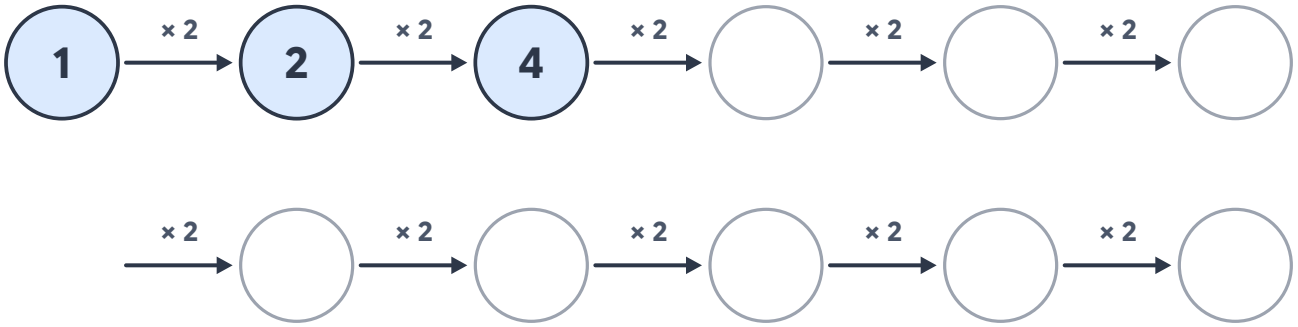
Name _____ Date _____



Powers of 2

Start at 1 and double, again and again. Fill in the circles.



Double from other numbers.

1. **3** , **6** , **12** , **24** , **48** , **96** Example
2. **5** , _____ , _____ , _____ , _____ , _____
3. **7** , _____ , _____ , _____ , _____
4. **25** , _____ , _____ , _____ , _____

5. How many times do you double **1** to get to **64**? _____
6. How many times do you double **1** to get to **1,024**? _____
7. Double **512**. _____

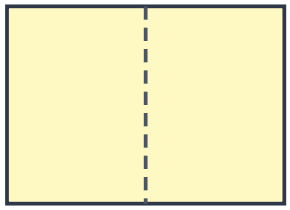
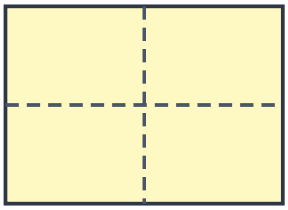
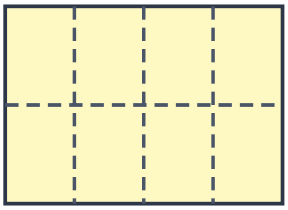
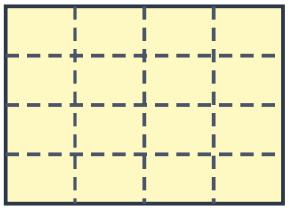
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Powers of 2

Fold a paper in half, then in half again. Count the parts.

1 fold	2 folds	3 folds	4 folds
			
2 parts	_____ parts	_____ parts	_____ parts

Example

Each part is one layer when the paper is folded up.

Folds	0	1	2	3	4	5	6	7	8
Layers	1	2	4						

1. Each fold makes how many times as many layers? _____

2. How many folds make 32 layers? _____

3. How many layers after 7 folds? _____

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Powers of 2

Multiply 2 again and again, and write it the short way.

$2 \times 2 \times 2 = 8$ can be written 2^3

The small 3 says how many 2s are multiplied. Say "two to the third."

Write the 2s, then multiply.

1. $2^4 =$ $2 \times 2 \times 2 \times 2$ $= 16$ Example
2. $2^5 =$ _____ = _____
3. $2^2 =$ _____ = _____
4. $2^6 =$ _____ = _____
5. $2^7 =$ _____ = _____
6. $2^8 =$ _____ = _____

Write each one the short way.

1. $2 \times 2 \times 2 \times 2 \times 2 = 2^5$
2. $8 =$ _____
3. $64 =$ _____
4. $2 \times 2 \times 2 \times 2 =$ _____
5. $512 =$ _____
6. $1{,}024 =$ _____

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Powers of 2

Find each power of 2 and circle its ones digit. See the pattern?

$2^1 = \textcircled{2}$ Example

$2^2 = 4$

$2^3 = 8$

$2^4 = 16$

$2^5 =$ _____

$2^6 =$ _____

$2^7 =$ _____

$2^8 =$ _____

$2^9 =$ _____

$2^{10} =$ _____

$2^{11} =$ _____

$2^{12} =$ _____

The ones digits go 2, 4, 8, 6, then start again.

