

Mathematical analysis of co-relation between tesla and bitcoin during covid

RHEA KHOSLA

Abstract – this research paper summarizes a mathematical derivation stating the co-relation between the share of **tesla** and **bitcoin**. The derivation has been shown below by means of a formula and the graphs for the same have been presented too. The **correlation** between the stock and crypto is **positive** giving us the conclusion that these two are inter-related. Data has been taken from 2019 to 2022 to analyze the relation pre covid, during covid as well as post covid.

INTRODUCTION

Warren Buffet once said “Price is what you pay, value is what you get.” As we delve deep into this famous quote, we understand the need of regular inflows of cash in our daily lives. The trying times of 2020, famously known as the covid phase have led to skyrocketing rates of inflation throughout the world. During the covid times, passive income became a boon for many and a bane for some too. Passive income can be generated in many ways, the stock market and cryptocurrencies being two easy money making modes. Although both of these modes are extremely unpredictable, if the time and circumstances are favorable, there could be a boost in share and stock prices. In today’s world almost every other lay man has some kind of general knowledge about the financial market. I have prepared a research statement in order to understand the correlation between the stock market and the crypto currencies during covid times. For this I have taken up the famous billionaire Elon Musk’s ‘Tesla share’ and the first ever cryptocurrency to be created ‘The Bitcoin’.

THE MATHEMATICAL ANALYSIS OF CORRELATION BETWEEN BITCOIN AND TESLA BY MEANS OF GRAPHS AND EQUATIONS.

A mathematical equation has been derived with the aim to understand whether the variation of stock prices of Tesla have been similar to the rates of bitcoin. The aim of this paper is to give readers an idea whether future assumptions can be made about bitcoin prices by simultaneously looking at the Tesla prices. Through this analysis, we can also get a clear idea about the effect that the corona virus has had on both cryptos and the stock market.

THE FINANCIAL MARKET

The financial market is like a deep hole with never ending opportunities. It is so vast that even if one studies it for a lifetime, his knowledge is only to a limited extent. One can never fully understand or predict what will happen next. While there are millions of undiscovered shares, that only a few know about, there are some that are in the limelight thanks to the excellent results and performance of their companies. The history of the modern stock market goes back to the 1600’s when the stock of the Dutch East India Company was publicly traded in order to raise capital for the latter company. After this, in the year 1611, the Amsterdam Stock Exchange was created. Ever since then, about four centuries later, today there are about sixty stock exchanges in the world, the NYSE and BSE to name a few.

CRYPTOCURRENCY

A crypto currency is a digitally created currency which does not involve any government participation. It is a form of virtual currency which can be purchased via crypto wallets. Crypto currency has extreme price fluctuations, since it is not reliant on the government and has no ceiling. Bitcoin was the first ever crypto currency to be created. Only within a few years of its launch, Bitcoin had created a very good name for itself. It also created a path for future potential cryptos. Now, there are approximately 18000 cryptocurrencies. Bitcoin, Ethereum and Tether are amongst some of the most famous currencies.

TESLA

Tesla is an American company that deals in automobiles and clean energy. It is famous for its electric vehicles. The shares of Tesla first entered the market on June 29th, 2010. They were launched in NASDAQ at the price of seventeen dollars per share. Today, the price of Tesla shares has risen to about 738 dollars per share (as on 28th June, 2022). These shares have provided investors with sky rocketing returns during covid times. The graph for Tesla shares is quite positive.

WHY I CHOSE THIS SHARE?

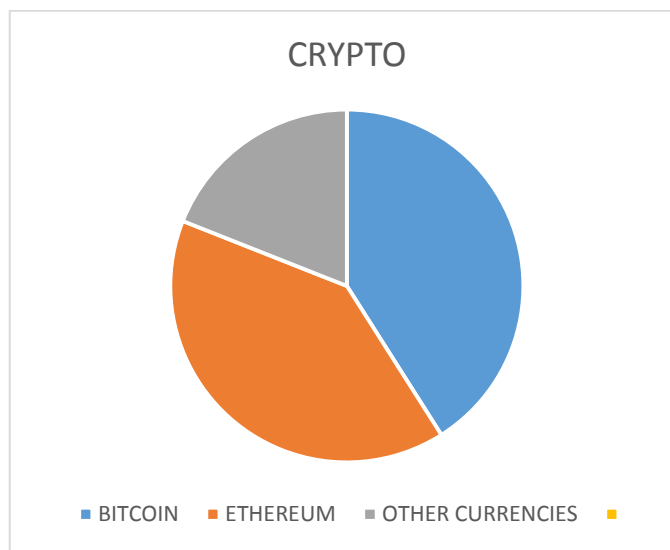
The share of Tesla has been in the market for about a decade now. It has provided excellent results to investors with a graph growing upwards. For choosing this share, I took bitcoin as the base and then compared the graph of bitcoin to that of a few shares. While apple failed in providing a definite co1relation, both Tesla and Facebook were showing positive results. After comparing the two, Tesla started to seem exactly like I wanted the graph to be. The co-relation was easily calculable by means of formulas. This encouraged me to use Tesla as my unit for comparison.

