

Palindromic Numbers

Unit: Number Play - Student Practice Worksheet

Overview: Anaya read 121 forwards. Then she read it backwards. Same number. Kabir tried it with 123 — forwards and backwards gave two different numbers entirely. One of those numbers had a name, and the other one didn't.

Practice Questions (30 Total)

Section A - Easy

Q1. The two teal boxes match from both ends. Which palindromic number is shown?



- ☐ A. 121
- ☐ B. 123
- ☐ C. 120
- ☐ D. 125

Q2. The first step of the reverse-and-add process is to:

- ☐ A. Divide the number by 2
- ☐ B. Multiply the number by itself
- ☐ C. Reverse the number's digits
- ☐ D. Subtract 1 from the number

Q3. Which of these is NOT a palindromic number?

- ☐ A. 1331
- ☐ B. 1234
- ☐ C. 1221
- ☐ D. 1111

Q4. The arrow reverses the digits of 47. What lands in the peach box?



- ☐ A. 47
- ☐ B. 40
- ☐ C. 7
- ☐ D. 74

Q5. The number 196 is famous in mathematics because:

- ☐ A. No one has proven if it reaches a palindrome
- ☐ B. It is the largest known palindrome
- ☐ C. It is the smallest palindrome
- ☐ D. It cannot be reversed

Q6. $47 + 74$ equals:

- ☐ A. 111
- ☐ B. 121
- ☐ C. 131
- ☐ D. 141

Q7. The letter boxes of MADAM match from both ends. Why is this a palindrome?



- ☐ A. It has 5 letters
- ☐ B. It starts and ends with M
- ☐ C. It reads the same forwards and backwards
- ☐ D. It is a common name

Q8. What is a palindromic number?

- ☐ A. A number that is always even
- ☐ B. A number with three digits

- ☐ C. A number that cannot be reversed
- ☐ D. A number that reads the same forwards and backwards

Q9. Is 305 a palindrome?

- ☐ A. Yes
- ☐ B. Only sometimes
- ☐ C. All 3-digit numbers are palindromes
- ☐ D. No

Q10. Is 202 a palindrome?

- ☐ A. No, it does not match
- ☐ B. Only if reversed twice
- ☐ C. Yes, it reads the same both ways
- ☐ D. Cannot be determined here

Section B - Medium

Q11. The teal bar shows one reverse-and-add step. What palindrome is the result?

$$47 + 74 = 121$$

- ☐ A. 121
- ☐ B. 111
- ☐ C. 47
- ☐ D. 74

Q12. Why does Ms. Rao call 196 'genuinely unsolved' rather than just a hard example?

- ☐ A. Because 196 is not actually a real number
- ☐ B. No one has proven it either does or does not reach a palindrome
- ☐ C. Because no one has ever tried the process on 196
- ☐ D. Because 196 already is a palindrome

Q13. Anaya took 68 through reverse-and-add. After round 1 (68+86), what number did she get?

- ☐ A. 121

- ☐ B. 154
- ☐ C. 605
- ☐ D. 1111

Q14. How many reverse-and-add rounds does this 68 chain take to reach a palindrome?

$$68 + 86 = 154$$

$$154 + 451 = 605$$

$$605 + 506 = 1111$$

- ☐ A. 1
- ☐ B. 2
- ☐ C. 3
- ☐ D. 4

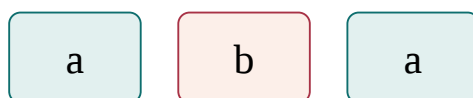
Q15. Which single-digit numbers are automatically palindromes?

- ☐ A. None of them
- ☐ B. Only even numbers
- ☐ C. Only 0
- ☐ D. All of them

Q16. Apply reverse-and-add to 23. What is the result?

- ☐ A. 32
- ☐ B. 23
- ☐ C. 65
- ☐ D. 55

Q17. The form aba means the first and last digits match. How many 3-digit palindromes exist (first digit 1–9, middle 0–9)?



- ☐ A. 100
- ☐ B. 9
- ☐ C. 90
- ☐ D. 81

Q18. If a two-digit number's two digits are already equal (like 33), is it already a palindrome?

- ☐ A. Yes
- ☐ B. No, it still needs reverse-and-add
- ☐ C. Only if the digits are both even
- ☐ D. Only if the number is bigger than 50

Q19. Apply reverse-and-add to 15. What is the result?

- ☐ A. 66
- ☐ B. 15
- ☐ C. 51
- ☐ D. 16

Q20. Is 1000 a palindrome?

- ☐ A. Yes
- ☐ B. No
- ☐ C. Only 4-digit numbers ending in 0 are
- ☐ D. Only if you add a leading zero

Section C - Challenge

Q21. The boxes show $a=3$, $b=7$ in the pattern $a-b-b-a$. What 4-digit palindrome is that?



Read the four boxes in order

- ☐ A. 3737
- ☐ B. 7337
- ☐ C. 3377
- ☐ D. 3773

Q22. A student claims every number reaches a palindrome within 3 rounds of reverse-and-add. Is this claim provably true?

