

Lesson 17: Divisibility Tests for 3 and 9

Classwork

Opening Exercise

Below is a list of 10 numbers. Place each number in the circle(s) that is a factor of the number. Some numbers can be placed in more than one circle. For example, if 32 were on the list, it would be placed in the circles with 2, 4, and 8 because they are all factors of 32.

24; 36; 80; 115; 214; 360; 975; 4,678; 29,785; 414,940

The diagram shows five circles, each containing a factor in a box at the top and a list of numbers from the opening exercise that are divisible by that factor:

- Circle 2:** 24, 36, 80, 214, 360, 4,678, 414,940
- Circle 4:** 24, 36, 80, 360, 414,940
- Circle 5:** 80, 115, 360, 975, 29,785, 414,940
- Circle 8:** 24, 80, 360
- Circle 10:** 80, 360, 414,940

Discussion

- Divisibility rule for 2: If $\bar{2}$ only if its unit (end) digit is 0, 2, 4, 6, 8
- Divisibility rule for 4: If $\bar{4}$ only if its last two digits are a number divisible by 4.
- Divisibility rule for 5: If $\bar{5}$ only if its unit digit is 0 or 5.
- Divisibility rule for 8: If $\bar{8}$ only if its last three digits are a number divisible by 8.
- Divisibility rule for 10: If $\bar{10}$ only if its unit (end) digit is 0.
- Decimal numbers with fraction parts do not follow the divisibility tests.
- Divisibility rule for 3: if the sum of the digits is divisible by 3, then the number is divisible by 3.
- Divisibility rule for 9: if the sum of the digits is divisible by 9, then the number is divisible by 9.

Example 1

This example shows how to apply the two new divisibility rules we just discussed.

Explain why 378 is divisible by 3 and 9.

- a. Expand 378.

$$300 + 70 + 8$$

$$3 \times 100 + 7 \times 10 + 8$$

- b. Decompose the expression to factor by 9.

$$3(99+1) + 7(9+1) + 8$$

$$3(99) + 3 + 7(9) + 7 + 8$$

- c. Factor the 9.

$$3(9 \times 11) + 3 + 7(9 \times 1) + 7 + 8$$

$$9(3 \times 11 + 7) + 3 + 7 + 8$$

- d. What is the sum of the three digits?

$$3 + 7 + 8 = 18 ; \text{ The sum of the three digits is 18.}$$

- e. Is 18 divisible by 9?

Yes.

$$\frac{18}{9} = 2$$

- f. Is the number 378 divisible by 9? Why or why not?

The number 378 is divisible by 9 because the sum of the digits is divisible by 9.

- g. Is the number 378 divisible by 3? Why or why not?

Three is a factor of 378 because if 9 is a factor of 378, then 3 will also be a factor.
OR

The number 378 is divisible by 3 because the sum of the digits is divisible by 3.

Example 2

Is 3,822 divisible by 3 or 9? Why or why not?

The number 3,822 is divisible by 3 but not by 9 because the sum of the digits is $3 + 8 + 2 + 2 = 15$. 15 is divisible by 3 but not by 9.

Exercises 1–5

Circle ALL the numbers that are factors of the given number. Complete any necessary work in the space provided.

1. 2,838 is divisible by

3

9

4

Explain your reasoning for your choice(s).

Three is a factor of 2,838

2. 34,515 is divisible by

3

9

5

Explain your reasoning for your choice(s).

Three and nine are factors of 34,515. It is also divisible by 5 because the last digit is 5.

3. 10,534,341 is divisible by

3

9

2

Explain your reasoning for your choice(s).

Three is a factor of 10,534,341.

4. 4,320 is divisible by

3

9

10

Explain your reasoning for your choice(s).

Three & nine are factors of 4,320. 4320 is divisible by 10 because the last digit is a 0.

5. 6,240 is divisible by

3

9

8

Explain your reasoning for your choice(s).

Three is a factor of 6240. It is also divisible by 8 because the last three digits (240) is divisible by 8.