Name: Date:

WORKSHEET :

Divisibility Rules

Evaluate if the number divides exactly into the numerator i.e. no remainder: (Yes or No)

1.	193 ÷ 2 =	216 ÷ 2 =	10 ÷ 0 =
2.	216 ÷ 3 =	61,875 ÷ 3 =	346 ÷ 3 =
3.	216 ÷ 4 =	210,384 ÷ 4 =	822 ÷ 4 =
4.	210 ÷ 5 =	215 ÷ 10 =	$25^2 \div 5$ =
5.	36 ÷ 6 =	975 ÷ 6 =	9,228 ÷ 6 =
6.	777 ÷ 7 =	238 ÷ 7 =	168 ÷ 7 =
7.	608 ÷ 8 =	1,005,024 ÷ 8 =	997 ÷ 8 =
8.	609 ÷ 9 =	123,354 ÷ 9 =	300 ÷ 9 =
9.	222 ÷ 11 =	3,663 ÷ 11 =	9,976,747 ÷ 11 =

Find the missing digit that makes 3848586?9693 divisible....

10.	by 9?	by 11?	by 8?

ANSWERS :

Divisibility Rules

Evaluate if the number divides exactly into the numerator i.e. no remainder: (Yes or No)

1.	$193 \div 2$ = No	$216 \div 2$ = Yes	$10 \div 0$ = No, undefined
2.	$216 \div 3$ = Yes	$61{,}875 \div 3$ = Yes	$346 \div 3$ = No
3.	$216 \div 4$ = Yes	$210{,}384 \div 4$ = Yes	$822 \div 4$ = No
4.	$210 \div 5$ = Yes	$215 \div 10$ = No	$25^2 \div 5$ = Yes
5.	$36 \div 6$ = Yes	$975 \div 6$ = No	$9{,}228 \div 6$ = Yes
6.	$777 \div 7$ = Yes	$238 \div 7$ = Yes	$168 \div 7$ = Yes
7.	$608 \div 8$ = Yes	$1{,}005{,}024 \div 8$ = Yes	$997 \div 8$ = No
8.	$609 \div 9$ = No	$123{,}354 \div 9$ = Yes	$300 \div 9$ = No
9.	$222 \div 11$ = No	$3{,}663 \div 11$ = Yes	$9{,}976{,}747 \div 11$ = Yes

Find the missing digit that makes 3848586?9693 divisible....

10.	by 9? 3	by 11? 8	by 8? None Possible

KEY CONCEPTS:

Learn to check divisibility quickly both in general and with the aid of the following rules. Students will utilize it when finding factors, prime factors and elsewhere throughout the exam.

1. Divisibility occurs when one integer divides exactly into another integer with no remainder. Note the concept of divisibility applies only to integers (not fractions, decimals etc.)

2. Long division can be used to check, but that can be time consuming and error prone. Another method in general is to estimate the largest round number multiple of the divisor (denominator) that is close to the number being divided then check if the remainder or difference is a multiple of the divisor. Note this method uses the property of distribution to quickly check divisibility e.g.

450/7

$7 \times 60 = 420$.
450 - 420 = 30. 7 does not divided into 30 so 450 cannot be divisibly by 7.

312/6

$6 \times 50 = 300$. $312 - 300 = 12 = 2 \times 6$.
$312 = (50 + 2) \times 6$ therefore 312 is divisible into 312

3. Learn the following divisibility rules.

Divisor	Rule
2:	Check the last digit to see if the number **ends in 0,2,4,6,8** e.g. 456
3:	**Sum the digits** and check if the result is divisible by 3. e.g. **669 ➔ 6 + 6 + 9** **= 21/3 = 7**
4:	**Check the last 2 digits** to see if the number is divisible by 4. e.g. 812. 12/4 = 3
5:	The **number ends in 0, 5**. e.g. 100/5 = 20
6:	**Check divisibility by 2 and 3** on the number. Note $6 = 2 \times 3$ so you are checking both factors. e.g. 123 passes the test for 3 (1 + 2 + 3 = 6/3 = 2), but it does not end in 0,2,4,6,8 i.e. it is not even therefore it is not divisible by 2 and cannot be divisible by 6.

7: Double the last digit and subtract it from the others and check if the result is divisible by 7 or 0**.** e.g. 784. 78 - 2×4 = 78 - 8 = 70/7 = 10.

* This rule is not our favorite because it requires many iterations on larger numbers. Method 2 above can be easier.

8: **Check the last 3 digits for divisibility by 8.** Notice the check for 2 was the last digit, for 2^2 it was the last two digits and for 2^3 it is the last three digits. on the number. e.g. 567,840. Check only 840/8 = 105

* Checking the last 3 digits may not be immediately obvious. In practice, another useful method is to divide by 2 three times or divide by 4 and then by 2. Each of these checks is often faster and can be applied to the last 3 digits too.

9: **Sum the digits** and check if the result is divisible by 9.
e.g. **669 ➔ 6 + 6 + 9 = 21/9 is not a whole number result** so 669 is not divisible by 9.

*Note how this method is analogous to 3. The rules are easier to remember when you realize they form groups based on the factors. i.e. the rules for 2,4, and 8 are similar and the rules for 3 and 9 are similar.

10: The **number ends in 0**. e.g. 100/10 = 10

11: **Check the sum of the alternating sequence of digits in the number if divisible by 11 or 0.**
e.g. 4565 ➔ (4 + 6) - (5 + 5) = 0 therefore 4565 is divisible by 11.
Note 4 and 6 are the 1st and 3rd digits and 5 and 5 are the 2nd and 4th digits.

e.g. 81,301 ➔ (8 + 3 + 1) - (1 + 0) = 12 -1 = 11/11 =1 therefore 81,301 is divisible by 11.

4. *(Advanced Optional)* In many cases you will need to check divisibility above 11 if none of the previous checks work on a number provided. It is unnecessary to check any number that is not a prime number above 11 (can you figure out why?) which means the next higher checks will be 13, 17, 19, 23, 29 etc. In either case you will never have to check any integer greater than the square root of the number provided. e.g. 221. The square root is just below $\sqrt{225} = \pm 15$ so the only additional check required is 13. Once checked you can be absolutely certain the number provided is a prime number itself. In this case 221 is divisible by 13. 13 × 17 = 221.