1. The ones digit of 2^{13} is _____
2. The ones digit of 2^{16} is _____
3. The ones digit of 2^{15} is _____
4. The ones digit of 2^{22} is _____

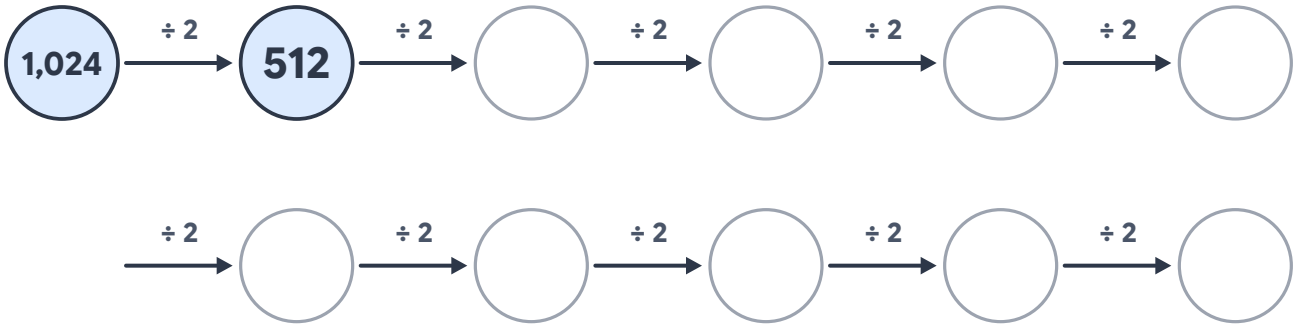
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Powers of 2

Start at 1,024 and halve, again and again, down to 1.



Halving undoes doubling.

1. How many times do you halve **256** to get to **1**? **8** Example

2. Halve **64** three times. _____

3. Halve **2,048**. _____

4. Half of 2^6 is _____

5. Half of 2^9 is _____

6. Double 2^4 is _____

7. Double 2^7 is _____

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Powers of 2

Each binary place is a power of 2. Write each code as a sum.

2^6	2^5	2^4	2^3	2^2	2^1	
64	32	16	8	4	2	1

Code to number

1. **10110** = 16 + 4 + 2 = 22 Example

2. **1001** = _____ = _____

3. **11010** = _____ = _____

4. **100100** = _____ = _____

5. **1111** = _____ = _____

6. **101001** = _____ = _____

Number to code

1. **40** = 32 + 8
   In binary: 101000 Example

2. **13** = _____
   In binary: _____

3. **50** = _____
   In binary: _____

4. **7** = _____
   In binary: _____

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Powers of 2

Doubling and halving stories. Solve each one.

1. A pond plant covers **1** square foot on Monday. Each day it covers twice as much. How many square feet on Saturday?

32 square feet

Example

2. A chessboard has **1** grain of rice on the **1**st square, **2** on the **2**nd, **4** on the **3**rd, and so on. How many grains on the **10**th square?

_____ grains

3. **64** teams start a tournament. Each round, half the teams are out. How many rounds until one team is left?

_____ rounds

4. Max saves **1** cent in week **1**, **2** cents in week **2**, and doubles it every week. How many cents does he save in week **8**?

_____ cents

5. **1** bit makes **2** codes, and each bit you add doubles the codes. How many codes do **10** bits make?

_____ codes

6. A toy ball is dropped from **64** inches. Each bounce goes half as high as the one before. How high is the **4**th bounce?

_____ inches

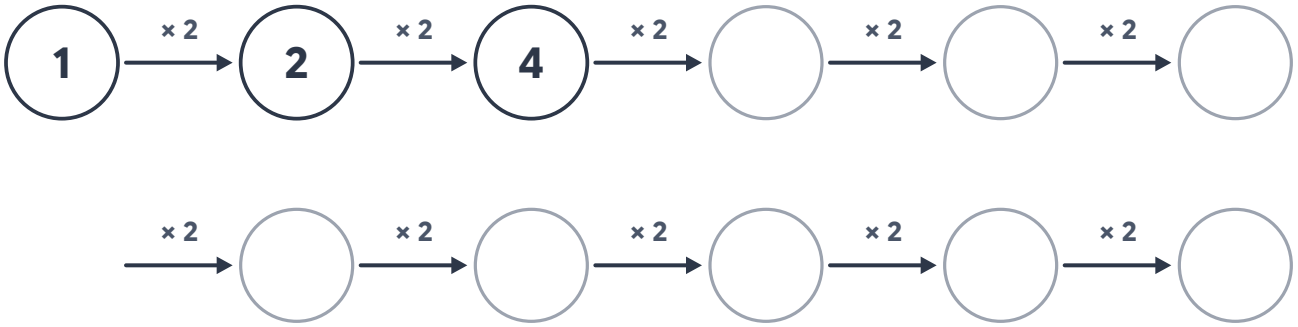
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Powers of 2

Start at 1 and double, again and again. Fill in the circles.



