Journal 9. Applied Maths (Team)

Activity	Deadline (tick off checklist)
JOURNAL	☐ Upload Journal completed in OneNote Monday 4th April 5pm ☐ **Accuracy Check Quiz :** Monday 4th April 5pm
QUIZ	☐ Mastery Quiz (8/04/22)

Important Note

This is a team project!

1. Complete OneNote Team Template
2. You can create a pdf of the team page and upload to the journal 9 space on Moodle as you normally would.
3. You can individually complete the accuracy check based on your Team's answers.

N.B.!! you cannot submit any journal or accuracy quiz if you do not contribute to the Team Work

This is a team project, you can see which team you belong to in the Student Teams
Students initials will appear beside the section they edited and contributed to.

Evidence of Team Work

(a) Teams Members

Omit team members who have not contributed to Team Meetings or Journal Template

Name	Group (eg Software A, Digital A)	Signature *
Darragh Ruane	Software D	Darragh Ruane
Andrew Coffey	Software A	Andrew Coffey
Colin Williams	Software D	Colin Williams
Thomas Mitchell	Software D	Thomas Mitchell
David Vlasic	Software D	David Vlasic
1Estevan Fernandez	Software D	Estevan Fernandez
Muhammad Hinan Ali	Software B	Muhammad

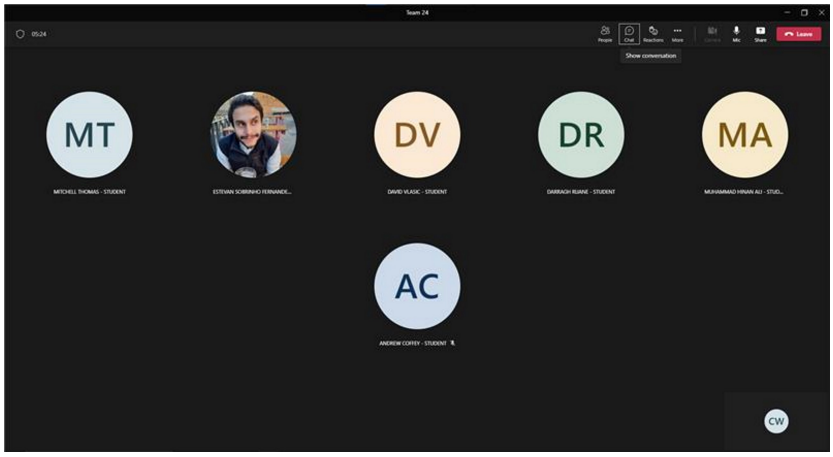
***N.B .Students should not sign this document if you haven't contributed to the team.**

(b) Evidence Teams Planning

Attendance	Tasks	Completion Status
Andrew Coffey	Q3	Finished
Darragh Ruane	Q2	Finished
Estevan Fernandez	Q1	Finished
Thomas Mitchell	Q1	Finished
Colin Williams	Q3	Finished
David Vlasic	Q2	Finished

	Muhammad Hinan Ali	-	-

(c) Insert Screen Shot of Team Meeting



Q1. Free Style Maths

Question 1 - Create Maths Learning Resource

Insert or Embed Demo here and/or Video showing how to use it.

MathsLearningApp.zip

Q2. COVID-19

Watch Video Microsoft Stream

A virus will typically spread exponentially at first if there is no immunization available.
Each infected person can infect multiple new people.

Days	0	1	2	3	4	5	6	7	8	9	10	11
Number Infected	200	310	425	591	856	1355	2018	2799	4565	6087	7842	9835

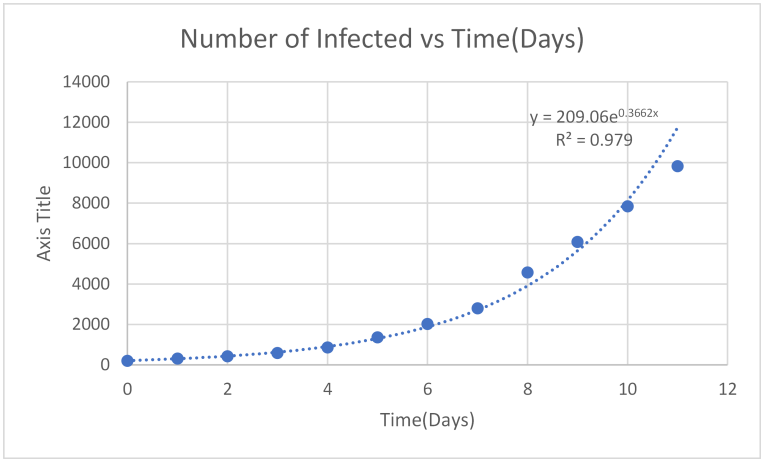
The size population infected N is given by

$N = No \cdot e^{kt}$

t days after growth commenced.

