Name _____ Date _____



Add & Subtract in Binary

Add the binary numbers. Then check: turn them into base ten.

Adding in binary

0 + 0 = 0 0 + 1 = 1 1 + 0 = 1 1 + 1 = 10



1 + 1 is two, so it is written 10: one 2 and no 1.

1.

32	16	8	4	2	1
	1	0	1	0	0
+			1	0	1	0
	1	1	1	1	0

Check: 20 + 10 = 30 Example

2.

32	16	8	4	2	1
	1	0	0	0	1
+			1	1	0	0

Check: ____ + ____ = ____

3.

32	16	8	4	2	1
			1	0	1
+		1	1	0	1	0

Check: ____ + ____ = ____

4.

32	16	8	4	2	1
		1	0	0	1
+				1	1	0

Check: ____ + ____ = ____

5.

32	16	8	4	2	1
	1	1	0	0	0
+					1	1

Check: ____ + ____ = ____

6.

32	16	8	4	2	1
	1	0	0	0	0
+				1	1	1

Check: ____ + ____ = ____

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Add & Subtract in Binary

1 + 1 = 10: write 0 and carry 1 to the next place. Then check.

1.

32	16	8	4	2	1
	1	1	1		
		1	0	1	1
+			1	1	0
	1	0	0	0	1

Check: 11 + 6 = 17 Example

2.

32	16	8	4	2	1
			1	0	1
+				1	1

Check: ____ + ____ = ____

3.

32	16	8	4	2	1
		1	1	0	1
+		1	0	0	1

Check: ____ + ____ = ____

4.

32	16	8	4	2	1
		1	1	0	0
+			1	1	0

Check: ____ + ____ = ____

5.

32	16	8	4	2	1
		1	0	1	0
+			1	1	0

Check: ____ + ____ = ____

6.

32	16	8	4	2	1
	1	0	0	1	1
+			1	1	0

Check: ____ + ____ = ____

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Name _____ Date _____



Add & Subtract in Binary

1 + 1 + 1 = 11: write 1 and carry 1. Then check.

1.

32	16	8	4	2	1
☐	1	1	1	1	
		1	1	1	1
+			1	1	1
☐	1	0	1	1	0

Check: 15 + 7 = 22 Example

2.

32	16	8	4	2	1
☐	☐	☐	☐	☐	
	1	0	1	1	1
+		1	1	0	1
☐	☐	☐	☐	☐	☐

Check: ___ + ___ = ___

3.

32	16	8	4	2	1
☐	☐	☐	☐	☐	
	1	1	0	1	1
+		1	1	1	1
☐	☐	☐	☐	☐	☐

Check: ___ + ___ = ___

4.

32	16	8	4	2	1
☐	☐	☐	☐	☐	
	1	1	1	0	1
+		1	0	1	1
☐	☐	☐	☐	☐	☐

Check: ___ + ___ = ___

5.

32	16	8	4	2	1
☐	☐	☐	☐	☐	
	1	1	1	1	1
+					1
☐	☐	☐	☐	☐	☐

Check: ___ + ___ = ___

6.

32	16	8	4	2	1
☐	☐	☐	☐	☐	
	1	1	0	1	0
+	1	0	1	1	0
☐	☐	☐	☐	☐	☐

Check: ___ + ___ = ___

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Name _____ Date _____



Add & Subtract in Binary

Subtract the binary numbers. Then check in base ten.

Subtracting in binary

0 – 0 = 0 1 – 0 = 1 1 – 1 = 0 10 – 1 = 1

10 is two, so 10 – 1 is two take away one: 1.

1.

	32	16	8	4	2	1
			1	1	1	0	1
–				1	1	0	0
		1	0	0	0	1

Check: 29 – 12 = 17 Example

2.

	32	16	8	4	2	1
			1	1	1	1	1
–				1	0	1	0

Check: ___ – ___ = ___

3.

	32	16	8	4	2	1
			1	1	0	1	1
–				1	0	0	1	0

Check: ___ – ___ = ___

4.

	32	16	8	4	2	1
			1	0	1	1	0
–					1	0	0

Check: ___ – ___ = ___

5.

	32	16	8	4	2	1
				1	1	1	1
–				1	0	0	1

Check: ___ – ___ = ___

6.

	32	16	8	4	2	1
			1	1	0	1	0
–		1	1	0	0	0

Check: ___ – ___ = ___

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Name _____ Date _____



Add & Subtract in Binary

Can't take 1 from 0? Borrow from the next place: it is 10 here.

