Modelling Situations with Trigonometric Functions

1. Ayten wants to go to university in Germany, but Germany’s temperature is quite different from Egypt’s. Ayten is nervous about how much of the time will be “un-brrrr-ably” cold. Germany’s temperature, $T(m)$, in °C, over time in months, $m$, can be represented by the function:

$$T(m) = 15 \cos \left( \frac{\pi}{6} (m - 8) \right) + 10$$

a) Explain where the function $T(m)$ comes from (ie: explain each transformation in terms of this situation).

b) If Ayten doesn’t like temperatures below freezing, approximately when will she find Germany too cold during her four-year degree? (Graph the function for four years to help you answer this).

2. Amr is studying a pendulum. It swings back and forth 10 times in 6 seconds. It swings through a total horizontal distance of 20cm.

a) Sketch a graph of this motion for two cycles, beginning with the pendulum at the end of its swing.

b) Write the equation that models this situation and explain each parameter.
3. Ali is on a Ferris wheel that takes 3 minutes to complete a full revolution. It has a diameter of 30m and the lowest point is 2m off the ground. The platform to get on the Ferris wheel is 5m high on the side going up. Find an equation to represent the height of Ali, \( H(m) \), after \( m \) minutes.

4. Write a scenario that goes along with the following graph. State the equation of the function.