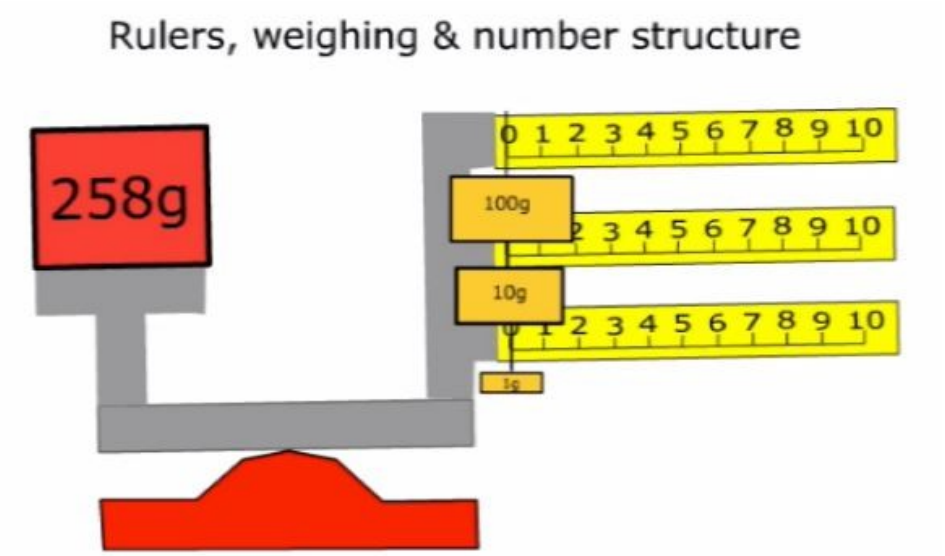
How to fix math Education

Do mathematicans understand math?
Can they convey their intelligence to others?

Its a matter of opinon



How to fix math Education

Do mathematicans understand math?
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Its a matter of opinon!

Zero to infinity - Nova Presentation
Zero is nothing — I disagree
Proof: 0+5=5 refute 1x5=5
Does not have a sign — I disagree
Zero is a place holding — Misleading
Zero is the center of the number sytem — Opinion is abritary

What gives me confidence that my opinion is correct or better?

Direction of number line

932 largest digit is at the left

9 8 7 6 5 4 3 2 1 0 -1 -2 -3 -4 -5 -6 -7 -8 -9

Geometric

We count forward by adding and backward by subtracting

Algebraic Adding subtracting
Create numbers 1+2=3 3-2=1
0+1=1 1-1=0
0-1=-1 notation

The integer before 1, when added to a number gives the same number
0+1=1 creation
Replacement associative replacement
2=1+1=(0+1)+1 =0+(1+1) =0+2

Discovering negative numbers and the rules

B A 0 1 2 3
A+1=0 B+1=A
B+1+1=A+1
B+2=0
A=0-1=-1 B=0-2=-2 notation
-1+1=0 -2+2=0 DEFINITION of negative number

Definition of negative numbers

-2+2=0

-2=0-2 2=0 - -2

0+1=1 0=1-1

0+1-1 =1-1

0+ 0 = 0

Adding two negatives

-2+2+-3+3=0+0=0

(-2+-3)+(2+3)=0

- 2+-3 =-0-(2+3)=-(2+3)

Adding positive and negative

-2+2+-3+3=0 defintion

(-3+2)+(3+-2)=0 commutive, associative

-3+2 =0-(3+-2)=-(3+-2) subtraction

Adding and subtracting Zero

0+2=2

0=2-2 2=2-0

Add negative

0+0=0

0+0-2=0-2

0+-2=-2

3+0=3

3+0-2=3-2

3+-2=3-2

Subtract negative

3+0=3

3+0 - -2= 3 - -2

3+2=3 - -2

12 is like 0, because it is the integer before 1. 11 is like -1 10 like -2

1/5 x12	1/5 x 24	1/5x36	1/5x 48	1/5x60	5x5=25=1
2.4	4.8	7.2	9.6	12	5=1/5

Refuted: Zero is nothing

Zero is the integer before 1.

Zero has a sign

0-2=-2
0+0=0
0=0-0=-0

It is the way we define negative numbers, zero is a number.

The function 1/x at 0 is - ∞ and $+\infty$

Both +0 and -0 occupy the same position!

A better explanation than indeterminant.

