Epidemic Project

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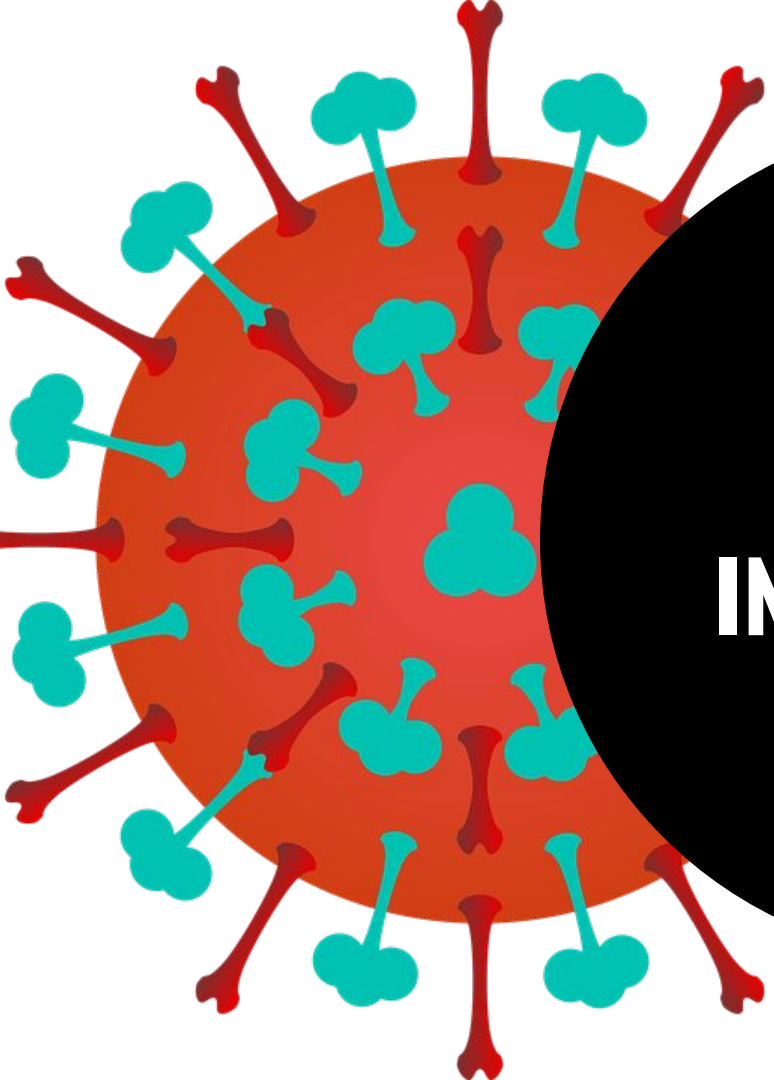
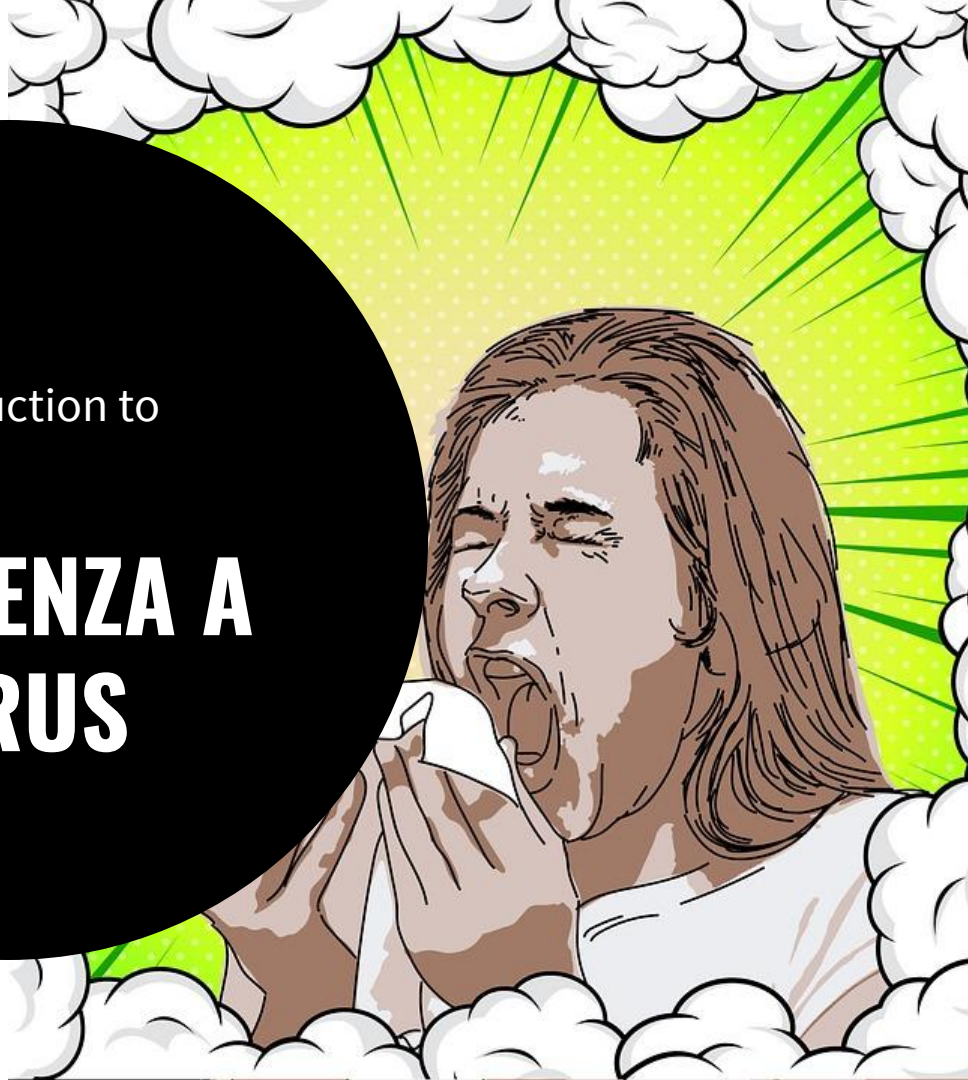
Algebra II - 23 March 2018

