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Encryption Algorithm with Linear Equations

Remzi Aktay
Keçiören Şehit Halil Işılar Middle School, Ankara 06300, Turkey

Abstract: In this study, it is aimed to develop an encryption algorithm by finding a third point based on the line equation and the two points taken on it. In the literature review, a method was found to find the third point based on the two points given on the elliptic curves $y^2 = x^3 + a \cdot x + b$, where a and b are real numbers. However, it has not been found adapted to the correct equation. In this study, it is proved that this method, which is primarily used in elliptic curves, is provided in line equations that intersect both axes. Then, using this method, an encryption algorithm has been made by connecting the points where the axes are cut to ASCII Character Codes and finding the third point. Thanks to the algorithm, an encryption consisting of two numbers was made for these binary characters by taking binary characters for each character of a secret text. This algorithm has some differences from other algorithms. The first of these is that normal encryption algorithms generate a separate password for each character, while a password is created for two characters in the algorithm. The second difference is that a character can be encoded in infinitely different ways due to the formation of the algorithm. When the software of this algorithm is made, it can be used in every field where Elliptic Curve Algorithm is used. In addition, instead of finding only a third point in encryption with the correct equation, studies can be done to create different algorithms by finding a different number of third points.

Key words: Line equation, slope, ASCII characters, encryption.

1. Introduction

In this study, starting from two points taken on a line in the coordinate system, it is tried to find a third point that will be on the line again. The encryption algorithm has been developed by using the third point found from two points.

In the literature review, an encryption algorithm based on the equation of the line could not be found. However, the following studies were found.

(1) Elliptic Curves, with the general equation a, b being real numbers

$y^2 = x^3 + a \cdot x + b$. The coordinates of the P (x_3, y_3) point for the m_1 (x_1, y_1) and m_2 (x_2, y_2) points taken over the elliptic curves as seen in Fig. 1 are as follows;

- Let s be the slope of the line passing through m_1 and m_2.
- The coordinates of the point P (x_3, y_3) such that $x_3 = s^2 - x_1 - x_2$ and $y_3 = s \cdot (x_1 - x_3) - y_1$.

The point m_3 (x_3, $-y_3$), which is the symmetry of the point P with respect to the x-axis, is again a point on the elliptic curve [1].

(2) Elliptic Curve Algorithm based on this feature of elliptic curves is based on discrete logarithms, groups, finite fields and Double and Add algorithm [2]. In this study, the rule of finding the third point according to the two points taken on the curve, which is the property of only elliptic curves, is used. It has been proved that this rule is also valid for correct equations. A new encryption algorithm has been developed using the correct equations. While developing this algorithm, ASCII Character Codes of all characters of a text were written from the beginning. The binary codes taken from the beginning were accepted as lines where they intersect the x and y axis respectively. The cut points were accepted as two points, the third point was found and certain operations were performed on the coordinates of this point and the encrypted form of the two codes was found. Then, the original version of the encrypted text was found by doing the reverse process.

Corresponding author: Remzi Aktay, Math Teacher, research field: computational number theory. E-mail: aktayremzi@outlook.com,

