Divisibility Rules for 7, 8, and 11

Unit: Playing with Numbers - Student Practice Worksheet

Overview: Ms. Rao offered a prize: whoever could tell her, without dividing, whether 4,928 was divisible by 8, in under five seconds, first. Kabir grabbed a pencil to do long division. Anaya just looked at the last three digits. Anaya called out "yes!" before Kabir had written the first line.

Practice Questions (30 Total)

Section A - Easy

Q1. The teal boxes are the last three digits of 4,928. For the 8-rule, which digits do you check?

- [ ] **A.** Only the last three
- [ ] **B.** All of them
- [ ] **C.** Only the first digit
- [ ] **D.** Only the last digit

Q2. For the 7-rule, what do you do to the last digit first?

- [ ] **A.** Triple it
- [ ] **B.** Halve it
- [ ] **C.** Double it
- [ ] **D.** Ignore it

Q3. Is 928 divisible by 8?

- [ ] **A.** No
- [ ] **B.** Yes
- [ ] **C.** Only if doubled
- [ ] **D.** Cannot be checked

Q4. The 7-rule flow is 48 minus doubled last digit 6. What is 48 - 6?

$\boxed{48} - \boxed{3x2=6} = \boxed{?}$

- ☐ **A.** 54
- ☐ **B.** 40
- ☐ **C.** 36
- ☐ **D.** 42

Q5. For divisibility by 11, what do you do with the digits?

- ☐ **A.** Multiply them all together
- ☐ **B.** Add and subtract them alternately
- ☐ **C.** Only look at the first digit
- ☐ **D.** Divide each digit by 11

Q6. Is 42 divisible by 7?

- ☐ **A.** Yes
- ☐ **B.** No
- ☐ **C.** Only sometimes
- ☐ **D.** Cannot be determined

Q7. The underlined part is what Anaya checked on 4,928. Which smaller number is that?

4, <u>928</u> Anaya checked this

- ☐ **A.** 4928
- ☐ **B.** 492
- ☐ **C.** 28
- ☐ **D.** 928

Q8. What result indicates divisibility by 11, from the alternating sum?

- ☐ **A.** Any positive number
- ☐ **B.** Any even number

- [ ] **C.** 0 or a multiple of 11
- [ ] **D.** Exactly 11 only

Q9. Which number is divisible by 8?

- [ ] **A.** 1,234
- [ ] **B.** 3,016
- [ ] **C.** 5,678
- [ ] **D.** 9,999

Q10. Do these shortcuts ever disagree with long division, or do they match and just run faster?

- [ ] **A.** No, they give the exact same answer, just faster
- [ ] **B.** Yes, always different
- [ ] **C.** Only for numbers over 1000
- [ ] **D.** Only for even numbers

Section B - Medium

Q11. Last three digits of 6,144 are shown as 144, and 144/8=18. Is 6,144 divisible by 8?

6, 144   144 / 8 = 18

- [ ] **A.** Yes, since 144/8=18
- [ ] **B.** No, since 144 isn't divisible by 8
- [ ] **C.** Cannot be determined this way
- [ ] **D.** Only the digit 6 matters

Q12. Why does checking only the last three digits work for the 8-rule?

- [ ] **A.** Because every multiple of 1000 is automatically divisible by 8
- [ ] **B.** Because 8 is an even number
- [ ] **C.** Because 1000 is not divisible by 8
- [ ] **D.** There is no real reason, it's a coincidence

Q13. Apply the 11-rule to 2,728: alternating sum of digits (from the right: 8-2+7-2).

- [ ] **A.** 9, not divisible

- [ ] **B.** 11, so divisible by 11
- [ ] **C.** 13, not divisible
- [ ] **D.** 0, so not divisible

Q14. The card highlights last-three 624 from 7,624. Which listed number is divisible by 8?

$7{,}624 \to 624$

624 / 8 = 78

- [ ] **A.** 5,430
- [ ] **B.** 8,890
- [ ] **C.** 2,345
- [ ] **D.** 7,624

Q15. A number's alternating digit sum for the 11-rule comes out to 22. What does this mean?

- [ ] **A.** It is not divisible by 11
- [ ] **B.** It is divisible by 22 only
- [ ] **C.** The rule cannot be applied to results over 11
- [ ] **D.** It is divisible by 11, since 22 is a multiple of 11

Q16. Use the 7-rule on 91: double the last digit (1x2=2), subtract from the rest (9).

- [ ] **A.** 9-2=7, not divisible
- [ ] **B.** 9+2=11, divisible
- [ ] **C.** 9-2=7, divisible by 7
- [ ] **D.** Cannot apply the rule to two-digit numbers

Q17. The maroon number 4,502 ends in 502. Which listed number fails the 8-rule?