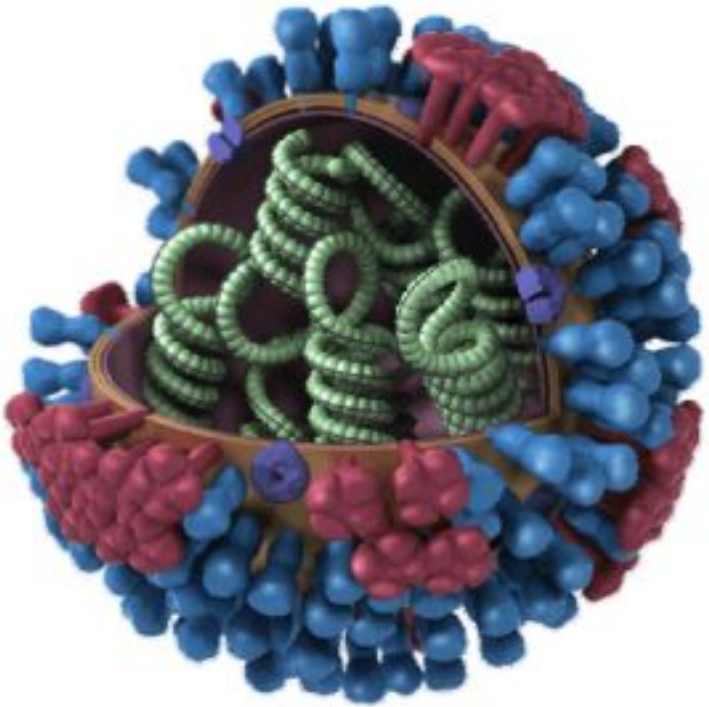


Introduction to

INFLUENZA A VIRUS



H1N1 Influenza Virus

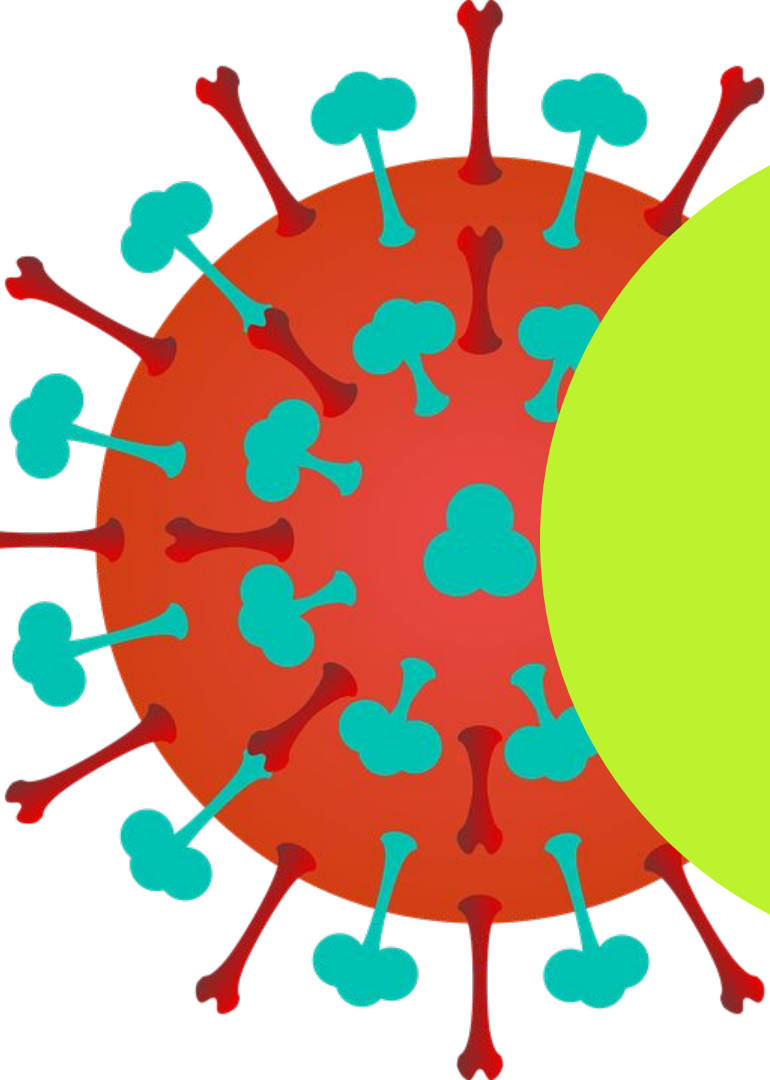


Hemagglutinin- protein the virus uses to attach to the host cells

Neuraminidase- enables the virus to be released from the host cell

M2 Ion Channel- allows protons to move through the viral envelope and is essential for the virus replication process