(i) Graph the data (insert image here)

Include Excel File HERE



(ii) Find the equation of the graph

$y = 209.06e^{0.3662x}$

(iii) From the equation, what is k, the growth rate (correct to 3 s.f)

$N = N_o \cdot e^{kt}$

0.366

(iv) Find the number infected after 14 days?

Answer:

35222

Show calculations

= 209.06*EXP(0.3662*14)

Q3. Mobile Phone Data Speed

need to know

Shannon-Hartley Theorem.

$$\text{Bitrate} = \frac{B}{\log 2} \log\left(1 + \frac{P \times c^2}{(4 \times \pi \times d \times f)^2 \times k \times B \times T}\right)$$

Term	Symbol	Definition	Value	Unit
Power of the tower	P	Energy/time	10	Watt (W)
Speed of Light	c	Distance/time	3×10^8	Metre per second (m/s)
Boltzmann's constant	k	Energy/temperature	1.38×10^{-23}	Joule per Kelvin (J/K)
Temperature	T	Temperature	2.9×10^2	Kelvin

Question 2 -Shannon-Hartley Theorem

$$\text{4G Bitrate} = \frac{B}{\log 2} \log\left(1 + \frac{P\ x\ C^2}{(4\ x\ \pi\ x\ d\ x\ f)^2 x\ k\ x\ B\ x\ T}\right)$$

Network	Bandwidth (B)(Hz)	Frequency (f) (Hz)	Hardware Maximum Bitrate (bps)
4G (LTE)	2×10^7	8×10^8	1.5×10^8

(i) Use the Shannon-Hartley Theorem Calculate the maximum bitrate possible for a 4G mobile phone network at a distance of d = 15000 m

Answer:

179053957.2

Show calculations

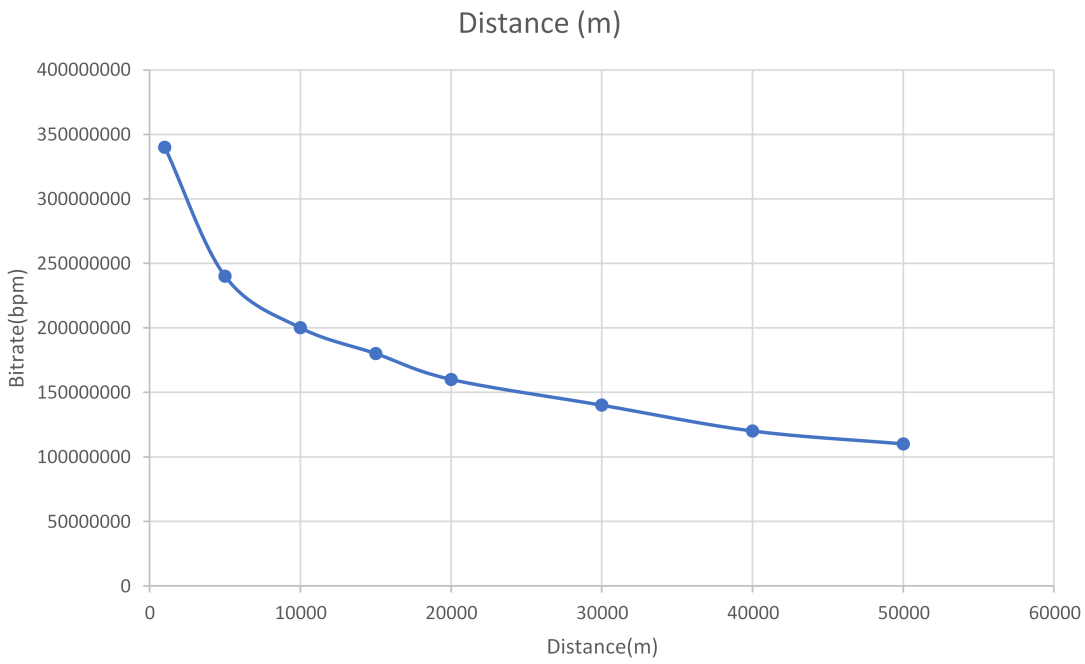
$$\frac{2 \cdot 10^7}{\log_{10}(2)} \log_{10}\left(1 + \frac{10\ (3 \cdot 10^8)^2}{(4\ \pi \cdot 15000 \cdot 8 \cdot 10^8)^2 \cdot 1.38 \cdot 10^{-23} \cdot 2 \cdot 10^7 \cdot 2.9 \cdot 10^2}\right)$$

(ii) Plot the curve (log) to represent the variation of 4G Bitrate as a function of Distance.

