

Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



TEST RUNS		
TEST 1		
3	→	12
TEST 2		
5	→	20
TEST 3		
8	→	32

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

	AGENT J Add 9	AGENT R Add 15	MY GUESS _____
Test 1			
Test 2			
Test 3			

2 Finish the log

Some rows run backward.

IN	OUT
6	_____
10	_____
_____	36
_____	4
_____	48

DECODER DIAL



3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

	32	12	44	24	48	8
	↓	↓	↓	↓	↓	↓
IN	_____	_____	_____	_____	_____	_____
	□	□	□	□	□	□

To run the machine backward, _____ by 4.

The signal says _____

4 Prove it

Can this machine ever print 30? Explain.

Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



TEST RUNS		
TEST 1		
4	→	12
TEST 2		
6	→	18
TEST 3		
9	→	27

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

	AGENT J Add 8	AGENT R Add 12	MY GUESS _____
Test 1			
Test 2			
Test 3			

2 Finish the log

Some rows run backward.

IN	OUT
5	_____
7	_____
_____	33
_____	6
_____	24

DECODER DIAL



3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

	6	30	18	36	27	24
	↓	↓	↓	↓	↓	↓
IN	_____	_____	_____	_____	_____	_____

To run the machine backward, _____ by 3.

The signal says _____

4 Prove it

Can this machine ever print 20? Explain.



Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



TEST RUNS

TEST 1
2 → 10

TEST 2
7 → 35

TEST 3
4 → 20

1 Test the guesses

Write ✓ if a guess works for a test run, or ✗ if it does not. Then make your own guess.

	AGENT J Add 8	AGENT R Add 16	MY GUESS _____
Test 1			
Test 2			
Test 3			

2 Finish the log

Some rows run backward.

IN	OUT
3	_____
9	_____
_____	40
_____	55
_____	5

DECODER DIAL



3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

15	20	10	30	60	45
↓	↓	↓	↓	↓	↓
IN _____	_____	_____	_____	_____	_____

To run the machine backward, _____ by 5.

The signal says _____

4 Prove it

Can this machine ever print 32? Explain.

Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



TEST RUNS		
TEST 1		
3	→	18
TEST 2		
5	→	30
TEST 3		
9	→	54

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

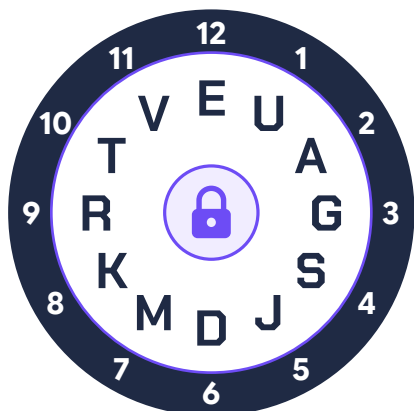
	AGENT J Add 15	AGENT R Add 25	MY GUESS _____
Test 1			
Test 2			
Test 3			

2 Finish the log

Some rows run backward.

IN	OUT
4	_____
8	_____
_____	42
_____	12
_____	66

DECODER DIAL



3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

	42	12	24	60	72	54
	↓	↓	↓	↓	↓	↓
IN	_____	_____	_____	_____	_____	_____

To run the machine backward, _____ by 6.

The signal says _____

4 Prove it

Can this machine ever print 40? Explain.



Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



TEST RUNS		
TEST 1		
2	→	8
TEST 2		
3	→	9
TEST 3		
8	→	14

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

	AGENT J Multiply by 4	AGENT R Multiply by 3	MY GUESS _____
Test 1			
Test 2			
Test 3			

2 Finish the log

Some rows run backward.

IN	OUT
4	_____
7	_____
_____	16
_____	10
_____	18

DECODER DIAL



3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

12	7	11	14	9	13
↓	↓	↓	↓	↓	↓
IN _____	_____	_____	_____	_____	_____

To run the machine backward, _____ 6.

The signal says _____

4 Prove it

The machine printed 20. What number went IN?



Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



TEST RUNS		
TEST 1	3 →	12
TEST 2	9 →	18
TEST 3	5 →	14

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

	AGENT J Multiply by 4	AGENT R Multiply by 2	MY GUESS _____
Test 1			
Test 2			
Test 3			

2 Finish the log

Some rows run backward.