1.

32	16	8	4	2	1
			0	1	10
			1	~~1~~	~~0~~ 0
−				1	1
		1	0	0	1

Check: 12 − 3 = 9 Example

2.

32	16	8	4	2	1
	1	0	0	0	0
−				1	0	1

Check: ___ − ___ = ___

3.

32	16	8	4	2	1
	1	0	1	1	0
−			1	0	0	1

Check: ___ − ___ = ___

4.

32	16	8	4	2	1
	1	1	0	0	1
−				1	1	0

Check: ___ − ___ = ___

5.

32	16	8	4	2	1
	1	0	1	0	0
−				1	1

Check: ___ − ___ = ___

6.

32	16	8	4	2	1
	1	0	0	1	1
−			1	1	0	0

Check: ___ − ___ = ___

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Name _____ Date _____



Add & Subtract in Binary

Is each answer right? Circle. Fix the wrong ones in the boxes.

1.

	32	16	8	4	2	1
Example			1	1	0	1
+				1	1	0
			1	2	1	1

Right (Wrong)

Fix: 1 0 0 1 1

2.

	32	16	8	4	2	1
				1	1	0
+				1	1	1
			1	1	0	1

Right Wrong

Fix: _____

3.

	32	16	8	4	2	1
			1	0	1	1
+				1	0	1
			1	1	1	0

Right Wrong

Fix: _____

4.

	32	16	8	4	2	1
			1	1	0	0
−				1	0	1
			1	0	0	1

Right Wrong

Fix: _____

5.

	32	16	8	4	2	1
		1	0	1	0	1
−				1	0	1
		1	0	0	0	0

Right Wrong

Fix: _____

6.

	32	16	8	4	2	1
			1	1	1	0
+					1	1
		1	0	0	0	1

Right Wrong

Fix: _____

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Name _____ Date _____



Add & Subtract in Binary

A magic trick! Each card is one binary place in disguise.

Card A			
4	5	6	7
12	13	14	15
20	21	22	23
28	29	30	31

Card B			
1	3	5	7
9	11	13	15
17	19	21	23
25	27	29	31

Card C			
16	17	18	19
20	21	22	23
24	25	26	27
28	29	30	31

Card D			
2	3	6	7
10	11	14	15
18	19	22	23
26	27	30	31

Card E			
8	9	10	11
12	13	14	15
24	25	26	27
28	29	30	31

1. Ask a friend to think of a number from **1** to **31** and tell you which cards it is on.
2. Add the first number on each of those cards. That is your friend's number!

What number is it?

Example

On cards B, D and E **11**

On cards A and C _____

On cards A, B, C, D and E _____

On card E only _____

Which cards is it on?

13 _____

22 _____

7 _____

Why does it work?

Card B holds every number whose binary code ends in _____

Card C is the binary place worth _____

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Name _____ Date _____



Add & Subtract in Binary

Add the binary numbers. Then check: turn them into base ten.

Adding in binary

0 + 0 = 0 0 + 1 = 1 1 + 0 = 1 1 + 1 = 10



1 + 1 is two, so it is written 10: one 2 and no 1.

1.

32	16	8	4	2	1
	1	0	1	0	0
+			1	0	1	0
	1	1	1	1	0

Check: 20 + 10 = 30 Example

2.

32	16	8	4	2	1
	1	0	0	0	1
+			1	1	0	0

Check: ___ + ___ = ___

3.

32	16	8	4	2	1
			1	0	1
+		1	1	0	1	0

Check: ___ + ___ = ___

4.

32	16	8	4	2	1
		1	0	0	1
+				1	1	0

Check: ___ + ___ = ___

5.

32	16	8	4	2	1
	1	1	0	0	0
+					1	1

Check: ___ + ___ = ___

6.

32	16	8	4	2	1
	1	0	0	0	0
+				1	1	1

Check: ___ + ___ = ___

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Name _____ Date _____



Add & Subtract in Binary

1 + 1 = 10: write 0 and carry 1 to the next place. Then check.

1.

32	16	8	4	2	1
	1	1	1		
		1	0	1	1
+			1	1	0
	1	0	0	0	1

Check: 11 + 6 = 17 Example

2.

32	16	8	4	2	1
			1	0	1
+				1	1

Check: ___ + ___ = ___

3.

32	16	8	4	2	1
		1	1	0	1
+		1	0	0	1

Check: ___ + ___ = ___

4.

