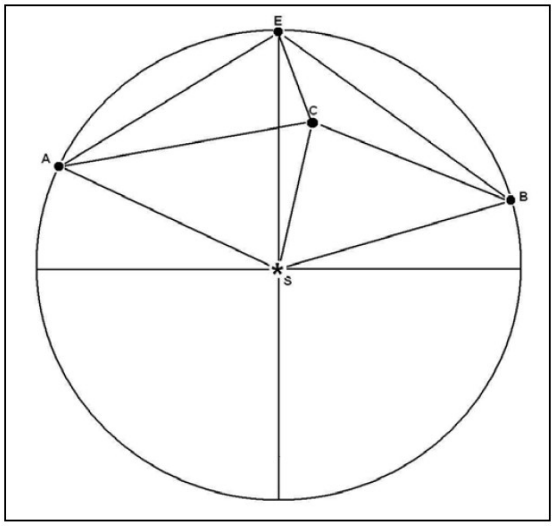
How long until impact



Background Story:

A meteorite is heading your way and your planet is in great danger! Your scientists have foreseen that your colony will not survive the impact. You need to escape!

Your job is to determine how far is the meteorite and how long do you have to plan your escape?

Some time ago, your scientists placed two satellites in orbit around your current planet, just in case this situation happens someday. Satellite A and Satellite B are located along a circular orbit of planet "**", with the Sun S located in the center.

They spotted the meteorite at position C heading towards the planet (Refer to the image on the right). Answer the following questions to help you figure out how long you have until impact. Each question is worth 2 points.

Data about the satellite and the planet:

Satellite A gives the measure of the angle that the meteor makes with the sun as 45º (i.e. ∠CAS = 45º).
Satellite B gives the measure of the angle that the meteor makes with the Sun as 50º (i.e. ∠CBS = 50º).
It is observed that ∠CSE = 14º
The radius of the circular orbit is 150 million km (i.e. SB = SA = SE = 150)
Satellite A is 136 million kms from the planet (i.e. AE = 136)
Satellite B is 122 million kms from the planet (i.e. BE = 122)
Angle that Satellite A makes with the Sun from the planet (i.e. ∠ASE) = 54º
Angle that Satellite B makes with the Sun from the planet (i.e. ∠BSE) = 48º
Angle between planet and sun measured from satellite A (i.e. ∠EAS) = 63º
Angle between planet and sun measured from satellite B A (i.e. ∠EBS) = 66º

Useful identities:

- Law of Sines: In a triangle Δ ABC $\frac{a}{\sin\angle A}=\frac{b}{\sin\angle B}=\frac{c}{\sin\angle C}$ where *a, b, c* are lengths of the sides opposite to angles A, B and C respectively
- $\sin(A-B)=\sin A\cos B-\cos A\sin B$
- $\cos^2\theta=1-\sin^2\theta$

Procedure:

1) Find the angles between meteor and planet as measured from satellites A and B
   i.e. find ∠CAE and ∠CBE
2) Find ∠ACB
Take $\angle ACE=\theta$
3) Apply Law of Sines to Δ ACE and express distance EC in terms of θ
4) Represent ∠BCE in terms of θ
5) Apply Law of Sines to Δ BCE and express distance EC in terms of θ
6) Set the results from 3) and 5) equal to solve for θ .
7) Use your result from either 3) or 5) to find the value of EC, the distance of the meteor from the planet.
8) If the meteor was traveling at 2 million km/hr, how much time do you have until meteor hits the planet.

Congratulations you will be able to escape!