Zero is a place holder

```
    12345
   X50050
   00000
  617250
 0000000
00000000
617250000
617867250
```

Zero is not a place holder

```
    12345
   x50050
  617250
 61725
617867250
```

As a placeholder zero makes computation harder!

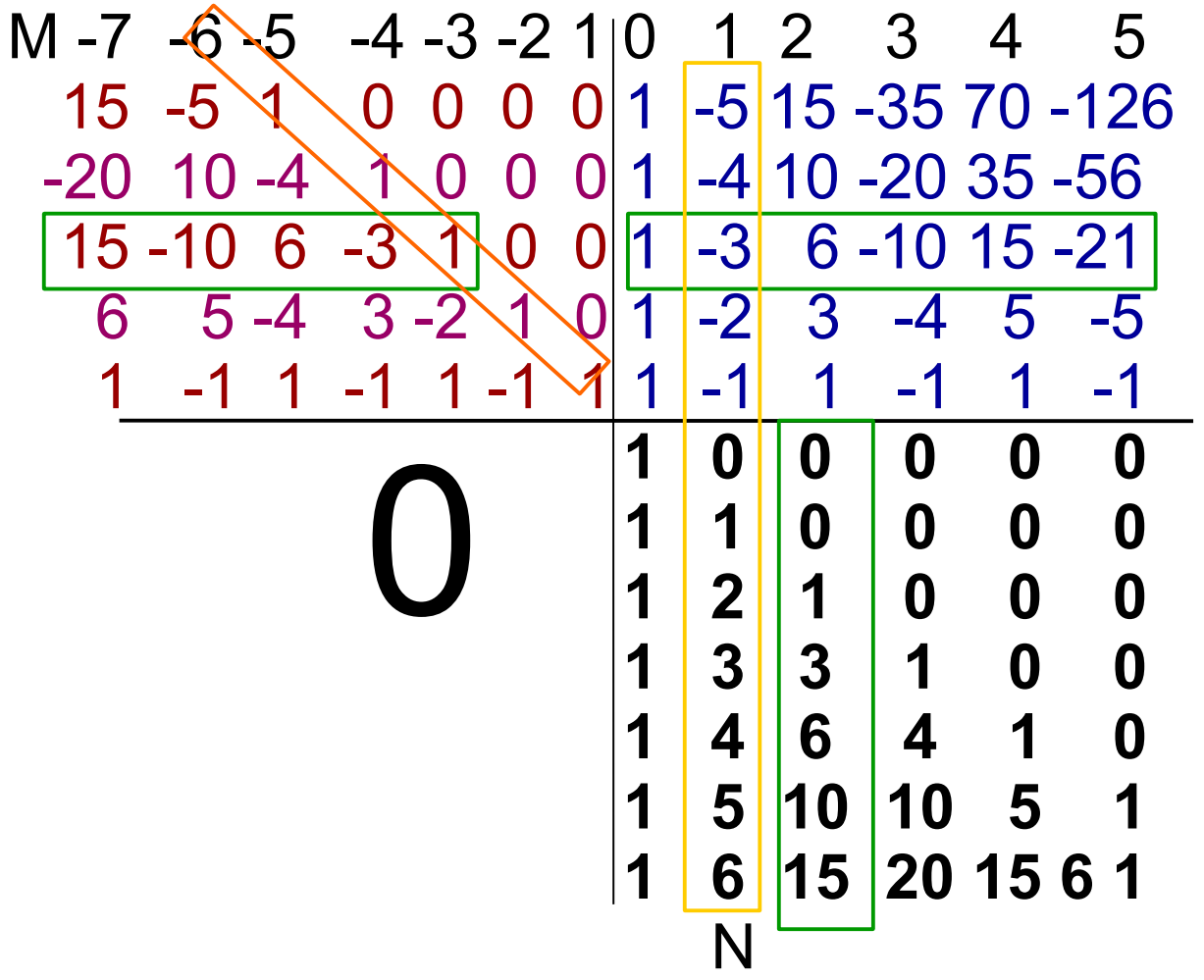
For infinities any number is the center of the number line.
However, the numbers have a symmetry pattern about zero.
Zero has two values
Therfore, an decision can be made on symmetry, but this decision must declared

The existing outlook on zero leads to a misunderstanding of numbers.
0! and 2^0 and not =0 , but =1

Summary

The novel approach was to think inversely (subtraction). This enabled us to discover negative numbers with little effort. We also proved what we did allowing us to understand the basic properties of association and commutation.

