

Base 4 Number Prediction Cards

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1	2	3	5	6	7
9	10	11	13	14	15
17	18	19	21	22	23
25	26	27	29	30	31
33	34	35	37	38	39
41	42	43	45	46	47
49	50	51	53	54	55
57	58	59	61	62	63

4	5	6	7	8	9
10	11	12	13	14	15
20	21	22	23	24	25
26	27	28	29	30	31
36	37	38	39	40	41
42	43	44	45	46	47
52	53	54	55	56	57
58	59	60	61	62	63

16	17	18	19	20	21
22	23	24	25	26	27
28	29	30	31	32	33
34	35	36	37	38	39
40	41	42	43	44	45
46	47	48	49	50	51
52	53	54	55	56	57
58	59	60	61	62	63

Base 4: Predict a number from 1 to 63

Procedure: Cut out the 3 cards.

Ask a student to think of a number from 1 to 63 inclusive. You then hand the student the 3 cards . You ask the student to look at the cards and find the cards that have their number on it. Tell them that their number may not be on all the cards. Be sure to ask them to look closely at the cards so they do not miss a number on one of the cards. Ask the student to **hand you each card that has their number on it one card at a time and to tell you if the number they selected is red or black.** After the cards with their number on them have been given back and the color of the number has been stated you announce their exact number!

How it's done:

As they hand you a card find the **smallest number on the card that has the color the student stated their number was.** For these cards the smallest number is the first occurrence of the color on the card. Add up those numbers. The total will be the number that they thought of.

Example 1:

The student picks 39 They hand you 3 cards

They hand you a card and their number is green. The smallest black number on that cards is 3.

They hand you a card and their number is red. The smallest red number on that cards is 4

They hand you a card and their number is black. The smallest black number on that cards is 32.

Their number is $32 + 4 + 3 = 39$

Base 4 notation for the numbers 1 to 63 base 10

Base 10	1	2	3	4	5	6	7	8
Base 4	001	002	003	010	011	012	013	020

Base 10	9	10	11	12	13	14	15	16
Base 4	021	022	023	030	031	032	033	100

Base 10	17	18	19	20	21	22	23	24
Base 4	101	102	103	110	111	112	113	120

Base 10	25	26	27	28	29	30	31	32
Base 4	121	122	123	130	131	132	133	200

Base 10	33	34	35	36	37	38	39	40
Base 4	201	202	203	210	211	212	213	220

Base 10	41	42	43	44	45	46	47	48
Base 4	221	222	223	230	231	232	233	300

Base 10	49	50	51	52	53	54	55	56
Base 4	301	302	303	310	311	312	313	320

Base 10	57	58	59	60	61	62	63	64
Base 4	321	322	323	330	331	332	333	1000

Card 1					
1	2	3	5	6	7
9	10	11	13	14	15
17	18	19	21	22	23
25	26	27	29	30	31
33	34	35	37	38	39
41	42	43	45	46	47
49	50	51	53	54	55
57	58	59	61	62	63

How to make a card to find the number in the 1's place

We need a card to let us know if a 0, 1 or 2 or 3 is in the 1's place. We will call this Card 1.

Use the table on the previous page to help complete the card. It shows the numbers 1 to 63 base 10 written in base 4. Since the numbers are in base 4 the numbers are represented using the digits 0, 1, 2 and 3 and have 3 place values 1, 4, and 16

All of the numbers from 1 to 63 base 10 that have a 1 in the 1's place base 4 will go on Card 1 in red. The lowest number in red on this card is a 1.

All of the numbers from 1 to 63 base 10 that have a 2 in the 1's place base 4 will go on Card 1 in black. The lowest number in black on this card is a 3.

All of the numbers from 1 to 63 base 10 that have a 3 in the 1's place base 4 will go on Card 2 in green. The lowest number in black on this card is a 3.

If the number you are looking for is not on the card a 0 is in the 1's place.

Card 2					
4	5	6	7	8	9
10	11	12	13	14	15
20	21	22	23	24	25
26	27	28	29	30	31
36	37	38	39	40	41
42	43	44	45	46	47
52	53	54	55	56	57
58	59	60	61	62	63

How to make a card to find the number in the 4's place

All of the numbers from 1 to 63 base 10 that have a 1 in the 4's place base 4 will go on Card 2 in red. The lowest number in red on this card is a 4.

All of the numbers from 1 to 63 base 10 that have a 2 in the 4's place base 4 will go on Card 2 in black. The lowest number in black on this card is an 8.

All of the numbers from 1 to 63 base 10 that have a 3 in the 4's place base 4 will go on Card 2 in green. The lowest number in black on this card is a 12.

If the number you are looking for is not on the card a 0 is in the 1's place.

Card 3					
16	17	18	19	20	21
22	23	24	25	26	27
28	29	30	31	32	33
34	35	36	37	38	39
40	41	42	43	44	45
46	47	48	49	50	51
52	53	54	55	56	57
58	59	60	61	62	63

How to make a card to find the number in the 8's place

All of the numbers from 1 to 63 base 10 that have a 1 in the 16's place base 4 will go on Card 3 in red. The lowest number in red on this card is a 16.