IN	OUT
6	_____
2	_____
_____	20
_____	11
_____	19

DECODER DIAL



3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

	17	15	11	12	16	21
	↓	↓	↓	↓	↓	↓
IN	_____	_____	_____	_____	_____	_____

To run the machine backward, _____ 9.

The signal says _____

4 Prove it

The machine printed 25. What number went IN?



Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



TEST RUNS

TEST 1
3 → 24

TEST 2
7 → 56

TEST 3
6 → 48

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

	AGENT J Add 21	AGENT R Add 42	MY GUESS _____
Test 1			
Test 2			
Test 3			

2 Finish the log

Some rows run backward.

IN	OUT
9	_____
_____	40
_____	96
_____	16
_____	72

DECODER DIAL



3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

96	80	72	16	32	56
↓	↓	↓	↓	↓	↓
IN _____	_____	_____	_____	_____	_____

To run the machine backward, _____ by 8.

The signal says _____

4 Prove it

Can this machine ever print 60? Explain.

Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



TEST RUNS		
TEST 1		
4	→	36
TEST 2		
8	→	72
TEST 3		
6	→	54

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

	AGENT J Add 32	AGENT R Add 48	MY GUESS _____
Test 1			
Test 2			
Test 3			

2 Finish the log

Some rows run backward.

IN	OUT
7	_____
_____	99
_____	27
_____	108
_____	45

DECODER DIAL



3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

54	45	63	99	108	9
↓	↓	↓	↓	↓	↓
IN _____	_____	_____	_____	_____	_____

To run the machine backward, _____ by 9.

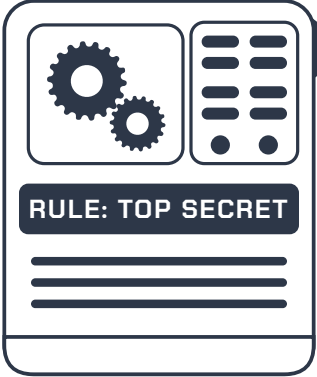
The signal says _____

4 Prove it

Can this machine ever print 50? Explain.

Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



RULE: TOP SECRET

TEST RUNS

TEST 1
3 → 12

TEST 2
5 → 20

TEST 3
8 → 32

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

	AGENT J Add 9	AGENT R Add 15	MY GUESS _____
Test 1			
Test 2			
Test 3			

2 Finish the log

Some rows run backward.

IN	OUT
6	_____
10	_____
_____	36
_____	4
_____	48

DECODER DIAL



The secret rule is _____.

3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

32

12

44

24

48

8

↓ ↓ ↓ ↓ ↓ ↓

IN _____

□

□

□

□

□

□

To run the machine backward, _____ by 4.

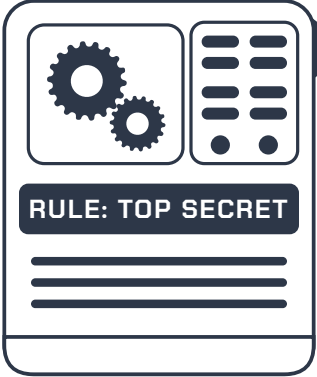
The signal says _____

4 Prove it

Can this machine ever print 30? Explain.

Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



RULE: TOP SECRET

TEST RUNS

TEST 1
4 → 12

TEST 2
6 → 18

TEST 3
9 → 27

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

	AGENT J Add 8	AGENT R Add 12	MY GUESS _____
Test 1			
Test 2			
Test 3			

2 Finish the log

Some rows run backward.

IN	OUT
5	_____
7	_____
_____	33
_____	6
_____	24

The secret rule is _____.

3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

6

30

18

36

27

24

↓ ↓ ↓ ↓ ↓ ↓

IN _____

□

□

□

□

□

□

To run the machine backward, _____ by 3.

The signal says _____

4 Prove it

Can this machine ever print 20? Explain.

