**6.6 – Modelling Using Trigonometric Functions**

**Example 1:** The table shows the average monthly means of the daily (24 h) temperatures in Hamilton, Ontario. Each month's average temperature is represented by the day in the middle of the month.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Month | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct  | Nov | Dec |
| Day of Year | 15 | 45 | 75 | 106 | 136 | 167 | 197 | 228 | 259 | 289 | 320 | 350 |
| Temp (C) | -4.8 | -4.8 | -0.2 | 6.6 | 12.7 | 18.6 | 21.9 | 20.7 | 16.4 | 10.5 | 3.6 | -2.3 |

a) Plot the temperature data for Hamilton, and fit a sinusoidal curve to the points.

b) Estimate the average daily temperature in Hamilton on the 200th day of the year.



**Example 2:** The population of rabbits, R(t), and the population of foxes, F(t), in a given region are modelled by the functions R(t) = 10 000 + 5000cos($π$t/12) and F(t) = 1000 + 500sin($π$t/12) , where t is the time in months.

a) Sketch the graphs of these functions.



b) Compare the graphs and discuss the relationships between the two populations.

c) How does the rabbit to fox ratio change over time?

|  |  |  |  |
| --- | --- | --- | --- |
| Time | Rabbits | Fox | Rabbits to Fox Ratio |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

Summary

$\left|a\right|$ is the amplitude and a = (max - min)/2

$\left|k\right|$ is the number of cycles in 2$π$ radians, when the period = 2$π$/k

d is the horizontal translation or phase shift

c is the vertical translation and y=c is the horizontal axis.