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IB SL Math 11
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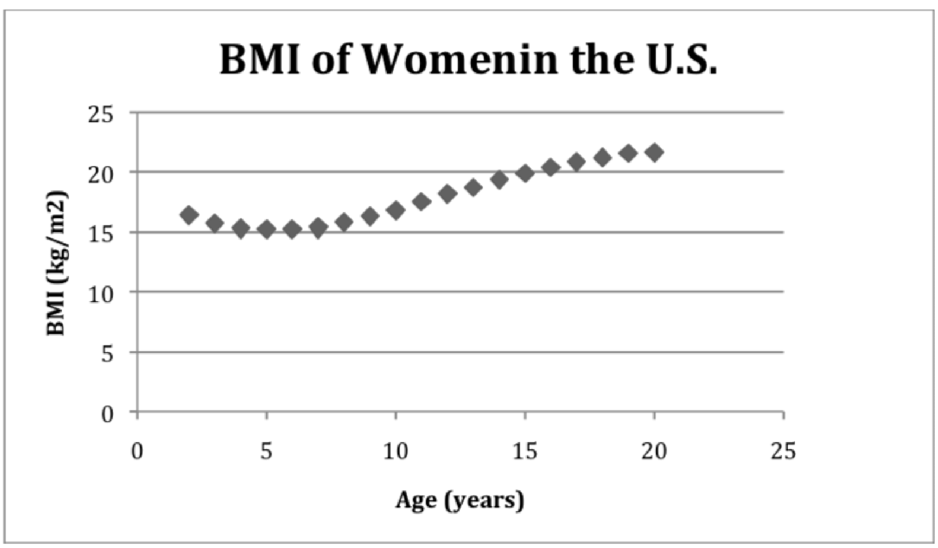
This portfolio will consist of trigonometry and technology in order to represent the BMI of the females in the year 2000 for the US and the other country. Using technology, we will be able to plot the BMI of females in the year 2000 as a function where x is the age of the female in years and y is that age's correspondent BMI.

The domain of the function will be *D:* $2 \le x \le 20$ because we only have data for the females in the US between ages 2 and 20. Additionally, the range will be *R:* $15.20 \le y \le 21.65$ since our data is restricted, we must make out function with the same restrictions.

Age (yrs)	BMI
2	16.4
3	15.7
4	15.3
5	15.2
6	15.21
7	15.4
8	15.8
9	16.3
10	16.8
11	17.5
12	18.18
13	18.7
14	19.36
15	19.88
16	20.4
17	20.85
18	21.22
19	21.6
20	21.65



*Data of the BMI of women in the U.S. in 2000

In order to figure out the function of this graph we must first assess that it seems to be a sine curve as it begins around the middle of the minimum or maximum where as a cosine graph begins at the minimum or maximum and tangent graph has clear asymptotes which this does not. Therefore the equation of the line would be given by the following calculations:

Work

$$y = asin(bx + c) + d$$

Value of A

$$21.65 - 15.20 = 6.45$$

$$\frac{6.4}{2} = 3.225$$

$$a = 3.225$$

Value of B

$$20 - 5 = 15$$

$$15 * 2 = 30$$

$$\frac{2\Pi}{b} = 30$$

$$b = .2094395102$$

Value of D

$$15.20 + 3.225 = 18.425$$

$$d = 18.425$$

We can check the value of d by doing the following:

$$21.65 - 3.225 = 18.425$$

On a new set of axis, we will graph our found function next to our original plot and comment on any differences: (see graph paper 1)

Now that I can see out found function and our date plot next to each other, we can see there is indeed a horizontal shift. We will need to refine our equation.

We should calculate the minimum of the function we derived in order to finds its x-value. When we have that value, we can subtract the minimum data point from it to get the horizontal shift. We can then add it to our equation and check again.

Value of C

Now an apparent horizontal shift is to be made.

$$7.499989 - 5 = 2.499989$$

$$c = 2.499989$$

All of the values are as the following:

$$a = 3.225$$

$$b = .2094395102$$

$$c = 2.499989$$

$$d = 18.425$$

Hence the final equation is as the following:

$$y = 3.225sin(.20943495102(x + 2., 499989) + 18.425$$

On another set of axis, we will graph our revised function next to our plotted data once again.

Now that we have refined our equation, we can determine that came up very close in representing that data correctly. We can see that the data is a bit steeper at the beginning and a bit shallower at the end but the rest of our found function matches up pretty much flawlessly. These slight mistakes could very easily be incorrect data when the collection was done.

If we are to enter this data in our T.I. (Texas instrument) calculators, we simply can use the SineReg option in the STAT menu of our calculator and it will compute the closest equation it possible can to our BMI of females in the US (in 2000) data. We can then compare that to our model function (the one we found from data).

Using technology, we were able to acquire the following equation:

$$y = 3.150950416sin(.2181267428(x - 2.75205449) + 18.43408389$$

Our equation is:

$$y = 3.225sin(.20943495102(x + 2., 499989) + 18.425$$

As we can see, our function and technology's function are very similar. The technology's function follows the data a bit more precisely since its curve is stretched upward more in the more in the beginning and downward more in the end. He exact flaws our own function had as we had previously discussed. We should say this is due to technology's great computing skills, which can hold more digits, and then it displays and uses those longer figures in its own calculations.

We will now use our function (the one we found from the data) to estimate the BMI of 30 old women in the U.S.

We can understand that a 30-year-old woman in the year 2000 would approximately have a BMI of about 16.812506 because 16.812506 is the y-coordinate when x is equal to 30 (x=30). Since this data is based on how close our function was to the original data, we can never be closer than the original difference between the actual data points and our revised function was so close to the data, we can be very sure the 16.812506, however we will round it to three significant figures making it 16.8.

We will now look at the BMI's of females in Scotland from the ages of 3 and 16 from years 1989-1991. The time and ages are different from the prior data we received but the representation is somewhat close to the year 2000 regarding the BMI in Scotland as well.

For analysis purposes, we will only look at the 97th percentile on the above data. Our model fits this data very slightly. If we try to fit a function on this graph, we would have to shift out sine graph so the minimum was close to x=3 (yrs) instead of 7, increase the initial amount (d) by about 1. Scottish female BMI between the ages 3 and 16 are similar to the American females BMI of between 5 and 20.

The model obviously has limitations for example, its actual values would not work in many other regions of the world, and the frequency may change due to possible eating habits and available food changes tremendously if we are to look art it from a global perspective. It is probable to say that our model could represent North America's BMI at the greatest.