Properties of Integers

Unit: Integers and Rationals - Student Practice Worksheet

Overview: Kabir claimed that subtraction works like addition: "Just swap the order, the answer's the same either way." Zara bet him a chocolate that 5 – 3 does NOT equal 3 – 5. Kabir checked on paper and owed her a chocolate by lunch.

Practice Questions (30 Total)

Section A - Easy

Q1. Two teal/maroon groupings of 10, 4, 2. Equal?

$(10-4)-2 = 4$

$10-(4-2) = 8$

- [ ] **A.** Yes, both equal 4
- [ ] **B.** Yes, both equal 8
- [ ] **C.** No — 4 and 8
- [ ] **D.** No — 6 and 2

Q2. Is addition of integers commutative?

- [ ] **A.** Yes, order never matters
- [ ] **B.** No, order always matters
- [ ] **C.** Only for positives
- [ ] **D.** Only for even integers

Q3. Is subtraction of integers commutative?

- [ ] **A.** Yes, always
- [ ] **B.** No, order can change it
- [ ] **C.** Only when equal
- [ ] **D.** Only for negatives

Q4. Teal 3 times the (5-2) split. Equal to 3x5 minus 3x2?

3 x (5-2) both 9?

- [ ] **A.** Yes, both equal 9
- [ ] **B.** No, 9 and 6
- [ ] **C.** Yes, both equal 15
- [ ] **D.** No, 3 and 9

Q5. What does the distributive property connect?

- [ ] **A.** Multiplication with addition and subtraction
- [ ] **B.** Only addition with subtraction
- [ ] **C.** Only division with multiplication
- [ ] **D.** Squares with cubes

Q6. Are integers closed under division?

- [ ] **A.** Yes, always
- [ ] **B.** No, 1÷2 is not an integer
- [ ] **C.** Only when dividing by 1
- [ ] **D.** Only for even integers

Q7. One maroon counterexample. How many are needed to kill a claimed property?

1 counterexample kills a claim

- [ ] **A.** At least ten
- [ ] **B.** Every possible case
- [ ] **C.** Half of all cases
- [ ] **D.** Just one

Q8. Is multiplication of integers associative?

- [ ] **A.** No, never
- [ ] **B.** Only for two numbers
- [ ] **C.** Only for positives
- [ ] **D.** Yes, grouping is free

Q9. Are integers closed under subtraction?

- ☐ **A.** No, not closed
- ☐ **B.** Only for positive results
- ☐ **C.** Yes, the result stays an integer
- ☐ **D.** Only if both are positive

Q10. Which two operations fail both commutative and associative, with one example each?

- ☐ **A.** Addition and multiplication
- ☐ **B.** Subtraction and division
- ☐ **C.** Addition and subtraction
- ☐ **D.** Multiplication and division

Section B - Medium

Q11. Two division groupings of 12, 4, 2. Equal?

$(12 \div 4) \div 2$

$12 \div (4 \div 2)$

- ☐ **A.** Yes, both equal 1.5
- ☐ **B.** No — 1.5 and 6
- ☐ **C.** Yes, both equal 6
- ☐ **D.** No — 3 and 6

Q12. A student claims "all four basic operations on integers are commutative." What is the fastest way to disprove this?

- ☐ **A.** Prove addition is commutative
- ☐ **B.** Test every possible integer pair
- ☐ **C.** Give one subtraction example where order matters
- ☐ **D.** Show multiplication works

Q13. Verify: does -4 × (6 – 3) equal (-4 × 6) – (-4 × 3)?

- ☐ **A.** No, they differ
- ☐ **B.** Yes, both equal -12
- ☐ **C.** Yes, both equal 12

- [ ] **D.** Yes, both equal -18

Q14. 7-3 lands at 4, 3-7 at -4. Valid counterexample?

- [ ] **A.** 2 – 2 = 2 – 2
- [ ] **B.** 0 – 0 = 0 – 0
- [ ] **C.** 7 – 3 ≠ 3 – 7
- [ ] **D.** 1 + 1 = 1 + 1

Q15. If a÷b happens to be an integer for one particular pair a, b, does that prove integers are closed under division?

- [ ] **A.** Yes, that one case proves it
- [ ] **B.** Yes, if a is even
- [ ] **C.** Yes, if b is positive
- [ ] **D.** No — a real property needs every case

Q16. Is the set of integers closed under multiplication?

- [ ] **A.** No, sometimes it gives a fraction
- [ ] **B.** Only for positive integers
- [ ] **C.** Only for even integers
- [ ] **D.** Yes, always

Q17. 25 times the (8-3) split. What is 25x8 - 25x3?

