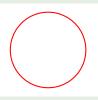
Precalculus Inverse trig word problem

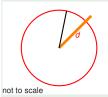
Todor Miley

2019

The horizon at sea is viewed at from a ship height of 10m. How far does the ship need to travel to reach the horizon just observed?

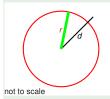




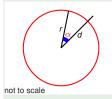


The horizon at sea is viewed at from a ship height of 10m. How far does the ship need to travel to reach the horizon just observed? Assume earth is round with radius 6371 km and that the ship sails along the shortest curved path.

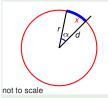
• Let *d* be the distance from eyes of seaman to the center of earth.



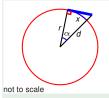
- Let *d* be the distance from eyes of seaman to the center of earth.
- Let *r* be the radius of earth.



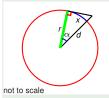
- Let *d* be the distance from eyes of seaman to the center of earth.
- Let r be the radius of earth. Let α be the indicated angle.



- Let *d* be the distance from eyes of seaman to the center of earth.
- Let r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be x.



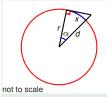
- Let *d* be the distance from eyes of seaman to the center of earth.
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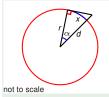
- Let *d* be the distance from eyes of seaman to the center of earth.
- Let r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be *x*.

r=6371km



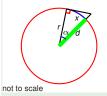
- Let *d* be the distance from eyes of seaman to the center of earth.
- Let r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be x.
 r=6371km

$$d=?$$



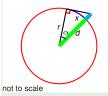
- Let *d* be the distance from eyes of seaman to the center of earth.
- Let r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be x.

```
r=6371km d=6371km + 0.01km
```



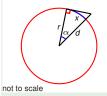
- Let *d* be the distance from eyes of seaman to the center of earth.
- Let r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be x.

$$d = 6371 \text{km} + 0.01 \text{km}$$



- Let *d* be the distance from eyes of seaman to the center of earth.
- Let r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be x.

```
r=6371km
d=6371km + 0.01km
```

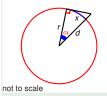


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r=6371km

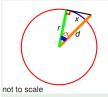
d = 6371 km + 0.01 km = 6371.01 km



- Let *d* be the distance from eyes of seaman to the center of earth.
- Let r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be *x*.

$$d = 6371 \text{km} + 0.01 \text{km} = 6371.01 \text{km}$$

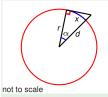
$$\cos \alpha = ?$$



- Let *d* be the distance from eyes of seaman to the center of earth.
- Let r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be *x*.

$$d = 6371 \text{km} + 0.01 \text{km} = 6371.01 \text{km}$$

$$\cos \alpha = \frac{r}{a}$$

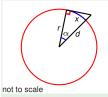


- Let *d* be the distance from eyes of seaman to the center of earth.
- Let r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be *x*.

$$d = 6371 \text{km} + 0.01 \text{km} = 6371.01 \text{km}$$

$$\cos \alpha = \frac{r}{d}$$

$$\alpha = \arccos \left(\frac{r}{d}\right)$$



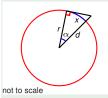
- Let d be the distance from eyes of seaman to the center of earth.
- Let r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be *x*.

$$d = 6371 \text{km} + 0.01 \text{km} = 6371.01 \text{km}$$

$$\cos \alpha = \frac{r}{d}$$

$$\alpha = \arccos\left(\frac{r}{d}\right)$$

$$x=?$$



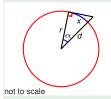
- Let *d* be the distance from eyes of seaman to the center of earth.
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- Let the distance to the horizon be *x*.

$$d = 6371 \text{km} + 0.01 \text{km} = 6371.01 \text{km}$$

$$\cos \alpha = \frac{r}{d}$$

$$\alpha = \arccos\left(\frac{r}{d}\right)$$

$$x = r\alpha$$



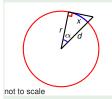
- Let *d* be the distance from eyes of seaman to the center of earth.
- Let r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be *x*.

$$d = 6371 \text{km} + 0.01 \text{km} = 6371.01 \text{km}$$

$$\cos \alpha = \frac{1}{d}$$

$$\alpha = \arccos\left(\frac{r}{d}\right)$$

$$x = r\alpha = r \arccos\left(\frac{r}{d}\right)$$



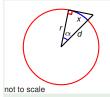
- Let *d* be the distance from eyes of seaman to the center of earth.
- Let r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be x.

$$r=6371 \text{km}$$

 $d=6371 \text{km} + 0.01 \text{km} = 6371.01 \text{km}$
 $\cos \alpha = \frac{r}{d}$

$$\alpha = \arccos\left(\frac{r}{d}\right)$$

$$x = r\alpha = r \arccos\left(\frac{r}{d}\right) = 6371 \text{km} \arccos\left(\frac{6371 \text{km}}{6371.01 \text{km}}\right)$$



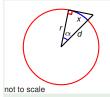
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 r=6371km

$$d = 6371 \text{km} + 0.01 \text{km} = 6371.01 \text{km}$$

$$\cos \alpha = \frac{r}{d}$$

$$\alpha = \arccos\left(\frac{r}{d}\right)$$

$$x = r\alpha = r \arccos\left(\frac{r}{d}\right) = 6371 \text{km} \arccos\left(\frac{6371 \text{km}}{6371.01 \text{km}}\right)$$



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$$r$$
=6371km
 d =6371km + 0.01km = 6371.01km

$$\cos \alpha = \frac{r}{d}$$

$$\alpha = \arccos\left(\frac{r}{d}\right)$$

$$x = r\alpha = r \arccos\left(\frac{r}{d}\right) = 6371 \text{km} \arccos\left(\frac{6371 \text{km}}{6371.01 \text{km}}\right) \approx 11.29 \text{km}$$