 0.02237751 AND VC = 0.011764553

THE AREA OF ANY TRIANGLE IS:

½ (0.0308)(0.02237751) sin18°= 0.000106491

½ (0.0308)(0.011764553) sin36° = 0.000106491, OR

½ (0.02237751)(0.011764553) sin126° = 0.000106491

TEN TRIANGLES MAKE A STAR AND THERE ARE 50 STARS:

THE AREA OF ALL THE WHITE STARS IS:
(500)(0.000106491)=0.053246 SQ.UNITS

BLUE IS (7/13 x 0.76) – 0.053246 = 0.355985 SQ. UNITS (18.74%)

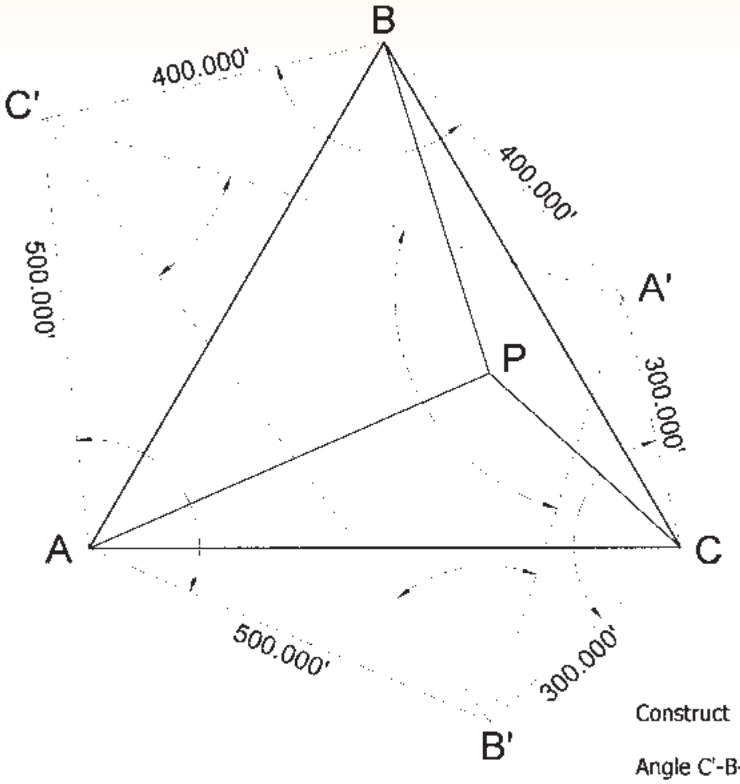
RED IS (3/13 x 1.90) + (1.90 – 0.76)(4/13) = 0.789231 SQ. UNITS (41.54%)

WHITE IS (3/13 x 1.90) + (1.90 – 0.76)(4/13) = 0.754784 SQ. UNITS (39.72%

(AS A CHECK, THE SUM OF THE AREAS IS 1.900000 SQ. UNITS)

RED IS THE DOMINANT COLOR.

Solution to Problem 102



Construct BC' = BP = BA', AC' = AP = AB', and CB' = CP = CA'

Angle C'-B-A' = angle A'-C-B' = angle B'-A-C' = 120°

A'-C' = 2(400) cos 30° = 692.8203'

C'-B' = 2(500) cos 30° = 866.0254'

B'-A' = 2(300) cos 30° = 519.6152'

In triangle A'-B'-C', by Law of Cosines

$$\text{Angle A'-C'-B'} = \cos^{-1}\frac{692.8203^2+866.0254^2-519.6152^2}{2(692.8203)(866.0254)} = 36°52'11.6''$$

$$\text{Angle C'-B'-A'} = \cos^{-1}\frac{866.0254^2+519.6152^2-692.8203^2}{2(866.0254)(519.6152)} = 53°07'48.4''$$

$$\text{Angle C'-A'-B'} = \cos^{-1}\frac{692.8203^2+519.6152^2-866.0254^2}{2(692.8203)(519.6152)} = 90°00'00''$$

In triangle A-C'-B, angle C' = 96°52'11.6", by Law of Cosines

$(AB)^2 = 500^2+400^2 - 2(500)(400)\cos 96°52'11.6''$, and AB = 676.643'

In triangle B-A'-C, angle A' = 150°00'00"

$(BC)^2 = 400^2 + 300^2 - 2(400)(300)\cos 150°00'00''$, so BC = 676.643'

In triangle A-B'-C, angle B' = 113°07'48.4"

$(AC)^2 = 500^2+300^2 - 2(500)(300)\cos 113°07'48.4''$, so AC = 676.643'