

# Answers

## Step 1: Let's start from the city center

Area of a Circle  $A = \pi r^2$ , where  $\pi$  (pi) is a mathematical constant approximately equal to 3.14159, and  $r$  is the radius of the circle.

Perimeter or Circumference of a Circle  $C = 2\pi r$ .

Internal circle (approx.):

$$\text{Area } A = \pi r^2 = 3.14159 \times 1^2 = 3.14159 \text{ m}^2$$

$$\text{Perimeter } C = 2\pi r = 2 \times 3.14159 \times 1 = 6.28318 \text{ m}$$

The external circle has a radius of 3m:

$$\text{Area: } A = \pi r^2 = 3.14159 \times 3^2 = 28.27431 \text{ m}^2$$

$$\text{Perimeter } C = 2\pi r = 2 \times 3.14159 \times 3 = 18.84954 \text{ m}$$

## Step 2: How long does it take to go from one end to the other?

$$1 \text{ mile} = 1609.344 \text{ m} = 1.609344 \text{ km}$$

If we assume, that someone travels with at a steady speed then the formula is  $\text{Distance} = \text{Time} \times \text{Speed}$  which means that  $\text{Time} = \text{Distance} / \text{Speed}$ .

So, the time to cover a distance of 2.4 km ( $= 2.4 / 1.609344 = 1.49129086$  miles) with 2 miles per hour is  $\text{Time} = 1.49129086 \text{ miles} / 2 \text{ miles/per hour} = 0.745645 \text{ hours} = 44.73 \text{ min}$

## Step 3: The tobacco industry

The formula for the area of a rectangle is  $\text{Area} = \text{Length} \times \text{Width}$

The total area then is  $67 \text{ m} \times 37 \text{ m} = 2479 \text{ m}^2$ . The usable area is 1775. Thus,  $704 \text{ m}^2$  are lost which means  $704 / 2479$  approximately 28.4% is lost.

## Step 4: Make our park more accessible

The horizontal distance is 300cm

The height is 50cm

Thus, the slope is  $\text{Opposite Side} / \text{Adjacent Side}$ , which is basically the Tangent function  $\tan x = \text{Opposite Side} / \text{Adjacent Side}$

The slope is  $50 / 300 = 0.1617$  and if we multiply by 100 it is 16.17% which is more than 10% unfortunately.

## Step 5: How big is the park area?

The long sides are approximately 350m

The short sides are approximately 240m

If we consider that it is a parallelogram then the area is approximately  $84000 \text{ m}^2$

So, choice b is the correct.

## Step 6: Let's have a short trip outside the city

Area of the Largest Lake / Area of the Smallest Lake = 9.86 times

### Step 7: Finally, let's celebrate

Based on how the lamps and ornaments are distributed in the figure, the weight of “lamps\*distance” should equal the weight of “ornaments\*distance” from the balancing point.

The total weight of lamps is  $9 \times 50\text{gr} = 450\text{ gr}$

The total weight of ornaments is  $4 \times 150\text{gr} = 600\text{ gr}$

Since the weight of lamps/weight of ornaments =  $450/600 = 3/4$ , then we need to have more part of the stick towards the lamps, and practically this happens if we have 1m of the horizontal stick on the left side with respect to the wooden spike and on the right side 0.75m

That way,  $450 \times 1 = 600 \times 0.75$  so the horizontal stick balances.

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