Mathematics Question-1

HAPPY NEW YEAR!

Following cartoon appeared in *Times of India newspaper on 27ᵗʰ December 2019.*

According to NASA, the rotational and orbital periods of the Mercury, the Venus and the Earth are given below:

	Mercury	Venus	Earth
Rotational Period(Hours)	1407.5	-5832.4	23.934
Orbital Period(Earth Days)	87.97	224.70	365.26

(Source: https://solarsystem.nasa.gov/planet-compare/)

Challenge:

1. State whether Garfield's thought "where Mondays last 2802 hours "is factually correct. Justify your answer.

2. Suppose Garfield thinks that the Venus is a place "where one can celebrate **New Year seven times in a week**". (Consider a week equals to **7 Venus days**.) Is this scientifically correct? Justify your answer.

Mathematics Question-2

CHINESE CALENDAR!

A child sits on an installation of a rat, the Chinese zodiac sign for the next Lunar New Year, in Beijing (**Source : Times of India 28 December 2019**) .Table below can be used for conversion of date from Gregorian calendar to Chinese lunar calendar and vice versa.

Gregorian-Lunar Calendar Conversion Table of 2020 (Geng-zi year of the Mouse)

Gregorian date		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Solar Terms
Jan	Lunar date	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1st Lunar Month	2	3	4	5	6	7	Moderate Cold : **6** Severe Cold : **20**
Feb	Lunar date	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	2nd Lunar Month	2	3	4	5	6	7			Spring Commences : **4** Spring Showers : **19**
Mar	Lunar date	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	3rd Lunar Month	2	3	4	5	6	7	8	Insects Waken : **5** Vernal Equinox : **20**
Apr	Lunar date	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	4th Lunar Month	2	3	4	5	6	7	8		Bright & Clear : **4** Corn Rain : **19**
May	Lunar date	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	4th Lunar Month	2	3	4	5	6	7	8	9	Summer Commences : **5** Corn Forms : **20**
Jun	Lunar date	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	Lunar Month	2	3	4	5	6	7	8	9	10		Corn on Ear : **5** Summer Solstice : **21**
Jul	Lunar date	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	6th Lunar Month	2	3	4	5	6	7	8	9	10	11	Moderate Heat : **6** Great Heat : **22**
Aug	Lunar date	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	Lunar Month	2	3	4	5	6	7	8	9	10	11	12	13	Autumn Commences : **7** End of Heat : **22**
Sep	Lunar date	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	Lunar Month	2	3	4	5	6	7	8	9	10	11	12	13	14		White Dew : **7** Autumnal Equinox : **22**
Oct	Lunar date	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Lunar Month	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Cold Dew : **8** Frost : **23**
Nov	Lunar date	16	17	18	19	20	21	22	23	24	25	26	27	28	29	Lunar Month	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		Winter Commences : **7** Light Snow : **22**
Dec	Lunar date	17	18	19	20	21	22	23	24	25	26	27	28	29	30	11th Lunar Month	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Heavy Snow : **7** Winter Solstice : **21**

Remarks: ▢ 1. Represent the first day of the Lunar month   2. Sundays are in red

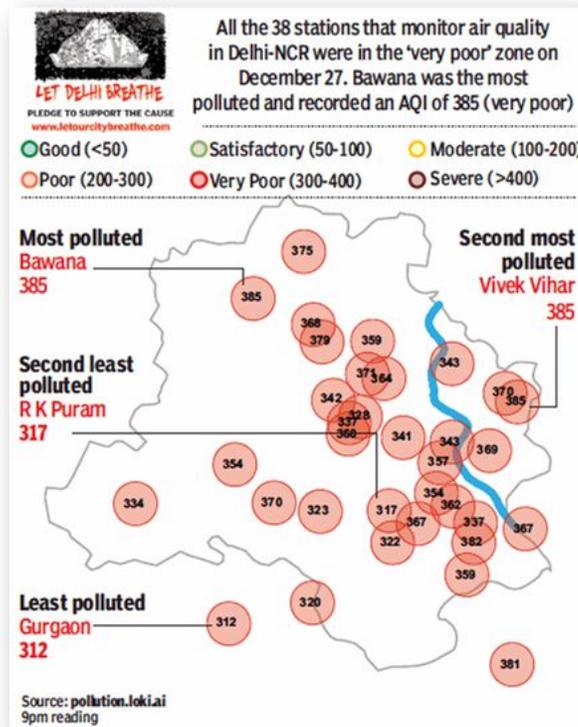(Source: https://www.hko.gov.hk/en/gts/time/conversion.htm)

Challenge: Make an algorithm/ Formula to calculate the Chinese date from a Gregorian date for the year 2020.

Mathematics Question-3

WHAT ARE YOU SMOKING?