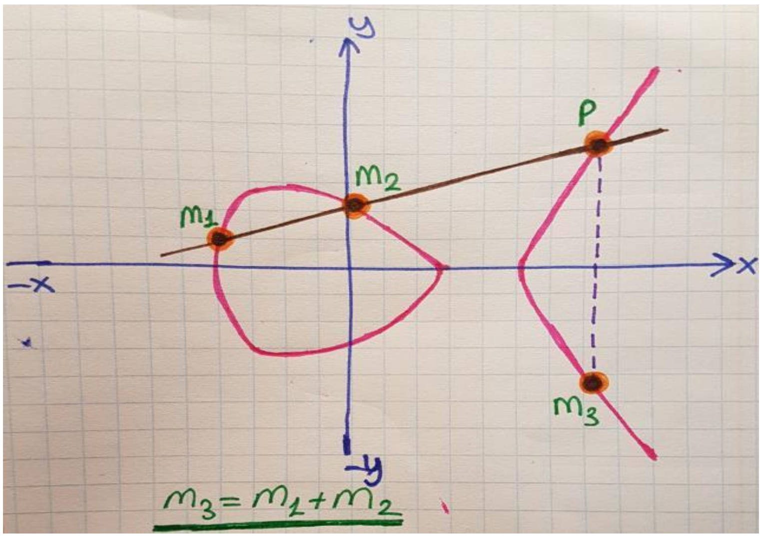

Fig. 1 Elliptic Curve Graph and Three Points Taken on it

2. Method

In this study, it has been proved that the rule, which gives the third point on it, based on the two points taken on it, which is the property of Elliptic Curves, is also met in the line equations. Later, the encryption algorithm was developed based on correct equations and finding a point.

2.1 Finding the Third Point on the Line Equation

Elliptic Curves, the general equation a, b being real numbers:

$y^2 = x^3 + a \cdot x + b$. The coordinates of the point P (x_3, y_3) for the m_1 (x_1, y_1) and m_2 (x_2, y_2) points taken over the elliptic curves are as follows.

Let s be the slope of the line passing through m_1 and m_2 points.

The coordinates of the point P (x_3, y_3) such that $x_3 = s^2 - x_1 - x_2$ and $y_3 = s \cdot (x_1 - x_3) - y_1$.

The point m_3 (x_3, $-y_3$), which is the symmetry of the point P with respect to the x-axis, is again on the elliptic curve. Let us prove whether this method satisfies in the correct equation.

Let $y = s \cdot x + b$ be our line equation (1)

If m_2 (x_2, y_2) is on the line, it must provide the right.

$y_2 = s \cdot x_2 + b$, then $b = y_2 - s \cdot x_2$ (2)

$x_3 = s^2 - x_2 - x_1$.

$$y_3 = s \cdot (x_1 - x_3) - y_1 \quad (3)$$

When y_3 is written instead of x_3;

$$y_3 = s \cdot (x_1 - s^2 + x_2 + x_1) - y_1 = 2 \cdot s \cdot x_1 - s^3 + s \cdot x_2 \quad (4)$$

Suppose that for point P (x_3, y_3), point P” (x_3, $-y_3$) satisfies the line equation. In this case, let us write this point instead of Eq. (1).

$$-(2 \cdot s \cdot x_1 - s^3 + s \cdot x_2) + y_1 = s \cdot (S^2 - x_2 - x_1) + b \quad (5)$$

When Eq. (2) is written instead of Eq. (5);

$$-2 \cdot s \cdot x_1 + s^3 - s \cdot x_2 = s \cdot (S^2 - x_2 - x_1) + y_2 - s \cdot x_2 \quad (6)$$

$$-2 \cdot s \cdot x_1 + s^3 - s \cdot x_2 + y_1 = s^3 - s \cdot x_2 - s \cdot x_1 + y_2 - s \cdot x_2$$

$$-2 \cdot s \cdot x_1 - \cdot s \cdot x_2 + y_1 = -2 \cdot s \cdot x_2 - \cdot s \cdot x_1 + y_2$$

$$s \cdot x_2 - \cdot s \cdot x_1 = y_2 - y_1$$

$$s \cdot (x_2 - x_1) = y_2 - y_1$$

get the equation. Since the value of s means slope, this feature used in Elliptic Curves has actually been proven to be valid in line equations.

2.2 Writing ASCII Character Codes and the Correct Equation

While doing the encryption algorithm, the ASCII character code of all characters in a text will be written in order. Then the pairs selected from the beginning will be converted into lines that intersect the x and y axis, respectively. A third point will be found starting from the points that intersect the axes. The process steps are as follows in order.

2.2.1 Writing the Correct Equation

After the ASCII Character Codes of all the characters of a text are written in order, the ordered binaries from the beginning will be converted to the correct equations that are accepted as the point where the x and y axis intersect.