All of the numbers from 1 to 63 base 10 that have a 2 in the 16's place base 4 will go on Card 3 in black. The lowest number in black on this card is a 32.

All of the numbers from 1 to 63 base 10 that have a 3 in the 16's place base 4 will go on Card 3 in green. The lowest number in black on this card is a 48.

If the number you are looking for is not on the card a 0 is in the 1's place.

The numbers 1 to 31 base 10 written in in base 4

Base 10		How many			card 3	card 3	card 3	base 4		
		16's	4's	1's	16's	4's	1's	16	4	1
1	0 + 0 + 1	16(0) + 4(0) + 1(1)	0	0	1	0	0	1		
2	0 + 0 + 2	16(0) + 4(0) + 1(2)	0	0	2	0	0	2		
3	0 + 0 + 3	16(0) + 4(0) + 1(3)	0	0	3	0	0	3		
4	0 + 4 + 0	16(0) + 4(1) + 1(0)	0	1	0	0	1	0		
5	0 + 4 + 1	16(0) + 4(1) + 1(1)	0	1	1	0	1	1		
6	0 + 4 + 2	16(0) + 4(1) + 1(2)	0	1	2	0	1	2		
7	0 + 4 + 3	16(0) + 4(1) + 1(3)	0	1	3	0	1	3		
8	0 + 8 + 0	16(0) + 4(2) + 1(0)	0	2	0	0	2	0		
9	0 + 8 + 1	16(0) + 4(2) + 1(1)	0	2	1	0	2	1		
10	0 + 8 + 2	16(0) + 4(2) + 1(2)	0	2	2	0	2	2		
11	0 + 8 + 3	16(0) + 4(2) + 1(3)	0	2	3	0	2	3		
12	0 + 12 + 0	16(0) + 4(3) + 1(0)	0	3	0	0	3	0		
13	0 + 12 + 1	16(0) + 4(3) + 1(1)	0	3	1	0	3	1		
14	0 + 12 + 2	16(0) + 4(3) + 1(2)	0	3	2	0	3	2		
15	0 + 12 + 3	16(0) + 4(3) + 1(3)	0	3	3	0	3	3		
16	16 + 0 + 0	16(1) + 4(0) + 1(0)	1	0	0	1	0	0		
17	16 + 0 + 1	16(1) + 4(0) + 1(1)	1	0	1	1	0	1		
18	16 + 0 + 2	16(1) + 4(0) + 1(2)	1	0	2	1	0	2		
19	16 + 0 + 3	16(1) + 4(0) + 1(3)	1	0	3	1	0	3		
20	16 + 4 + 0	16(1) + 4(1) + 1(0)	1	1	0	1	1	0		
21	16 + 4 + 1	16(1) + 4(1) + 1(1)	1	1	1	1	1	1		
22	16 + 4 + 2	16(1) + 4(1) + 1(2)	1	1	2	1	1	2		
23	16 + 4 + 3	16(1) + 4(1) + 1(3)	1	1	3	1	1	3		
24	16 + 8 + 0	16(1) + 4(2) + 1(0)	1	2	0	1	2	0		
25	16 + 8 + 1	16(2) + 4(2) + 1(1)	1	2	1	1	2	1		
26	16 + 8 + 2	16(1) + 4(2) + 1(2)	1	2	2	1	2	2		
27	16 + 8 + 3	16(1) + 4(2) + 1(3)	1	2	3	1	2	3		
28	16 + 12 + 0	16(1) + 4(3) + 1(0)	1	3	0	1	3	0		
29	16 + 12 + 1	16(1) + 4(3) + 1(1)	1	3	1	1	3	1		
30	16 + 12 + 2	16(1) + 4(3) + 1(2)	1	3	2	1	3	2		
31	16 + 12 + 3	16(1) + 4(3) + 1(3)	1	3	3	1	3	3		
32	32 + 0 + 0	16(2) + 4(0) + 1(0)	2	0	0	2	0	0		

