Hint on Prob. 7.3-17

C : Center of the earth

distance CA = Radius of the earth R
= 6400 Km (See Prob. 7.6-15)

distance CB = 42000 Km (Given)

$$\alpha = \sin^{-1}\left(\frac{CE}{CB}\right) = \sin^{-1}\left(\frac{6400}{42000}\right)$$

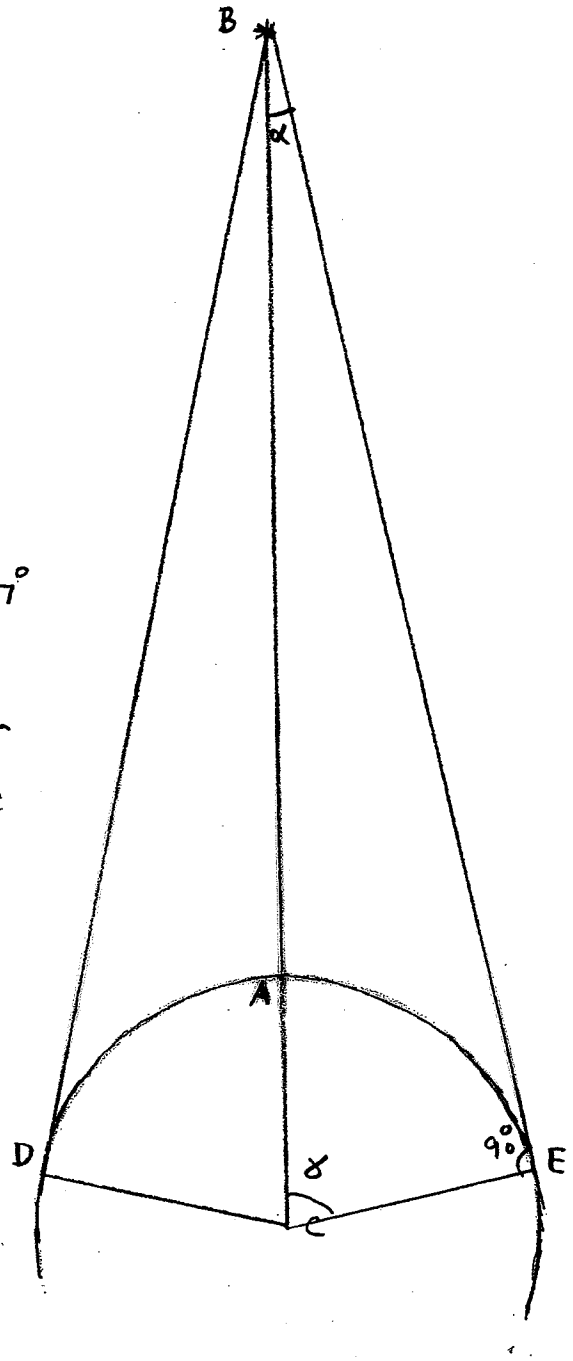
$$= 8.765^\circ$$

$2\alpha = 17.53^\circ$

$\gamma = 90 - \alpha$; $2\gamma = 180 - 2\alpha = 162.47^\circ$

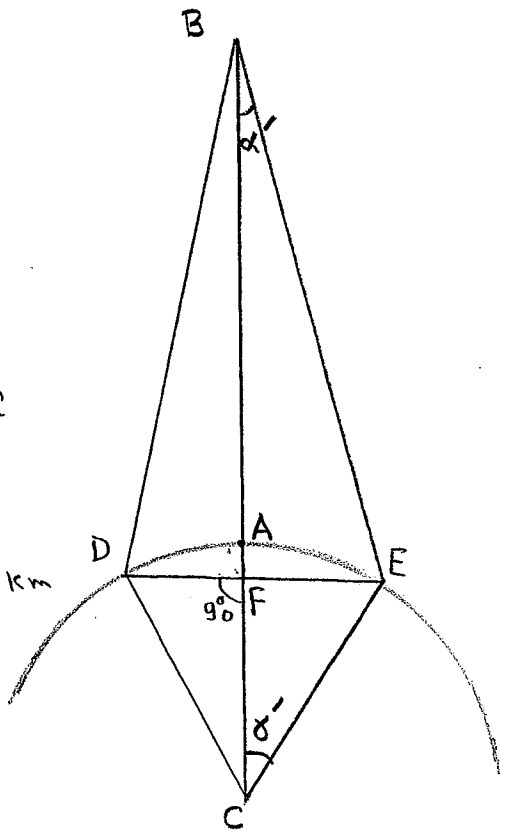
Distance DE along the surface of the earth $= \frac{2\pi R}{360^\circ} \times 162.47^\circ = 18148$ Km

(almost half of the circumference of the earth).



Hint on Prob. 7.6-15

Angle $2\alpha'$ subtended at the satellite B for any two points on the earth (say the East and the West coasts of the U.S.)



Take distance DE along the surface of the earth to be say, 6000 Km

$$\text{angle } \gamma' = \frac{\text{Arc AE}}{\text{radius of the earth} = 6400 \text{ Km}}$$

$$= \frac{3000}{6400} \text{ rad.}$$

$$= 0.468 \text{ rad} = 26.86^\circ$$

$$\text{distance EF} = CE \sin\gamma'$$

$$= 6400 \times \sin 26.86^\circ = 2891.6 \text{ Km}$$

distance AB = distance of the satellite from the earth = 42000 Km

$$\text{distance FA} = CA - CF = CA(1 - \cos\gamma') = 6400(1 - \cos\gamma')$$

$$= 690.5 \text{ Km}$$

$$\tan\alpha' = \frac{EF}{FB} = \frac{2891.6}{FA + AB} = \frac{2891.6}{44891.6}$$

$$\alpha' = 3.685^\circ$$

$$HP = 2\alpha' = 7.37^\circ$$