

Expressions and Equations

Ontario MTH1W · Algebra: expressions, equations, formulas and word problems

vertexmath.ca
Worksheet, answers &
this cheat sheet



MOST TESTED Solve $3(x - 2) = x + 8$ and check your answer. (card 6)

Which move?

The equation has
brackets

Expand them

There are
fractions

Multiply by the LCD

x is on both sides

Collect x terms

1 Words to algebra

For a number n :

3 more than n $n + 3$

3 less than n $n - 3$

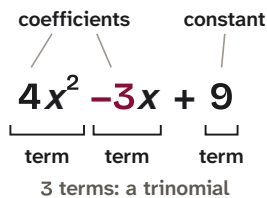
twice the sum of n and 3 $2(n + 3)$

n squared n^2 , not $2n$

TRAP "10 less than x " is $x - 10$, not $10 - x$: take 10 away from x .

2 Terms and substituting

USE Substitute in **brackets**; exponents before multiplying.



EXAMPLE $2a - b^2$ at $a = 5$, $b = -3$:
 $2(5) - (-3)^2 = 10 - 9 = 1$.

TRAP $-x^2$ at $x = -3$ is $-(-3)^2 = -9$, not 9: square first, then apply the minus.

TRAP In $10 - 2x$: coefficient -2 , constant 10.

3 Like terms

USE Like terms: same variables, same exponents. Add their coefficients; the variable part stays.

EXAMPLE $6a^2 + 4a - a^2 - 9a = 5a^2 - 5a$

TRAP $3x^2y$ and $5xy^2$ are **unlike**: a different variable is squared.

TRAP $5x + 3y - x = 4x + 3y$, not $8xy - x$: unlike terms stay apart.

4 Distributive property

$$a(b + c) = ab + ac$$

$$-a(b - c) = -ab + ac$$

USE Multiply **every** term in the bracket by the number in front, sign included. Then collect like terms.

EXAMPLE $4(x + 3) - (2x - 5) = 4x + 12 - 2x + 5 = 2x + 17$

TRAP $-2(3x - 4) = -6x + 8$, not $-6x - 8$: $(-2)(-4) = +8$.

TRAP
 $5 - 2(3x - 1) = 5 - 6x + 2 = 7 - 6x$.
Doing $5 - 2 = 3$ first gives $9x - 3$: wrong.

5 Solving equations

USE Two steps: undo $+$ or $-$, then $\times$ or $\div$. Check in the original.

Undo with the inverse, on **both** sides:

$$x + 5 = 12 \quad \text{subtract 5: } x = 7$$

$$x - 5 = 12 \quad \text{add 5: } x = 17$$

$$4x = 10 \quad \text{divide by 4: } x = 2.5$$

$$\frac{x}{4} = 10 \quad \text{multiply by 4: } x = 40$$

TRAP $2x + 8 = 20$: $2x = 12$, $x = 6$. Not $x + 8 = 10$: divide **every** term.

TRAP $-x = 7$ is not finished: $x = -7$.

6 Multi-step equations

USE 1. Expand brackets. 2. Multiply **every** term by the LCD. 3. Collect x terms on one side. 4. Divide.

EXAMPLE $3(x - 2) = x + 8$:
 $3x - 6 = x + 8$, $2x = 14$, $x = 7$. Check:
 $3(5) = 15 = 7 + 8$.

TRAP $x/3 + 2 = x/4$, times 12:
 $4x + 24 = 3x$, not $4x + 2 = 3x$.

TRAP $7x = 4x + 9$: subtract $4x$, so
 $3x = 9$, not $11x = 9$.

7 Rearranging formulas

USE Treat the other letters as numbers. Undo the operations on your variable in reverse order, on **both** sides.

EXAMPLE $F = 1.8C + 32$ for C :
 $F - 32 = 1.8C$, so $C = (F - 32)/1.8$. At $F = 86$: $C = 30$.

TIP Check a formula with two sets of numbers, not one.

TRAP $y = 4x - 10$ for x : add 10 first, so $x = (y + 10)/4$, not $y/4 + 10$.

8 Writing equations

consecutive: x , $x + 1$, $x + 2$

even or odd: x , $x + 2$, $x + 4$

USE Let x be the unknown, with units. *Is* means $=$.

EXAMPLE Three consecutive odd numbers add to 87: $3x + 6 = 87$, $x = 27$: 27, 29, 31.

TRAP 4 times as many students as teachers: $s = 4t$, not $4s = t$.

TRAP Answer with **every** number asked for, not only x .

9 Shapes, rates, money

$$P = 2l + 2w$$

$$\text{average speed} = \frac{\text{total distance}}{\text{total time}}$$

USE 20% off, then 13% HST: multiply by 0.80, then by 1.13.

TRAP Perimeter 100:
 $2w + 2(w + 10) = 100$, $w = 20$. Not $w + (w + 10) = 100$: count all four sides.

TRAP 20% off, then 13% HST:
 $0.80 \times 1.13 = 0.904$, so you pay 90.4%, not 93%.