- [ ] **A.** 25 × (8 – 3) = 125
- [ ] **B.** 25 × (8 + 3) = 275
- [ ] **C.** 25 × 5 = 100
- [ ] **D.** 50 × 5 = 250

Q18. Evaluate (-2 + 5) + (-3) and -2 + (5 + (-3)) — are they equal, confirming a property?

- [ ] **A.** Yes, both equal 0, confirming associativity
- [ ] **B.** No, they differ
- [ ] **C.** Yes, both equal 6
- [ ] **D.** Yes, but only by coincidence

Q19. Which correctly applies the distributive property to -6 × (4 + 7)?

- [ ] **A.** -6×4 – 6×7
- [ ] **B.** -6×4 + -6×7
- [ ] **C.** 6×4 + 6×7
- [ ] **D.** -6×11 + 6

Q20. Does (-3)x(-4)x2 stay 24 whichever pair you multiply first, and which property is that?

- [ ] **A.** Yes, both groupings give 24
- [ ] **B.** No, groupings give different signs
- [ ] **C.** Yes, but only give -24
- [ ] **D.** It depends on the order of the numbers

Section C - Challenge

Q21. Same three 5s, two groupings. Associative?

$(5-5)-5 = -5$

$5-(5-5) = 5$

- [ ] **A.** Yes: both equal 0
- [ ] **B.** No: -5 and 5
- [ ] **C.** Yes: both equal -5
- [ ] **D.** No: 0 and -5

Q22. For which values of a and b does a – b = b – a actually hold?

- [ ] **A.** Never
- [ ] **B.** Only when a = b
- [ ] **C.** Only when a and b are both positive
- [ ] **D.** Always

Q23. Simplify 17×99 using distributivity, treating 99 as $(100 - 1)$.

☐ **A.** $1700 - 17 = 1683$

☐ **B.** $1700 + 17 = 1717$

☐ **C.** $17 \times 100 = 1700$

☐ **D.** 1683, but using 17×98 instead

Q24. Operation a-2b: 4 then 1 vs 1 then 4. Commutative?

4 then 1: 4-2x1=2

1 then 4: 1-2x4=-7

☐ **A.** Yes: both give 2

☐ **B.** No: 2 and -7

☐ **C.** Yes: both give -7

☐ **D.** No: 2 and 7

Q25. If $a \times (b - c) = a \times b - a \times c$ holds for all integers, what can you say about $a \times (c - b)$?

☐ **A.** It equals $a \times b - a \times c$, unchanged

☐ **B.** It is always zero

☐ **C.** It equals $a \times c - a \times b$, the negative of the original

☐ **D.** It cannot be determined

Q26. A set of numbers is closed under an operation if the result always stays inside that set. Is the set of non-zero integers closed under division?

☐ **A.** Neither integers nor non-zero integers are closed under division

☐ **B.** Yes, all non-zero integers are closed under division

☐ **C.** Only positive integers are closed

☐ **D.** Only even integers are closed

Q27. 6 times (5+2) split into two products. Which property?

$\boxed{6}$ x (5+2) = 6x5 + 6x2

☐ **A.** Commutativity

☐ **B.** Associativity

- [ ] **C.** Closure
- [ ] **D.** Distributivity, treating 7 as (5+2)

Q28. A store computes total cost as price×(quantity – returned). Why is distributivity useful here rather than computing price×quantity and price×returned as two separate steps mentally?

- [ ] **A.** It isn't useful — both approaches take equal effort
- [ ] **B.** It only works for whole-number prices
- [ ] **C.** It lets you compute one combined multiplication instead of two, when that's easier
- [ ] **D.** It only works if returned is zero

Q29. Simplify (-8) × 15 + (-8) × (-5) using distributivity.

- [ ] **A.** -8 × (15 – 5) = -80
- [ ] **B.** -8 × (15 + 5) = -160
- [ ] **C.** -8 × 10 = -80, using addition instead
- [ ] **D.** 8 × 10 = 80

Q30. Test a=8, b=3, c=1 for subtraction associativity, and say what it shows.

- [ ] **A.** Yes: (8–3)–1 = 8–(3–1) = 4
- [ ] **B.** Yes: both equal 6
- [ ] **C.** No: 5 and 4
- [ ] **D.** No: 4 and 6

Answer Key

Q1: (C) (c) No — 4 and 8. (10–4)–2=6–2=4, while 10–(4–2)=10–2=8, proving subtraction is not associative.

