ISS passing distance and time

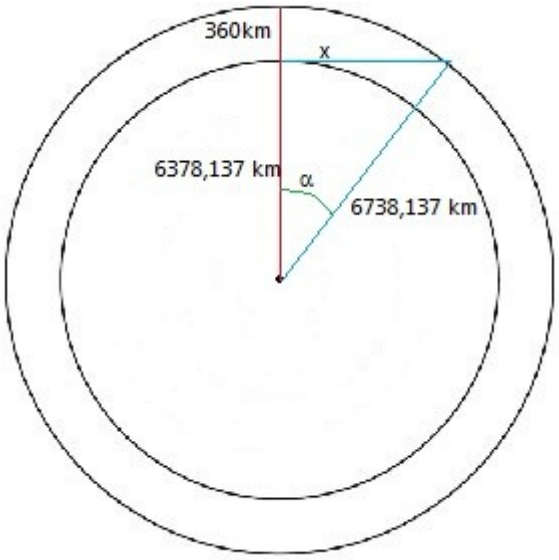

Illustration 1: Schematic of distance. Not to scale

So, if we want to know the length that ISS travels, we need to do some calculations.
First, we like to know from which point we (theoratically, without obstructions like buildings and trees and such) can see the ISS.
That's not that hard, it's a simple Pythagoras calculation.
Step one is to find out the radius of the Earth. Some google-abuse tells us it's 6378,137 km.
Step two, is calculate X then, offcourse.
To calculate X, we take the radius of the Earth and add 360 km to that (flight height of the ISS)
With that information, we can calculate X:

$$A^2 + B^2 = C^2$$
$$A = 6378{,}137\,km$$
$$B = X$$
$$C = 6738{,}137\,km$$
$$X = \sqrt{(B^2)} = \sqrt{(C^2 - A^2)}$$
$$X = \sqrt{(4186.89^2 - 6378{,}137^2)} = 2173{,}0\,km$$

Ok, what does this help us? Not much really, but it's a fun fact to know that the first moment you can see the ISS is 2173,0 km away.

Next, we want to know how much distance the ISS travels. For that, we need to calculate the angle α with some Cosinus calculations:

$$\cos\alpha = \frac{A}{C}$$
$$A = 6378{,}137\,km$$
$$C = 6738{,}137\,km$$
$$\cos\alpha = \frac{6378{,}137}{6738{,}137}$$
$$\arccos\left(\frac{6378{,}137}{6738{,}137}\right) = 18.81^o$$

Now, we know the angle of half the arc of the ISS we can see, is 18,81 degrees. Now we can simply calculate the distance ISS travels:

$$d = \frac{(2*\alpha)}{360} * 2 * \pi * R$$
$$\alpha = 18{,}81^o$$
$$R = C = 6738{,}137\,km$$
$$d = \frac{(2*18{,}81)}{360} * 2 * \pi * 6738{,}137 = 4425{,}1\,km$$

With this, we can also calculate how long the ISS is visible in the skies above. The ISS travels at 7,7 km/s, thus:

$$t = \frac{m}{v}$$
$$m = 4425{,}1\,km$$
$$v = 7{,}7\,km/s$$
$$t = \frac{4425{,}1}{7{,}7} = 574.69\text{s}$$
$$574{,}69\,s = 9{,}58\,minutes = 9\text{m}35\text{s}$$

We have about 10 minutes of visible ISS every passing.