

Working Backwards — Practice

CKSTEM Math Problem Solving · Grades 4–7

1 REVERSE THE OPERATIONS

Ravi spent half of his pocket money on a comic. Then he spent \$4 on a snack. He has \$3 left. How much pocket money did he start with?

WORK IT OUT HERE

2 REVERSE THE OPERATIONS

A water jar is poured out by half. Then 2 more cups are scooped out. The jar has 3 cups left. How many cups were in the jar at the start?

WORK IT OUT HERE

3 REVERSE THE OPERATIONS

Dana spent half of her birthday money on a video game. Then she spent \$6 on a movie ticket. Then she spent \$2 on popcorn. She has \$5 left. How much birthday money did she start with?

WORK IT OUT HERE

4 REVERSE THE OPERATIONS

Liam hands 12 stickers to his sister. After that, they each have 30 stickers. How many stickers did Liam have at the start?

WORK IT OUT HERE

5 REVERSE THE OPERATIONS

A library passes 25 books to a new branch. Afterwards, both branches have 40 books. How many books did the first library have before it passed any along?

WORK IT OUT HERE

6 REVERSE THE OPERATIONS

Noah passes 16 marbles to Eli. Afterwards, both boys have 40 marbles. How many marbles did Eli have at the start?

WORK IT OUT HERE

7 REVERSE THE OPERATIONS (MULTI-OP)

A baker doubles her batch of muffins. Then she gives away 4 muffins. She has 16 muffins left. How many muffins did she bake at the start?

WORK IT OUT HERE

8 REVERSE THE OPERATIONS (MULTI-OP)

A gardener triples her pile of seed packets. Then she hands out 5 packets. She has 25 packets left. How many packets did she start with?

WORK IT OUT HERE

9 REVERSE THE OPERATIONS (MULTI-OP)

A coach doubles his bag of practice balls. Then he adds 7 more balls. Then he removes 3 worn-out balls. He ends with 20 balls. How many balls did he start with?

WORK IT OUT HERE

10 REVERSE TRANSFERS, TRACK EVERYONE

First Tom gives 2 pencils to Uma. Then Uma gives 1 pencil to Vik. After both moves, all three have 8 pencils each. How many pencils did Tom have at the start?

WORK IT OUT HERE

11 REVERSE TRANSFERS, TRACK EVERYONE

Priya gives 5 stamps to Quinn. Then Rosa gives 2 stamps to Priya. After both moves, all three have 12 stamps each. How many stamps did Priya have at the start?

WORK IT OUT HERE

12 REVERSE TRANSFERS, TRACK EVERYONE

Xander gives 5 buttons to Yuki. Then Zane gives 3 buttons to Xander. Then Xander gives 4 buttons to Zane. After all three moves, each volunteer has 12 buttons. How many buttons did Xander have at the start?

WORK IT OUT HERE

13 FIND THE INVARIANT FIRST

Today two siblings have ages 13 and 31 — the same two digits, reversed. Years from now, the NEXT time their ages will again be digit-reverses of each other, how old will the older sibling be?

WORK IT OUT HERE

14 FIND THE INVARIANT FIRST

A mother and her son have ages that are digit-reverses of each other. The two ages add up to 121, and the two digits used differ by 3. How old is the mother?

WORK IT OUT HERE

15 FIND THE INVARIANT FIRST

Two relatives have ages that are digit-reverses of each other. Their two age digits differ by 4, and the two ages add up to 110. How old is the older relative?

WORK IT OUT HERE

16 REVERSE THE SUM, NOT THE PARTS

Two book bins each start with a positive whole number of books. To each bin, 5 books are added and then the total is doubled. After both steps, the two bin counts add up to 46. How many possible starting counts could the first bin have had?

WORK IT OUT HERE

17 REVERSE THE SUM, NOT THE PARTS

Two donation jars each start with a positive whole number of coins. To each jar, the count is tripled and then 6 coins are removed. After both steps, the two jar counts add up to 66. How many possible starting counts could the first jar have had?

WORK IT OUT HERE

18 REVERSE THE SUM, NOT THE PARTS

Two seed trays each start with a positive whole number of seeds. To each tray, 4 seeds are added, then the count is doubled, then 10 seeds are taken out. After all three steps, the two tray counts add up to 80. How many possible starting counts could the first tray have had?

WORK IT OUT HERE

19 CONSTANT SPEEDS, PROPORTIONAL DISTANCES

Two runners start at the same time from opposite ends of a track and run back and forth at constant but different speeds. They first meet 20 m from the start line. After each turns once at the ends, they meet again 10 m from the far end. How long is the track?

WORK IT OUT HERE

20 CONSTANT SPEEDS, PROPORTIONAL DISTANCES

Two cyclists start at the same time from opposite ends of a path and ride back and forth at constant but different speeds. They first meet 25 m from the north gate. Each turns once at the ends, then they meet again 15 m from the south gate. How long is the path?

WORK IT OUT HERE

21 CONSTANT SPEEDS, PROPORTIONAL DISTANCES

Two ferries start at the same time from opposite docks and cross back and forth at constant but different speeds. They first meet 21 m from the east dock. They keep crossing, turning at each dock, and on their THIRD meeting they are 15 m from the east dock. How long is the crossing?

WORK IT OUT HERE

22 SHORT LIST, THEN FILTER

Two couriers start at the same time from opposite ends of a hallway and walk back and forth at constant but different speeds. They first meet 8 m from end A. After each turns at the ends, they meet again 4 m from end B. The faster courier walks 2 m/min more than the slower one, and both speeds are whole numbers. How long is the hallway?