For example, the ASCII character codes of a 4 character word are the numbers *a*, *b*, *c*, *d* respectively. In this case, the equations are:

$\frac{x}{a} + \frac{y}{b} = 1$. The points where the axes intersect are

$$m_1 \ (a,\ 0) \ \text{and} \ m_2 \ (0,\ b) \tag{7}$$

$\frac{x}{c} + \frac{y}{d} = 1$. The points where the axes intersect are

$$m_1 \ (c,\ 0) \ \text{and} \ m_2 \ (0,\ d) \tag{8}$$

In this way, equations based on ASCII codes are written for the characters of the entire text. There are points where the axes cross. In short, two points are taken on each line equation.

There may be a problem like this here. If the total number of characters in the text is odd, it is converted to double by adding a dot character with code 46 after the last character. In this way, all correct equations are formed. The only problem is that an extra dot is put at the end of the text.

2.2.2 Finding the Third Point from Line Equations

The two points on each line, that is, the third point shown to the points where the axes intersect is found. The coordinates of the third point found would actually be the values corresponding to the codes of the two selected characters.

Example: Let "-Z" be a two-character expression. Here "-" character's ASCII Character Code is 45, and *Z*'s ASCII Character Code is 90. In other words, the line to be formed will be the line that cuts the x-axis at 45 and the y-axis at 90. On this line: m_1 (45.0) and m_2 (0.90). Accordingly, $x_1 = 45$, $x_2 = 0$ and $y_1 = 0$, $y_2 = 90$, $s = -2$. Solet's find P (x_3, y).

$x_3 = s^2 - x_2 - x_1 = (-2)\ 2 - 0 - 45 = -41.$

$y_3 = s\cdot(x_1 - x_3) - y_1 = (-2)\ (45 - (-41)) - 0 = -172.$

P (x_3, y_3) = P (-41, -172). The point that is symmetrical to the point P with respect to the x-axis will be the point on the line.

P" (-41, 172), Let us write this point on the line and try it now. If

$$\frac{x}{45} + \frac{y}{90} = 1,$$

$$\frac{-41}{45} + \frac{172}{90} = 1,$$

when the necessary adjustments are made, it is understood that the line is above the line. Accordingly, the values found for the codes of the two characters we chose are as follows.

45 → -41

It becomes 90 → 172. When these operations are done for each character in the text, new values will come for each character.

3. Results

In this study, starting from two points in the method section, encryption and decryption processes were found with possible trials by finding the third point on the line.

3.1 Encryption Process

The coordinates of the third point on the line formed according to both consecutive characters will be the encrypted form of the characters.

- The x component of the third point found will correspond to the code where the line written according to ASCII Character Codes intersects the x-axis.
- The y component of the third point found will correspond to the code where the line written according to ASCII Character Codes intersects the y axis.

Let us assume that the two characters "-Z" are encrypted (*a*, *b*). When the encryption process is done, the encrypted form of the two characters "-Z" becomes (*a*, *b*) = (-41, 172).