Bitrate (bps)	Distance (m)
1000	340000000
5000	240000000
10000	200000000
15000	180000000
20000	160000000

30000	140000000
40000	120000000
50000	110000000

Graph Image Here



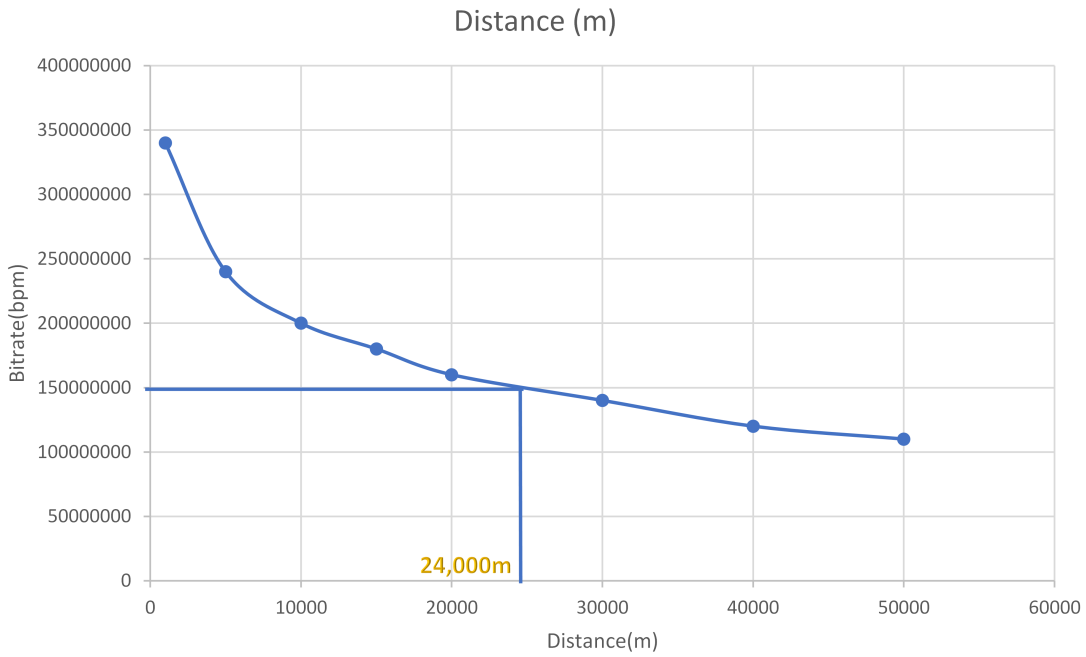
Include Excel File HERE	

(iii) Use the curve to work out up to what distance the maximum rate at which the transmission of information is limited by the hardware maximum bitrate for 4G technology.

Answer:

24,000m

Show calculations



(iv) Evaluate the time it would take to download 1 x 10^9 bits of information using 4G network when you are

(a) 10,000 metres away and when you are

Answer:

4.9402211723537

Show calculations

1)

$$\frac{2 \cdot 10^7}{\log_{10}(2)} \log_{10}\left(1 + \frac{10\ (3 \cdot 10^8)^2}{(4\ \pi \cdot 10000 \cdot 8 \cdot 10^8)^2 \cdot 1.38 \cdot 10^{-23} \cdot 2 \cdot 10^7 \cdot 2.9 \cdot 10^2}\right)$$

$$= 202420087.09977567196$$

2)

$$\frac{1 \cdot 10^9}{202420087.09977567196}$$

$$= 4.9402211723537$$

bits of information/maximum bitrate = time

(b) 40,000 metres away from the tower

Answer:

8.1429144808148

Show calculations

1)

$$\frac{2 \cdot 10^7}{\log_{10}(2)} \log_{10}\left(1 + \frac{10\ (3 \cdot 10^8)^2}{(4\ \pi \cdot 40000 \cdot 8 \cdot 10^8)^2 \cdot 1.38 \cdot 10^{-23} \cdot 2 \cdot 10^7 \cdot 2.9 \cdot 10^2}\right)$$

$$= 122806152.80389605463$$

2)

$$\frac{1 \cdot 10^9}{122806152.80389605463}$$

$$= 8.1429144808148$$

bits of information/maximum bitrate = time

Our Conclusion is:

The closer you are to the 4G tower, the faster your download rate will be