



Checking solutions by substitution

GRADE 6 MATH

Answer keys for the exit ticket, practice worksheet, and homework, plus notes for the lesson slides. Each answer shows the steps and the most likely wrong answer (“If wrong”), so you can tell what a mistake means, not just that it is one. Questions go from **fluency** to **application** to **reasoning**.

Exit Ticket — answer key

Use: End of the substitution-check lesson. 5–8 min, independent.

Timing: 5–8 min · independent. Item 3 tests the strict-vs-inclusive boundary; item 4 tests the range idea that inequalities depend on.

1. Is $x = 5$ a solution of $x + 7 = 12$? **FLUENCY**

Answer: **Yes**

1. Substitute: $5 + 7 = 12$.
2. $12 = 12$ is true, so $x = 5$ is a solution.

If wrong: Re-solved the equation instead of substituting. Checking means putting the value IN, not working it out again.

2. Is $x = 6$ a solution of $3x = 18$? **APPLICATION**

Answer: **Yes**

1. Substitute: $3(6) = 18$.
2. $18 = 18$ is true, so yes.

If wrong: Wrote 36 by reading $3x$ at $x = 6$ as the digits 3 and 6 together.

3. Is $x = 7$ a solution of $x > 4$? Is $x = 4$? **APPLICATION**

Answer: **7 is a solution; 4 is not**

1. $7 > 4$ is true, so 7 is a solution.
2. $4 > 4$ is false — 4 is not greater than itself, so 4 is NOT a solution.
3. (It would be a solution of $x \geq 4$.)

If wrong: Counted 4 as a solution. The strict symbol $>$ excludes the boundary value; $\geq$ includes it.

4. Three solutions of $x > 4$; why many vs one? REASONING

Answer: **Any three values above 4, e.g. 5, 10, 100 — an inequality names a whole range, an equation pins one value**

1. $5 > 4$ ✓, $10 > 4$ ✓, $100 > 4$ ✓ — all are solutions (and so is 4.5).
2. $x > 4$ describes every number to the right of 4 on the number line: infinitely many.
3. $x - 3 = 10$ is only true when $x = 13$; any other value makes the two sides unequal.

If wrong: Gave only one solution, or claimed the inequality also has exactly one. The comparison symbol is what opens it to a range.

Quick answers for fast checking:

#	Level	Answer
1	fluency	Yes
2	application	Yes
3	application	7 yes, 4 no
4	reasoning	Many vs one

Practice Worksheet — answer key

Use: During the lesson after the mini-lesson/deck. Item 9 names why substitution is the right check — it is independent of the student's own reasoning.

Timing: 15–25 min · pairs or independent · circulate on 7–9. Items 1–3 fluency, 4–6 application, 7–9 reasoning. Items 6–8 all hinge on whether the boundary value counts.

1. $n = 7$ in $n + 8 = 15$? FLUENCY

Answer: **Yes**

1. $7 + 8 = 15 \rightarrow \text{true}$.

If wrong: Re-solved instead of substituting.

2. $y = 7$ in $4y = 28$? FLUENCY

Answer: **Yes**

1. $4(7) = 28 \rightarrow \text{true}$.

If wrong: Read $4y$ at $y = 7$ as 47.

3. $m = 14$ in $m - 5 = 9$? **FLUENCY**

Answer: **Yes**

1. $14 - 5 = 9 \rightarrow \text{true}$.

If wrong: Subtracted in the wrong order.

4. $x = 18$ in $x \div 3 = 6$? **APPLICATION**

Answer: **Yes**

1. $18 \div 3 = 6 \rightarrow \text{true}$.

If wrong: Multiplied instead of dividing.

5. $x = 5$ in $2x + 1 = 11$? **APPLICATION**

Answer: **Yes**

1. Substitute: $2(5) + 1$.

2. Multiply first: $10 + 1 = 11$.

3. $11 = 11 \rightarrow \text{true}$.

If wrong: Added before multiplying: $(2 + 5) + 1 = 8$, concluding 'no.' Order of operations still applies inside a check.

6. $x < 10$: is 9 a solution? is 10? **APPLICATION**

Answer: **9 yes; 10 no**

1. $9 < 10$ is true.

2. $10 < 10$ is false — 10 is not less than itself.

3. The strict symbol $<$ excludes the boundary.

If wrong: Counted 10 as a solution.

7. $x \geq 6$: is 6? is 5? REASONING

Answer: **6 yes; 5 no**

1. $\geq$ means 'greater than OR EQUAL TO', so $6 \geq 6$ is true.
2. $5 \geq 6$ is false.
3. With $>$, the value 6 would NOT be a solution; the line under the symbol adds the boundary.

If wrong: Excluded 6 by treating $\geq$ as $>$. The extra line is not decoration.

8. Solutions of $x > 4$ in {2, 4, 5, 9}? REASONING

Answer: **5 and 9**

1. $2 > 4$ false. $4 > 4$ false (not strictly greater). $5 > 4$ true. $9 > 4$ true.
2. Solutions: 5 and 9.