DECODER DIAL





Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



TEST RUNS

TEST 1
2 → 10

TEST 2
7 → 35

TEST 3
4 → 20

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

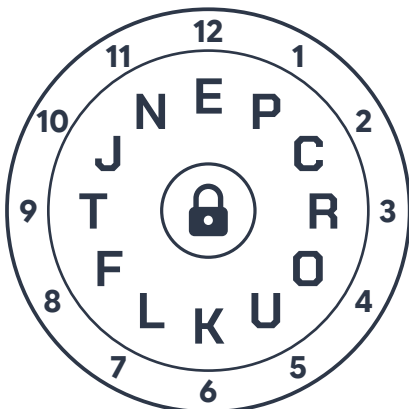
	AGENT J Add 8	AGENT R Add 16	MY GUESS _____
Test 1			
Test 2			
Test 3			

2 Finish the log

Some rows run backward.

IN	OUT
3	_____
9	_____
_____	40
_____	55
_____	5

DECODER DIAL



3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

15	20	10	30	60	45
↓	↓	↓	↓	↓	↓
IN _____	_____	_____	_____	_____	_____

To run the machine backward, _____ by 5.

The signal says _____

4 Prove it

Can this machine ever print 32? Explain.



Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



TEST RUNS

TEST 1
3 → 18

TEST 2
5 → 30

TEST 3
9 → 54

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

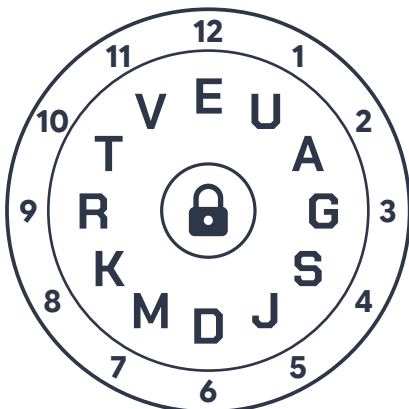
	AGENT J Add 15	AGENT R Add 25	MY GUESS _____
Test 1			
Test 2			
Test 3			

2 Finish the log

Some rows run backward.

IN	OUT
4	_____
8	_____
_____	42
_____	12
_____	66

DECODER DIAL



3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

42	12	24	60	72	54
↓	↓	↓	↓	↓	↓
IN _____	_____	_____	_____	_____	_____

To run the machine backward, _____ by 6.

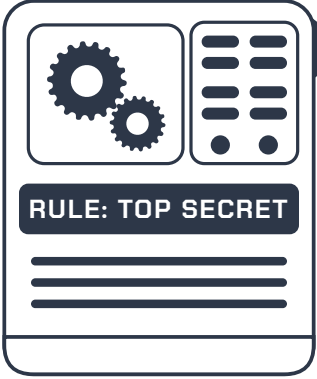
The signal says _____

4 Prove it

Can this machine ever print 40? Explain.

Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



RULE: TOP SECRET

TEST RUNS

TEST 1
2 → 8

TEST 2
3 → 9

TEST 3
8 → 14

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

	AGENT J Multiply by 4	AGENT R Multiply by 3	MY GUESS _____
Test 1			
Test 2			
Test 3			

2 Finish the log

Some rows run backward.

IN	OUT
4	_____
7	_____
_____	16
_____	10
_____	18

The secret rule is _____.

3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

12

7

11

14

9

13

↓

↓

↓

↓

↓

↓

IN

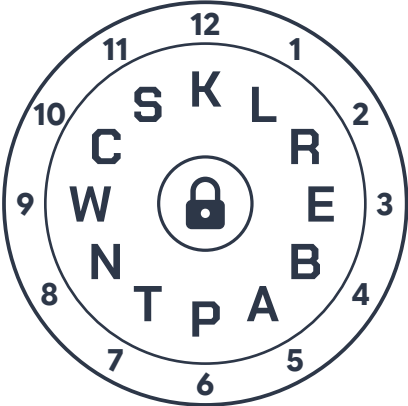
To run the machine backward, _____ 6.

The signal says _____

4 Prove it

The machine printed 20. What number went IN?

DECODER DIAL





Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



TEST RUNS

TEST 1
3 → 12

TEST 2
9 → 18

TEST 3
5 → 14

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

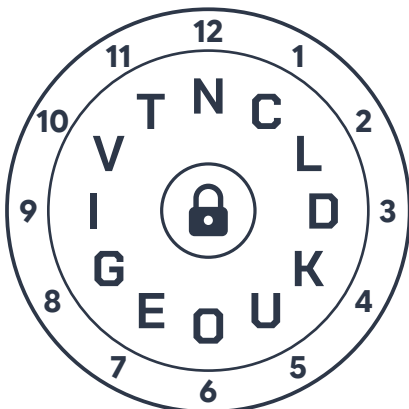
	AGENT J Multiply by 4	AGENT R Multiply by 2	MY GUESS _____
Test 1			
Test 2			
Test 3			

2 Finish the log

Some rows run backward.