Table 1 ASCII Character Code Table

KOD	CHAR	KOD	CHAR	KOD	CHAR	KOD	CHAR	KOD	CHAR	KOD	CHAR
000	(nul)	043	+	087	W	138	Ë	185	╣	221	▌
001	(soh)	044	,	088	X	139	Ô	186	║	222	▐
002	(stx)	045	-	089	Y	140	Ó	187	╗	223	▀
003	(etx)	046	.	090	Z	141	ı	188	╝	224	α
004	(eot)	047	/	091	[	142	ƒ	189	┘	225	β
005	(enq)	048	0	092	\	143	≈	190	╛	226	γ
006	(ack)	049	1	093	]	144	…	191	┐	227	π
007	(bel)	050	2	094	^	145	Ê	192	└	228	Σ
008	(bs)	051	3	095	_	146	Δ	193	┴	229	σ
009	(tab)	052	4	096	,	147	Ù	194	┬	230	µ
010	(lf)	053	5	097	a	148	ˆ	195	├	231	τ
011	(vt)	054	6	098	b	149	Ú	196	─	232	Φ
012	(np)	055	7	099	c	150	º	197	┼	233	θ
013	(cr)	056	8	100	d	151	ˇ	198	╞	234	Ω
014	(so)	057	9	101	e	152	0	199	╟	235	δ
015	(si)	058	:	102	f	153	Ö	200	╚	236	∞
016	(dle)	059	;	103	g	154	Ü	201	╔	237	Ø
017	(dc1)	060	<	104	h	155	-	202	╩	238	ε
018	(dc2)	061	=	105	i	156	£	203	╦	239	∩
019	(dc3)	062	>	106	j	157		204	╠	240	≡
020	(dc4)	063	?	107	k	158	Ş	205	═	241	±
021	(nak)	064	@	108	l	159	Ş	206	╬	242	≥
022	(syn)	065	A	109	m	160	.	207	╧	243	≤
023	(etb)	066	B	110	n	161	Ì	208	╨	244	⌠
024	(can)	067	C	111	o	162	Û	209	╤	245	⌡
025	(em)	068	D	112	p	163	·	210	╥	246	÷
026	(eof)	069	E	113	q	164	Ò	211	╙	247	≈
027	(esc)	070	F	114	r	165	羊	212	╘	248	o
028	(fs)	071	G	115	s	166		213	╒	249	“
029	(gs)	072	H	116	t	167	ğ	214	∏	250	
030	(rs)	073	I	117	u	168	TL	215	╫	251	-
031	(us)	074	J	118	v	169		216	╪	252	√
032	sp	075	K	119	w	170	“	217	┘	253	∩
033	!	076	L	120	x	171	Ω	218	┌	254	²
034	ì	077	M	121	y	172	O	219	█	255	■
035	#	078	N	122	z	173	0	220	▄		
036	$	079	O	123	{	174	´				
037	%	080	P	124		175	ª				
038	&	081	Q	125	}	176	░				
039	ë	082	R	126	~	177	▒				
040	(	083	S	127		178	▓				
041	)	084	T	128	Ç	179	│				
042	*	085	U	129	ü	180	┤				
		086	V	130	È	181	╡				
				131	,	182	╢				
				132	‰	183	∏				
				133	‡	184	╕				
				134	Â						
				135	ç						
				136	Í						
				137	Î						

3.2 Decoding Encrypted Text

Let the encrypted trio of two characters be (a, b). Deciphering process steps are as follows;

(1) Since the points where the line intersects the axes (x, 0) and (0, y), $y = -s \cdot x$ since it will be found with $s = -\frac{y}{x}$, y= -s.x. The points where the line intersects the axes are (x, 0) and (0, $-s \cdot x$).

(2) The rule of finding the third point from two

points on the line is applied. However, the two points to be taken here will be m_1 (a, b) and m_2 (x, 0). These two points (0, $-s\cdot x$) will be found. When the operation is performed according to the given two points, $x_1 = a$, $x_2 = x$ and $y_1 = b$, $y_2 = 0$. According to this;

with $x_3 = 0$, $y_3 = -s\cdot x$ should result.

(3) $x_3 = s^2 - x_2 - x_1$ and $y_3 = s\cdot(x_1 - x_3) - y_1$ equations are checked. However, the negative value of y_3 is on the line.

In the equation $x_3 = s^2 - x - a = 0$, at the value of $x = s^2 - a$, a is known, so the equation depending on s occurs. In the resulting equation, x will be a positive integer, because it is the point where the x-axis intersects in the first region.

(4) In the equation $y_3 = s\cdot(x_1 - x_3) - y_1$, you get $y_3 = s\cdot(a - 0) - b$. Its reverse sign, $y_3 = -s\cdot a + b$, is the point where the line intersects the y-axis and is a positive natural number.

(5) also since $y_3 = -s\cdot x$;

$y_3 = -s\cdot a + b = -s\cdot(s^2 - a) = -s^3 + s\cdot a$ then $s^3 - 2\cdot s\cdot a + b = 0$ subtract the third-order equation. Only one of the s values found with the Calclab program at the same time;

$$x = s^2 - a$$

It makes $y = -s\cdot a + b$ both positive natural numbers.