RNP- Ribonucleoprotein containing the virus RNA genome



Information of

DISEASES

H4N1 Virus

Initial Population

2,000,000 people

Growth Rate

500,000 people per day

Equation

$y_1 \sim mx_1 + b$

Mathematical Model

Linear model

H6N3 Virus

Initial Population

100 people

Growth Rate

50 % per day

Equation

$y_1 \sim A \,.\, B^{x1}$

Mathematical Model

Exponential model

H8N9 Virus

Initial Population

20,000 people

Growth Rate

20 % per day

Equation

$y_1 \sim A \,.\, B^{x1}$

Mathematical Model

Exponential model

H8N2 Virus

Initial Population

50,000 people

Growth Rate

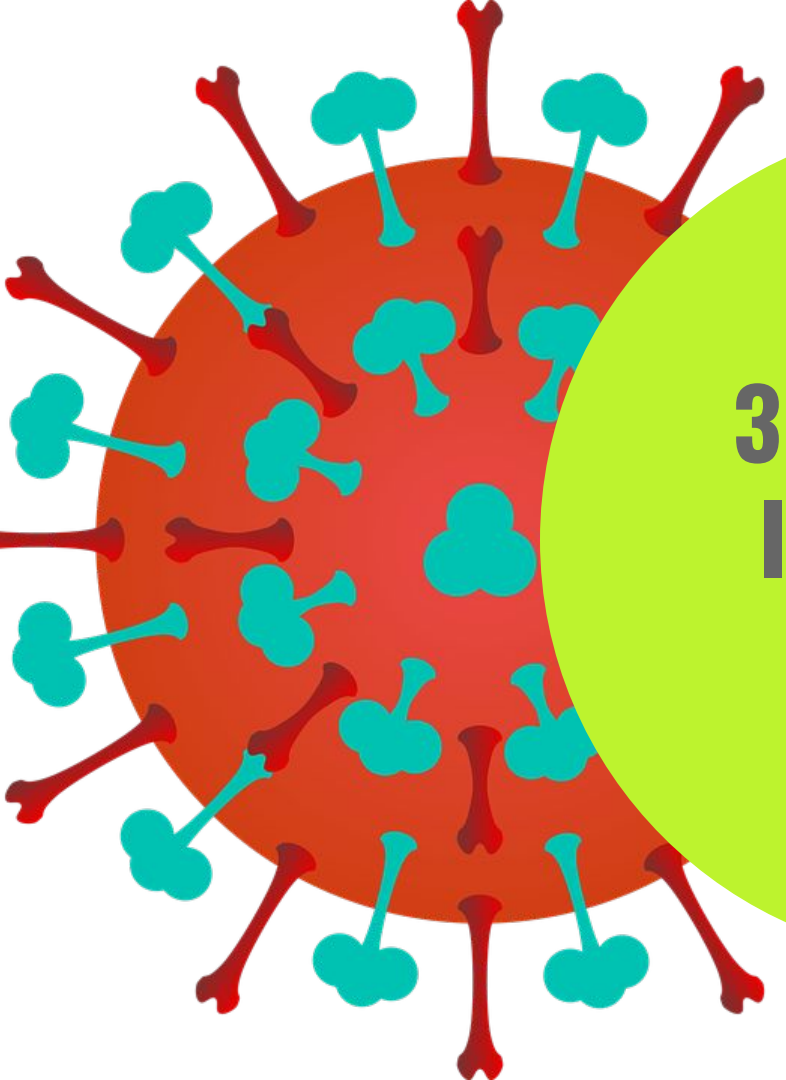
30 % per day

Equation

$$y_1 \sim \frac{7.5 \times 10^9}{1 + e^{-0.26x+11.9}}$$

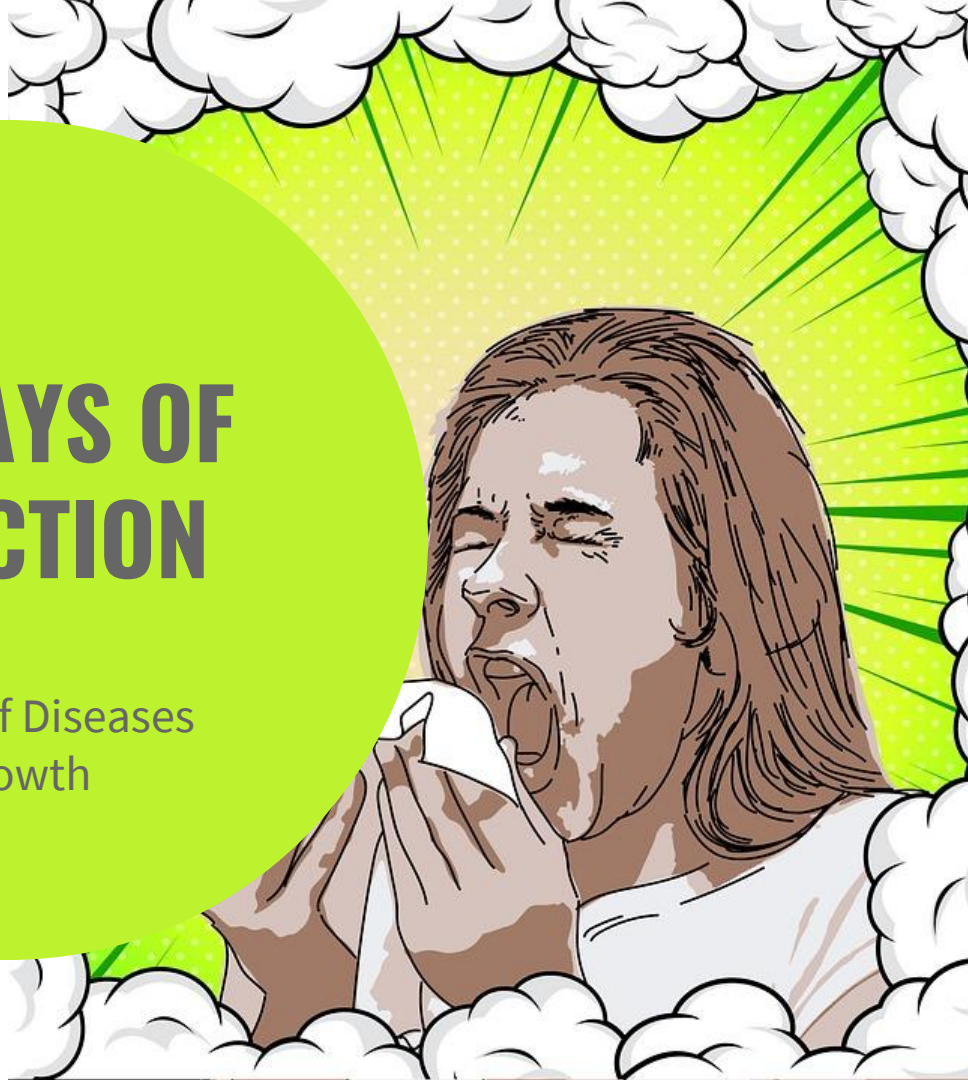
Mathematical Model

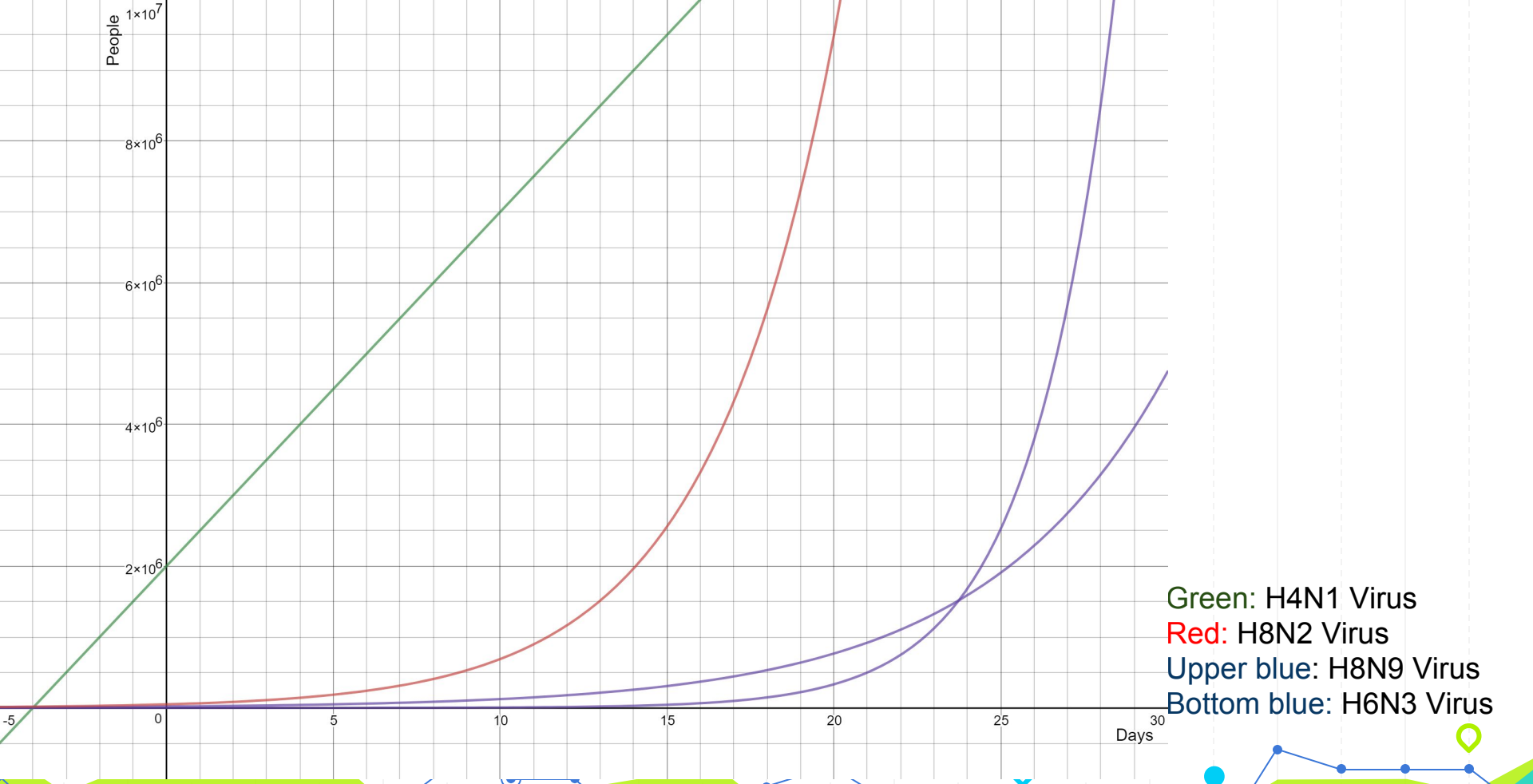
Logistic model

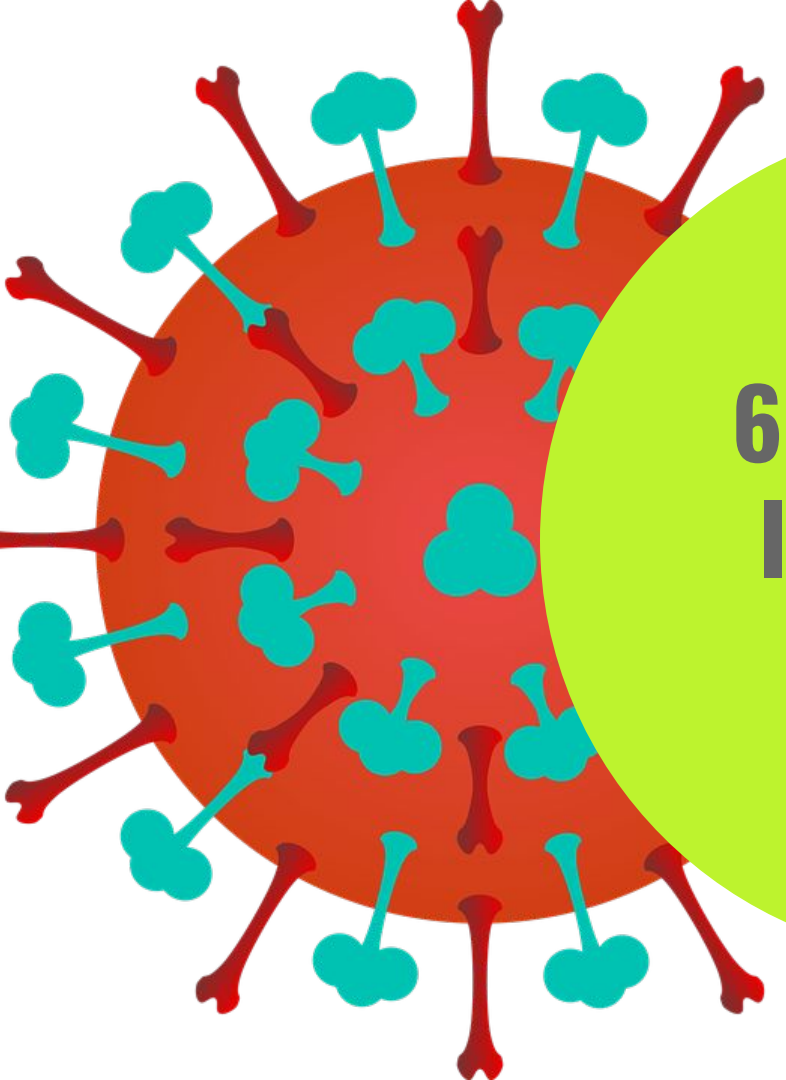


