

Order of Operations and Evaluating Expressions

Name: _____

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Q Quick Review

When an expression mixes more than one operation, follow **PEMDAS** from top to bottom. **P**arentheses (and any other grouping symbols like brackets or the bar of a fraction) come first. Then **E**xponents (powers and roots). Then **M**ultiplication and **D**ivision left to right — they're the same priority, so just go in reading order. Then **A**ddition and **S**ubtraction left to right, same idea. To **evaluate** an algebraic expression, substitute each variable's given value — always in parentheses — and then simplify with PEMDAS. The parentheses around substituted values are non-negotiable; they're how you avoid sign mistakes.

PRACTICE

Simplify or evaluate each expression.

- | | | | |
|--------------------------------|-------|--|-------|
| 1. $8 + 3 \times 2$ | _____ | 11. $\frac{m+n}{m-n}$ when $m = 7, n = 3$ | _____ |
| 2. $(8 + 3) \times 2$ | _____ | 12. $4(x-1)^2 + 3$ when $x = 2$ | _____ |
| 3. $12 \div 4 + 5 \times 3$ | _____ | 13. $10 - 2(3 + 1)$ | _____ |
| 4. $20 - 3^2 + 1$ | _____ | 14. $24 \div (4 + 2) \times 3$ | _____ |
| 5. $4 \times (6 - 2)^2 \div 8$ | _____ | 15. $-2^2 + (-2)^2$ | _____ |
| 6. $\frac{18}{3+6}$ | _____ | 16. $\frac{6+2 \cdot 3}{4-1}$ | _____ |
| 7. $-3 + (-4)^2 \div 2$ | _____ | 17. $5 - x^2$ when $x = -3$ | _____ |
| 8. $5^2 - 4 \times 3 + 7$ | _____ | 18. $\sqrt{x+5}$ when $x = 11$ | _____ |
| 9. $2x + 5$ when $x = 3$ | _____ | 19. $3a - b^2$ when $a = 4, b = 2$ | _____ |
| 10. $3a^2 - 2a$ when $a = -1$ | _____ | 20. $\frac{2x+y}{x-y}$ when $x = 5, y = 1$ | _____ |

◆ Word Problems

21. A phone plan costs \$25 for the base fee plus \$0.05 per text. If t is the number of texts, the monthly cost is $25 + 0.05t$. Find the cost for 120 texts.

22. Marcus earns d dollars per hour and works h hours per week. His weekly pay after a \$15 parking deduction is $dh - 15$. Find his pay when $d = 12$ and $h = 20$.

23. A taxi fare is \$3.50 plus \$2 per mile. The total cost is $3.50 + 2m$. How much does an 8-mile ride cost?

24. The area of a triangle is $A = \frac{1}{2}bh$. Find the area of a triangle with base 14 cm and height 9 cm.



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Answer Keys

1. 14
2. 22
3. 18
4. 12
5. 8
6. 2
7. 5
8. 20
9. 11
10. 5
11. $\frac{5}{2}$
12. 7

13. 2
14. 12
15. 0
16. 4
17. -4
18. 4
19. 8
20. $\frac{11}{4}$
21. \$31
22. \$225
23. \$19.50
24. 63 cm²