BITCOIN

Bitcoin was created in the year 2008 by a user or group of users by the name of Satoshi Nakamoto. The implementation of this currency was started in 2009. Since then, bitcoin has risen and crashed a large number of times leading to heavy losses as well as extreme profits to traders. This is one of the most traded crypto currencies with millions of traders across the world. Its risky yet quick returns excite new investors and they get attracted seeing the scope for life changing profits.

WHY I CHOSE BITCOIN?

Bitcoin is an extremely popular crypto currency that has been in the market for about two decades now. The aim of my paper is to find a co-relation between different financial tools. So while choosing a cryptocurrency, Bitcoin and Ethereum, both came to my mind. But since Bitcoin has a larger rate of fluctuation, a larger market capitalisation and is better known as compared to Ethereum, I realised that it would be more convenient for people to relate to it. Below is a chart showcasing the market capitalisation of various cryptos.



Methodology

In order to derive the graphs and equations of the co-relation between Tesla and Bitcoin, various steps have been followed.

Step 1 Firstly, all the values of both Tesla and Bitcoin were sorted in a tabular form keeping in mind the months as well as the years. All the monthly prices from January 2019 to June 2022 taken. Below are tables showing values of Tesla shares.

Month	2019	2020	2021	2022
January	62.024	86.052	729.77	1199.78
February	62.442	156	839.81	931.25
March	58.958	148.724	718.43	864.37
April	57.836	96.312	661.75	1084.59
May	46.802	140.264	684.9	902.94
June	35.794	179.62	623.9	740.37
july	45.434	223.926	677.92	--
August	46.77	297	709.67	--
September	45.002	475.05	734.79	--
October	48.938	448.16	775.22	--
November	62.662	400.51	1208.59	--
December	66.974	584.76	1095	--

Month	2019	2020	2021	2022
January	3869.47	7188.46	29391.78	47743
February	3468.25	9388.66	33543.77	38718.81
March	3850.07	8540.26	49619.64	44438.34
April	4156.39	6671.95	58726.68	46154.50
May	5423.06	8771.57	57836.01	37923.81
June	8553.13	9564.95	36681.74	31451.50
July	10577.33	9153.95	33524.98	--
August	10404.21	11354.16	39882.39	--
September	9773.34	11964.21	48840.96	--
October	8326.58	10626.60	48162.71	--
November	9265.43	13762.97	60955.77	--
December	7420.84	18795.20	57238.62	--

Table for bitcoin

Step 2 Graphs were then framed according to these units. Graph 1 depicts the course of Tesla shares, while graph 2 shows the fluctuation in bitcoin prices. After looking at the two shares, another graph was created both manually and using excel. This helped to create a clear idea about the fluctuation in prices of two shares.

Step 3 We studies various types of graphs, namely linear, quadratic, power and exponential graphs. While the quadratic graph was quite similar, the exponential graph gave a more accurate value.

Step 4 We have now been able to calculate the co-relation between prices of Tesla and Bitcoin by using the techniques of correlation and regression.