Pascal Triangle



Factorials

Inventing a new notation

evolving $3!=3x2x1!=3x2!$ $\int_0^\infty (x^n e^{-x})dx=n!$ (gamma function)

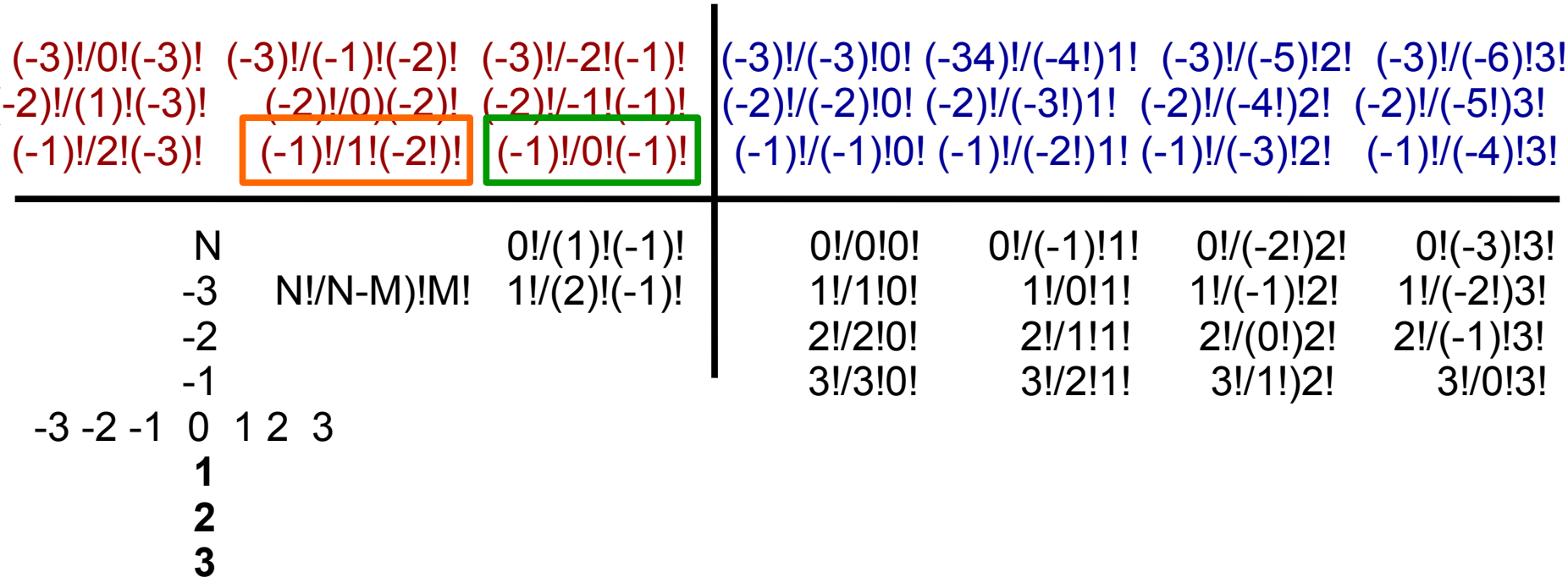
$n!=n*(n-1)!$ $1/(n-1)!=n/n!$

$1!=1*0!$
$0!= 1!/1=1$

$n=0$ $1/(-1)! = 0/0!=0$
$N=-1$ $1/(-2)! =-1/(-1)!$ $(-2!)=-(-1)!1!$
$N=-2$ $1/(-3)! =-2/(-2)!=-1*-2/(-1)!=2!/(-1)!$ $(-3)!= (-1)!/2!$
$N=-3$ $1/(-4)!=-3/(-3)!=-3*2!/(-1)!=-3!/-1!$ $(-4)!=-(-1)!/3!$

$4!/(2!2!)=6$ $(-3)!/(-5)!2!= (-1)!/2! \times 4!/(-1)! \times 1/2! =4!/2!/2!=6!$
$(-3)!/2!(-5)! = (-3)!/(-5)!2!$

$5!/3!2!=120/6X2)=10$
$(-4)!/2!(-6)!= -(-1)!/3! X -5!/(-1)! X 1/2! X 5!/3!2!=10$
$(-3)!/3!(-6)!=(-1)!/2! X 1/3! X -(-5!)/(-1)!=-5!/3!2!=-10$