Double from other numbers.

1. **3** , **6** , **12** , **24** , **48** , **96** Example
2. **5** , _____ , _____ , _____ , _____ , _____
3. **7** , _____ , _____ , _____ , _____
4. **25** , _____ , _____ , _____ , _____

5. **How many times do you double 1 to get to 64?** _____
6. **How many times do you double 1 to get to 1,024?** _____
7. **Double 512.** _____

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Powers of 2

Fold a paper in half, then in half again. Count the parts.

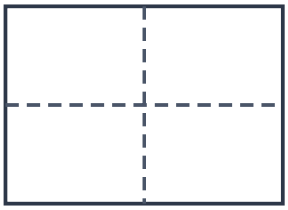
1 fold



2 parts

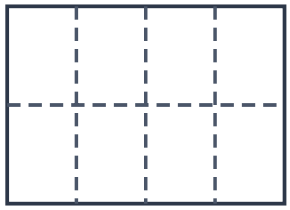
Example

2 folds



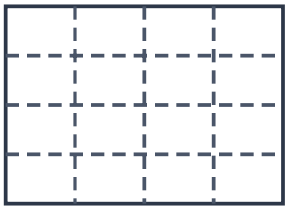
_____ parts

3 folds



_____ parts

4 folds



_____ parts

Each part is one layer when the paper is folded up.

Folds	0	1	2	3	4	5	6	7	8
Layers	1	2	4						

1. Each fold makes how many times as many layers? _____

2. How many folds make **32** layers? _____

3. How many layers after **7** folds? _____

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Name _____ Date _____



Powers of 2

Multiply 2 again and again, and write it the short way.

$2 \times 2 \times 2 = 8$ can be written 2^3

The small 3 says how many 2s are multiplied. Say "two to the third."

Write the 2s, then multiply.

1. $2^4 =$ $2 \times 2 \times 2 \times 2$ $= 16$ Example
2. $2^5 =$ _____ = _____
3. $2^2 =$ _____ = _____
4. $2^6 =$ _____ = _____
5. $2^7 =$ _____ = _____
6. $2^8 =$ _____ = _____

Write each one the short way.

1. $2 \times 2 \times 2 \times 2 \times 2 = 2^5$
2. $8 =$ _____
3. $64 =$ _____
4. $2 \times 2 \times 2 \times 2 =$ _____
5. $512 =$ _____
6. $1{,}024 =$ _____

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Powers of 2

Find each power of 2 and circle its ones digit. See the pattern?

$2^1 = \textcircled{2}$ Example

$2^2 = 4$

$2^3 = 8$

$2^4 = 16$

$2^5 =$ _____

$2^6 =$ _____

$2^7 =$ _____

$2^8 =$ _____

$2^9 =$ _____

$2^{10} =$ _____

$2^{11} =$ _____

$2^{12} =$ _____

The ones digits go 2, 4, 8, 6, then start again.

1. The ones digit of 2^{13} is _____
2. The ones digit of 2^{16} is _____
3. The ones digit of 2^{15} is _____
4. The ones digit of 2^{22} is _____

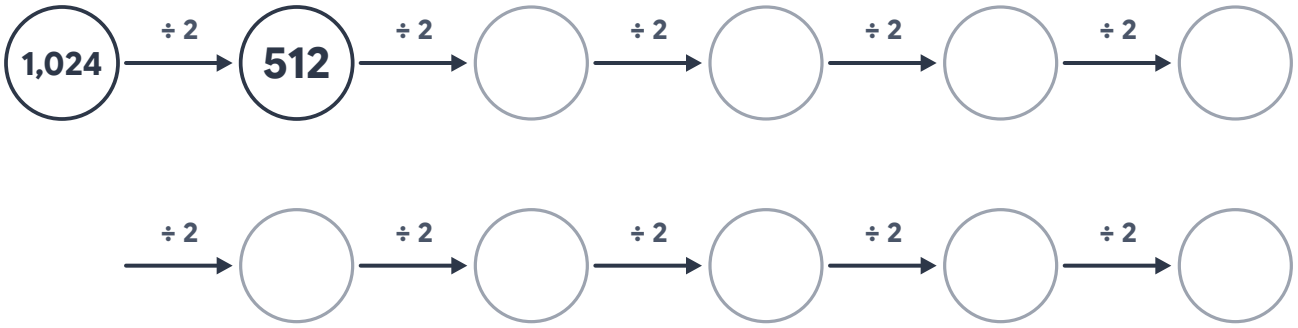
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Powers of 2

Start at 1,024 and halve, again and again, down to 1.



