Names (pair) _____ Date _____

Divisibility by 3 and 9

You cannot tell divisibility by 3 or 9 from the last digit: 12 is divisible by 3, but 22 is not, although both end in 2. So what decides?

1 IN PAIRS Check divisibility by 3 and by 9 by dividing, then work out the digit sum. What do you notice?

number	divisible by 3?	divisible by 9?	digit sum
27	yes / no	yes / no	
48	yes / no	yes / no	
75	yes / no	yes / no	
126	yes / no	yes / no	
215	yes / no	yes / no	
342	yes / no	yes / no	
413	yes / no	yes / no	
1,005	yes / no	yes / no	
2,025	yes / no	yes / no	
3,721	yes / no	yes / no	

Remember

A number is divisible by 3 if its **digit sum** is divisible by 3, and by 9 if its digit sum is divisible by 9. Every number divisible by 9 is also divisible by 3.

Names (pair) _____ Date _____

Example

Why? Because $10 = 9 + 1$ and $100 = 99 + 1$. Every ten and every hundred "leaves over" one:

$$372 = 3 \times 100 + 7 \times 10 + 2 = 3 \times 99 + 7 \times 9 + (3 + 7 + 2)$$

The parts 3×99 and 7×9 are always divisible by 9 (and so by 3). What is left, $3 + 7 + 2 = 12$, decides, and that is the **digit sum**: it is divisible by 3 but not by 9.

2 ON YOUR OWN Complete as in the example and decide.

$513 = 5 \times 99 + 1 \times 9 + (\square + \square + \square)$ divisible by 3: **yes** / **no** by 9: **yes** / **no**

$742 = 7 \times 99 + 4 \times 9 + (\square + \square + \square)$ divisible by 3: **yes** / **no** by 9: **yes** / **no**

3 ON YOUR OWN Without dividing, decide whether each number is divisible by 3 and by 9.

number	digit sum	divisible by 3?	divisible by 9?
1,002	☐	**yes** / **no**	**yes** / **no**
4,518	☐	**yes** / **no**	**yes** / **no**
7,777	☐	**yes** / **no**	**yes** / **no**
9,999	☐	**yes** / **no**	**yes** / **no**

4 IN PAIRS **Find the mistake.** Peter says: "3,333 is divisible by 9 because it is made only of threes." What is wrong?

5 IN PAIRS CHALLENGE Every number divisible by 9 is also divisible by 3. Does it work the other way round? Find an example.

The Hundred Chart app · otooly.com/hundred-chart

Multiples mode: in the View menu choose 9 columns and colour the multiples of 9. Which column are they in?

★ ON YOUR OWN **Exit card.** Is 2,457 divisible by 3? **yes** / **no** And by 9? **yes** / **no**

Why? ☐