One or three reciprocal negative factorials are zero

(-1)!/1!(-2!) = (-1)!/((1!)(-1*(-1)!))= 1/(1!(-1))==-1

(-3)!/0!/(-3)!=((-3)!/(-3)!))/0!=1/1=1

(-2)!/0!/(-2)!=((-2)!/(-2)!))/0!=1/1=1

(-1)!/0!/(-1)!=((-1)!/(-1)!))/0!=1/1=1 **The anomaly!**

BINOMIAL EXPANSION

(A+B)^0=1
(A+B)^1=A+B=1A^1(B^0)+1A^0(B^1)
(A+B)^2= 1A^2(B^0)+2A^1(B^1)+1A^0(B^2)
(A+B)^3= 1A^3(B^0)+3A^2(B^1)+3A^1(B^2)+1A^0(B^3)

$$(A+B)^n = \sum_{M=0} A^{(n-m)}B^m/((n-m)!m!)$$

1/A^2-2B/A^3+3B^2/A^4-4B^3/A^4... =1/A^2(1-2(B/A)+3(B/A)^2-.....)

A^2+2AB+B^2)1
1+2B/A+(B/A)^2
-2B/A- (B/A)/^2
-2B/A-4(B/A)^2-2(B/A)^3
3(B/A)^2+2(B/A)^3
3(B/A)^2+6(B/A)^3+3(B/A)^4
-4(B/A)^3-3(B/A)^4

```
      1-x+x^2-x^3+....                    1/x-1/x^2+1/x^3+....
1+x)1                               x+1)1
      1+x                                 1+1/x
        -x                                  -1/x
        -x-x^2                              -1/x-1/x^2
           X^2                                    1/x^2
           x^2+x^3                                1/x^2+1/x^3
               -x^3                                      -1/x^3
```

$S=a+ab+ab^2+..+ab^n= a(b^n-1)/b-1$

$|b|<1$ $n=\infty$ $S=a/(1-b)$ $a=1$ $b=-x$

$S=1/(1+x)$

$b<1$ $a=1/x$ $b=-1/x$

$S=(1/x)((1/x)^n-1)(1/x -1)$

$|b|<1$ $n= \infty$ $S=1/x(-1/(-1/x – 1)=1/(1+x)$

$1/(1+x)=$

$-1>x>1$	**$1/x-1/x^2+1/x^3-....$**	**$x=2$**	**$s=.5-.25+.125-.0625+.03125=.3$**	**$1/(1+2)=1/3=.33$**
$-1<x<1$	$1-x+x^2-x^3$	$x=.5$	$s=1-.5+.25-.125+.0625...=.6$	$1/1+.5)=2/3=.66$
		$x=1$	$s=2$	

Three power series represent $1/1+x$ The reciprocal is new

Checking your work and finding Errors

Google(R)	Microsoft(R)
(-1.01)!/((-4.01)!)=-6.110601	-6.110601
(-1.00001)!/((-4.00001)!)=-6.0001100006	
(-1.000000001)!/((-4.000000001)!)=-6.000000011	-6.000000011000000006000000001
(-1.00000000001)!/((-4.00000000001)!)=-5.99946714043	-6.000000000110000000006
(-.99)!/((-3.99)!)=-5.890599	-5.890599
(-.99999)!/((-3.99999)!)=-5.9998900006	
(-.999999999)!/((3.999999999)!)=-5.999999989	
(-.99999999999)!/((-3.99999999999)!)=-5.99946714021	-5.999999989000000000059999999999
6!=720	
(-1.00000001)!/((-7.00000001)!)=720.000182726	720.000017640000162400000735
(-.99999999)!/((-6.99999999)!)=719.999918342	719.999982360000162399999265
9!=328880	
(-.99999999)!/((-9.99999999)!) =**0.00260927651 + 83 055.8454 i**	-362879.9897342401172699992763 2
(-1.00000001)!/(-10.00000001)!)=**-0.0026092773 + 83 055.8761 i**	-362880.0102657601172700007236 8

Very Long Multiplication

493827160
9)4444444444

Make use of previous work

20+2	220+2	2222	22222222
X20+2	X220+2	X2222	X22222222
400	48400	4	4
40	440	4	4
40	440	4	44
4	4	4	44
484	**49**284	4444	484
		4444	484
		4444	48884
		4444	48884
		4937284	4937284
			4937284
			49377777284
			49377777284
			493827150617284

