



**Solution**  
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*by Benjamin Bloch, Ph.D.*

1.  $OA = OB = R$ ,  $PO = PO$  so that for right triangles  $POA$  and  $POB$  we have hypotenuse-leg = hypotenuse-leg and thus right triangles  $POA$  and  $POB$  are congruent.
2. Corresponding angles of congruent triangles are equal
3. Since angle  $OPB =$  angle  $O'PB'$  by construction,  
 $R/d = \sin(OPB) = \sin(O'PB') = R'/d'$  and by rearrangement  $R/R' = d/d'$
4. NO.  $Rd' = 2.600 \times 10^{17}$  and  $R'd = 2.675 \times 10^{17}$
5. These values are for the moon ( $R$  and  $d$ ) and the sun ( $R'$  and  $d'$ ) where  $d$  and  $d'$  are the earth - moon and earth - sun distances respectively. It is remarkable that the sun and the moon and the earth have just the right dimensions to subtend almost the same angle as seen from the earth
6.  $d^* = Rd'/R' = 3.736 \times 10^8$  meters
7.  $R'/d' = \sin A'PO'$  and since  $A'PO' = B'PO'$ , then  $R'/d' = \sin(A'PB'/2)$   
And finally angle  $A'PB' = 2 \arcsin(R'/d') = 2 \arcsin(0.00465) = 0.53$  degrees
8. Inserting the  $R$  and  $d$  values in answer 7 yields: angle  $APB = 0.518$  degrees
9. If the moon recedes from the earth at  $0.0038$  meters/year, then since  $d - d^* = 1.08 \times 10^7$  meters, it would mean that  $(d - d^*)/0.0038 = 284.2$  million years ago the moon exactly eclipsed the sun, all other factors being unchanged.