Note: whether the roots of the third-order equation $s^3 - 2\cdot a\cdot s + b = 0$ are real that can be found as follows. Let the general form of the quadratic equation be $a\cdot x^3 + b\cdot x^2 + c\cdot x + d = 0$.

$\Delta = 18\cdot a\cdot b\cdot c\cdot d - 4\cdot b^3\cdot d + b^2\cdot c^2 - 4\cdot a\cdot c^3 - 27\cdot a^2\cdot d^2$;

$\Delta > 0$, there are three different real roots.

$\Delta = 0$, there is one real root and it is threefold.

$\Delta < 0$, a real root has two virtual roots.

Accordingly, the discriminant value for the equation $s^3 - 2\cdot a\cdot s + b = 0$ is $32\cdot a^3 - 27\cdot b^2$.

We can also comment on the s value by looking at this discriminant value. However, here the important s value at the same time

$$x = s^2 - a$$

This is because $y_3 = -s\cdot a + b$ makes both positive natural numbers. This s value is only one.

For “-Z” encrypted form of two characters (a, b) = (-41, 172) the comment about s would be as follows.

The value of $32\cdot a^3 - 27\cdot b^2$ is -3004240; in this case there is one s real root. However, we can easily find this s value with the Calcalb program.

The encrypted form of the two characters “-Z” is (-41, 172) = (a, b).

Since the points where the line crosses the axes will be (x, 0) and (0, $-s\cdot x$), the cut points will be (x, 0) and (0, $-2x$). In addition, the following expression occurs with the third point on the line.

m_1 (a, b) = m_1 (-41, 172). It will be m_2 (x, 0) P” (x_3, $-y_3$) = P” (0, $-s\cdot x$).

According to this;

$$x_1 = -41,\ x_2 = x,\ x_3 = 0$$

It will be $y_1 = 172$, $y_2 = 0$, $y_3 = -s.x$.

$$x_3 = s^2 - x_2 - x_1$$

Since $0 = (s)^2 - x - (-41)$, subtract $x = s + 41$.

$$y_3 = s\cdot(x_1 - x_3) - y_1$$

$$y_3 = s\cdot(-41 - 0) - 172 = -41\cdot s - 172.$$

$$y_3 = -s\cdot x,\ \text{then}\ 41\cdot s + 172 = -s\cdot(s^2 + 41)$$

When the roots of the third order equation $s^3 + 82\cdot s + 172 = 0$ are found with the Calcalb program;

Subtract $s_1 = -2$, $s_2 = 1 + 9.22\cdot i$, $s_3 = 1 - 9.22\cdot i$ of these values only for $s_1 = -2$.

$$x = s^2 + 41 = 45$$

Both are positive natural numbers such that $-y_3 = -s\cdot x = 90$.

In this case, the two characters have sequential ASCII Character codes (45, 90). These character codes are respectively;

$$45 \rightarrow -90 \rightarrow Z \text{ characters}$$

3.3 Sample Encryption and Analysis

Let us encrypt the text with six characters "# F) {0 ≡" for the application in encryption. The reason for choosing these characters is that the slopes in line equations are integer. This way, we do not have to deal with fractions. However, even if it is a fraction when it is coded or software, there is no problem.

3.3.1 Encryption Process

(1) First, let us write the ASCII Character Codes of each character in the given sentence.

→ 35 F → 70) → 41 (→ 123 0 → 48 ≡ → 240

(2) Let us write the codes of the characters in order.

35-70-41-123-48-240

(3) Let us take binaries from the beginning. Let these pairs be the points where the line intersects the x and y axis:

Points intersecting the (35, 0) and (0, 70) axes for the pair 35-70;

For the pair 41-123, the points intersecting the (41, 0) and (0, 123) axes;

For the 48-240 binary, the points intersecting the (48, 0) and (0, 240) axes.

(4) Let us write equations of lines according to the points intersecting the axes and find their slopes.

$\frac{x}{35} + \frac{y}{70} = 1$ and $s = -2$

$\frac{x}{41} + \frac{y}{123} = 1$ and $s = -3$

$\frac{x}{48} + \frac{y}{240} = 1$ and $s = -5$

(5) In each line equation, let us make the third point on the line and encode from the points that intersect the axes.