IN	OUT
6	_____
2	_____
_____	20
_____	11
_____	19

DECODER DIAL



3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

17	15	11	12	16	21
↓	↓	↓	↓	↓	↓
IN _____	_____	_____	_____	_____	_____

To run the machine backward, _____ 9.

The signal says _____

4 Prove it

The machine printed 25. What number went IN?



Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



TEST RUNS

TEST 1
3 → 24

TEST 2
7 → 56

TEST 3
6 → 48

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

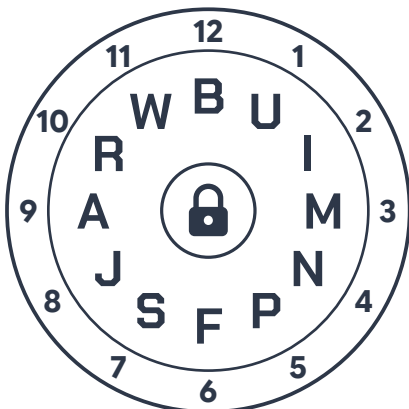
	AGENT J Add 21	AGENT R Add 42	MY GUESS _____
Test 1			
Test 2			
Test 3			

2 Finish the log

Some rows run backward.

IN	OUT
9	_____
_____	40
_____	96
_____	16
_____	72

DECODER DIAL



3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

96	80	72	16	32	56
↓	↓	↓	↓	↓	↓
IN _____	_____	_____	_____	_____	_____

To run the machine backward, _____ by 8.

The signal says _____

4 Prove it

Can this machine ever print 60? Explain.

Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



TEST RUNS		
TEST 1		
4	→	36
TEST 2		
8	→	72
TEST 3		
6	→	54

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

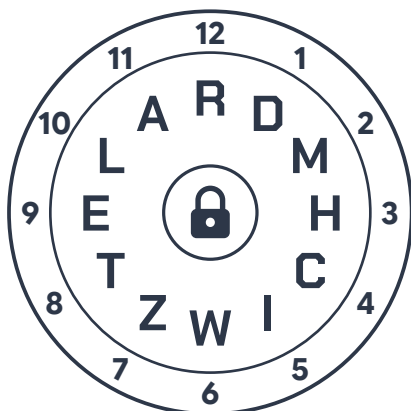
	AGENT J Add 32	AGENT R Add 48	MY GUESS _____
Test 1			
Test 2			
Test 3			

2 Finish the log

Some rows run backward.

IN	OUT
7	_____
_____	99
_____	27
_____	108
_____	45

DECODER DIAL



3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

54	45	63	99	108	9
↓	↓	↓	↓	↓	↓
IN _____	_____	_____	_____	_____	_____

To run the machine backward, _____ by 9.

The signal says _____

4 Prove it

Can this machine ever print 50? Explain.

Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



TEST RUNS		
TEST 1		
3	→	12
TEST 2		
5	→	20
TEST 3		
8	→	32

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

	AGENT J Add 9	AGENT R Add 15	MY GUESS <i>Multiply by 4</i>
Test 1	✓	X	✓
Test 2	X	✓	✓
Test 3	X	X	✓

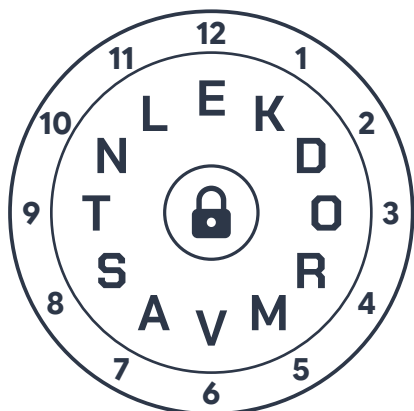
The secret rule is *Multiply by 4*.

2 Finish the log

Some rows run backward.

