

GRADE 6 · EXPRESSIONS & EQUATIONS · ANSWER KEY

SOLVING $PX = Q$

Today's goal: I can represent real-world problems by writing equations in the form $px = q$ for cases in which p , q , and x are all nonnegative rational numbers, solve real-world problems by solving equations in the form $px = q$ for cases in which p , q , and x are all nonnegative rational numbers, represent mathematical problems by writing equations in the form $px = q$ for cases in which p , q , and x are all nonnegative rational numbers and solve mathematical problems by solving equations in the form $px = q$ for cases in which p , q , and x are all nonnegative rational numbers.



How to use this key. Problem numbers match the student sheets. Each answer shows the steps and the slip Mr DJ sees most, so a wrong answer tells you what to reteach. Pepper levels: **Mild** warm-up, **Medium** stretch, **Spicy** challenge, **Extra Spicy** big brain.

Practice

8 problems + Mr DJ's worked example

Use: During the lesson after the mini-lesson/deck. Item 2 ($12x = 12 \rightarrow x = 1$) is the mirror of the additive case ($x + 13 = 13 \rightarrow x = 0$) — contrast them explicitly. **Timing:** 15–25 min · pairs or independent · circulate on 7–9. Items 1–3 fluency, 4–6 application, 7–9 reasoning. Watch for subtraction carried over from the previous skill.

1 $x = 7$

2 $x = 1$

3 $x = 2.5$ (5/2)

4 $x = 4$

5 $x = 0$

6 $4x = 52$; $x = 13$ tickets

7 Wrong — $3(18) = 54$, not 21; the answer is $x = 7$

8 $x = 4.5$ — solutions can be fractions or decimals

1 **MILD** $5x = 35?$

$x = 7$

1. $35 \div 5 = 7$. Check: $5(7) = 35$ ✓

Watch for: Answered 30 — subtracted 5.

2 **MILD** $12x = 12?$

$x = 1$

1. $12 \div 12 = 1$. Check: $12(1) = 12$ ✓

Watch for: Answered 0 — confused this with $x + 12 = 12$. Multiplying by 1 leaves a number unchanged.

3 **MEDIUM** $6x = 15?$

$x = 2.5$ (5/2)

1. $15 \div 6 = 2.5$.

2. Check: $6(2.5) = 15$ ✓

Watch for: Rounded to 3, or answered 9 by subtracting.

4 **MEDIUM** $2.5x = 10?$

$x = 4$

1. $10 \div 2.5 \rightarrow$ shift both points: $100 \div 25 = 4$.

2. Check: $2.5(4) = 10$ ✓

Watch for: Answered 7.5 — subtracted 2.5; or divided $2.5 \div 10$.

5 **MEDIUM** $9x = 0?$

$x = 0$

1. $0 \div 9 = 0$.

2. Check: $9(0) = 0$ ✓

3. The only number you can multiply by 9 to get 0 is 0 itself.

Watch for: Said 'no solution' or 9. Zero is a valid solution here.

6 **SPICY** \$4 tickets, \$52 spent?

$4x = 52$; $x = 13$ tickets

1. Each ticket costs 4, repeated x times, totalling 52: $4x = 52$.

2. $x = 52 \div 4 = 13$. Check: $4(13) = 52$ ✓

Watch for: Wrote $52 - 4 = 48$, or $4 \div 52$. Divide the total by the per-unit cost.

7 **SPICY** Ravi: $3x = 21$ gives $x = 18$?

Wrong — $3(18) = 54$, not 21; the answer is $x = 7$

1. Check: $3(18) = 54 \neq 21$, so 18 is not a solution.
2. Ravi SUBTRACTED 3 instead of dividing by 3.
3. Correct: $21 \div 3 = 7$. Check: $3(7) = 21$ ✓

Watch for: Spotted the error but could not name it. The fix is recognising that $3x$ is multiplication, so the inverse is division.

8 **EXTRA SPICY** $10x = 45$, and why not whole?

$x = 4.5$ — solutions can be fractions or decimals

1. $45 \div 10 = 4.5$.
2. Check: $10(4.5) = 45$ ✓
3. Nothing requires x to be a whole number; 45 simply is not a multiple of 10. In a context like 'number of people' you would reconsider, but as a pure equation 4.5 is exactly right.

Watch for: Rounded to 5 or 4, or declared 'no solution' because the division was not exact.

Homework

7 problems + Mr DJ's worked example

Use: Parallels the practice sheet. Item 2 contrasts directly with $x + 15 = 15$ from the previous skill — same numbers, different inverse, different answer. **Timing:** ~15 min at home · independent · review item 2 beside $x + 15 = 15$ as the next-day warm-up.

1 $x = 7$

2 $x = 1$

3 $x = 2.5$ (5/2)

4 $x = 6$

5 $x = 0$

6 $5x = 85$; $x = 17$ boxes

7 $x = 2.5$ — a solution does not have to be a whole number

1 **MILD** $6x = 42$?