Halving undoes doubling.

1. How many times do you halve **256** to get to **1**? **8** Example

2. Halve **64** three times. _____

3. Halve **2,048**. _____

4. Half of 2^6 is _____

5. Half of 2^9 is _____

6. Double 2^4 is _____

7. Double 2^7 is _____

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Name _____ Date _____



Powers of 2

Each binary place is a power of 2. Write each code as a sum.

2^6	2^5	2^4	2^3	2^2	2^1	
64	32	16	8	4	2	1

Code to number

1. **10110** = 16 + 4 + 2 = 22 Example
2. **1001** = _____ = _____
3. **11010** = _____ = _____
4. **100100** = _____ = _____
5. **1111** = _____ = _____
6. **101001** = _____ = _____

Number to code

1. **40** = 32 + 8
   In binary: 101000 Example
2. **13** = _____
   In binary: _____
3. **50** = _____
   In binary: _____
4. **7** = _____
   In binary: _____

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Name _____ Date _____



Powers of 2

Doubling and halving stories. Solve each one.

1. A pond plant covers **1** square foot on Monday. Each day it covers twice as much. How many square feet on Saturday?

32 square feet

Example

2. A chessboard has **1** grain of rice on the **1**st square, **2** on the **2**nd, **4** on the **3**rd, and so on. How many grains on the **10**th square?

_____ grains

3. **64** teams start a tournament. Each round, half the teams are out. How many rounds until one team is left?

_____ rounds

4. Max saves **1** cent in week **1**, **2** cents in week **2**, and doubles it every week. How many cents does he save in week **8**?

_____ cents

5. **1** bit makes **2** codes, and each bit you add doubles the codes. How many codes do **10** bits make?

_____ codes

6. A toy ball is dropped from **64** inches. Each bounce goes half as high as the one before. How high is the **4**th bounce?

_____ inches

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Powers of 2

Start at 1 and double, again and again. Fill in the circles.

1 → (×2) → 2 → (×2) → 4 → (×2) → 8 → (×2) → 16 → (×2) → 32

(×2) → 64 → (×2) → 128 → (×2) → 256 → (×2) → 512 → (×2) → 1,024

Double from other numbers.

1. **3** , **6** , **12** , **24** , **48** , **96** Example

2. **5** , **10** , **20** , **40** , **80** , **160**

3. **7** , **14** , **28** , **56** , **112**

4. **25** , **50** , **100** , **200** , **400**

5. How many times do you double **1** to get to **64**? **6**

6. How many times do you double **1** to get to **1,024**? **10**

7. Double **512**. **1,024**

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Powers of 2

Fold a paper in half, then in half again. Count the parts.

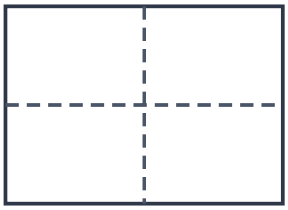
1 fold



2 parts

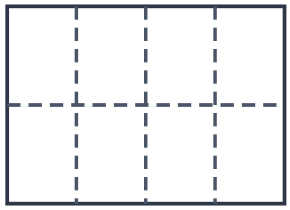
Example

2 folds



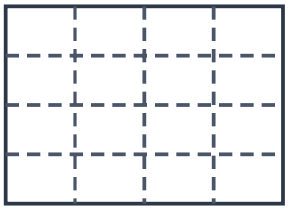
4 parts

3 folds



8 parts

4 folds



16 parts

Each part is one layer when the paper is folded up.

Folds	0	1	2	3	4	5	6	7	8
Layers	1	2	4	8	16	32	64	128	256

1. Each fold makes how many times as many layers? **2**

2. How many folds make **32** layers? **5**

3. How many layers after **7** folds? **128**

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Powers of 2

Multiply 2 again and again, and write it the short way.

$2 \times 2 \times 2 = 8$ can be written 2^3

The small 3 says how many 2s are multiplied. Say "two to the third."

Write the 2s, then multiply.

1. $2^4 =$ $2 \times 2 \times 2 \times 2$ $= 16$ Example
2. $2^5 =$ $2 \times 2 \times 2 \times 2 \times 2$ $= 32$
3. $2^2 =$ 2×2 $= 4$
4. $2^6 =$ $2 \times 2 \times 2 \times 2 \times 2 \times 2$ $= 64$
5. $2^7 =$ $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$ $= 128$
6. $2^8 =$ $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$ $= 256$

Write each one the short way.