30 DAYS OF INFECTION

Graph of Diseases Growth

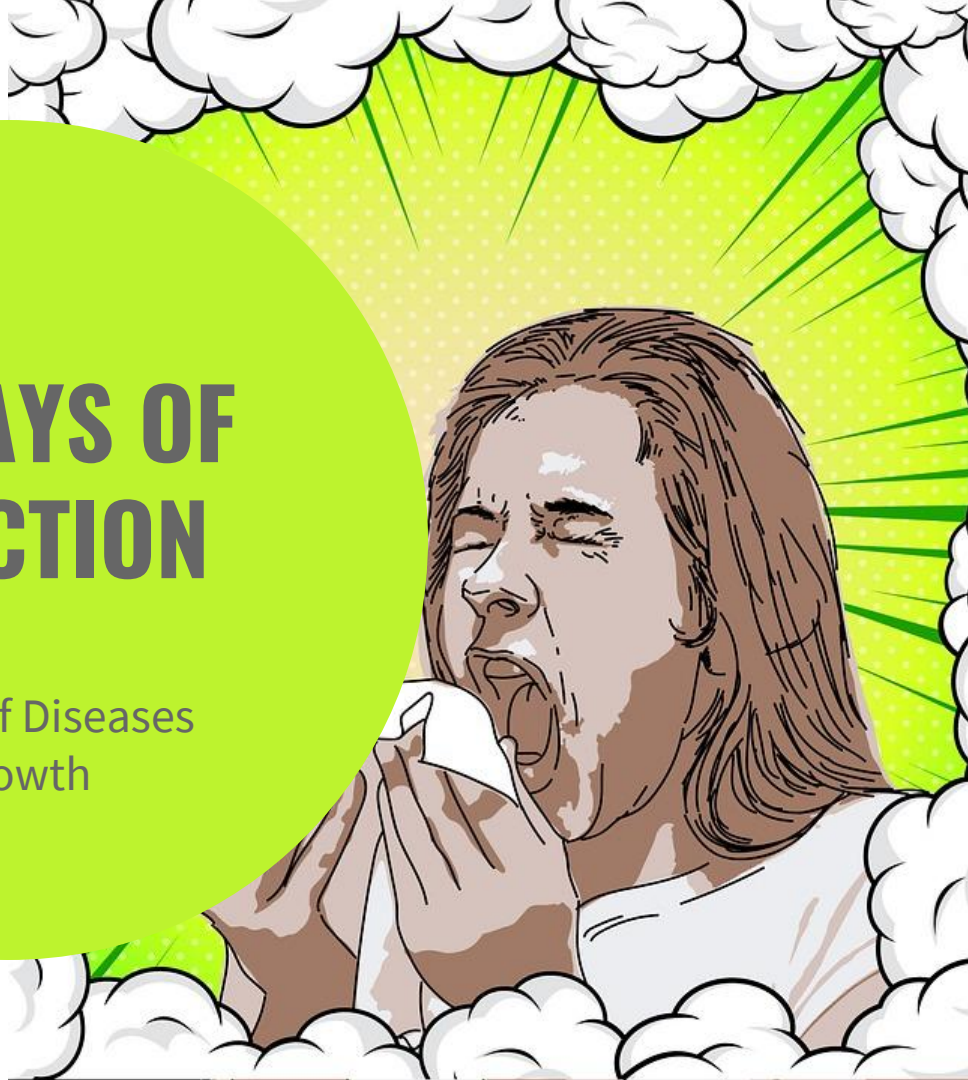


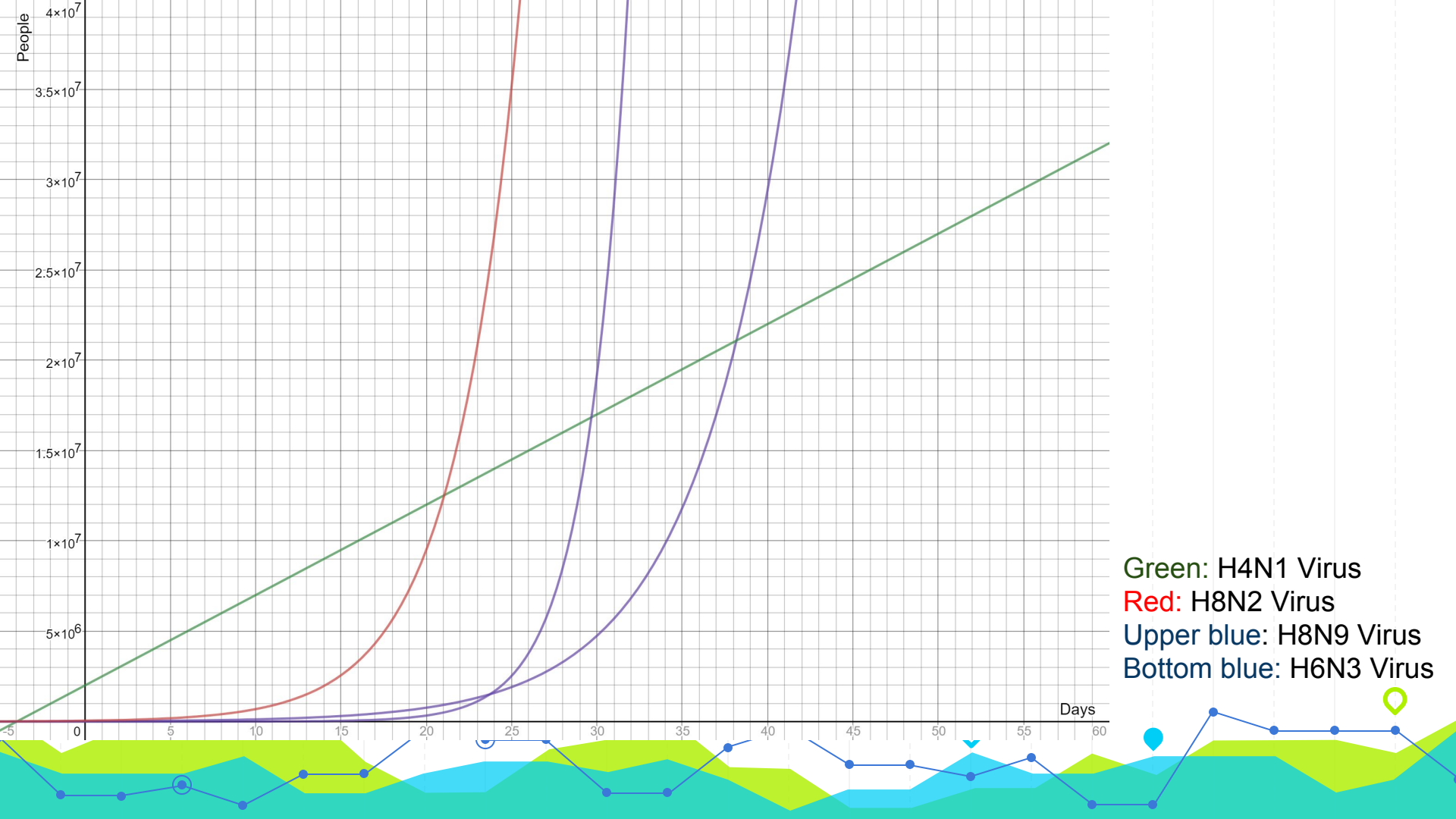

People
1×10^7
8×10^6
6×10^6
4×10^6
2×10^6
-5
0
5
10
15
20
25
30
Days
Green: H4N1 Virus
Red: H8N2 Virus
Upper blue: H8N9 Virus
Bottom blue: H6N3 Virus