IN	OUT
6	<u>24</u>
10	<u>40</u>
<u>9</u>	36
<u>1</u>	4
<u>12</u>	48

DECODER DIAL



3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

	32	12	44	24	48	8
	↓	↓	↓	↓	↓	↓
IN	<u>8</u>	<u>3</u>	<u>11</u>	<u>6</u>	<u>12</u>	<u>2</u>
	<u>S</u>	<u>O</u>	<u>L</u>	<u>V</u>	<u>E</u>	<u>D</u>

To run the machine backward, *divide* by 4.

The signal says *SOLVED*

4 Prove it

Can this machine ever print 30? Explain.

No. Every output is a multiple of 4.

$7 \times 4 = 28$ and $8 \times 4 = 32$, so 30 is skipped.

Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



TEST RUNS		
TEST 1		
4	→	12
TEST 2		
6	→	18
TEST 3		
9	→	27

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

	AGENT J Add 8	AGENT R Add 12	MY GUESS <u>Multiply by 3</u>
Test 1	✓	X	✓
Test 2	X	✓	✓
Test 3	X	X	✓

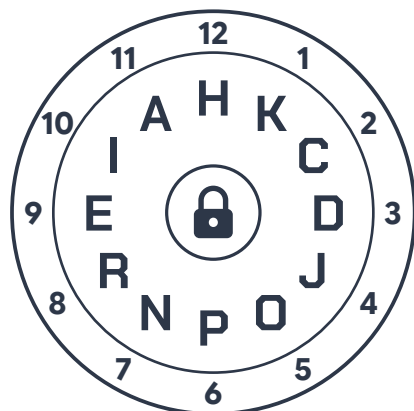
The secret rule is Multiply by 3.

2 Finish the log

Some rows run backward.

IN	OUT
5	<u>15</u>
7	<u>21</u>
<u>11</u>	33
<u>2</u>	6
<u>8</u>	24

DECODER DIAL



3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

	6	30	18	36	27	24
	↓	↓	↓	↓	↓	↓
IN	<u>2</u>	<u>10</u>	<u>6</u>	<u>12</u>	<u>9</u>	<u>8</u>
	<u>C</u>	<u>I</u>	<u>P</u>	<u>H</u>	<u>E</u>	<u>R</u>

To run the machine backward, divide by 3.

The signal says CIPHER

4 Prove it

Can this machine ever print 20? Explain.

No. Every output is a multiple of 3.

$6 \times 3 = 18$ and $7 \times 3 = 21$, so 20 is skipped.

Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



TEST RUNS		
TEST 1		
2	→	10
TEST 2		
7	→	35
TEST 3		
4	→	20

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

	AGENT J Add 8	AGENT R Add 16	MY GUESS <u>Multiply by 5</u>
Test 1	✓	X	✓
Test 2	X	X	✓
Test 3	X	✓	✓

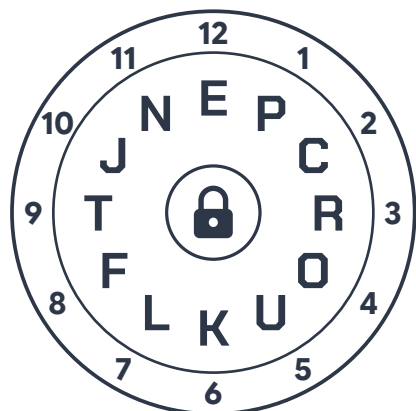
The secret rule is Multiply by 5.

2 Finish the log

Some rows run backward.

IN	OUT
3	<u>15</u>
9	<u>45</u>
<u>8</u>	40
<u>11</u>	55
<u>1</u>	5

DECODER DIAL



3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

	15	20	10	30	60	45
	↓	↓	↓	↓	↓	↓
IN	<u>3</u>	<u>4</u>	<u>2</u>	<u>6</u>	<u>12</u>	<u>9</u>
	<u>R</u>	<u>O</u>	<u>C</u>	<u>K</u>	<u>E</u>	<u>T</u>

To run the machine backward, divide by 5.

The signal says ROCKET

4 Prove it

Can this machine ever print 32? Explain.

No. Every output is a multiple of 5.

$6 \times 5 = 30$ and $7 \times 5 = 35$, so 32 is skipped.

Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



TEST RUNS		
TEST 1	3 →	18
TEST 2	5 →	30
TEST 3	9 →	54

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

	AGENT J Add 15	AGENT R Add 25	MY GUESS <i>Multiply by 6</i>
Test 1	✓	X	✓
Test 2	X	✓	✓
Test 3	X	X	✓

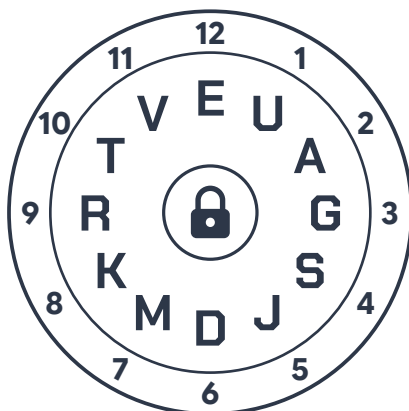
The secret rule is *Multiply by 6*.

2 Finish the log

Some rows run backward.

IN	OUT
4	<u>24</u>
8	<u>48</u>
<u>7</u>	42
<u>2</u>	12
<u>11</u>	66

DECODER DIAL



3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

	42	12	24	60	72	54
	↓	↓	↓	↓	↓	↓
IN	<u>7</u>	<u>2</u>	<u>4</u>	<u>10</u>	<u>12</u>	<u>9</u>
	<u>M</u>	<u>A</u>	<u>S</u>	<u>T</u>	<u>E</u>	<u>R</u>

To run the machine backward, *divide* by 6.

The signal says *MASTER*

4 Prove it

Can this machine ever print 40? Explain.

No. Every output is a multiple of 6.

6 × 6 = 36 and 7 × 6 = 42, so 40 is skipped.

Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



TEST RUNS		
TEST 1		
2	→	8
TEST 2		
3	→	9
TEST 3		
8	→	14

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

	AGENT J Multiply by 4	AGENT R Multiply by 3	MY GUESS <u>Add 6</u>
Test 1	✓	X	✓
Test 2	X	✓	✓
Test 3	X	X	✓

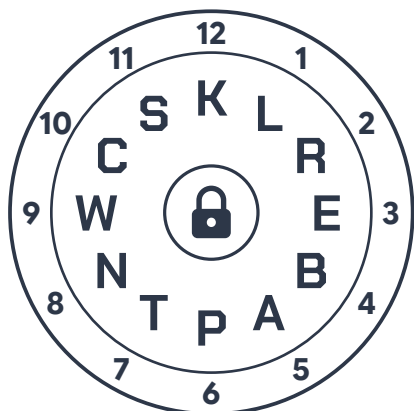
The secret rule is Add 6.

2 Finish the log

Some rows run backward.

IN	OUT
4	<u>10</u>
7	<u>13</u>
<u>10</u>	16
<u>4</u>	10
<u>12</u>	18

DECODER DIAL



3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

	12	7	11	14	9	13
	↓	↓	↓	↓	↓	↓
IN	<u>6</u>	<u>1</u>	<u>5</u>	<u>8</u>	<u>3</u>	<u>7</u>
	P	L	A	N	E	T

To run the machine backward, subtract 6.

The signal says PLANET

4 Prove it

The machine printed 20. What number went IN?

14, because $20 - 6 = 14$.

Run the machine backward: subtract 6.

Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



TEST RUNS		
TEST 1		
3	→	12
TEST 2		
9	→	18
TEST 3		
5	→	14

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

	AGENT J Multiply by 4	AGENT R Multiply by 2	MY GUESS <u>Add 9</u>
Test 1	✓	X	✓
Test 2	X	✓	✓
Test 3	X	X	✓

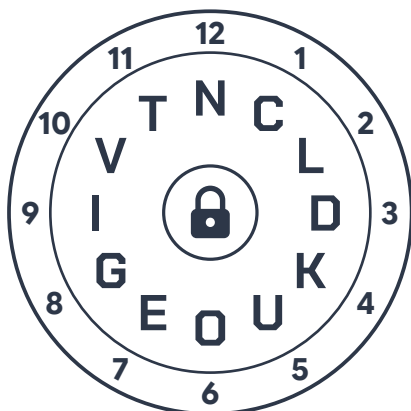
The secret rule is Add 9.

2 Finish the log

Some rows run backward.