$x = 7$

1. $42 \div 6 = 7$. Check ✓

Watch for: Answered 36 — subtracted.

2 **MILD** $15x = 15$?

$x = 1$

1. $15 \div 15 = 1$. Check: $15(1) = 15$ ✓

Watch for: Answered 0 — that is the answer to $x + 15 = 15$, a different equation.

3 **MEDIUM** $8x = 20$?

$x = 2.5$ (5/2)

1. $20 \div 8 = 2.5$. Check: $8(2.5) = 20$ ✓

Watch for: Rounded to 3, or answered 12 by subtracting.

4 **MEDIUM** $1.5x = 9$?

$x = 6$

1. $9 \div 1.5 \rightarrow$ shift both points: $90 \div 15 = 6$.
2. Check: $1.5(6) = 9$ ✓

Watch for: Answered 7.5 — subtracted 1.5.

5 MEDIUM $7x = 0?$

$x = 0$

1. $0 \div 7 = 0$. Check: $7(0) = 0$ ✓
2. Only zero times 7 gives zero.

Watch for: Said 'no solution' or 7.

6 SPICY Boxes of 5, 85 pencils?

$5x = 85$; $x = 17$ boxes

1. Each box holds 5, repeated x times, totalling 85: $5x = 85$.
2. $x = 85 \div 5 = 17$. Check: $5(17) = 85$ ✓

Watch for: Wrote $85 - 5$, or divided $5 \div 85$.

7 SPICY $12x = 30$, not whole — still correct?

$x = 2.5$ — a solution does not have to be a whole number

1. $30 \div 12 = 2.5$.
2. Check: $12(2.5) = 30$ ✓ It satisfies the equation exactly.
3. 30 is simply not a multiple of 12. The solution is exact, just not an integer.

Watch for: Rounded to 3 (which gives 36, not 30) or said there is no solution.

Exit Ticket

4 problems

Use: End of the $px = q$ lesson. 5–8 min, independent. Deliberately follows $x + p = q$ so the two inverse operations sit side by side. **Timing:** 5–8 min · independent. The error to watch for is carrying yesterday's subtraction habit into a multiplication equation.

1 $x = 6$

2 $x = 8$

3 $x = 2.5$ (or $5/2$)

4 $6x = 54$; $x = 9$ rows

1 MILD $3x = 18?$

$x = 6$

1. $3x$ means $3 \times x$, so undo with division.
2. Divide both sides by 3: $18 \div 3 = 6$.
3. $x = 6$. Check: $3(6) = 18$ ✓

Watch for: Answered 15 — subtracted 3. Subtraction undoes addition; division undoes multiplication.

2 MEDIUM $7x = 56?$

$x = 8$

1. Divide both sides by 7: $56 \div 7 = 8$.
2. Check: $7(8) = 56$ ✓

Watch for: Answered 49 — subtracted 7.

3 MEDIUM $4x = 10?$

$x = 2.5$ (or $5/2$)

1. Divide both sides by 4: $10 \div 4 = 2.5$.
2. Check: $4(2.5) = 10$ ✓

Watch for: Answered 6 (subtracted), or rounded to 2 because the answer 'should' be whole. Solutions need not be whole numbers.

4 SPICY 54 seats in rows of 6 — how many rows?

$6x = 54$; $x = 9$ rows

1. Each row holds 6, repeated x times, giving 54: $6x = 54$.
2. Divide both sides by 6: $x = 9$. Check: $6(9) = 54$ ✓
3. Division, because the 6 is MULTIPLYING x — subtracting 6 would only remove one seat, not one row.

Watch for: Wrote $54 - 6 = 48$. Ask what the 6 is DOING to x in the equation; that decides the inverse.

Lesson slides

teaching notes & timing

Slide	Time	What to do
1	0:00	Frame the skill: same balance idea as yesterday, different inverse operation.
2	1:00	Hook — poll subtract vs divide. Do NOT resolve. Carrying yesterday's method over is the dominant error.
3	3:00	Put the two equation types side by side. The question is always 'what is being done TO x '?

4	5:00	WE1 — resolve the hook, then show the subtraction route failing its check. Let the check do the arguing.
5	7:00	WE2 — division direction. Reversing it is the second most common error and produces an absurdly small answer.
6	11:00	Non-whole solutions. Students round because they expect tidy answers; the check settles it.
7		Show the problem and the slip. Pairs: what went wrong, and what is the right answer? Take two answers before moving on.
8		Solve it together, one step at a time. It is also the worked example at the top of the practice sheet, so students can look back at it.
9	9:00	CFU — all-student response. Answer $x = 8$. Watch for 49. Whiteboards: everyone tries Mild, then climbs. These are #1, #3, #6 on the practice sheet.
10		Fingers up: 3 = got it, 2 = almost, 1 = not yet. Pull the 1s for a quick reteach while everyone else starts the practice sheet.
11	13:00	Launch the in-class practice sheet. Launch the practice sheet. Exit ticket in the last 5–8 minutes.