

Kaprekar Constant

Unit: Number Play - Student Practice Worksheet

Overview: Kabir picked any 4-digit number he liked. Anaya picked a completely different one. Both followed the same simple steps. Both landed on the exact same number: 6174. Every single time, no matter the starting number — as long as it wasn't all-one-digit.

Practice Questions (30 Total)

Section A - Easy

Q1. The teal box names the Kaprekar constant. What number is it?

6174

- ☐ A. 6174
- ☐ B. 1234
- ☐ C. 9999
- ☐ D. 121

Q2. Kaprekar's routine involves:

- ☐ A. Adding digits together
- ☐ B. Largest arrangement minus smallest arrangement
- ☐ C. Multiplying by 2
- ☐ D. Reversing the digits

Q3. For 3524, the largest digit arrangement is:

- ☐ A. 2345
- ☐ B. 3524
- ☐ C. 5432
- ☐ D. 4253

Q4. The peach box is 3524 with digits sorted smallest-first. What number is that?

digits of 3524

largest 5432

smallest 2345

- ☐ A. 5432
- ☐ B. 3524
- ☐ C. 4253
- ☐ D. 2345

Q5. Which starting numbers does Kaprekar's routine NOT work on?

- ☐ A. Numbers starting with an even digit
- ☐ B. Numbers with all identical digits, like 4444
- ☐ C. Numbers over 9000
- ☐ D. Numbers with a 0 in them

Q6. 5432 – 2345 equals:

- ☐ A. 3087
- ☐ B. 3097
- ☐ C. 3187
- ☐ D. 2087

Q7. The peach bar applies the routine to 6174. What comes out?

$$7641 - 1467 = 6174$$

- ☐ A. 0
- ☐ B. 1000
- ☐ C. 6174
- ☐ D. 9999

Q8. Who discovered the Kaprekar constant?

- ☐ A. Ms. Rao
- ☐ B. Kabir

- ☐ C. Anaya
- ☐ D. D. R. Kaprekar

Q9. Within how many rounds does the routine always reach 6174?

- ☐ A. Exactly 1
- ☐ B. At most 7
- ☐ C. At least 20
- ☐ D. It never reaches it

Q10. Is the Kaprekar constant result proven or still an open question?

- ☐ A. Still open
- ☐ B. Disproven
- ☐ C. Proven
- ☐ D. Only tested, never proven

Section B - Medium

Q11. Kabir's path from 3524 is shown. After how many of these subtractions does he first reach 6174?

$$5432 - 2345 = 3087$$

$$8730 - 0378 = 8352$$

$$8532 - 2358 = 6174$$

- ☐ A. 1
- ☐ B. 3
- ☐ C. 2
- ☐ D. 5

Q12. Anaya started with 8091 and reached 6174 in a few rounds. What does this show?

- ☐ A. 6174 only works for certain starting numbers
- ☐ B. Anaya made an arithmetic mistake
- ☐ C. 6174 changes depending on the start
- ☐ D. Different starting numbers still converge to the same 6174

Q13. Kabir's second round on 3087 gave what result?

- ☐ A. 8352
- ☐ B. 6174
- ☐ C. 3087
- ☐ D. 9999

Q14. The two boxes show largest and smallest of 9831. What is the smallest arrangement?

9831

1389

- ☐ A. 9831
- ☐ B. 3819
- ☐ C. 1389
- ☐ D. 8319

Q15. Why can't a number like 5555 ever reach 6174 through Kaprekar's routine?

- ☐ A. Its largest and smallest arrangements are identical
- ☐ B. 5555 is too large a number
- ☐ C. 5555 is a palindrome
- ☐ D. 5555 has too many digits

Q16. Apply Kaprekar's routine once to 1234. What is the result?

- ☐ A. 6174
- ☐ B. 1234
- ☐ C. 3087
- ☐ D. 4321

Q17. The peach box pads 999 back to four digits after $1000 - 1$. What 4-digit result is that?

$$1000 - 0001 = 999$$

pad $\rightarrow$ 0999

- ☐ A. 0999
- ☐ B. 1000
- ☐ C. 9000
- ☐ D. 0000

Q18. What makes 6174 different from a typical answer in a maths problem?

- ☐ A. It is the biggest 4-digit number
- ☐ B. It has its own name and a mathematically proven universal property
- ☐ C. It cannot be written in digits
- ☐ D. It is never actually reached in practice

Q19. 9831 – 1389 equals:

- ☐ A. 8432
- ☐ B. 7442
- ☐ C. 8342
- ☐ D. 8442

Q20. 8532 – 2358 equals:

- ☐ A. 6174
- ☐ B. 6274
- ☐ C. 5174
- ☐ D. 6184

Section C - Challenge

Q21. The teal box 1212 still has mixed digits; the peach box 4444 does not. Which number is still a valid Kaprekar start?

1212

4444

- ☐ A. 4444 — invalid, all digits identical
- ☐ B. 5555 — invalid, all digits identical
- ☐ C. 1212 — still valid since not every digit is the same
- ☐ D. 9999 — invalid, all digits identical

Q22. Kabir claims Kaprekar's routine works the same way for 3-digit numbers, just with a different constant. Is this true?