FORMULA FOR CO-RELATION

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

Table 1

Graph 1

Month, Year	Price of Tesla
Jan-19	62.024
Feb-19	62.442
Mar-19	58.958
Apr-19	57.836
May-19	46.802
Jun-19	35.794
Jul-19	45.434
Aug-19	46.77
Sep-19	45.002
Oct-19	48.938
Nov-19	62.662
Dec-19	66.974
Jan-20	86.052
Feb-20	156
Mar-20	148.72
Apr-20	96.312
May-20	140.26
Jun-20	179.62
Jul-20	223.92
Aug-20	297
Sep-20	475.05
Oct-20	448.16
Nov-20	400.51
Dec-20	584.76
Jan-21	729.77
Feb-21	839.81
Mar-21	718.43
Apr-21	661.75
May-21	684.9
Jun-21	623.9
Jul-21	677.92
Aug-21	709.67
Sep-21	734.09
Oct-21	775.22
Nov-21	1208.5
Dec-21	1095
Jan-22	1199.7
Feb-22	931.25
Mar-22	864.37
Apr-22	1084.5
May-22	902.94
Jun-22	740.37



Table 1 depicts graph of Tesla in

Table 2

Graph 2

Month, Year	Price of Bitcoin
Jan-19	3869.4
Feb-19	3468.2
Mar-19	3850
Apr-19	4156.3
May-19	5423.6
Jun-19	8553.1
Jul-19	10577
Aug-19	10404
Sep-19	9773.3
Oct-19	8326.5
Nov-19	9265.4
Dec-19	7420.8
Jan-20	7188.4
Feb-20	9388.6
Mar-20	8540.2
Apr-20	6671.9
May-20	8771.5
Jun-20	9564.9
Jul-20	9153.9
Aug-20	11354
Sep-20	11964
Oct-20	10626
Nov-20	13762
Dec-20	18795
Jan-21	29391
Feb-21	33543
Mar-21	49619
Apr-21	58726
May-21	57836
Jun-21	36681
Jul-21	33524
Aug-21	3882
Sep-21	48840
Oct-21	48162
Nov-21	60955
Dec-21	57238
Jan-22	47743
Feb-22	38718
Mar-22	44438
Apr-22	46154
May-22	37923
Jun-22	31451

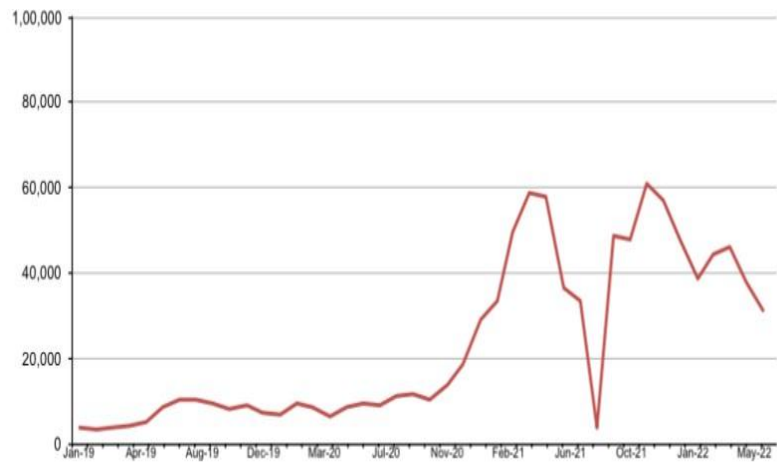


Table 2 depicts the graph of bitcoin in Red

Table 3

Graph 3

Sr. No.	Month, Year	Price of Tesla	Price of Bitcoin
1	Jan-19	62.024	3869.4
2	Feb-19	62.442	3468.2
3	Mar-19	58.958	3850
4	Apr-19	57.836	4156.3
5	May-19	46.802	5423.6
6	Jun-19	35.794	8553.1
7	Jul-19	45.434	10577
8	Aug-19	46.77	10404
9	Sep-19	45.002	9773.3
10	Oct-19	48.938	8326.5
11	Nov-19	62.662	9265.4
12	Dec-19	66.974	7420.8
13	Jan-20	86.052	7188.4
14	Feb-20	156	9388.6
15	Mar-20	148.72	8540.2
16	Apr-20	96.312	6671.9
17	May-20	140.26	8771.5
18	Jun-20	179.62	9564.9
19	Jul-20	223.92	9153.9
20	Aug-20	297	11354
21	Sep-20	475.05	11964
22	Oct-20	448.16	10626
23	Nov-20	400.51	13762
24	Dec-20	584.76	18795
25	Jan-21	729.77	29391
26	Feb-21	839.81	33543
27	Mar-21	718.43	49619
28	Apr-21	661.75	58726
29	May-21	684.9	57836
30	Jun-21	623.9	36681
31	Jul-21	677.92	33524
32	Aug-21	709.67	3882
33	Sep-21	734.09	48840
34	Oct-21	775.22	48162
35	Nov-21	1208.5	60955
36	Dec-21	1095	57238
37	Jan-22	1199.7	47743
38	Feb-22	931.25	38718
39	Mar-22	864.37	44438
40	Apr-22	1084.5	46154
41	May-22	902.94	37923
42	Jun-22	740.37	31451