32	16	8	4	2	1
		1	1	0	0
+			1	1	0

Check: ___ + ___ = ___

5.

32	16	8	4	2	1
		1	0	1	0
+			1	1	0

Check: ___ + ___ = ___

6.

32	16	8	4	2	1
	1	0	0	1	1
+			1	1	0

Check: ___ + ___ = ___

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Name _____ Date _____



Add & Subtract in Binary

1 + 1 + 1 = 11: write 1 and carry 1. Then check.

1.

32	16	8	4	2	1
	1	1	1	1	
		1	1	1	1
+			1	1	1
	1	0	1	1	0

Check: 15 + 7 = 22 Example

2.

32	16	8	4	2	1
	1	0	1	1	1
+		1	1	0	1

Check: ___ + ___ = ___

3.

32	16	8	4	2	1
	1	1	0	1	1
+		1	1	1	1

Check: ___ + ___ = ___

4.

32	16	8	4	2	1
	1	1	1	0	1
+		1	0	1	1

Check: ___ + ___ = ___

5.

32	16	8	4	2	1
	1	1	1	1	1
+					1

Check: ___ + ___ = ___

6.

32	16	8	4	2	1
	1	1	0	1	0
+	1	0	1	1	0

Check: ___ + ___ = ___

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Name _____ Date _____



Add & Subtract in Binary

Subtract the binary numbers. Then check in base ten.

Subtracting in binary

0 – 0 = 0 1 – 0 = 1 1 – 1 = 0 10 – 1 = 1

10 is two, so **10 – 1** is two take away one: **1**.

1.

32	16	8	4	2	1
	1	1	1	0	1
–		1	1	0	0
	1	0	0	0	1

Check: 29 – 12 = 17 Example

2.

32	16	8	4	2	1
	1	1	1	1	1
–		1	0	1	0

Check: ___ – ___ = ___

3.

32	16	8	4	2	1
	1	1	0	1	1
–		1	0	0	1	0

Check: ___ – ___ = ___

4.

32	16	8	4	2	1
	1	0	1	1	0
–			1	0	0

Check: ___ – ___ = ___

5.

32	16	8	4	2	1
		1	1	1	1
–		1	0	0	1

Check: ___ – ___ = ___

6.

32	16	8	4	2	1
	1	1	0	1	0
–	1	1	0	0	0

Check: ___ – ___ = ___

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Name _____ Date _____



Add & Subtract in Binary

Can't take 1 from 0? Borrow from the next place: it is 10 here.

1.

32	16	8	4	2	1
			0	1	10
			1	~~1~~	~~0~~	~~0~~
−				1	1
			1	0	0	1

Check: 12 − 3 = 9 Example

2.

32	16	8	4	2	1
			1	0	0	0	0
−				1	0	1

Check: ___ − ___ = ___

3.

32	16	8	4	2	1
		1	0	1	1	0
−			1	0	0	1

Check: ___ − ___ = ___

4.

32	16	8	4	2	1
		1	1	0	0	1
−				1	1	0

Check: ___ − ___ = ___

5.

32	16	8	4	2	1
		1	0	1	0	0
−				1	1

Check: ___ − ___ = ___

6.

32	16	8	4	2	1
		1	0	0	1	1
−			1	1	0	0

Check: ___ − ___ = ___

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Name _____ Date _____



Add & Subtract in Binary

Is each answer right? Circle. Fix the wrong ones in the boxes.

1.

	32	16	8	4	2	1
Example			1	1	0	1
+				1	1	0
			1	2	1	1

Right (Wrong)

Fix: 1 0 0 1 1

2.

	32	16	8	4	2	1
				1	1	0
+				1	1	1
			1	1	0	1

Right Wrong

Fix: _____

3.

	32	16	8	4	2	1
			1	0	1	1
+				1	0	1
			1	1	1	0

Right Wrong

Fix: _____

4.

	32	16	8	4	2	1
			1	1	0	0
−				1	0	1
			1	0	0	1

Right Wrong

Fix: _____

5.

	32	16	8	4	2	1
		1	0	1	0	1
−				1	0	1
		1	0	0	0	0

Right Wrong

Fix: _____

6.

	32	16	8	4	2	1
			1	1	1	0
+					1	1
		1	0	0	0	1

Right Wrong

Fix: _____

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Name _____ Date _____



Add & Subtract in Binary

A magic trick! Each card is one binary place in disguise.