- ☐ A. No, the routine only exists for 4-digit numbers
- ☐ B. Yes, but it also converges to 6174
- ☐ C. Yes — a similar routine on 3-digit numbers converges to 495
- ☐ D. No, 3-digit numbers never converge to anything

Q23. Continuing from 0999, what is the next Kaprekar result?

- ☐ A. 9990
- ☐ B. 8991
- ☐ C. 0999
- ☐ D. 1000

Q24. The peach bar shows 6174 mapping to itself. What does that make 6174?

$$7641 - 1467 = 6174$$

- ☐ A. A number that cannot be rearranged
- ☐ B. A palindrome
- ☐ C. An open unsolved case
- ☐ D. A fixed point of the routine

Q25. How is the Kaprekar constant result different in kind from the still-open palindrome (196) question?

- ☐ A. Kaprekar's result is fully proven; 196 is not
- ☐ B. They are exactly the same kind of question
- ☐ C. The palindrome question is proven and Kaprekar's is not
- ☐ D. Neither has ever been proven

Q26. Anaya wonders what $6+1+7+4$ sums to. What is that sum?

- ☐ A. 18
- ☐ B. 17
- ☐ C. 19
- ☐ D. 20

Q27. For 9831 the teal box is already the largest arrangement. What is that largest number?

9831

1389

- ☐ A. 9813
- ☐ B. 9831
- ☐ C. 8931
- ☐ D. 3189

Q28. Why is proving the Kaprekar constant harder than just testing many 4-digit numbers?

- ☐ A. It isn't harder at all, testing is the same as proving
- ☐ B. Because 4-digit numbers cannot be tested by computer
- ☐ C. Because Kaprekar never actually proved it
- ☐ D. A proof must cover all roughly 9000 possible starting numbers with certainty

Q29. A number reaches 6174 after exactly 1 round. What can you conclude?

- ☐ A. The number must have been 6174 already
- ☐ B. The subtraction directly equalled 6174
- ☐ C. It is impossible to reach 6174 in 1 round
- ☐ D. The number had all identical digits

Q30. Suppose a number reaches 6174 in 7 rounds — the known maximum. What does this tell you?

- ☐ A. That number is a special exception
- ☐ B. The routine failed for that number
- ☐ C. It means the number was already 6174
- ☐ D. 7 rounds is the worst case, so every valid start reaches 6174 in 7 rounds or fewer

Answer Key

- Q1:** (A) (a) 6174. That is the fixed number Kaprekar's 4-digit routine always reaches.
- Q2:** (B) (b) Largest arrangement minus smallest arrangement.
- Q3:** (C) (c) 5432 — digits sorted from biggest to smallest.
- Q4:** (D) (d) 2345 — digits sorted from smallest to biggest.
- Q5:** (B) (b) Numbers with all identical digits, since largest minus smallest would always be zero.
- Q6:** (A) (a) 3087.
- Q7:** (C) (c) 6174 — it's a fixed point: $7641 - 1467 = 6174$.
- Q8:** (D) (d) D. R. Kaprekar, the mathematician it is named after.
- Q9:** (B) (b) At most 7 rounds, for any valid 4-digit starting number.
- Q10:** (C) (c) Proven — mathematicians have confirmed it holds for every valid starting number.
- Q11:** (B) (b) 3 rounds: $3524 \rightarrow 3087 \rightarrow 8352 \rightarrow 6174$. The teal bar is the third subtraction.
- Q12:** (D) (d) Different starting numbers all converge to the identical constant, 6174.
- Q13:** (A) (a) 8352. $8730 - 378 = 8352$.
- Q14:** (C) (c) 1389 — digits sorted ascending: 1, 3, 8, 9.
- Q15:** (A) (a) All digits identical means largest equals smallest, so the subtraction is always 0.
- Q16:** (C) (c) 3087. Largest is 4321, smallest is 1234; $4321 - 1234 = 3087$.
- Q17:** (A) (a) 0999. Largest 1000 minus smallest 0001 is 999, written as 0999 for the next round.
- Q18:** (B) (b) It has its own name (the Kaprekar constant) and a fully proven property.
- Q19:** (D) (d) 8442.
- Q20:** (A) (a) 6174.
- Q21:** (C) (c) 1212 has repeated digits but is not all-identical, so the routine still applies.
- Q22:** (C) (c) Yes — the 3-digit analogue converges to 495.
- Q23:** (B) (b) 8991. Largest 9990 minus smallest 0999 is 8991.
- Q24:** (D) (d) A fixed point: once you arrive, $7641 - 1467$ gives 6174 again.
- Q25:** (A) (a) The Kaprekar constant is fully proven; whether 196 ever reaches a palindrome is still open.
- Q26:** (A) (a) 18. $6+1+7+4=18$ (arithmetic curiosity, not why 6174 is special).
- Q27:** (B) (b) 9831 — its digits 9,8,3,1 are already sorted largest to smallest.
- Q28:** (D) (d) A real proof must guarantee the result for every valid start, not just the ones that happened to be tested.
- Q29:** (B) (b) Reaching 6174 in exactly 1 round means the first largest-minus-smallest already equalled 6174.
- Q30:** (D) (d) 7 rounds is the proven maximum — this start just happened to take the full amount.

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