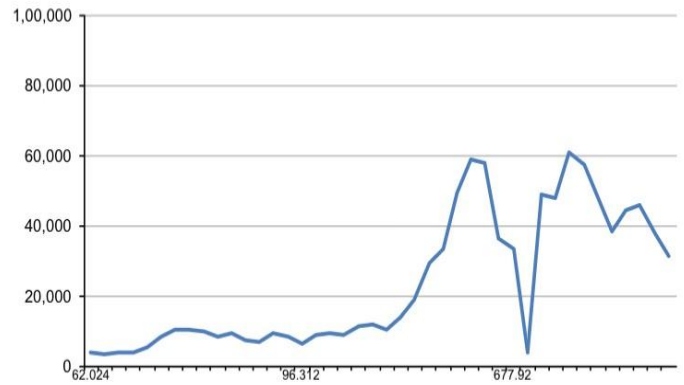


Table 4

Graph 4

LINEAR EQUATION

Month, Year	Price of Tesla	Price of Bitcoin	Value of Bitcoin by Eq 1.
Jan-19	62.024	3869.4	6060.59192
Feb-19	62.442	3468.2	6078.91286
Mar-19	58.958	3850	5926.20914
Apr-19	57.836	4156.3	5877.03188
May-19	46.802	5423.6	5393.41166
Jun-19	35.794	8553.1	4910.93102
Jul-19	45.434	10577	5333.45222
Aug-19	46.77	10404	5392.0091
Sep-19	45.002	9773.3	5314.51766
Oct-19	48.938	8326.5	5487.03254
Nov-19	62.662	9265.4	6088.55546
Dec-19	66.974	7420.8	6277.55042
Jan-20	86.052	7188.4	7113.73916
Feb-20	156	9388.6	10179.56
Mar-20	148.72	8540.2	9860.4776
Apr-20	96.312	6671.9	7563.43496
May-20	140.26	8771.5	9489.6758
Jun-20	179.62	9564.9	11214.8246
Jul-20	223.92	9153.9	13156.4936
Aug-20	297	11354	16359.59
Sep-20	475.05	11964	24163.5215
Oct-20	448.16	10626	22984.9328
Nov-20	400.51	13762	20896.4333
Dec-20	584.76	18795	28972.1108
Jan-21	729.77	29391	35327.8991
Feb-21	839.81	33543	40150.9523
Mar-21	718.43	49619	34830.8669
Apr-21	661.75	58726	32346.5825
May-21	684.9	57836	33361.247
Jun-21	623.9	36681	30687.617
Jul-21	677.92	33524	33055.3136
Aug-21	709.67	3882	34446.9161
Sep-21	734.09	48840	35517.2447
Oct-21	775.22	48162	37319.9726
Nov-21	1208.5	60955	56310.635
Dec-21	1095	57238	51335.93
Jan-22	1199.7	47743	55924.931
Feb-22	931.25	38718	44158.7675
Mar-22	864.37	44438	41227.4171
Apr-22	1084.5	46154	50875.715
May-22	902.94	37923	42917.9402
Jun-22	740.37	31451	35792.4971