Card A			
4	5	6	7
12	13	14	15
20	21	22	23
28	29	30	31

Card B			
1	3	5	7
9	11	13	15
17	19	21	23
25	27	29	31

Card C			
16	17	18	19
20	21	22	23
24	25	26	27
28	29	30	31

Card D			
2	3	6	7
10	11	14	15
18	19	22	23
26	27	30	31

Card E			
8	9	10	11
12	13	14	15
24	25	26	27
28	29	30	31

1. Ask a friend to think of a number from **1** to **31** and tell you which cards it is on.
2. Add the first number on each of those cards. That is your friend's number!

What number is it?

Example

On cards B, D and E **11**

On cards A and C _____

On cards A, B, C, D and E _____

On card E only _____

Which cards is it on?

13 _____

22 _____

7 _____

Why does it work?

Card B holds every number whose binary code ends in _____

Card C is the binary place worth _____

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Add & Subtract in Binary

Add the binary numbers. Then check: turn them into base ten.

Adding in binary

0 + 0 = 0 **0 + 1 = 1** **1 + 0 = 1** **1 + 1 = 10**



1 + 1 is two, so it is written 10: one 2 and no 1.

1.

32	16	8	4	2	1
	1	0	1	0	0
+			1	0	1	0
	1	1	1	1	0

Check: 20 + 10 = 30 (Example)

2.

32	16	8	4	2	1
	1	0	0	0	1
+			1	1	0	0
	1	1	1	0	1

Check: 17 + 12 = 29

3.

32	16	8	4	2	1
			1	0	1
+		1	1	0	1	0
	1	1	1	1	1

Check: 5 + 26 = 31

4.

32	16	8	4	2	1
		1	0	0	1
+				1	1	0
		1	1	1	1

Check: 9 + 6 = 15

5.

32	16	8	4	2	1
	1	1	0	0	0
+					1	1
	1	1	0	1	1

Check: 24 + 3 = 27

6.

32	16	8	4	2	1
	1	0	0	0	0
+				1	1	1
	1	0	1	1	1

Check: 16 + 7 = 23

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Add & Subtract in Binary

1 + 1 = 10: write 0 and carry 1 to the next place. Then check.

1.

32	16	8	4	2	1
	1	1	1		
		1	0	1	1
+			1	1	0
	1	0	0	0	1

Check: 11 + 6 = 17 (Example)

2.

32	16	8	4	2	1
		1	1	1	
			1	0	1
+				1	1
		1	0	0	0

Check: 5 + 3 = 8

3.

32	16	8	4	2	1
	1			1	
		1	1	0	1
+		1	0	0	1
	1	0	1	1	0

Check: 13 + 9 = 22

4.

32	16	8	4	2	1
	1	1			
		1	1	0	0
+			1	1	0
	1	0	0	1	0

Check: 12 + 6 = 18

5.

32	16	8	4	2	1
	1	1	1		
		1	0	1	0
+			1	1	0
	1	0	0	0	0

Check: 10 + 6 = 16

6.

32	16	8	4	2	1
		1	1		
	1	0	0	1	1
+			1	1	0
	1	1	0	0	1

Check: 19 + 6 = 25

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Add & Subtract in Binary

1 + 1 + 1 = 11: write 1 and carry 1. Then check.

1.

32	16	8	4	2	1
	1	1	1	1	
		1	1	1	1
+			1	1	1
	1	0	1	1	0

Check: 15 + 7 = 22 (Example)

2.

32	16	8	4	2	1
1	1	1	1	1	
	1	0	1	1	1
+		1	1	0	1
1	0	0	1	0	0

Check: 23 + 13 = 36

3.

32	16	8	4	2	1
1	1	1	1	1	
	1	1	0	1	1
+		1	1	1	1
1	0	1	0	1	0

Check: 27 + 15 = 42

4.

32	16	8	4	2	1
1	1	1	1	1	
	1	1	1	0	1
+		1	0	1	1
1	0	1	0	0	0

Check: 29 + 11 = 40

5.

32	16	8	4	2	1
1	1	1	1	1	
	1	1	1	1	1
+					1
1	0	0	0	0	0

Check: 31 + 1 = 32

6.

32	16	8	4	2	1
1	1	1	1		
	1	1	0	1	0
+		1	0	1	1	0
1	1	0	0	0	0

Check: 26 + 22 = 48

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Add & Subtract in Binary

Subtract the binary numbers. Then check in base ten.