$4{,}502 \to 502$

502 is not 8 x a whole number

- [ ] **A.** 2,120

- [ ] **B.** 3,344
- [ ] **C.** 4,502
- [ ] **D.** 1,600

Q18. Kabir tests 5,236 for divisibility by 11 using digits from the right: 6-3+2-5.

- [ ] **A.** 0, so it is divisible by 11
- [ ] **B.** 0, so it is NOT divisible
- [ ] **C.** 16, not divisible
- [ ] **D.** -16, not divisible

Q19. Apply the 7-rule to 203: double 3 to get 6, subtract from 20.

- [ ] **A.** 20-6=14, not divisible by 7
- [ ] **B.** 20-6=14, which is 7x2, so divisible
- [ ] **C.** 20+6=26, divisible
- [ ] **D.** Cannot apply since 203 ends in 3

Q20. Which method would you use to check if 3,003 is divisible by 7, using the doubling rule?

- [ ] **A.** Double all four digits and add them
- [ ] **B.** Double last 3 to 6, subtract from 300, get 294, check 294/7
- [ ] **C.** Only check if the number is odd
- [ ] **D.** Divide the first digit by 7 directly

Section C - Challenge

Q21. The last three digit-boxes are 000. What can you conclude about divisibility by 8?

...	0 0 0

- [ ] **A.** It is always divisible by 8
- [ ] **B.** It is never divisible by 8
- [ ] **C.** It depends on the earlier digits
- [ ] **D.** The rule cannot be applied

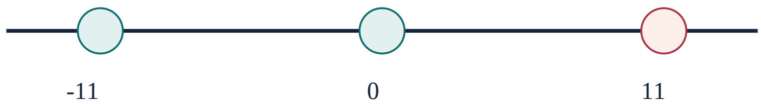
Q22. Applying the 7-rule to a large number sometimes requires repeating the double-and-subtract step more than once. Why?

- [ ] **A.** Because the rule only works once, ever
- [ ] **B.** Because the result may still be too big to recognise
- [ ] **C.** Because 7 is a prime number
- [ ] **D.** The rule never needs repeating

Q23. A number N has last three digits 104. Is N divisible by 8?

- [ ] **A.** Yes, since 104/8=13 exactly
- [ ] **B.** No, since 104 is odd
- [ ] **C.** Cannot be determined without N's other digits
- [ ] **D.** Only if N itself ends in 0

Q24. The ticks are -11, 0 and 11. If the 11-rule sum is -11, is the number divisible by 11?



- [ ] **A.** No — only positive results count
- [ ] **B.** Only if you add 11 first
- [ ] **C.** Yes — negative multiples of 11 still count
- [ ] **D.** The rule fails for negative results

Q25. Ms. Rao says the 11-rule and the 8-rule work for structurally different reasons. What is the key difference?

- [ ] **A.** There is no real structural difference between them
- [ ] **B.** The 8-rule uses all digits; the 11-rule uses only the last one
- [ ] **C.** Both rules use exactly the same method
- [ ] **D.** 8-rule uses last 3 digits; 11-rule uses all digits alternating

Q26. Which number fails BOTH the 8-rule and the 11-rule?

- [ ] **A.** 1,232
- [ ] **B.** 1,331
- [ ] **C.** 2,024
- [ ] **D.** 1,235

Q27. The card shows 8 x 11 = 88. If a number is divisible by both 8 and 11, what about 88?

8 x 11 = 88

- ☐ **A.** It cannot be determined at all
- ☐ **B.** It is only divisible by 88 if it's also divisible by 7
- ☐ **C.** It must be divisible by 88 too, since 8 and 11 are co-prime
- ☐ **D.** It is never divisible by 88

Q28. Kabir claims the 7-rule's doubling trick works because 10 = 3x(-1) mod 7-ish reasoning. Without needing the algebra, what's a simpler way to justify trusting the rule?

- ☐ **A.** Just memorise it without ever checking
- ☐ **B.** Test it on several known multiples of 7 and confirm it always gives a multiple of 7 back
- ☐ **C.** Assume it's wrong since the reasoning sounds complicated
- ☐ **D.** It cannot be justified at all without formal algebra

Q29. A student wants a divisibility rule for 56 (=7x8). What is the most efficient approach?

- ☐ **A.** Check divisibility by 7 AND by 8 separately, since 56 = 7x8 and 7,8 are co-prime
- ☐ **B.** Invent a completely new rule from scratch
- ☐ **C.** Only check divisibility by 7
- ☐ **D.** It is impossible to check divisibility by 56 using smaller rules

Q30. A number divisible by 7, 8 and 11 must be a multiple of which product, and why?

- ☐ **A.** A multiple of 26 (7+8+11)
- ☐ **B.** A multiple of 616 (7x8x11), since all three are pairwise co-prime
- ☐ **C.** A multiple of 7 only, since 7 is the smallest
- ☐ **D.** There is no such requirement

Answer Key

Q1: (A) (a) Only the last three. Every multiple of 1000 is automatically divisible by 8, so only the last three digits determine the answer.