22222222**22222222**
X22222222**22222222**
493827150617284
4938271515172 84
49382715555555550617284
493827155555555551517284
493827160493827061728395061728 4

Complex Numbers

Throwing away solutions

$5^x+25x=30$

$5^x+(5^x)^2=30$

$y=-5^x$

$y^2+y=30$

$(y+6))(y-5)=0$

$5^x=5$ $5^x=-6$

$x\ln(5)=\ln(5)$ $x\ln(5)=\ln(-6)=\ln(-1)+\ln(6)=\pi i+\ln(6)$ this one has been thrown away

$X=1$ $x=(\pi i + \ln(6))/\ln(5) = \log_5(e)*(\pi i +\ln(6)$

$5^1=5$ $(5^{(\log_5(e))})^{(\pi l +\ln(6))}= e(\pi l +\ln(6)=-1x6=-6$

$5+ 5x5= 5+25=30$

$-6+(-6*-6)=-6+36=30$

$e^{(\pi i)}=\cos(\pi)+i \sin(\pi)=-1$

$\pi l =\ln(-1)$

$\log_5(e)*\ln(5)=1$ $1/\ln(5)=\log_5(e)$

Subtracting numbers raised to a Power

0^2	1^2	2^2	3^2	4^2	5^2	
0	1	4	9	16	25	Subtract
	1	3	5	7	9	2y+1
		2	2	2	2	

Try some more

0^3	1^3	2^3	3^3	4^3	5^3
0	**1**	**8**	**27**	**64**	**125**
	1	7	19	37	61
		6	12	18	24
			6	6	6

0^4	1^4	2^4	3^4	4^4	5^4
0	**1**	**16**	**81**	**256**	**625**
	1	15	65	175	369
		14	50	110	194
			36	60	84
				24	24

See a pattern numbers getting big number of subtractions equal power n! 1<n<4!

-3^5	-2^5	-1^5	0^5	1^5	2^5	3^5
-243	**-32**	**-1**	**0**	**1**	**32**	**243**
	211	31	1	1	31	211
		-180	-30	0	30	180
			150	30	30	150
				-120	0	120
					120	120

y^1	y^2	y^3	y^4
1=1!	2y+1	3y^2+3y+1	4y^3+6y^2+4y+1
	2=2!	3x2y+ 6	4x3y^2+24y+14
		3X2=3!	4x3x2y+36
			4X3x2=4!

Satisfied the hypotheses.

The start

0^2	1^2	2^2	3^2	4^2	5^2	
0	1	4	9	16	25	Subtract
	1	3	5	7	9	2y+1
		2	2	2	2	

Try some more

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0	**1**	**8**	**27**	**64**	**125**
	1	7	19	37	61
		6	12	18	24
			6	6	6

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-3^5	-2^5	-1^5	0^5	1^5	2^5	3^5
-243	**-32**	**-1**	**0**	**1**	**32**	**243**
	211	31	1	1	31	211
		-180	-30	0	30	180
			150	30	30	150
				-120	0	120
					120	120

Satisfied the hypotheses.

Y=5x^2-3x+4 y=-3x+4

X	y			
0	4	0	+0+4	4
1	6	5	-3+4	1
2	18	20	-6+4	-2
3	40	45	-9+4	-5

Extra data point for check

Subtract out square term

4 6 18 40

2 12 22

10 10 10/2!=5

4 6 18 40

0 5 20 45

4 1 -2 -5

-3 -3 -3 -3/1!=-3

subtract out linear term

4 1 -2 -5

0 -3 -6 -9

4 4 4 4

Try unkown

x	y	pow
-2	55	1
-1	15	2
0	1	3
1	1	
2	3	

55 15 1 1 3

-40 -14 0 2

26 14 2

-12 -12

-12/3!=-2

cubed squared linear

x -8 -1 0 1 4 1 0 1 -2 -1

55 15 1 1 39 13 1 3 11 6

-2x^3 16 2 0 -2 7x^2 28 7 0 7 -5x^1 10 5

39 13 1 3 11 6 1 -4 1 1

-26 -12 2 -5 -5 -5

14 14

14/2!=7 -5/1!=-5 1/1!=1

---

y=-2x^3 +7x^2 -5x +1

Check work x=-2 -2x(-2)^3 +7x(-2)^2 -5x(-2)+ 1

16 + 28 +10 +1=55

X=-1 2 + 7 +5 +1=15

Using subtraction of powers to find order of equation, and
Solving linear equations