If wrong: Included 4. Each value must be tested individually against the exact symbol.

9. Tomas re-solves instead of substituting — why is substitution better? REASONING

Answer: **Re-solving repeats any mistake he already made; substituting tests the answer independently**

1. If he made an error while solving, he will likely make the same error again and 'confirm' a wrong answer.
2. Substituting puts the value into the ORIGINAL statement: $5(7) = 35 \rightarrow 35 = 35 \checkmark$
3. That checks the answer against the problem itself, not against his own work.

If wrong: Saw the two methods as equally good. A check must be independent of the work being checked.

Quick answers for fast checking:

#	Level	Answer
1	fluency	Yes
2	fluency	Yes
3	fluency	Yes
4	application	Yes
5	application	Yes
6	application	9 yes, 10 no
7	reasoning	6 yes, 5 no

8	reasoning	5 and 9
9	reasoning	Substitution is independent

Homework — answer key

Use: Parallels the practice sheet. Item 8 distinguishes ‘solutions within this set’ from ‘the whole solution set’ — the idea graphing an inequality depends on.

Timing: ~15 min at home · independent · review item 8 as the next-day warm-up; it sets up the inequality-graphing skill.

1. $n = 8$ in $n + 6 = 14$? FLUENCY

Answer: **Yes**

1. $8 + 6 = 14 \rightarrow \text{true.}$

If wrong: Re-solved instead of substituting.

2. $y = 7$ in $6y = 42$? FLUENCY

Answer: **Yes**

1. $6(7) = 42 \rightarrow \text{true.}$

If wrong: Read $6y$ at $y = 7$ as 67 .

3. $m = 13$ in $m - 9 = 4$? FLUENCY

Answer: **Yes**

1. $13 - 9 = 4 \rightarrow \text{true.}$

If wrong: Reversed the subtraction.

4. $x = 20$ in $x \div 4 = 5$? APPLICATION

Answer: **Yes**

1. $20 \div 4 = 5 \rightarrow \text{true.}$

If wrong: Multiplied instead.

5. $x = 5$ in $3x + 2 = 17$? APPLICATIONAnswer: **Yes**

1. Substitute: $3(5) + 2$.
2. Multiply first: $15 + 2 = 17$.
3. $17 = 17 \rightarrow$ true.

If wrong: Added first: $(3 + 5) + 2 = 10$, concluding 'no.'**6. $x < 7$: is 6? is 7? APPLICATION**Answer: **6 yes; 7 no**

1. $6 < 7$ true.
2. $7 < 7$ false — not less than itself.

If wrong: Counted 7 as a solution.**7. $x \leq 8$: is 8? is 9? REASONING**Answer: **8 yes; 9 no**

1. $\leq$ means 'less than OR EQUAL TO', so $8 \leq 8$ is true.
2. $9 \leq 8$ is false.
3. With $<$, the value 8 would not qualify; the line under the symbol includes the boundary.

If wrong: Excluded 8 by reading $\leq$ as $<$.**8. Solutions of $x < 3$ in $\{1, 2, 3, 6\}$; why not fully listable? REASONING**Answer: **1 and 2 from the set — but the full solution set is infinite**

1. $1 < 3$ true. $2 < 3$ true. $3 < 3$ false. $6 < 3$ false.
2. From this set: 1 and 2.
3. But $x < 3$ also allows 0, -5 , 2.9, 2.99... — every number left of 3 on the line. You cannot list them all, which is why we describe the range instead.

If wrong: Listed 1 and 2 and stopped, concluding those are the ONLY solutions. They are the only ones in the given set, not the only ones that exist.**Quick answers** for fast checking:

#	Level	Answer
1	fluency	Yes
2	fluency	Yes

3	fluency	Yes
4	application	Yes
5	application	Yes
6	application	6 yes, 7 no
7	reasoning	8 yes, 9 no
8	reasoning	1 and 2; set is infinite

Lesson slides — teaching notes & timing

Mini-lesson deck: ~12–15 min, then launch into the practice sheet. Slide numbers match the deck.

Slide	~Time	Note
1/8	0:00	Frame the skill: testing a candidate value, for both equations and inequalities.
2/8	1:00	Hook — many students say ‘solve it again.’ Do NOT resolve yet; the difference matters.
3/8	3:00	Define solution as ‘makes it true’ and name substitution as the test.
4/8	5:00	WE1 — resolve the hook, and make the independence argument explicitly: re-solving repeats your own error.
5/8	7:00	WE2 — many vs one. Ask for several solutions of $x > 4$ aloud, including a decimal, so the range feels infinite.
6/8	9:00	CFU — all-student response. Answer yes, $11 = 11$. Watch for students adding before multiplying.
7/8	11:00	Strict vs inclusive symbols. This is the most common lost mark in the whole skill and takes thirty seconds to fix.
8/8	13:00	Launch the in-class practice sheet.