WORK IT OUT HERE

23 SHORT LIST, THEN FILTER

Two couriers start at the same time from opposite ends of a hallway and walk back and forth at constant but different speeds. They first meet 9 m from end A. After each turns at the ends, they meet again 6 m from end B. The faster courier walks 1 m/min more than the slower one, and both speeds are whole numbers. How long is the hallway?

WORK IT OUT HERE

24 SHORT LIST, THEN FILTER

Two couriers start at the same time from opposite ends of a hallway and walk back and forth at constant but different speeds. Their first meeting is 15 m from the welcome desk, and their third meeting is 3 m from the welcome desk. The faster courier walks 2 m/min more than the slower one, and both speeds are whole numbers. How long is the hallway?

WORK IT OUT HERE

Answer Key

Each answer comes with a hint that names the move. The tag says which video to rewatch if you are stuck.

1. \$14. — *Reverse the Operations*

Begin at the \$3 he has left and undo the last thing that happened first — add back the \$4 snack.

2. 10 cups. — *Reverse the Operations*

Start from the 3 cups left and reverse the final step first — add back the 2 scooped-out cups before undoing the halving.

3. \$26. — *Reverse the Operations*

Work from the \$5 left and undo the steps in reverse — add back the \$2 popcorn first, since it happened last.

4. 42 stickers. — *Reverse the Operations*

Start from Liam's final 30 and undo the gift — hand the 12 stickers back to him.

5. 65 books. — *Reverse the Operations*

Begin at the 40 books the first library ends with and reverse the move — take the 25 passed-along books back.

6. 24 marbles. — *Reverse the Operations*

Start at Eli's final 40 and undo the move — but Eli RECEIVED the 16, so reversing the transfer means handing those 16 marbles back to Noah.

7. 10 muffins. — *Reverse the Operations (multi-op)*

Undo the last step first — add back the 4 given-away muffins to the 16 before you halve.

8. 10 packets. — *Reverse the Operations (multi-op)*

Reverse the final move first — add the 5 handed-out packets back to 25, then undo the tripling by dividing by 3.

9. 8 balls. — *Reverse the Operations (multi-op)*

Undo the steps in reverse — first add back the 3 removed balls, then subtract the 7 he added, then halve.

10. 10 pencils. — *Reverse Transfers, Track Everyone*

Undo the transfers in reverse order, last move first; Uma's gift to Vik never touches Tom, so only give back the 2 pencils Tom handed to Uma.

11. 15 stamps. — *Reverse Transfers, Track Everyone*

Undo the last transfer first — take Rosa's 2 stamps back from Priya, then return the 5 stamps Priya gave Quinn.

12. 18 buttons. — *Reverse Transfers, Track Everyone*

Undo the three transfers in reverse order — begin at Xander's final 12, reverse the last move (Xander gave to Zane, so it comes back to Xander), then reverse Zane's gift to Xander (it leaves Xander), then reverse Xander's first gift.

13. 42 years old. — *Find the Invariant First*

Both siblings age at the same rate, so one quantity never changes between today and the next digit-reverse moment — find that invariant first, then hunt for the next two-digit pair that fits it.

14. 74 years old (the son is 47). — *Find the Invariant First*

The digit-reverse pair has a fixed gap equal to 9 times the difference of the two digits — start by turning that "3" into the actual age gap before you touch the sum.

15. 73 years old (the younger is 37). — *Find the Invariant First*

Lock onto the invariant first — for two-digit numbers that are digit-reverses, the gap between them is always 9 times the difference of their two digits. Use that to turn the digit-difference clue into a gap before you touch the sum.

16. 12 possible starting counts. — *Reverse the Sum, Not the Parts*

Undo the chain on the TOTAL, not each bin — reverse the doubling and the added books on the sum of 46 to get the starting total, then count the whole-number splits.

17. 25 possible starting counts. — *Reverse the Sum, Not the Parts*

Reverse the steps on the sum of 66 in one go — add back the removed coins and undo the tripling to find the starting total, then count the valid whole-number pairs.

18. 41 possible starting counts. — *Reverse the Sum, Not the Parts*

Work backwards on the total of 80, not on each tray — undo the three steps on the sum to get the starting total, then count how many whole-number splits keep both trays positive.

19. 50 m. — *Constant Speeds, Proportional Distances*

By the second meeting the runners' combined distance is three track-lengths, so the first runner has covered three times his first-meeting distance — set that equal to one length plus the 10 m back-walk.

20. 60 m. — *Constant Speeds, Proportional Distances*

At the second meeting the combined distance is three path-lengths, so the first cyclist has ridden three times her first-meeting distance — that equals one full length plus the 15 m she came back.

21. 45 m. — *Constant Speeds, Proportional Distances*

By the third meeting the combined distance is five crossing-lengths, so the first ferry has covered five times its first-meeting distance — here that traces two full lengths plus the 15 m, so undo that to size one length.

22. 20 m (speeds 4 and 6 m/min). — *Short List, Then Filter*

At the second meeting the couriers' combined distance is three hallway-lengths, so the courier from end A has walked three times her first-meeting distance — list the hallway lengths that put her 4 m from the far end, then keep only the one whose speed ratio gives whole numbers differing by 2.

23. 21 m (speeds 3 and 4 m/min). — *Short List, Then Filter*

Use combined distance equals three lengths at the second meeting — the courier from end A has walked three times 9 m. List the hallway lengths that land her 6 m from the far end, then filter to the one whose speed ratio gives whole numbers differing by 1.

24. 36 m (speeds 5 and 7 m/min). — *Short List, Then Filter*

Combined distance at the third meeting is five hallway-lengths, so the courier from the desk walked five times 15 m; that gives a short list of possible lengths, and only the one with whole-number speeds differing by 2 survives.