SUBSTITUTING NEGATIVE NUMBERS

BUILDING BLOCKS

NAME _____ CLASS _____ DATE _____

KEY IDEA

Substitute means swap the letter for its number.

Find 2x + 7 when x = –3



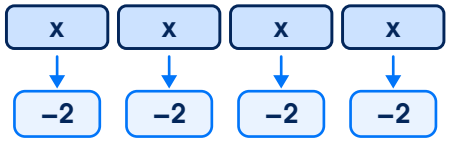
2 × –3 + 7 = –6 + 7 = 1

1 Warm up: work these out.

a) **–3 × 4** ☐ **b)** **–2 × –6** ☐ **c)** **–8 + 5** ☐ **d)** **10 – –2** ☐

2 x = –2. Swap each x for –2 and work out each value.

a)



4x = ☐

b) x + 10 = ☐ **c)** x – 3 = ☐

3 a = –4. Work out the value of each expression.

a) a + 6 = ☐ **b)** 3a = ☐

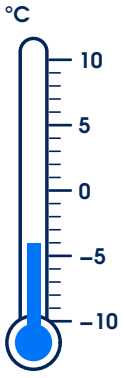
c) a – 9 = ☐ **d)** 10 – a = ☐

4 The temperature is t °C. Today t = –4.

a) It gets 7 degrees warmer. Work out t + 7. ☐

b) It gets 5 degrees colder. Work out t – 5. ☐

c) Work out 2t. ☐



SUBSTITUTING NEGATIVE NUMBERS

SUPPORT

NAME _____ CLASS _____ DATE _____

KEY IDEA

Put negative numbers in brackets when you substitute. Do powers first, then × and ÷, then + and –.

When x = –3: $2x + 1 = 2 \times (-3) + 1 = -6 + 1 = -5$

$x^2 = (-3)^2 = -3 \times -3 = 9$

1 a = –4. Work out the value of each expression.

a) a + 9 b) 5a c) 2a – 3 d) 10 – a

e) a ÷ 2 f) 3a + 12 g) 1 – 2a h) –a

2 Complete the table of values.

x	–3	–1	0	2
2x + 1				
5 – x				

3 y = –5. Work out the value of each expression.

a) y^2 b) $2y^2$ c) $y^2 - 10$

d) –2y e) $(y + 3)^2$ f) $y^2 + y$

4 p = –2 and q = 3. Work out the value of each expression.

a) p + q b) pq c) 4p – q

d) q – p e) p^2q f) 2(p + q)

SUBSTITUTING NEGATIVE NUMBERS

CORE

NAME _____ CLASS _____ DATE _____

KEY IDEA

Replace each letter with its value in brackets, then follow the order of operations. Take care with powers. When $x = -4$, $x^2 = (-4)^2 = 16$, but $-x^2 = -16$. On a calculator, type $(-4)^2$.

FLUENCY

1 $m = -3$ and $n = 4$. Work out the value of each expression.

a) $5m + 2n$ ☐ b) $m^2 + n$ ☐ c) $3(n - m)$ ☐

d) $\frac{mn}{2}$ ☐ e) $2m^2 - m$ ☐ f) $(m + n)^2$ ☐

2 Use the formula to convert temperatures.

$F = 1.8C + 32$ (F is the temperature in °F, C is the temperature in °C)

a) Find F when $C = -10$. ☐ b) Find F when $C = -40$. ☐

REASONING

3 Is $2x^2$ the same as $(2x)^2$?

a) Work out each value when $x = -3$. $2x^2 =$ ☐ $(2x)^2 =$ ☐

b) Explain why they are different.

.....

4 Ava finds x^2 when $x = -4$. She types -4^2 into her calculator and gets -16.

a) What has Ava done wrong?

.....

b) What is the correct value of x^2? ☐

SUBSTITUTING NEGATIVE NUMBERS

GREATER DEPTH

NAME _____ CLASS _____ DATE _____

REASONING

1 Is each statement always, sometimes or never true? Circle your answer.

If it is sometimes true, give an example of when it is true and when it is not.

a) x^2 is greater than x. ALWAYS SOMETIMES NEVER

b) If x is negative, x^3 is negative. ALWAYS SOMETIMES NEVER

c) 8 – 2x and 2x – 8 have the same value. ALWAYS SOMETIMES NEVER

d) $-x^2$ is positive. ALWAYS SOMETIMES NEVER

PROBLEM SOLVING

2 Find the missing values.

a) 5 – 2x = 17 when x = ☐

b) $y^2 - 1 = 24$ when y = ☐ or y = ☐

3 a = –2. Write the expressions in order of value, smallest first.

a^2 $-a$ $3a$ a^3 $a - 5$ $\frac{2}{a}$

smallest ☐ ☐ ☐ ☐ ☐ ☐ largest

★ CHALLENGE FOR ALL

4 Put x, y and z in the boxes.

x = –3 y = –2 z = 4

Use each letter once in each expression.

a) Make the largest value: ☐ × ☐ – ☐ = ☐

b) Make the largest value: ☐^{2} – ☐ × ☐ = ☐

STEP 5 · SUBSTITUTING NEGATIVE NUMBERS

ANSWERS

BUILDING BLOCKS

1 a) −12 · b) 12 · c) −3 · d) 12
2 a) −8 · b) 8 · c) −5
3 a) 2 · b) −12 · c) −13 · d) 14
4 a) 3 °C · b) −9 °C · c) −8

SUPPORT

1 a) 5 · b) −20 · c) −11 · d) 14 · e) −2 · f) 0 · g) 9 · h) 4
2 2x + 1: −5, −1, 1, 5 · 5 − x: 8, 6, 5, 3
3 a) 25 · b) 50 · c) 15 · d) 10 · e) 4 · f) 20
4 a) 1 · b) −6 · c) −11 · d) 5 · e) 12 · f) 2

CORE

1 a) −7 · b) 13 · c) 21 · d) −6 · e) 21 · f) 1
2 a) 14 °F · b) −40 °F
3 a) $2x^2 = 18$, $(2x)^2 = 36$ · b) In $2x^2$ only x is squared, then doubled; in $(2x)^2$ the whole of 2x (= −6) is squared
4 a) The calculator squares 4 first and then makes it negative; she needed brackets: $(-4)^2$ · b) 16

GREATER DEPTH

1 a) Sometimes: true for x = 3 or x = −2, false for x = 0.5 or 1 · b) Always · c) Sometimes: only when x = 4 (both are 0); e.g. x = 1 gives 6 and −6 · d) Never (it is 0 or negative)
2 a) x = −6 · b) y = 5 or y = −5
3 a^3 (−8), a − 5 (−7), 3a (−6), 2/a (−1), −a (2), a^2 (4)
4 a) y × x − z = 6 − 4 = 2 (or x × y − z) · b) $x^2 - y \times z = 9 + 8 = 17$