Given below is Air Quality Index of different localities of Delhi on 27th December 2019 reported by Times of India Newspaper on 28th December 2019 .
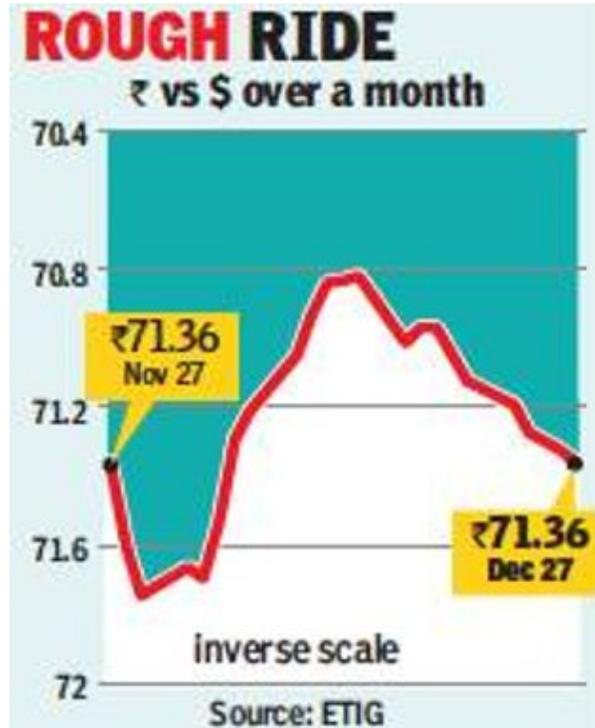

Challenge: Convert data related to AQI into a histogram. Identify and use any other graphical representation suitable for the given data.

Mathematics Question - 4

EXTRACTING DATA FROM GRAPH

Graph given below represents the conversion of one dollar into rupees over a period of past 30 days.

(Source : Times of India 28/12/2019)

Challenge:

From the graph given above, write down day to day value of one dollar in rupees for the past 30 days.
You may take a printout of the picture and use an appropriate scale for this activity.

Mathematics Question-5

COLDEST DECEMBERS

Content area   : Data and Uncertainty

Mathematical ability   : Formulate

Context   : Personal

 Level   : Class VIII

While reporting temperature of Delhi , following data was given by Times of India on 28/12/2019

Challenge:

1.   Why do we mention the average **maximum** temperature not the average **minimum** temperature for identification of the coldest Decembers since 1901?

2.   As per information given above, the average maximum temperature for December till 27th December 2019 is 19^oC. What should be the minimum value of average maximum temperature for remaining days to make it the coldest December since 1919?

Solutions

Mathematics Question-1

HAPPY NEW YEAR!

Solution 1

As per data given ,the rotational period of Venus is 5832 hours. Hence Garfield's thought is factually **incorrect**. Please note that daytime is different from a day. Negative sign indicates that it rotates in a direction opposite to that of the earth.

Solution 2

Orbital period corresponds to **one year** and rotational period corresponds to **one day.**

Orbital period of Venus in hours = Venus year =224.70 x23.934= 5377.97 hours

7 Venus years =37,645.79 hours

1 Venus week =5832.4 x7 = 40,826.8 hours , which is more than 7 Venus years and less than 8 Venus years

Hence once can celebrate New Year seven times in a Venus week. Garfield's thinking is correct.

Mathematics Question-2

CHINESE CALENDAR!

Solution:

To get Chinese date from Gregorian date, following algorithm can be used. You can also write a computer programme to do the conversion using this algorithm.

Month	Lunar Date from Gregorian date	Lunar month	Lunar Date from Gregorian date	Lunar Month
January			After 25th Subtract 24	1
February	Before 23rd Add 7	1	Rest of the days Subtract 22	2

| Month	Before date / Add		Rest of the days / Subtract	
March	Before 24th Add 7	2	Rest of the days Subtract 23	3
April	Before 23rd Add 8	3	Rest of the days Subtract 22	4
May	Before 23rd Add 8	4	Rest of the days Subtract 22	4 (leap)
June	Before 21st Add 9	4(leap)	Rest of the days Subtract 20	5
July	Before 21st Add 10	5	Rest of the days Subtract 20	6
August	Before 19th Add 11	6	Rest of the days Subtract 18	7
September	Before 17th Add 13	7	Rest of the days Subtract 16	8
October	Before 17th Add 14	8	Rest of the days Subtract 16	9
November	Before 15th Add 15	9	Rest of the days Subtract 15	10
December	Before 15th Add 16	10	Rest of the days Subtract 15	11

Please note that there can be multiple solutions to this problem.