Q2: (A) (a) Yes. a+b=b+a holds for every pair of integers, positive, negative, or zero.

Q3: (B) (b) No. 5–3=2 but 3–5=–2, so swapping the order changes the answer — subtraction is not commutative.

Q4: (A) (a) Yes, both equal 9. This confirms multiplication distributes over subtraction just as it does over addition.

Q5: (A) (a) Multiplication with addition and subtraction. a×(b+c)=a×b+a×c, and a×(b–c)=a×b–a×c, both hold.

Q6: (B) (b) No. 7÷2 is not an integer, so division can take you outside the set of integers — integers are not closed under division.

Q7: (D) (d) Just one. A single genuine counterexample is enough to disprove a general claim, even though proving a property true needs every case to hold.

Q8: (D) (d) Yes. (a×b)×c always equals a×(b×c) for integers, unlike subtraction and division.

Q9: (C) (c) Yes. Subtracting any two integers always gives another integer, even when the result is negative.

Q10: (B) (b) Subtraction and division. Both fail commutativity and associativity, unlike addition and multiplication which keep both.

Q11: (B) (b) No — 1.5 and 6. (12÷4)÷2=3÷2=1.5, while 12÷(4÷2)=12÷2=6, proving division is not associative.

Q12: (C) (c) Give one subtraction example where order matters. One genuine counterexample is enough to disprove a universal claim.

Q13: (B) (b) Yes, both equal -12. -4×3=-12 directly; and (-4×6)-(-4×3) = -24-(-12) = -24+12 = -12, confirming distributivity works with negative numbers too.

Q14: (C) (c) 7 – 3 ≠ 3 – 7. 7–3=4 while 3–7=–4, a genuine mismatch, unlike the trivial equal cases in the other options.

Q15: (D) (d) No — a real property needs every case. Plenty of integer pairs, like 7 and 2, give a non-integer result, so division is not closed in general.

Q16: (D) (d) Yes, always. Multiplying any two integers always produces another integer — never a fraction.

Q17: (A) (a) 25 × (8 – 3) = 125. Factor out the common 25 first using distributivity in reverse, then compute 25×5=125.

Q18: (A) (a) Yes, both equal 0, confirming associativity. (-2+5)+(-3) = 3+(-3) = 0, and -2+(5+(-3)) = -2+2 = 0.

Q19: (B) (b) -6×4 + -6×7. Every term inside the bracket must be multiplied by -6, keeping its sign attached correctly.

Q20: (A) (a) Yes, both groupings give 24. ((-3)×(-4))×2 = 12×2 = 24, and (-3)×((-4)×2) = (-3)×(-8) = 24 — associativity holds for multiplication.

Q21: (B) (b) No: -5 and 5. (5–5)–5 = 0–5 = -5, while 5–(5–5) = 5–0 = 5 — even with equal numbers, subtraction still fails to be associative.

Q22: (B) (b) Only when a = b. If a–b=b–a, then 2a=2b, so a=b — the ONE special case where subtraction's order doesn't matter, but that doesn't make it commutative in general.

Q23: (A) (a) 1700 – 17 = 1683. 17×(100–1) = 17×100 – 17×1 = 1700–17=1683, a genuinely faster mental calculation than multiplying 17×99 directly.

Q24: (B) (b) No: 2 and -7. a–2b with a=4,b=1 gives 4–2=2; swapping to b–2a gives 1–8=-7 — a new custom operation built from subtraction inherits its non-commutativity.

Q25: (C) (c) It equals a×c – a×b, the negative of the original. Swapping b and c inside the bracket flips the sign of the whole result, consistent with distributivity applied to (c–b) instead of (b–c).

Q26: (A) (a) Neither integers nor non-zero integers are closed under division. Even restricting to non-zero integers, a case like 5÷3 still produces a non-integer, so closure still fails.

Q27: (D) (d) Distributivity, treating 7 as (5+2). 6×(5+2) = 6×5+6×2 = 30+12=42, matching 6×7=42 directly.

Q28: (C) (c) It lets you compute one combined multiplication instead of two, when that's easier. Both approaches are mathematically identical thanks to distributivity — the choice is purely about which arithmetic is easier to do by hand.

Q29: (A) (a) -8 × (15 – 5) = -80. Factor -8 out: -8×15 + -8×(-5) = -8×(15 + (-5)) = -8×10 = -80.

Q30: (D) (d) No: 4 and 6. (8–3)–1=5–1=4, while 8–(3–1)=8–2=6 — still unequal, reinforcing that subtraction fails associativity even with varied, non-trivial numbers.

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