- For the line $\frac{x}{35} + \frac{y}{70} = 1$ and $s = -2$, let us find

$m_1(x_1, y_1) = m_1(35, 0)$ and $m_2(x_2, y_2) = m_2(0, 70)$ $P(x_3, y_3)$.

$x_3 = s^2 - x_2 - x_1 = (-2)^2 - 0 - 35 = -31$

$y_3 = s\cdot(x_1 - x_3) - y_1 = -2\cdot(35 + 31) - 0 = -132$

P” $(x_3, -y_3)$ = P” (-31, 132) becomes the third point on the line.

Two characters are encrypted (-31, 132).

- For the line $\frac{x}{41} + \frac{y}{123} = 1$ and $s = -3$, let us find

$m_1(x_1, y_1) = m_1(41, 0)$ and $m_2(x_2, y_2) = m_2(0, 123)$ $P(x_3, y_3)$.

$x_3 = s^2 - x_2 - x_1 = (-3)^2 - 0 - 41 = -32$

$y_3 = s\cdot(x_1 - x_3) - y_1 = -3\cdot(41 + 32) - 0 = -219$

P” $(x_3, -y_3)$ = P” (-32, 219) becomes the third point on the line.

The two characters are in encrypted form (-32, 219).

- For the line $\frac{x}{48} + \frac{y}{240} = 1$ and $s = -5$, let us find

$m_1(x_1, y_1) = m_1(48, 0)$ and $m_2(x_2, y_2) = m_2(0, 240)$, $P(x_3, y_3)$.

$x_3 = s^2 - x_2 - x_1 = (-5)\ 2 - 0 - 48 = -23$

$y_3 = s\cdot(x_1 - x_3) - y_1 = -\ 5\cdot(48 + 23) - 0 = -355$

P” $(x_3, -y_3)$ = P” (-23, 355) becomes the third point on the line.

The two characters are in encrypted form (-23, 355).

3.3.2 Parsing Encrypted Text

Let us find the binary characters from the passwords given in Table 2.

(1) (-31, 132) = (a, b)

Since the points where the line crosses the axes will be $(x, 0)$ and $(0, -s\cdot x)$, the cut points are $(x, 0)$ and it will be $(0, -s\cdot x)$. In addition, the following expression occurs with the third point on the line.

$m_1(a, b) = m_1(-31, 132)$. It will be $m_2(x, 0)$. P” $(x_3, -y_3)$ = P” $(0, -s\cdot x)$.

According to this;

$$x_1 = -31,\ x_2 = x,\ x_3 = 0$$

It will be $y_1 = 132$, $y_2 = 0$, $y_3 = -s\cdot x$.

$$x_3 = s^2 - x_2 - x_1$$

Since $0 = s^2 - x - (-31)$

$$y_3 = s\cdot(-31 - 0) -132 \text{ equations;}$$

Table 2 Encrypted form of six characters

Consecutive binary	Character encrypted
# F	(-31, 132)
){	(-32, 219)
0≡	(-23, 355)

When we solve the equation $s^3 + 62 \cdot s + 132 = 0$ with the help of the Calaclab program, we get $s = -2$.

In this case, the two characters have sequential ASCII Character codes (35, 70). These character codes are respectively;

35 → #

0 → F characters.

(2) (-32, 219) = (a, b)

Since the points where the line crosses the axes will be (x, 0) and (0, $-s \cdot x$), the cut points will be (x, 0) and (0, $-s \cdot x$). In addition, the following expression occurs with the third point on the line.

m_1 (a, b) = m_1 (-32, 219). It will be m_2 (x, 0). P” (x_3, $-y_3$) = P” (0, $-s \cdot x$).

According to this;

$$x_1 = -32,\ x_2 = x,\ x_3 = 0$$

It will be $y_1 = 219$, $y_2 = 0$, $y_3 = -s \cdot x$.

$$x_3 = s^2 - x_2 - x_1$$

Since $0 = s^2 - x - (-32)$.