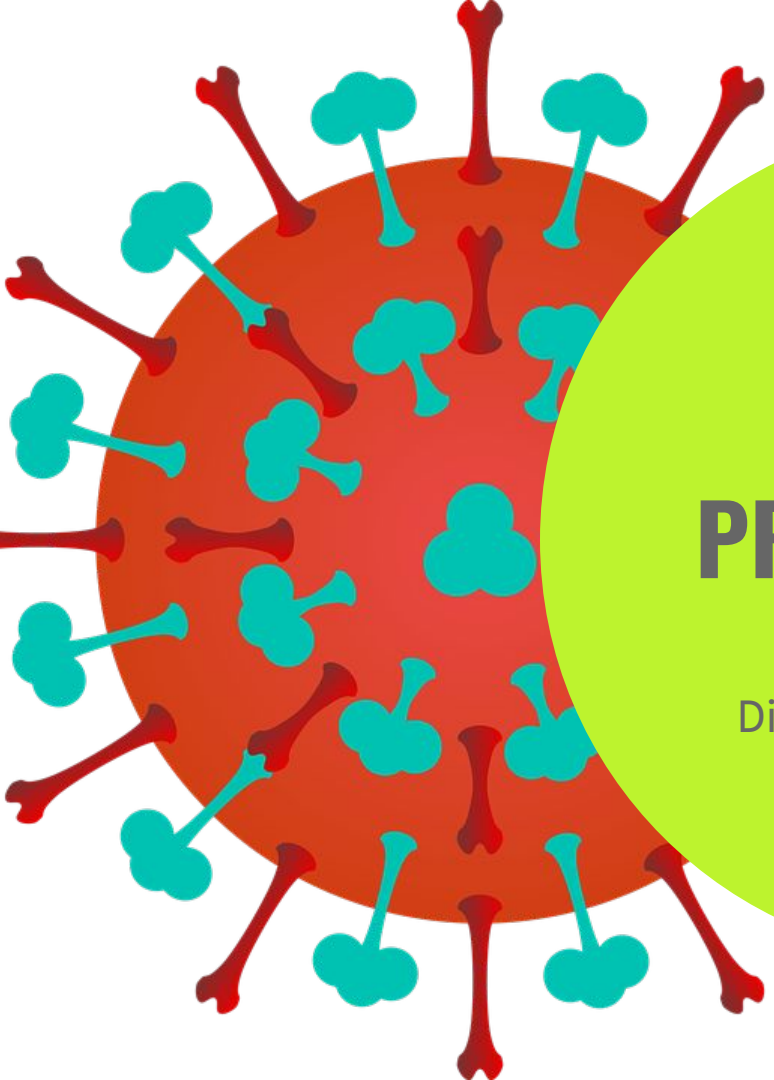


60 DAYS OF INFECTION

Graph of Diseases Growth




People
4×10^7
3.5×10^7
3×10^7
2.5×10^7
2×10^7
1.5×10^7
1×10^7
5×10^6
Days
-5
0
5
10
15
20
25
30
35
40
45
50
55
60
Green: H4N1 Virus
Red: H8N2 Virus
Upper blue: H8N9 Virus
Bottom blue: H6N3 Virus



PROJECTIONS

Diseases Growth in WA, USA, World

	Washington State	United States of America	World
H4N1	11 days	666 days	14996 days
H6N3	28 days	38 days	45 days
H8N9	33 days	54 days	71 days
H8N2	20 days	34 days	Never reach

