# Double sunset

Currently the world's tallest building, the Burj Khalifa in Dubai stands at 830m.

A fast elevator carries passengers from 140m up to a viewing platform at a height of 640m in just 60 seconds.

Would it be possible to watch the sunset on the lower floor, hop into the lift and watch it all over again from the top?

The radius of the earth is 6378km, and in Dubai the sunset is effectively moving away at the rate of $25km/min$. In other words, to watch a permanent sunset you would have to be moving west at a speed of $25km/min$ or $1500km/h$.

**1.**
**Using Pythagoras, calculate the distance to the horizon from a height of 140m.**

**2.**
**Calculate the distance to the horizon when at a height of 640m, and hence work out how much further you can see.**

**3.**
**Calculate how long it will take the sun to dip over the new, further, horizon after it's already set over the first one.**

**4.**
**Would you have enough time to watch it set a second time, and if so, how long would you have to wait at the top before it did?**

# Double sunset SOLUTIONS

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## 1.
**Using Pythagoras, calculate the distance to the horizon from a height of 140m.**

$$r^2 + d^2 = (r + h)^2 \quad \Longrightarrow \quad 6378000^2 + d^2 = 6378140^2$$
$$d = 42259m = \mathbf{42.259km}$$

## 2.
**Calculate the distance to the horizon when at a height of 640m, and hence work out how much further you can see.**

$$r^2 + d^2 = (r + h)^2 \quad \Longrightarrow \quad 6378000^2 + d^2 = 6378640^2$$
$$d = 90356m = 90.356km$$
$$90.356 - 42.259 = \mathbf{48.097km\ further}$$

## 3.
**Calculate how long it will take the sun to dip over the new, further, horizon after it's already set over the first one.**

At $25km/min$ the sun will move $48.097km$ in $\frac{48.097}{25} = 1.92388\ minutes$

Or: $1\ minute\ 55\ seconds$

## 4.
**Would you have enough time to watch it set a second time, and if so, how long would you have to wait at the top before it did?**

Yes. The lift takes a minute, so there would be another 55 seconds to watch before the sun disappears below the new horizon.