From the equations $y_3 = s \cdot (x_1 - x_3) - y_1$

The equation $s^3 + 64s + 219 = 0$ comes out. When the roots are found with the Calcalb program, the value of $s = -3$ simultaneously makes x_3 and y_3 positive natural numbers.

In this case, the two characters have sequential ASCII Character codes (41, 123). These character codes are respectively;

41 →)

123 → {.

(3) (-23, 355) = (a, b)

Since the points where the line crosses the axes will be (x, 0) and (0, $-s \cdot x$), the cut points are (x, 0) and it will be (0, $-s \cdot x$). In addition, the following expression occurs with the third point on the line.

m_1 (a, b) = m_1 (-23, 355). It will be m_2 (x, 0). P” (x_3, $-y_3$) = P” (0, $-s \cdot x$).

According to this;

$x_1 = -23$, $x_2 = x$, $x_3 = 0$.

It will be $y_1 = 355$, $y_2 = 0$, $y_3 = -s \cdot x$.

$x_3 = s^2 - x_2 - x_1$

$0 = s^2 - x - (-23)$

$y_3 = s \cdot (x_1 - x_3) - y_1$

From equations

$s^3 + 46s + 355 = 0$ derive. When the roots are found with the Calclab program, the value $s = -5$ makes x_3 and y_3 positive natural numbers.

In this case, the two characters have sequential ASCII Character codes (48, 240). These character codes are respectively;

48 → 0

240 → #

Now, when we type the character sequentially, # F) {0 ≡ 6 characters appear.

4. Discussion and Conclusion

The following results came from this study; the method used to find a third point on the two points, which is the property of elliptic curves, is also valid in line equations. This has been proven. My purpose in using the correct equation is to write the ASCII character code of the characters at the points where the axes intersect, and to generate a password for these points. The reason we take the points where the axes are crossed when generating the correct equations is to reduce the number of unknowns in the decoding of the cipher text. Especially when deciphering, $x_3 = 0$ is taken to find equations with one unknown and accordingly to find other unknowns. The reason for using ASCII Character Codes is to make it according to a character code table generally used when the software is made. If desired, a different character code table can be created. While in normal encryption methods, an encrypted number is dropped for each character, in this encryption method a two-character password is created. This has the following advantage: multiple different encrypted versions of a character are obtained.

While generating a password based on two characters, having a two-component password becomes difficult to decipher or crack the password. As shown in Table 2, the 2-component passwords created are written one after the other, and the entire text is encrypted. In the parsing phase, the original text is reached when the binary code in each line is written side by side in two characters. ASCII character codes do not need to write spaces between lines in encryption because they have punctuation marks and their code. The only disadvantage of this encryption is the number of characters of the text. Because in this encryption, a password for two characters is created, the text must have an even number of characters. If it has an odd number of characters, a period is placed next to the last character. This creates an even number of characters. When decrypted, there is a dot at the end of the text. This has no effect on the content of the text. In the study, when a line intersects the axes, when the third point is found according to two points, the coordinates of the point found (a, b), with the slope s, $s^3 - 2a\cdot s + b = 0$ comes from the third order equation. For only one of the roots of this equation, the points where the axes intersect become the positive natural number. This encryption software can be used for data transfer and secure communication.

An encryption can be made by adapting the process steps of the Elliptic Curve Algorithm to the encryption I have created.

Using this method, a study can be made not by finding the first third point, but by doing the third point finding more than once, accepting the third or fourth point as encryption.

In this method, two characters were encrypted according to the points that cut the axes. The codes of four characters can be encrypted according to the line formed by accepting 2 points respectively.

Encryption can be done in 2nd order functions by investigating whether the same rule is valid or not.

That line intersects the axes when the third point is found with respect to two points, the coordinates of the point found are (a, b), the slope s, $s^3 - a\cdot s + b = 0$ comes from the third order equation. Based on this equation, it seems that there are 3 different cases when writing the equations of the line given a point. These situations occur according to the points where the axes cross. A large-scale research can be done on this.

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