Q2: (C) (c) Double it. Doubling the last digit before subtracting it from the rest is the key step of the 7-rule.

Q3: (B) (b) Yes. 928 / 8 = 116 exactly, with no remainder.

Q4: (D) (d) 42. Subtracting the doubled last digit (6) from the remaining part (48) gives 42, which is 7x6.

Q5: (B) (b) Add and subtract them alternately. The alternating sum of digits determines divisibility by 11.

Q6: (A) (a) Yes. 42 = 7 x 6, so it divides evenly by 7.

Q7: (D) (d) 928. She checked only the last three digits, 928, instead of the whole four-digit number.

Q8: (C) (c) 0 or a multiple of 11. The alternating sum must land on 0, 11, 22, or any other multiple of 11 to confirm divisibility.

Q9: (B) (b) 3,016. Its last three digits, 016, divide by 8 (16/8=2), confirming the whole number does too.

Q10: (A) (a) No, they give the exact same answer, just faster. Divisibility rules are shortcuts, not different rules — they always agree with long division.

Q11: (A) (a) Yes, since 144/8=18. Checking only the last three digits, 144, confirms divisibility by 8 for the whole number.

Q12: (A) (a) Because every multiple of 1000 is automatically divisible by 8. Since 1000/8=125 exactly, any number of full thousands never affects divisibility by 8, leaving only the last three digits to matter.

Q13: (B) (b) 11, so divisible by 11. 8-2+7-2=11, a multiple of 11, confirming 2,728 divides evenly by 11 (2728/11=248).

Q14: (D) (d) 7,624. Its last three digits, 624, divide by 8 exactly (624/8=78).

Q15: (D) (d) It is divisible by 11, since 22 is a multiple of 11. Any multiple of 11 as the alternating sum, not just 0 or 11 itself, confirms divisibility.

Q16: (C) (c) 9-2=7, divisible by 7. The result, 7, is itself a multiple of 7, confirming 91 divides evenly by 7 (91=7x13).

Q17: (C) (c) 4,502. Its last three digits, 502, do not divide evenly by 8 (502/8=62.75), unlike the other three options.

Q18: (A) (a) 0, so it is divisible by 11. 6-3+2-5=0, and 0 counts as a valid result confirming divisibility (5236/11=476).

Q19: (B) (b) 20-6=14, which is 7x2, so divisible. 203 = 7 x 29, confirming the rule's result is correct.

Q20: (B) (b) Double 3 (last digit) to get 6, subtract from 300, giving 294, then check if 294 divides by 7. 294/7=42 exactly, confirming 3,003 is divisible by 7 (3003=7x429).

Q21: (A) (a) It is always divisible by 8. 000 as the last three digits means the number is a multiple of 1000, and every multiple of 1000 divides evenly by 8.

Q22: (B) (b) Because the first result may still be too large to recognise as a multiple of 7 by eye. Repeating the same doubling-and-subtracting step on the smaller result shrinks the number further, until it's small enough to check directly.

Q23: (A) (a) Yes, since 104/8=13 exactly. 104 divides evenly by 8, so by the rule, the whole number N is divisible by 8 regardless of its other digits.

Q24: (C) (c) Yes — negative multiples of 11 still count. -11 is still a multiple of 11 (11x-1), so the divisibility rule holds regardless of the sign of the result.

Q25: (D) (d) The 8-rule relies on a fixed digit window (last 3); the 11-rule relies on alternating positions across ALL digits. The 8-rule works because of how powers of 10 relate to 8, while the 11-rule works because of how alternating powers of 10 relate to 11 — genuinely different underlying reasons.

Q26: (D) (d) 1,235. Its last three digits 235 don't divide by 8, and its alternating sum 5-3+2-1=3 isn't a multiple of 11 either — failing both rules, unlike the other options which pass at least one.

Q27: (C) (c) It must be divisible by 88 too, since 8 and 11 are co-prime. When a number is divisible by two co-prime numbers, it is automatically divisible by their product — 8x11=88.

Q28: (B) (b) Test it on several known multiples of 7 and confirm it always gives a multiple of 7 back. Verifying a rule against several known cases (like 91, 203, 483 in this topic) builds justified confidence even before a full algebraic proof is understood.

Q29: (A) (a) Check divisibility by 7 AND by 8 separately, since 56 = 7x8 and 7,8 are co-prime. When two divisibility conditions for co-prime factors are both satisfied, the number is guaranteed divisible by their product, avoiding the need for a whole new rule.

Q30: (B) (b) A multiple of 616 (7x8x11), since all three are pairwise co-prime. Since 7, 8, and 11 share no common factors with each other, a number divisible by all three must be divisible by their full product, 616.

You've got this! Keep learning and shining! - Ruchi Math Coaching