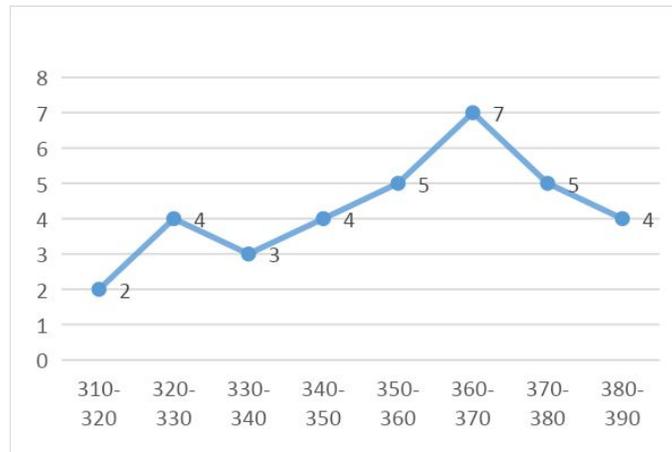**Mathematics Question-3**

WHAT ARE YOU SMOKING?

Solution:

AQI	Frequencies
310-320	2
320-330	4
330-340	3
340-350	4
350-360	5
360-370	7
370-380	5
380-390	4
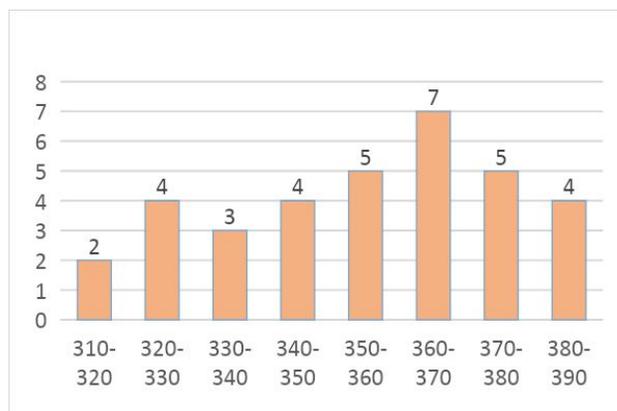
Note: Though 38 stations are mentioned data is only of 34 stations.

You can also make other plots like the one given below:

Mathematics Question-4

EXTRACTING DATA FROM GRAPH

Solution:

Take a print out of the graph. Divide X-axis to 30 equal parts to represent 30 days and Rs.0.40 on Y axis may also be appropriately divided (say to 40 parts to make one part equals to Rs.0.01). Tabulate the value of dollar in rupees against the dates as shown below from this graph.

Day	Value of one dollar (Rs)
27 November	71.36
28 November	71.52
.....	....
....	....
27 December	71.36

Mathematics Question-5

COLDEST DECEMBERS

Solution 1 :

All temperatures in a day will be less than average maximum temperature. Hence it is better to use average maximum temperature to represent the coldest day.

Solution 2 :

Given:

$$(T_1+T_2+.......+T_{27})/27 = 19$$

$$\text{Therefore } T1+T_2+.......+T_{27} = 27\text{x}19$$

If December 2019 has to be the coldest month since 1919 then the value of average maximum temperature should be less than 17.3 $^\circ$C.

Let average of last 4 days of December be x = $(T_{27}+T_{28}+T_{30}+T_{31}$) /4

$$\text{Therefore } (T_{27}+T_{28}+T_{30}+T_{31}$) = 4x$$

$$\text{We may equate } 17.3 = (T_1+T_2+.......+T_{31})/31 = (27\text{x}19 +4x)/31$$

Solving this equation we get, average temperature for 4 days = 5.825 $^\circ$C

Therefore the average maximum temperature for the remaining days should be less than 5.825 $^\circ$C to make it the coldest month since 1919

Mathematics Question-5

COLDEST DECEMBERS

Solution 1 :

All temperatures in a day will be less than average maximum temperature. Hence it is better to use average maximum temperature to represent the coldest day.

Solution 2 :

Given:

$$(T_1+T_2+.......+T_{27})/27 = 19$$

$$\text{Therefore } T1+T_2+.......+T_{27} = 27\text{x}19$$

If December 2019 has to be the coldest month since 1919 then the value of average maximum temperature should be less than 17.3 $^\circ$C.

Let average of last 4 days of December be x = $(T_{27}+T_{28}+T_{30}+T_{31}$) /4

Therefore $(T_{27}+T_{28}+T_{30}+T_{31}) = 4x$

We may equate $17.3 = (T_1+T_2+\ldots\ldots+T_{31})/31 = (27\text{x}19 +4x)/31$

Solving this equation we get, average temperature for 4 days = 5.825 °C

Therefore the average maximum temperature for the remaining days should be less than 5.825 °C to make it the coldest month since 1919