Subtracting in binary

0 – 0 = 0 1 – 0 = 1 1 – 1 = 0 10 – 1 = 1

10 is two, so 10 – 1 is two take away one: 1.

1.

32	16	8	4	2	1
	1	1	1	0	1
–		1	1	0	0
	1	0	0	0	1

Check: 29 – 12 = 17 (Example)

2.

32	16	8	4	2	1
	1	1	1	1	1
–		1	0	1	0
	1	0	1	0	1

Check: 31 – 10 = 21

3.

32	16	8	4	2	1
	1	1	0	1	1
–		1	0	0	1	0
		1	0	0	1

Check: 27 – 18 = 9

4.

32	16	8	4	2	1
	1	0	1	1	0
–			1	0	0
	1	0	0	1	0

Check: 22 – 4 = 18

5.

32	16	8	4	2	1
		1	1	1	1
–		1	0	0	1
			1	1	0

Check: 15 – 9 = 6

6.

32	16	8	4	2	1
	1	1	0	1	0
–	1	1	0	0	0
				1	0

Check: 26 – 24 = 2

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Add & Subtract in Binary

Can't take 1 from 0? Borrow from the next place: it is 10 here.

1.

32	16	8	4	2	1
			0	1	10
			1	~~1~~	~~0~~	~~0~~
–				1	1
			1	0	0	1

Check: 12 – 3 = 9 (Example)

2.

32	16	8	4	2	1
		0	1	1	1	10
		~~1~~	~~0~~	~~0~~	~~0~~	~~0~~
–				1	0	1
			1	0	1	1

Check: 16 – 5 = 11

3.

32	16	8	4	2	1
	0	10		0	10
	~~1~~	~~0~~	1	~~1~~	~~0~~
–			1	0	0	1
			1	1	0	1

Check: 22 – 9 = 13

4.

32	16	8	4	2	1
		0	1	10	
		1	~~1~~	~~0~~	~~0~~	1
–				1	1	0
		1	0	0	1	1

Check: 25 – 6 = 19

5.

32	16	8	4	2	1
			0	1	10
	1	0	~~1~~	~~0~~	~~0~~
–				1	1
	1	0	0	0	1

Check: 20 – 3 = 17

6.

32	16	8	4	2	1
		0	1	10		
		~~1~~	~~0~~	~~0~~	1	1
–			1	1	0	0
			1	1	1

Check: 19 – 12 = 7

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Add & Subtract in Binary

Is each answer right? Circle. Fix the wrong ones in the boxes.

1. Example

32	16	8	4	2	1
		1	1	0	1
+			1	1	0
		1	2	1	1

Right (Wrong)

Fix: 1 0 0 1 1

2.

32	16	8	4	2	1
			1	1	0
+			1	1	1
		1	1	0	1

(Right) Wrong

Fix:

3.

32	16	8	4	2	1
		1	0	1	1
+			1	0	1
		1	1	1	0

Right (Wrong)

Fix: 1 0 0 0 0

4.

32	16	8	4	2	1
		1	1	0	0
−			1	0	1
		1	0	0	1

Right (Wrong)

Fix: 1 1 1

5.

32	16	8	4	2	1
	1	0	1	0	1
−			1	0	1
	1	0	0	0	0

(Right) Wrong

Fix:

6.

32	16	8	4	2	1
		1	1	1	0
+				1	1
	1	0	0	0	1

(Right) Wrong

Fix:

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Add & Subtract in Binary

A magic trick! Each card is one binary place in disguise.

Card A			
4	5	6	7
12	13	14	15
20	21	22	23
28	29	30	31

Card B			
1	3	5	7
9	11	13	15
17	19	21	23
25	27	29	31

Card C			
16	17	18	19
20	21	22	23
24	25	26	27
28	29	30	31

Card D			
2	3	6	7
10	11	14	15
18	19	22	23
26	27	30	31

Card E			
8	9	10	11
12	13	14	15
24	25	26	27
28	29	30	31

1. Ask a friend to think of a number from **1** to **31** and tell you which cards it is on.
2. Add the first number on each of those cards. That is your friend's number!

What number is it?

Example

On cards B, D and E **11**

On cards A and C **20**

On cards A, B, C, D and E **31**

On card E only **8**

Which cards is it on?

13 A, B, E

22 A, C, D

7 A, B, D

Why does it work?

Card B holds every number whose binary code ends in **1**

Card C is the binary place worth **16**

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