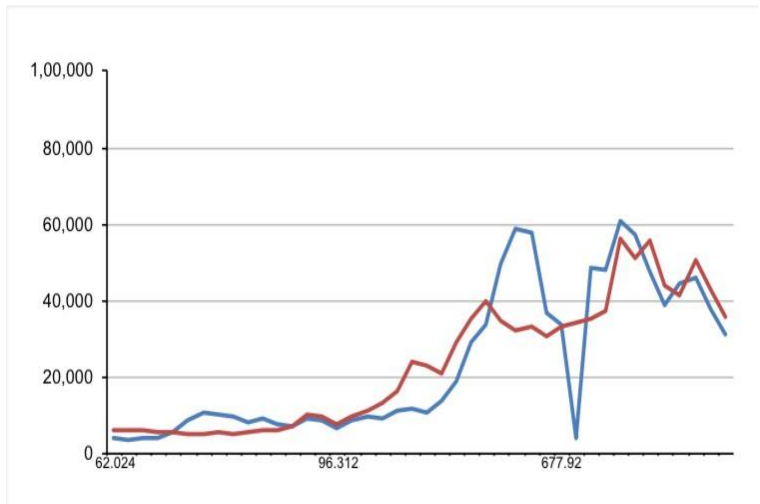
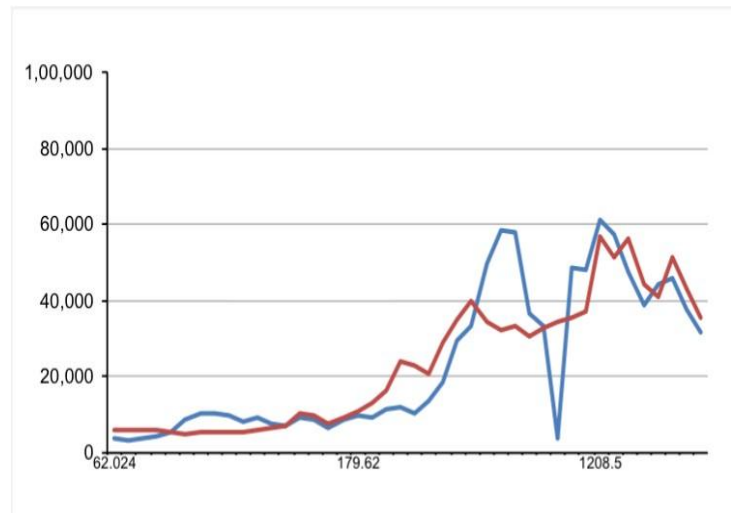


Table 5

QUADRATIC EQUATION

Graph 5

Month, Year	Price of Tesla	Price of Bitcoin	Value of Bitcoin by Eq 2.
Jan-19	62.024	3869.4	6164.750036
Feb-19	62.442	3468.2	6182.488075
Mar-19	58.958	3850	6034.658819
Apr-19	57.836	4156.3	5987.059101
May-19	46.802	5423.6	5519.153978
Jun-19	35.794	8553.1	5052.715363
Jul-19	45.434	10577	5461.168352
Aug-19	46.77	10404	5517.797525
Sep-19	45.002	9773.3	5442.858268
Oct-19	48.938	8326.5	5609.704166
Nov-19	62.662	9265.4	6191.824095
Dec-19	66.974	7420.8	6374.839406
Jan-20	86.052	7188.4	7185.241158
Feb-20	156	9388.6	10165.8568
Mar-20	148.72	8540.2	9854.957994
Apr-20	96.312	6671.9	7621.520428
May-20	140.26	8771.5	9493.865989
Jun-20	179.62	9564.9	11175.66447
Jul-20	223.92	9153.9	13074.10155
Aug-20	297	11354	16218.7471
Sep-20	475.05	11964	23947.34119
Oct-20	448.16	10626	22774.03329
Nov-20	400.51	13762	20700.21928
Dec-20	584.76	18795	28756.86467
Jan-21	729.77	29391	35169.29316
Feb-21	839.81	33543	40077.42598
Mar-21	718.43	49619	34665.55788
Apr-21	661.75	58726	32153.55299
May-21	684.9	57836	33178.37514
Jun-21	623.9	36681	30481.44314
Jul-21	677.92	33524	32869.20979
Aug-21	709.67	3882	34276.69316
Sep-21	734.09	48840	35361.29378
Oct-21	775.22	48162	37192.10381
Nov-21	1208.5	60955	56786.92318
Dec-21	1095	57238	51599.5135
Jan-22	1199.7	47743	56383.3455
Feb-22	931.25	38718	44183.57484
Mar-22	864.37	44438	41177.8385
Apr-22	1084.5	46154	51121.57398
May-22	902.94	37923	42909.62244
Jun-22	740.37	31451	35640.50566



CALCULATION USING

FORMULA (WORKING)

Calculation of correlation coefficient

$$r = \frac{n \sum xy - \sum x \sum y}{\sqrt{n \sum x^2 - (\sum x)^2} \sqrt{n \sum y^2 - (\sum y)^2}}$$

$$= \frac{42 \times 7.05 \times 10^8 - 19058 \times 975692}{\sqrt{42 \times 1.4623443 - (19058)^2} \sqrt{42 \times 3.79 \times 10^{10} - (975692)^2}}$$

$$= \frac{1.1015 \times 10^{10}}{15842.26 \times 799890.7}$$

$$= 0.8692$$

We can state that the correlation is highly positive

EQUATION 1

Let $y = ax + b$ — (1)

So, summing up all the table values.