X	y	pow	55	15	1	1	3
-2	55	1		-40	-14	0	2
-1	15	2			26	14	2
0	1	**3**				-12	-12
1	1						
2	3						

x	ax^3+bx^2+cx+d	d=1
-2	-8a +4b -2c+ d=55	-8a+4b-2c=55-1=54
-1	-a + b -c + d=15	-a+b-c =15-1=14
0	d= 1	a+b+c= 1-1=0
1	a + b +c +d = 1	2b = 14
		b=7

-8a+4x7-2c= 54
-a +7 -c= 14
a +7 + c= 0

-8a-2c=54-28= 26
a+c = 0-7 = -7

-4a-c=13
a+c=-7
-3a=6
a=-6/-3=-2

-2+c=-7
c=-7+2=-5

y==-2x^3+7x^2-5x+1

More than twice as much work

y==-2x^3+7x^2-5x+1

x	y			
-2	-2x(-8)+**7x4-5x(-2)+1**	=	16	+**28+10+1=55**
-1	-2x(-1)+**7x1-5x(-1)+1**	=	2	+**7+5+1 =15**
0	-2x(0) +7x(0)-5x(0)+1	=	0	+0+0+1 =1
1	-2x(1) +7x(1)-5x(1)+1	=	-2	+7-5+1 = 1
2	-2x(8) +7x(4)-5x(2)+1	=	-16	+28-10+1=3

Y=7x^2-5x+1

x	y
-2	**7x4-5x(-2)+1=28+10+1=39**
-1	**7x1 -5x(-1)+1= 7+5+1 =13**
0	7x0 -5x0 +1= 0+0+1 =1
1	7x(1)-5x(1)+1= 7 -5+1 =3
2	7x(4)-5x(2)+1=28-10+1 =19

y=-5x+1

x	y
-2	-5x(-2)+1=10+1=11
-1	-5x(-1)+1= 5+1= 6
0	-5x(0) +1= 0 +1= 1
1	-5x(1) +1= -5 +1=-4
2	-5(x2) +1=-10+1=-9

remove -2x^3

55	**15**	**1**	**1**	**3**
16	2	0	-2	-16
39	13	1	3	19

Remove 7x^2

39	13	1	3	19
28	7	0	7	28
11	6	1	-4	-9

remove -5x

11	6	1	-4	-9
10	5	0	-5	-10

Finding Polynomial function from table

Try unkown

x	y	pow	55	15	1	1	3
-2	55	1		-40	-14	0	2
-1	15	2			26	14	2
0	1	3				-12	-12
1	1						
2	3			-12/3!=-2			

cubed

x	-8	-1	0	1
	55	15	1	1
-2x^3	16	2	0	-2
	39	13	1	3
		-26	-12	2
			14	14
			14/2!=7	

squared

	4	1	0	1
	39	13	1	3
7x^2	28	7	0	7
	11	6	1	-4
		-5	-5	-5
		-5/1!=-5		

linear

	-2	-1
	11	6
-5x^1	10	5
	1	1
	1/1!=1	

y=-2x^3 +7x^2 -5x +1

Check work x=-2 -2x(-2)^3 +7x(-2)^2 -5x(-2)+ 1

16 + 28 +10 +1=55

X=-1 2 + 7 +5 +1=15

Using subtraction of powers to find order of equation, and
Solving linear equations

X	y	pow	55	15	1	1	3
-2	55	1		-40	-14	0	2
-1	15	2			26	14	2
0	1	**3**				-12	-12
1	1						
2	3						

x	ax^3+bx^2+cx+d
-2	-8a +4b -2c+ d=55
-1	-a + b -c + d=15
0	d= 1
1	a + b +c +d = 1

d=1

-8a+4b-2c=55-1=54

-a+b-c =15-1=14

a+b+c= 1-1=0

2b = 14

b=7

-8a+4x7-2c= 54

-a +7 -c= 14

a +7 + c= 0

-8a-2c=54-28= 26

a+c = 0-7 = -7

-4a-c=13

a+c=-7

-3a=6

a=-6/-3=-2

-2+c=-7

c=-7+2=-5

y==-2x^3+7x^2-5x+1

More than twice as much work

Summary

We looked for a pattern in subtracting powers.
We looked for a way of separating out these powers by reversing function process.
We find other approaches so we could check our work.

In the examples, we looked backward and compared our solutions to old approaches.
We looked for patterns.
We looked for explanations, proofs, and appliccation of these patterns.