Linear Equation

$$y = 500000x + 2000000$$

$$7500000 = 500000x + 2000000$$

$$5500000 = 500000x$$

$$x = 11 \text{ days}$$

Exponential Model

$$y = A \cdot B^x$$

$$335000000 = 100 \cdot 1.5^x$$

$$3350000 = 1.5^x$$

$$\log_{1.5} 3350000 = \log_{1.5} 1.5^x$$

$$x = 38 \quad \text{days}$$

Logistic Model

$$y = \frac{7.5 \times 10^9}{1 + e^{-0.26x+11.9}}$$

$$3.35 \times 10^8 = \frac{7.5 \times 10^9}{1 + e^{-0.26x+11.9}}$$

$$7.5 \times 10^9 = 3.35 \times 10^8 (1 + e^{-0.26x+9})$$

$$22.388 = 1 + e^{-0.26x+11.9}$$

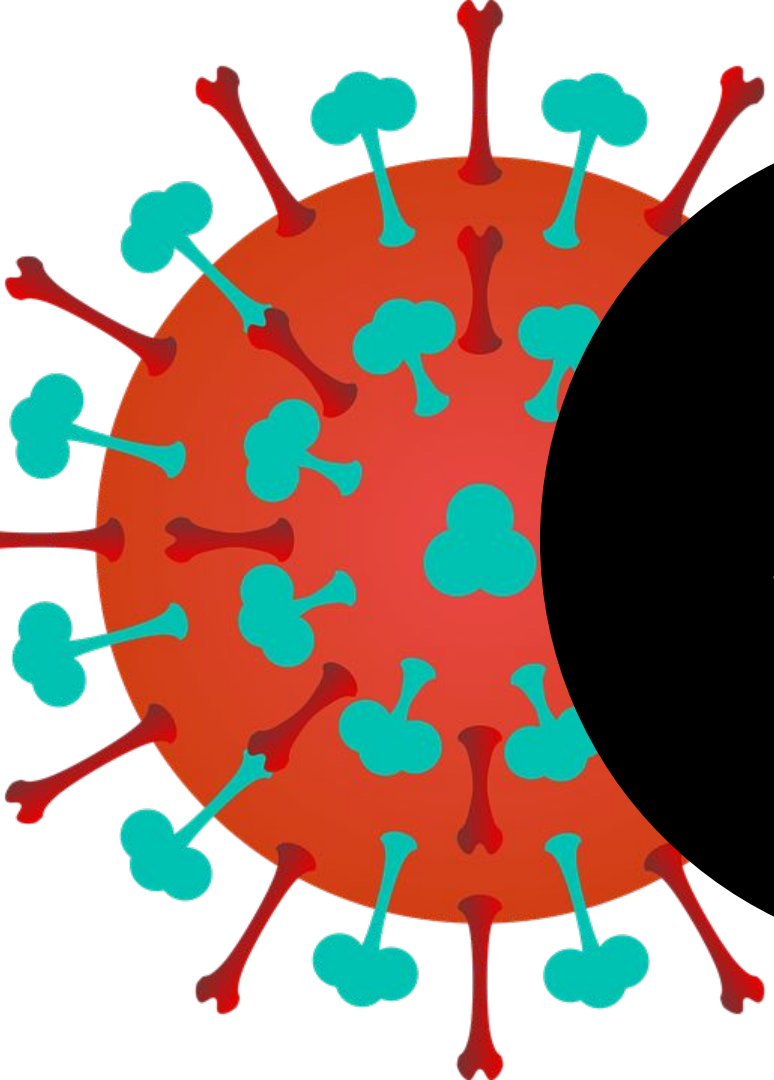
$$21.388 = e^{-0.26x+11.9}$$

$$\ln 21.388 = \ln e^{0.26x+11.9}$$

$$3.063 = -0.26x + 11.9$$

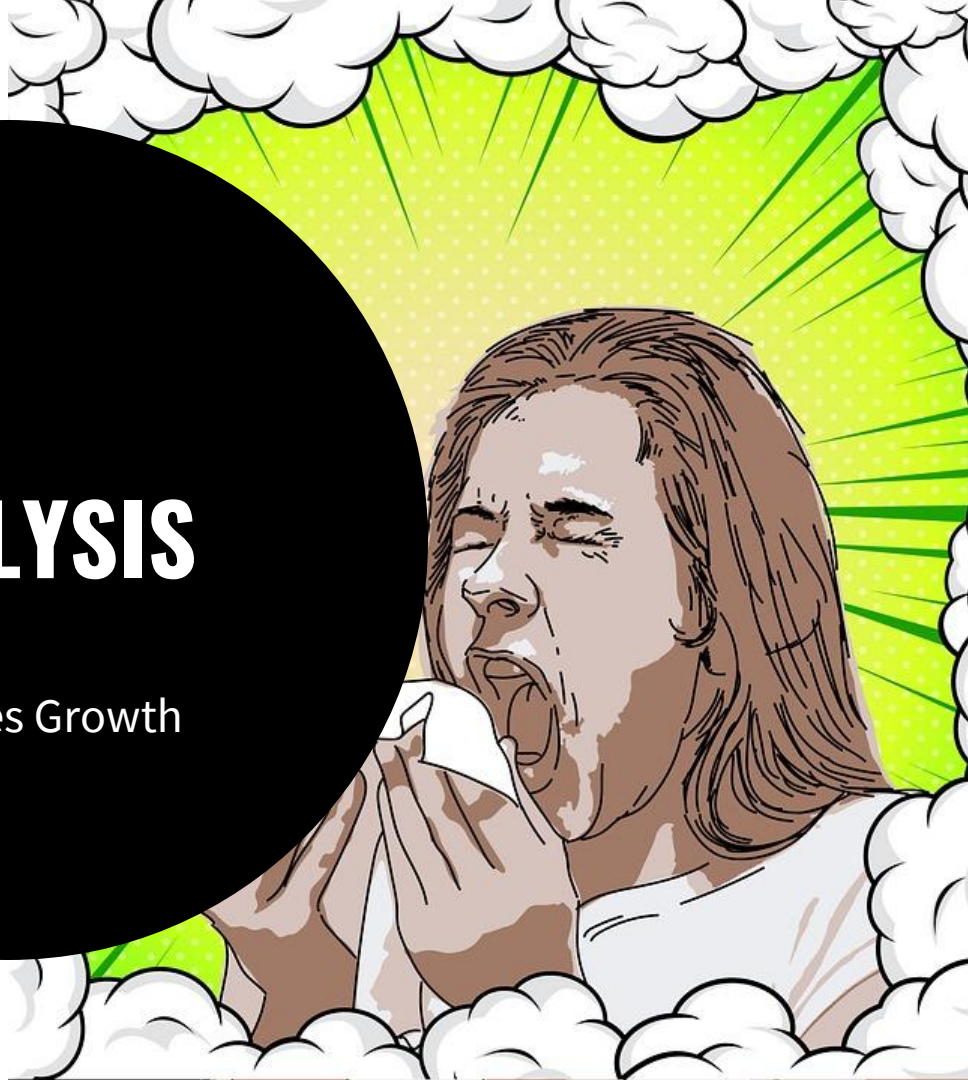
$$0.26x = 8.837$$

$$x = 34\text{days}$$



ANALYSIS

Diseases Growth



DANGEROUS

1st - 2nd weeks:

H4N1

+4 weeks:

H8N2

ANALYSIS

1st priority for vaccine:

H8N2

Most Realistic:

H8N2

IB LEARNER REFLECTION

Thinker

Inquirer

Knowledgeable

Caring

Bibliography

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Graph calculated from desmos.com