

1.1

Patterns in Division

Focus Explore divisibility by 2, 4, 5, 8, and 10.

Which of these numbers are divisible by 2? By 5? By 10?

How do you know?

- 78
- 27
- 35
- 410
- 123
- 2100
- 4126
- 795

Explore



You will need a hundred chart numbered 301–400, and three different coloured markers.

- Use a marker. Circle all numbers on the hundred chart that are divisible by 2. Use a different marker. Circle all numbers that are divisible by 4. Use a different marker. Circle all numbers that are divisible by 8. Describe the patterns you see in the numbers you circled.
- Choose 3 numbers greater than 400. Which of your numbers do you think are divisible by 2? By 4? By 8? Why do you think so?



Reflect & Share

Share your work with another pair of classmates.

Suppose a number is divisible by 8.

What else can you say about the number?

Suppose a number is divisible by 4.

What else can you say about the number?

Connect

We know that 100 is divisible by 4: $100 \div 4 = 25$

So, any multiple of 100 is divisible by 4.

To find out if any whole number with 3 or more digits is divisible by 4, we only need to check the last 2 digits.

To find out if 352 is divisible by 4, check if 52 is divisible by 4.

$$52 \div 4 = 13$$

52 is divisible by 4, so 352 is divisible by 4.

To check if a number, such as 1192, is divisible by 8,

think: $1192 = 1000 + 192$

We know 1000 is divisible by 8: $1000 \div 8 = 125$

So, we only need to check if 192 is divisible by 8.

Use mental math. $192 \div 8 = 24$

192 is divisible by 8, so 1192 is divisible by 8.

All multiples of 1000 are divisible by 8.

So, for any whole number with 4 or more digits, we only need to check the last 3 digits to find out if the number is divisible by 8.

Another way to check if a number is divisible by 8 is to divide by 4. If the quotient is even, then the number is divisible by 8.

A number that is divisible by 8 is also divisible by 2 and by 4 because $8 = 2 \times 4$.

So, a number divisible by 8 is even.

2 and 4 are factors of 8.

You can use patterns to find **divisibility rules** for other numbers.

- All multiples of 10, such as 30, 70, and 260, end in 0.

Any number whose ones digit is 0, is divisible by 10.

- Here are some multiples of 5.
5, 10, 15, 20, 25, 30, 35, 40, ..., 150, 155, 160, ...
The ones digits form a repeating pattern.
The core of the pattern is: 5, 0

Any number whose ones digit is 0 or 5, is divisible by 5.

- Multiples of 2 are even numbers: 2, 4, 6, 8, 10, ...
All even numbers are divisible by 2.

Any number whose ones digit is even, is divisible by 2.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	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	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Every multiple of 5 has a ones digit of 0 or 5.

Example

Which numbers are divisible by 5? By 8? Both by 5 and by 8?

How do you know?

12, 24, 35, 56, 80, 90, 128, 765, 1048, 1482, 3960, 15 019

A Solution

Any number with 0 or 5 in the ones place is divisible by 5.

So, the numbers divisible by 5 are: 35, 80, 90, 765, 3960

The divisibility rule for 8 only applies when a number is 1000 or greater.

For numbers less than 1000, use mental math or a calculator.

All multiples of 8 are even, so reject 35, 765, and 15 019.

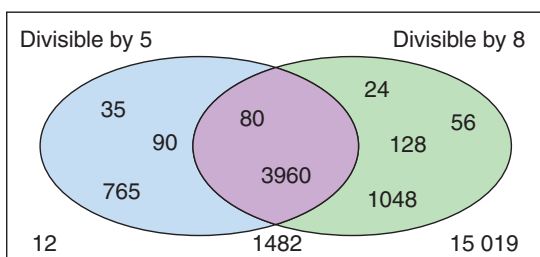
Use mental math to identify that 12 and 90 are not divisible by 8.

Use mental math to identify that 24, 56, 80, and 128 are divisible by 8.

1048 and 3960 are divisible by 8 because 48 and 960 are divisible by 8.

1482 is not divisible by 8 because 482 is not divisible by 8.

We can display the results in a Venn diagram.



The numbers in the overlapping region are divisible both by 5 and by 8.

So, 80 and 3960 are also divisible by 40, since $5 \times 8 = 40$.

Practice

1. Which numbers are divisible by 2? By 5?

How do you know?

- a) 106 b) 465 c) 2198
d) 215 e) 1399 f) 4530

2. Explain why a number with 0 in the ones place is divisible by 10.

3. Which numbers are divisible by 4? By 8? By 10?

How do you know?

- a) 212 b) 512 c) 5450
d) 380 e) 2132 f) 12 256

4. Maxine and Tony discuss divisibility.

Maxine says, "260 is divisible by 4 and by 5.

$4 \times 5 = 20$, so 260 is also divisible by 20."

Tony says, "148 is divisible by 2 and by 4.

$2 \times 4 = 8$, so 148 is also divisible by 8."

Are both Maxine and Tony correct? Explain your thinking.



5. Write 3 numbers that are divisible by 8.

How did you choose the numbers?

6. **Assessment Focus**

- a) Use the divisibility rules for 2, 4, and 8 to sort these numbers.

1046	322	460	1784	28
54	1088	224	382	3662

- b) Draw a Venn diagram with 3 loops.

Label the loops: "Divisible by 2," "Divisible by 4," and "Divisible by 8"

Explain why you drew the loops the way you did.

Place the numbers in part a in the Venn diagram.

How did you decide where to place each number?

- c) Find and insert 3 more 4-digit numbers in the Venn diagram.

7. Use the digits 0 to 9. Replace the \square in each number to make a number divisible by 4. Find as many answers as you can.

- a) $822\square$ b) $2114\square8$ c) $15\square32$

8. **Take It Further** A leap year occurs every 4 years.

The years 1992 and 2004 were leap years.

What do you notice about these numbers?

Was 1964 a leap year? 1852? 1788? Explain.

Reflect

Compare the divisibility rules for 4 and 8.

How can you use one rule to help you remember the other?