- ☐ **A.** Yes, it has been mathematically proven for all numbers
- ☐ **B.** No — this is exactly the kind of claim that remains unproven for numbers like 196
- ☐ **C.** Yes, but only for numbers under 100
- ☐ **D.** No number ever reaches a palindrome

Q23. Apply reverse-and-add to 59. How many rounds does it take to reach a palindrome, and what is it?

- ☐ **A.** 3 rounds, 1111
- ☐ **B.** 1 round, 154
- ☐ **C.** 2 rounds, 605
- ☐ **D.** 1 round, 121

Q24. 100 reversed as digits is 0, 0, 1. What number is that, and why does 100 fail the palindrome test?

100 $\rightarrow$ 0, 0, 1

as a number: 1

- ☐ **A.** 001, which as a number is simply 1
- ☐ **B.** 100, unchanged
- ☐ **C.** 1000, with an extra zero added
- ☐ **D.** It cannot be reversed at all

Q25. Anaya notices every number she tries eventually reaches a palindrome within 10 rounds. Does this prove all numbers do?

- ☐ **A.** Yes, testing enough examples always counts as a proof
- ☐ **B.** Yes, because 10 rounds is the mathematically proven maximum
- ☐ **C.** No — testing many examples is evidence, not a proof covering every number
- ☐ **D.** No, because reverse-and-add is not a real mathematical process

Q26. How many 2-digit palindromes exist (numbers like 11, 22, ..., 99)?

- ☐ **A.** 10
- ☐ **B.** 90

☐ C. 99

☐ D. 9

Q27. After round 2 on 154 (154+451), what number resulted? Use the same chain as 68.

$$68 + 86 = 154$$

$$154 + 451 = 605$$

$$605 + 506 = 1111$$

☐ A. 154

☐ B. 605

☐ C. 506

☐ D. 1111

Q28. What makes the reverse-and-add process a genuine piece of real mathematical research rather than just a classroom trick?

☐ A. It always produces the same answer for any number

☐ B. It connects to a real unsolved problem mathematicians still study

☐ C. It was invented specifically for this textbook

☐ D. It only works for numbers under 1000

Q29. After reversing 100, Kabir adds $100 + 1$. What does he get, and is it a palindrome?

☐ A. 101, which is a palindrome

☐ B. 100, unchanged

☐ C. 1000

☐ D. 001

Q30. Which of these famous numbers besides 196 is also suspected to never reach a palindrome via reverse-and-add?

☐ A. All two-digit numbers

☐ B. Every even number

☐ C. Numbers such as 295 and 394

☐ D. The number 121 itself

Answer Key

Q1: (A) (a) 121. The first and last digits match, so the number reads the same forwards and backwards.

Q2: (C) (c) Reverse the digits of the number first.

Q3: (B) (b) 1234 reversed is 4321, a different number.

Q4: (D) (d) 74 — the digits swap places.

Q5: (A) (a) It's an unsolved open question whether repeated reverse-and-add ever turns 196 into a palindrome.

Q6: (B) (b) 121, which is itself a palindrome.

Q7: (C) (c) It reads identically forwards and backwards, same as a palindromic number.

Q8: (D) (d) A number that reads the same forwards and backwards, like 121 or 1331.

Q9: (D) (d) No — 305 reversed is 503, a different number.

Q10: (C) (c) Yes — 202 reversed is still 202.

Q11: (A) (a) 121. $47 + 74 = 121$, which reads the same both ways.

Q12: (B) (b) It's genuinely unproven despite huge computational effort.

Q13: (B) (b) 154. $68 + 86 = 154$.

Q14: (C) (c) 3 rounds: $68 \rightarrow 154 \rightarrow 605 \rightarrow 1111$. The peach bar is the last, palindrome step.

Q15: (D) (d) All single-digit numbers are trivially palindromes, since there's nothing to reverse.

Q16: (D) (d) 55. 23 reversed is 32; $23 + 32 = 55$, itself a palindrome.

Q17: (C) (c) 90. 9 choices for a (1–9) times 10 choices for b (0–9).

Q18: (A) (a) Yes — reversing 33 gives 33 again.

Q19: (A) (a) 66. 15 reversed is 51; $15 + 51 = 66$.

Q20: (B) (b) No — 1000 reversed is 0001, which as a written number is 1, not 1000.

Q21: (D) (d) 3773. Read the four boxes in order: 3, 7, 7, 3.

Q22: (B) (b) No — 196 and similar numbers keep this an open question.

Q23: (A) (a) 3 rounds, 1111. $59 + 95 = 154$; $154 + 451 = 605$; $605 + 506 = 1111$.

Q24: (A) (a) Reversing 100 gives 001, which as a written number is 1, not 100. Leading zeros are dropped.

Q25: (C) (c) No — a real proof must cover every possible number, which remains unresolved.

Q26: (D) (d) 9. Only 11, 22, 33, 44, 55, 66, 77, 88, 99.

Q27: (B) (b) 605. $154 + 451 = 605$. This is the middle step of the 68/59 chain.

Q28: (B) (b) It connects to the real, unresolved Lychrel number question.

Q29: (A) (a) 101, which is a palindrome. Reverse-and-add uses the numerical reverse 1, not the three-digit string 001.

Q30: (C) (c) Several other numbers (like 295, 394) are similarly suspected Lychrel-like candidates.

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