Step-by-Step Tutor Notes

1. Multiplication wins before addition. So $3 \times 2 = 6$ first, then $8 + 6 = 14$. A common slip is doing left-to-right and getting $11 \times 2 = 22$ — PEMDAS protects you from that.
2. Now the parentheses say “do me first.” $8 + 3 = 11$, then $11 \times 2 = 22$. Notice how the parentheses flipped which operation came first — that’s their whole job.
3. Multiplication and division are at the same level, and they happen before addition. So do both first: $12 \div 4 = 3$ and $5 \times 3 = 15$. Then $3 + 15 = 18$.
4. Exponent first — $3^2 = 9$. Now it’s $20 - 9 + 1$, addition and subtraction left to right: $20 - 9 = 11$, then $11 + 1 = 12$.
5. Parentheses give $6 - 2 = 4$. Exponent gives $4^2 = 16$. Now go left to right: $4 \times 16 = 64$, then $64 \div 8 = 8$.
6. The fraction bar is a grouping symbol — it tells you to finish the denominator before dividing. So $3 + 6 = 9$, then $18 \div 9 = 2$.
7. Watch this one: $(-4)^2$ is a negative being squared, and two negatives multiply to a positive, so $(-4)^2 = 16$. Divide: $16 \div 2 = 8$. Then $-3 + 8 = 5$.
8. Power first: $5^2 = 25$. Multiplication next: $4 \times 3 = 12$. Then left to right with $-$ and $+$: $25 - 12 = 13$, $13 + 7 = 20$.
9. Start by substituting the given value or values carefully, using parentheses when a value is negative. Substitute 3 for x in parentheses — $2(3) + 5$. Multiply: 6. Add: $6 + 5 = 11$. That confirms the final answer is 11.
10. Always wrap a negative substitution in parentheses. $3(-1)^2 - 2(-1)$. Square first: $(-1)^2 = 1$, giving $3(1) = 3$. Then the $-2(-1) = +2$. So $3 + 2 = 5$.
11. Top and bottom each act like their own grouped expression. Top: $7 + 3 = 10$. Bottom: $7 - 3 = 4$. So $\frac{10}{4} = \frac{5}{2}$.
12. Substitute: $4(2 - 1)^2 + 3$. Inside the parens first: 1. Square: $1^2 = 1$. Multiply: $4(1) = 4$. Add: $4 + 3 = 7$.
13. Keep the order of operations in view, then simplify without skipping the sign check. Parentheses first: $3 + 1 = 4$. Then multiplication: $2 \cdot 4 = 8$. Subtract last: $10 - 8 = 2$. After simplifying, the answer is 2.
14. Parens: $4 + 2 = 6$. Now $24 \div 6 \times 3$. Same-level operations go left to right: $24 \div 6 = 4$, then $4 \times 3 = 12$. (Going right to left would give the wrong answer of $\frac{24}{18}$.)
15. The two halves look the same but they’re not. -2^2 means the negative of 2^2 , which is -4 , because the exponent only applies to the 2. But $(-2)^2$ squares the whole -2 , giving $+4$. So $-4 + 4 = 0$.
16. Treat top and bottom as separate PEMDAS problems. Top: multiply first ($2 \cdot 3 = 6$), then add ($6 + 6 = 12$). Bottom: $4 - 1 = 3$. Then $12 \div 3 = 4$.
17. Substitute in parentheses: $5 - (-3)^2$. Square first: $(-3)^2 = 9$. Then subtract: $5 - 9 = -4$.
18. The radical groups like parentheses, so finish what’s under it first: $11 + 5 = 16$. Then $\sqrt{16} = 4$.
19. Substitute: $3(4) - (2)^2$. Exponent first: $(2)^2 = 4$. Multiply: $3(4) = 12$. Subtract: $12 - 4 = 8$.
20. Top: $2(5) + 1 = 10 + 1 = 11$. Bottom: $5 - 1 = 4$. So $\frac{11}{4}$. Leave it as an improper fraction — it’s already in lowest terms.
21. Substitute $t = 120$ into the expression: $25 + 0.05(120)$. Multiplication before addition: $0.05 \times 120 = 6$. Then $25 + 6 = 31$ dollars. That’s \$25 for the plan plus \$6 for the texts.
22. Start by replacing the variables with the given values: $12 \times 20 - 15$. Multiplication comes before subtraction, so $12 \times 20 = 240$. Now subtract the parking deduction: $240 - 15 = 225$. His pay after parking is \$225.
23. Substitute $m = 8$: $3.50 + 2(8)$. Multiply first: $2 \times 8 = 16$. Add: $3.50 + 16 = 19.50$ dollars.
24. Substitute $b = 14$ and $h = 9$: $A = \frac{1}{2}(14)(9)$. Pair off the easy multiplication first — half of 14 is 7. Now $7 \times 9 = 63$. So the area is 63 square centimeters.



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