The numbers 33 to 63 base 10 written in in base 4

Base 10		How many			card 3	card 2	card 1	base 4		
		16's	4's	1's	16's	4's	1's	16	4	1
33	$32 + 0 + 1$	16(2)	4(0)	1(1)	2	0	1	0	0	1
34	$32 + 0 + 2$	16(2)	4(0)	1(2)	2	0	2	0	0	2
35	$32 + 0 + 3$	16(2)	4(0)	1(3)	2	0	3	0	0	3
36	$32 + 4 + 0$	16(2)	4(1)	1(0)	2	1	0	0	1	0
37	$32 + 4 + 1$	16(2)	4(1)	1(1)	2	1	1	0	1	1
38	$32 + 4 + 2$	16(2)	4(1)	1(2)	2	1	2	0	1	2
39	$32 + 4 + 3$	16(2)	4(1)	1(3)	2	1	3	0	1	3
40	$32 + 8 + 0$	16(2)	4(2)	1(0)	2	2	0	0	2	0
41	$32 + 8 + 1$	16(2)	4(2)	1(1)	2	2	1	0	2	1
42	$32 + 8 + 2$	16(2)	4(2)	1(2)	2	2	2	0	2	2
43	$32 + 8 + 3$	16(2)	4(2)	1(3)	2	2	3	0	2	3
44	$32 + 12 + 0$	16(2)	4(3)	1(0)	2	3	0	0	3	0
45	$32 + 12 + 1$	16(2)	4(3)	1(1)	2	3	1	0	3	1
46	$32 + 12 + 2$	16(2)	4(3)	1(2)	2	3	2	0	3	2
47	$32 + 12 + 3$	16(2)	4(3)	1(3)	2	3	3	0	3	3
48	$48 + 0 + 0$	16(3)	4(0)	1(0)	3	0	0	1	0	0
49	$48 + 0 + 1$	16(3)	4(0)	1(1)	3	0	1	1	0	1
50	$48 + 0 + 2$	16(3)	4(0)	1(2)	3	0	2	1	0	2
51	$48 + 0 + 3$	16(3)	4(0)	1(3)	3	0	3	1	0	3
52	$48 + 4 + 0$	16(3)	4(1)	1(0)	3	1	0	1	1	0
53	$48 + 4 + 1$	16(3)	4(1)	1(1)	3	1	1	1	1	1
54	$48 + 4 + 2$	16(3)	4(1)	1(2)	3	1	2	1	1	2
55	$48 + 4 + 3$	16(3)	4(1)	1(3)	3	1	3	1	1	3
56	$48 + 8 + 0$	16(3)	4(2)	1(0)	3	2	0	1	2	0
57	$48 + 8 + 1$	16(3)	4(2)	1(1)	3	2	1	1	2	1
58	$48 + 8 + 2$	16(3)	4(2)	1(2)	3	2	2	1	2	2
59	$48 + 8 + 3$	16(3)	4(2)	1(3)	3	2	3	1	2	3
60	$48 + 12 + 0$	16(3)	4(3)	1(0)	3	3	0	1	3	0
61	$48 + 12 + 1$	16(3)	4(3)	1(1)	3	3	1	1	3	1
62	$48 + 12 + 2$	16(3)	4(3)	1(2)	3	3	2	1	3	2
63	$48 + 12 + 3$	16(3)	4(3)	1(3)	3	3	3	1	3	3

What cards should the numbers 1– 32 be placed on ? What color should they be?

Base 10	base 4 16 4 1	On Card 3 Color	On Card 2 Color	On Card 1 Color
1	0 0 1			yes
2	0 0 2			yes
3	0 0 3			yes
4	0 1 0		yes	
5	0 1 1		yes	yes
6	0 1 2		yes	yes
7	0 1 3		yes	yes
8	0 2 0		yes	
9	0 2 1		yes	yes
10	0 2 2		yes	yes
11	0 2 3		yes	yes
12	0 3 0		yes	
13	0 3 1		yes	yes
14	0 3 2		yes	yes
15	0 3 3		yes	yes
16	1 0 0	yes		
17	1 0 1	yes		yes
18	1 0 2	yes		yes
19	1 0 3	yes		
20	1 1 0	yes	yes	
21	1 1 1	yes	yes	yes
22	1 1 2	yes	yes	yes
23	1 1 3	yes	yes	yes
24	1 2 0	yes	yes	
25	1 2 1	yes	yes	yes
26	1 2 2	yes	yes	yes
27	1 2 3	yes	yes	yes
28	1 3 0	yes	yes	
29	1 3 1	yes	yes	yes
30	1 3 2	yes	yes	yes
31	1 3 3	yes	yes	yes
32	2 0 0	yes		

What cards should the numbers 33– 63 be placed on? What color should they be?

Base 10	base 4 16 4 1	card 3 16's	card 2 4's	card 1 1's
33	2 0 1	2	0	1
34	2 0 2	2	0	2
35	2 0 3	2	0	3
36	2 1 0	2	1	0
37	2 1 1	2	1	1
38	2 1 2	2	1	2
39	2 1 3	2	1	3
40	2 2 0	2	2	0
41	2 2 1	2	2	1
42	2 2 2	2	2	2
43	2 2 3	2	2	3
44	2 3 0	2	3	0
45	2 3 1	2	3	1
46	2 3 2	2	3	2
47	2 3 3	2	3	3
48	3 0 0	3	0	0
49	3 0 1	3	0	1
50	3 0 2	3	0	2
51	3 0 3	3	0	3
52	3 1 0	3	1	0
53	3 1 1	3	1	1
54	3 1 2	3	1	2
55	3 1 3	3	1	3
56	3 2 0	3	2	0
57	3 2 1	3	2	1
58	3 2 2	3	2	2
59	3 2 3	3	2	3
60	3 3 0	3	3	0
61	3 3 1	3	3	1
62	3 3 2	3	3	2
63	3 3 3	3	3	3