1. $2 \times 2 \times 2 \times 2 \times 2 =$ 2^5
2. $8 =$ 2^3
3. $64 =$ 2^6
4. $2 \times 2 \times 2 \times 2 =$ 2^4
5. $512 =$ 2^9
6. $1{,}024 =$ 2^{10}

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Powers of 2

Find each power of 2 and circle its ones digit. See the pattern?

$2^1 = 2$ (Example)

$2^2 = 4$

$2^3 = 8$

$2^4 = 16$

$2^5 = 32$

$2^6 = 64$

$2^7 = 128$

$2^8 = 256$

$2^9 = 512$

$2^{10} = 1{,}024$

$2^{11} = 2{,}048$

$2^{12} = 4{,}096$

The ones digits go 2, 4, 8, 6, then start again.

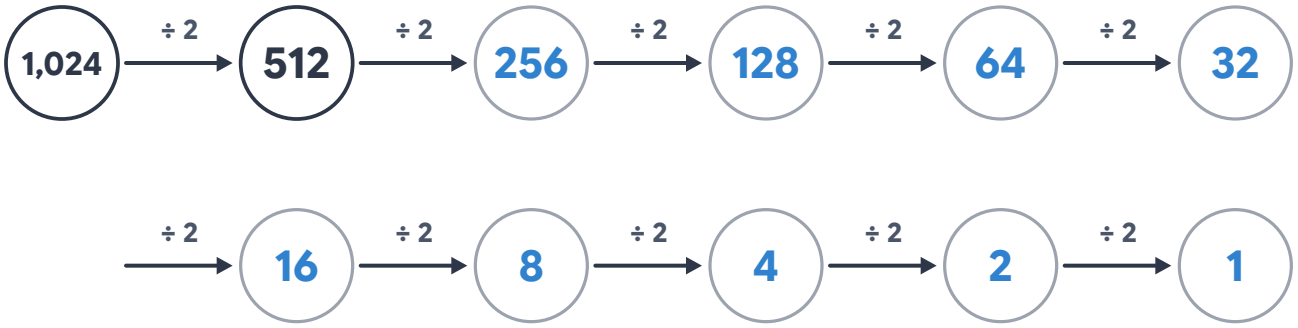
1. The ones digit of 2^{13} is 2
2. The ones digit of 2^{16} is 6
3. The ones digit of 2^{15} is 8
4. The ones digit of 2^{22} is 4

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Powers of 2

Start at 1,024 and halve, again and again, down to 1.



Halving undoes doubling.

1. How many times do you halve **256** to get to 1? 8 Example

2. Halve **64** three times. 8

3. Halve **2,048**. 1,024

4. Half of 2^6 is 2^5

5. Half of 2^9 is 2^8

6. Double 2^4 is 2^5

7. Double 2^7 is 2^8

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Powers of 2

Each binary place is a power of 2. Write each code as a sum.

2^6	2^5	2^4	2^3	2^2	2^1	
64	32	16	8	4	2	1

Code to number

1. **10110** = 16 + 4 + 2 = **22** Example
2. **1001** = 8 + 1 = **9**
3. **11010** = 16 + 8 + 2 = **26**
4. **100100** = 32 + 4 = **36**
5. **1111** = 8 + 4 + 2 + 1 = **15**
6. **101001** = 32 + 8 + 1 = **41**

Number to code

1. **40** = 32 + 8
   In binary: **101000** Example
2. **13** = 8 + 4 + 1
   In binary: **1101**
3. **50** = 32 + 16 + 2
   In binary: **110010**
4. **7** = 4 + 2 + 1
   In binary: **111**

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Powers of 2

Doubling and halving stories. Solve each one.

1. A pond plant covers **1** square foot on Monday. Each day it covers twice as much. How many square feet on Saturday?

32 square feet

Example

2. A chessboard has **1** grain of rice on the **1**st square, **2** on the **2**nd, **4** on the **3**rd, and so on. How many grains on the **10**th square?

512 grains

3. **64** teams start a tournament. Each round, half the teams are out. How many rounds until one team is left?

6 rounds

4. Max saves **1** cent in week **1**, **2** cents in week **2**, and doubles it every week. How many cents does he save in week **8**?

128 cents

5. **1** bit makes **2** codes, and each bit you add doubles the codes. How many codes do **10** bits make?

1,024 codes

6. A toy ball is dropped from **64** inches. Each bounce goes half as high as the one before. How high is the **4**th bounce?

4 inches

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