IN	OUT
6	<u>15</u>
2	<u>11</u>
<u>11</u>	20
<u>2</u>	11
<u>10</u>	19

DECODER DIAL



3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

	17	15	11	12	16	21
	↓	↓	↓	↓	↓	↓
IN	<u>8</u>	<u>6</u>	<u>2</u>	<u>3</u>	<u>7</u>	<u>12</u>
	G	O	L	D	E	N

To run the machine backward, subtract 9.

The signal says GOLDEN

4 Prove it

The machine printed 25. What number went IN?

16, because $25 - 9 = 16$.

Run the machine backward: subtract 9.

Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



TEST RUNS		
TEST 1		
3	→	24
TEST 2		
7	→	56
TEST 3		
6	→	48

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

	AGENT J Add 21	AGENT R Add 42	MY GUESS <i>Multiply by 8</i>
Test 1	✓	X	✓
Test 2	X	X	✓
Test 3	X	✓	✓

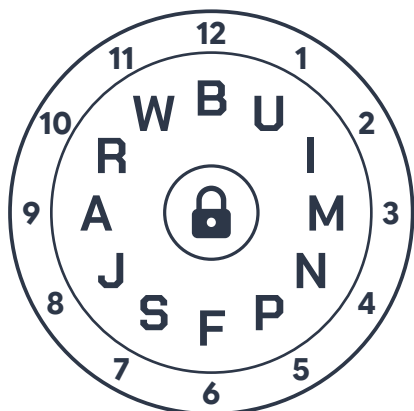
The secret rule is *Multiply by 8*.

2 Finish the log

Some rows run backward.

IN	OUT
9	<u>72</u>
<u>5</u>	40
<u>12</u>	96
<u>2</u>	16
<u>9</u>	72

DECODER DIAL



3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

	96	80	72	16	32	56
	↓	↓	↓	↓	↓	↓
IN	<u>12</u>	<u>10</u>	<u>9</u>	<u>2</u>	<u>4</u>	<u>7</u>
	<u>B</u>	<u>R</u>	<u>A</u>	<u>I</u>	<u>N</u>	<u>S</u>

To run the machine backward, *divide* by 8.

The signal says *BRAINS*

4 Prove it

Can this machine ever print 60? Explain.

No. Every output is a multiple of 8.

$7 \times 8 = 56$ and $8 \times 8 = 64$, so 60 is skipped.

Secret Rule Machine

This machine changes every number with the same secret rule. Study its test runs, crack the rule, then run the machine backward to read a hidden signal.



TEST RUNS		
TEST 1		
4	→	36
TEST 2		
8	→	72
TEST 3		
6	→	54

1 Test the guesses

Write ✓ if a guess works for a test run, or X if it does not. Then make your own guess.

	AGENT J Add 32	AGENT R Add 48	MY GUESS <u>Multiply by 9</u>
Test 1	✓	X	✓
Test 2	X	X	✓
Test 3	X	✓	✓

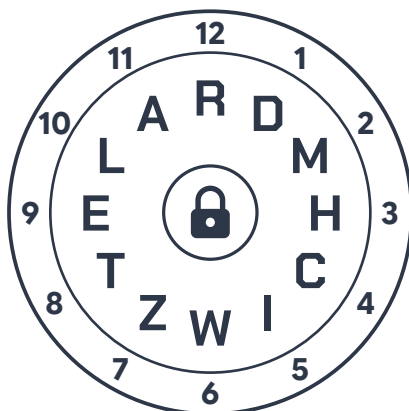
The secret rule is Multiply by 9.

2 Finish the log

Some rows run backward.

IN	OUT
7	<u>63</u>
<u>11</u>	99
<u>3</u>	27
<u>12</u>	108
<u>5</u>	45

DECODER DIAL



3 Decode the signal

Run the machine backward to find the number that went IN. Then find that number on the dial and write its letter.

	54	45	63	99	108	9
	↓	↓	↓	↓	↓	↓
IN	<u>6</u>	<u>5</u>	<u>7</u>	<u>11</u>	<u>12</u>	<u>1</u>
	<u>W</u>	<u>I</u>	<u>Z</u>	<u>A</u>	<u>R</u>	<u>D</u>

To run the machine backward, divide by 9.

The signal says WIZARD

4 Prove it

Can this machine ever print 50? Explain.

No. Every output is a multiple of 9.

$5 \times 9 = 45$ and $6 \times 9 = 54$, so 50 is skipped.