$\sum y = a \sum x + nb$ — (2)

Multiplying by x

$\sum xy = a \sum x^2 + b \sum x$ — (3)

Putting values from tables
in (2) and (3)

we get (2) $\rightarrow 975692 = a \times 19058 + 42b$

in (3) $\rightarrow 7.05 \times 10^8 = a \times 14023443 + 19058b$

Solving simultaneously with the help of calculator, we get.

$$a = 43.889$$

$$= 43.89$$

$$b = 3315.3$$

① is $y = 43.89x + 3315.3$

So, fitting a straight line in this data, taking x as price of Tesla (the independent variable) and y as price of Bitcoin (the dependant variable), we find gradient of line.

$$y = ax + b \text{ as a gradient is } 43.89$$

fitting a quadratic equation:

Equation 2

$$\text{Let } y = ax^2 + bx + c \text{ ———— (4)}$$

summing up and making equations

$$\sum y = \sum a x^2 + b \sum x + n \sum c \text{ — (6)}$$

Multiply
by x

$$\rightarrow \sum xy = a \sum x^3 + b \sum x^2 + c \sum x \text{ — (7)}$$

Multiply
again with
 x

$$\rightarrow \sum x^2 y = a \sum x^4 + b \sum x^3 + c \sum x^2 \text{ — (8)}$$

Putting values from the tables & solving simultaneously (6) (7) (8)

$$\textcircled{6} \quad 975692 = 14623443 \cdot a + 19058b + 42c$$

$$\textcircled{7} \quad 7.05 \times 10^8 = 1.29 \times 10^{10} a + 14623443b + 19508c$$

$$\textcircled{8} \quad 6.16 \times 10^{11} = 1.23 \times 10^{13} a + 1.29 \times 10^{10} b + 14623443c$$

Solving with the help of calculator

$$a = .0015$$

$$b = 42.24$$

$$c = 3538$$

$$y = .0015x^2 + 42.24x + 3538$$

Conclusion

In this paper, I tried to fit two types of regression equations. One is a straight line equation and the other is a quadratic equation. Though both the graphs show very close positive results, the quadratic graph shows a more accurate relation between Tesla and bitcoin prices. Also, the positive value of r depicts a strong relationship between Tesla and bitcoin. We can conclude that a hike in one may depict a hike in the other. Therefore, they are inter related. I have rounded off certain values as all the values are very large. My research to study a relationship between two different types of investable tools has been fruitful.

THE MOTIVATION BEHIND THIS TOPIC

I have had an interest in finance ever since I was a kid. Discussions about the stock market made me really curious. It became my aim to create a career in finance. As time passed by, I started understanding the various divisions of finance. I first got introduced to the stock market and then to crypto currencies. With such an avid interest, I realised that I wanted to create something in this field. My passion drove me towards creating a research paper about two globally recognised financial tools, shares and cryptos. Throughout this paper, I applied my knowledge in order to provide a detailed analysis on the topic and help readers to collect all valuable necessary information. I have used various graphs and pie charts to summarise the paper in a comprehensive manner and provide readers with a clear view about the sea changes that have taken place in the market since covid. Through my paper, readers will be able to understand the fluctuating nature of the market as well as the course of inflows and outflows of cash.

BIBLIOGRAPHY

<https://www.nasdaq.com>

<https://statisticsshowto.com>

<https://www.investopedia.com>

<https://economictimes.indiatimes.com>

THIS PROJECT HAS BEEN MADE BY:

Rhea Khosla

Class XI

Currently, a student of Welham Girls' School Dehradun, India

Scored 98.6% in Semester 1 Board Exams of ICSE, Second topper of her previous School and of Ludhiana District.

Under the guidance of:

Dr Mamta Jain

PhD (Mathematics)

M.Sc(Mathematics)

M.Phil(computer applications)

from University of Roorkee (now IIT Roorkee)

5 papers published in International journals Former Lead Author

ISO 9001- ISO 22000

School Accreditation Examiner by QCI

M Sc Double Gold Medalist.