

Precalculus

Inverse trig word problem

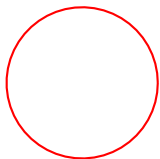
Todor Milev

2019

Example

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?

Example



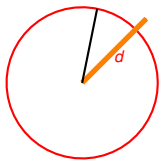
The horizon at sea is viewed at from a ship height of 10m. How far does the ship need to travel to reach the horizon just observed? Assume earth is round with radius 6371 km and that the ship sails along the shortest curved path.

Example



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.

Example

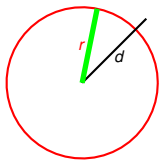


not to scale

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.

Example

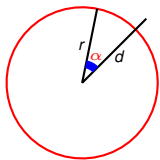


not to scale

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 r be the radius of earth.

Example

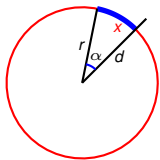


not to scale

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 r be the radius of earth. Let α be the indicated angle.

Example

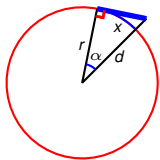


not to scale

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 r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be x .

Example

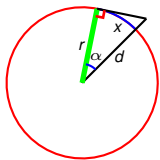


not to scale

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 r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be x .

Example



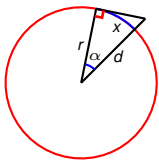
not to scale

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 r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be x .

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

Example



not to scale

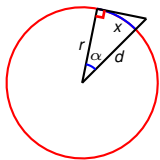
The horizon at sea is viewed at from a ship height of 10m. How far does the ship need to travel to reach the horizon just observed? Assume earth is round with radius 6371 km and that the ship sails along the shortest curved path.

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

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

$$d = ?$$

Example



not to scale

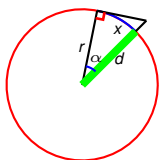
The horizon at sea is viewed at from a ship height of 10m. How far does the ship need to travel to reach the horizon just observed? Assume earth is round with radius 6371 km and that the ship sails along the shortest curved path.

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

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

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

Example



not to scale

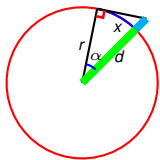
The horizon at sea is viewed at from a ship height of 10m. How far does the ship need to travel to reach the horizon just observed? Assume earth is round with radius 6371 km and that the ship sails along the shortest curved path.

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

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

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

Example



not to scale

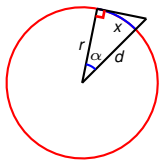
The horizon at sea is viewed at from a ship height of 10m. How far does the ship need to travel to reach the horizon just observed? Assume earth is round with radius 6371 km and that the ship sails along the shortest curved path.

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

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

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

Example



not to scale

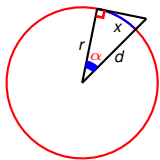
The horizon at sea is viewed at from a ship height of 10m. How far does the ship need to travel to reach the horizon just observed? Assume earth is round with radius 6371 km and that the ship sails along the shortest curved path.

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

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

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

Example



not to scale

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.

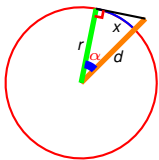
- Let d be the distance from eyes of seaman to the center of earth.
- Let r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be x .

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

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

$$\cos \alpha = ?$$

Example



not to scale

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.

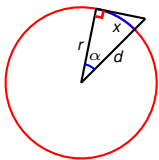
- Let d be the distance from eyes of seaman to the center of earth.
- Let r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be x .

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

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

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

Example



not to scale

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 r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be x .

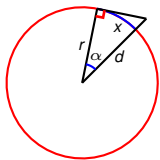
$$r = 6371 \text{ km}$$

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

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

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

Example



not to scale

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 r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be x .

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

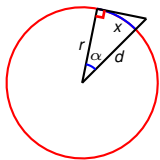
$$d = 6371 \text{ km} + 0.01 \text{ km} = 6371.01 \text{ km}$$

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

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

$$x = ?$$

Example



not to scale

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 r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be x .

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

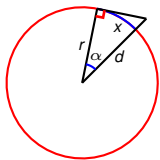
$$d = 6371 \text{ km} + 0.01 \text{ km} = 6371.01 \text{ km}$$

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

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

$$x = r\alpha$$

Example



not to scale

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 r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be x .

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

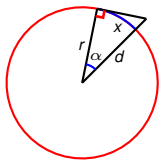
$$d = 6371 \text{ km} + 0.01 \text{ km} = 6371.01 \text{ km}$$

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

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

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

Example



not to scale

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 r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be x .

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

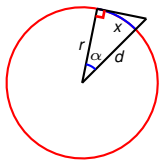
$$d = 6371 \text{ km} + 0.01 \text{ km} = 6371.01 \text{ km}$$

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

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

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

Example



not to scale

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 r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be x .

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

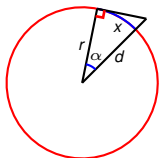
$$d = 6371 \text{ km} + 0.01 \text{ km} = 6371.01 \text{ km}$$

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

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

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

Example



not to scale

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 r be the radius of earth. Let α be the indicated angle.
- Let the distance to the horizon be x .

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

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

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

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

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