ALGEBRA

RULES

Isolating the variable

The goal is to isolate the variable:

2a + 4 = 8

a = ?

Opposite operations

|  |  |  |
| --- | --- | --- |
| **Equation** | **Operation** | **Opposite operation** |
| X + 3 = 5 | Addition | Subtraction |
| X – 3 = 2 | Subtraction | Addition |
| 3x = 6 | Multiplication | Division |
| x/2 = 3 | Division | Multiplication |

Balancing equations

Whatever you do to one side of the equation, you must do to the other side. E.g. if you add 3 to the left-hand side of the equation, then you must add 3 to the right-hand side.

ADDITION

X + 20 = -15

// minus 20 from the left hand side in order to isolate x

// minus 20 from the right hand side

X = -15 – 20

X = -35

Y+(-12) = 15

Y = 15 – (-12) // remember, subtracting a negative is like adding a positive

Y = 27

Decimals

-5.5 + c = 10

C = 10 + 5.5

C = 15.5

Challenges

1. X + 38 = -20 (answer -58)
2. 62 = y + (-10) (answer 72)
3. -14.7 + s = -18.9 (answer -4.2)
4. a + (-1/2) = -3/4 (answer -1/4)
5. 29 + c – 8 (answer -22)

SUBTRACTION

X – 20 = 40

X = 60 // x = 40 + 20

S – (-10) = -25 // AKA s + 10 = -25

S = -25 – 10

S = -35

-5.8 = z – 2.5

Z = 2.5 – 5.8

Z = -3.3

Challenges

1. X – 130 = -220 (answer -90)
2. 67 = y – 97 (answer 164)
3. -0.8 = s – 1.4 (answer 0.6)
4. Y – (-22) = -32 (answer -54)
5. D – 30 – 5 = -15 (answer 20)

MULTIPLICATION

A coefficient is a number being multiplied by a variable:

3x = -9 // 3 is a coefficient

X = -9/3

X = -3

-25p = -100

P = -100 \* - 25 = 4

2/3h = 9

// times the reciprocal *- this is flipping the fraction round so 2/3 becomes 3/2*

h *= 9 \* 3/2*

h = 9/1 \* 3/2 // put whole number over 1 to turn in to fraction

h = 27/2 or 13.5

Challenges

1. -12x = 84 (answer -7)
2. 1/4s = -2 (answer -8)
3. -3/4 = 1/3x (answer -9/(+)4)
4. -0.8x = -3.2 (answer 4)
5. 0.25x = 85 (answer 340) // tip– times decimals to make them whole numbers (e.g. x10)

DIVISION

x/5 = -95

x = -95 \* 5

x = -475

y/-6 = -17/+4

y = -17/+4 \* -6

y = -17/+4 \* -6/+1

y = 102/4

y = 51/2 or 25.5

Challenges

1. x/4 = -14 (answer -56)
2. y/-1.2 = 6 (answer -7.2)
3. x/0.3 = 4.2 (answer 1.26)
4. -3/+5 = y/-3 (answer 9/5)
5. -1/+4 = x/-8 (answer 4/2 or 2/1 or 2)

2 STEP EQUATIONS

2y + 3 = 43

In order to get the *y* by itself, we need to remove the 2 and the 3 (2 steps)

Do these in order:

1. Always remove the constant first

2y = 43 – 3

1. Remove the coefficient last

2y = 40

Y = 40 / 2

Y = 20

-r – 3 = 36

-r = 36 + 3

-r = 39

r = 39 / -1

r = -39

solving a 2 step equation with a fraction as the coefficient

1 = 2/3p + 6

2/3p + 6 = 1

2/3 p = -5

P = -5/1 \* 3/2

P = -15/2

P = 7.5

Solving a 2 step equation when you must combine like terms

3x + 5 – 8x = -24

-3x – 8x + 5 = -24

-5x = -29

X = -29/-5

Challenges

1. x/4 + 2 = -10 (answer: -48)
2. 0.6y – 2.5 = 8.9 (answer: 19)
3. 2/3x – 6 = 12 (answer: 27)
4. -18 = 3y + 5 – 6y (answer: 23/3)
5. 20 = 9 – 3x – 6 (answer: -17/3)

MULTISTEP EQUATIONS WITH DISTRIBUTIVE PROPERTY

3(x – 2) = 21

3x – 6 = 21

3x = 27

X = 9

Combining like terms

2b – 3(3b + 2) + 4 = -18

2b – 9b – 6 + 4 = -18

-7b = -18 + 6 – 4

-7b = -16

b = -16/7

double distributive property

20 = 2(2c – 4) – (3c + 1)

4c – 8 – 3c – 1 = 20 // remember *– (3c + 1) is same as –* ***1****(3c + 1)*

C = 20 + 8 +1

C = 29

Challenges

1. 3s – 5(s – 2) = -22 (answer: 16)
2. 8r – (2r + 4) + 1 = 36 (answer: 13/2)
3. -12 = 3w – 5(2w + 1) – 8 (answer: - 1/7)
4. 4(p + 3) + 3(2p – 1) = 21 (answer: 6/5)
5. 4(n + 3) – 2(4n – 1) = -42 (answer: 14)

EQUATIONS WITH DECIMALS

Times by 10, 100, 1000, ... so you don’t work with decimals!

All terms will need to be multiplied

0.7x – 3.9 + 2.45x = 21 x 100

100(0.7x – 3.9 + 2.45x) = (21)100

170x – 390 + 245x = 2100

170x + 245x – 390 = 2100

415x = 2490

X = 2490/415

X = 6

Using distributive property

0.5w – 2.1(w – 5) + 3.1w = 4.5 x10

5w – 21(w – 5) + 31w = 45

5w – 21w + 105 + 31w = 45

15w + 105 = 45

15w = -60

W = -4

Challenges

1. 2.532(w + 3) – 1.45 = 8.678 (answer: 1)
2. 0.3p + 2.54(p – 5) + 2.45 = -38.65 (answer: -10)
3. 4.5(p + 2) – 3.4(2p – 1) = 17 (answer: -2)

EQUATIONS WITH FRACTIONS

1/3y – 2/3 = -14

Multiply each term by denominator

3/1(1/3y) – 3/1(2/3) = (-14)3

Y – 2 = -42

Y = -40

Different denominators

3/4r + 2/3 = 5

Multiply common terms by the least common multiple (LCM)

4, 8, **12**, 16 - 3rd multiple

3, 6, 9, **12**, 15 – 4th multiple

12/1(3/4r) + 12/1(2/3) = (5)12

9r + 8 = 60 // numerator \* multiple

9r = 52

R = 52/9

Using distributive property

-13/6 = 2/3(x – 5) + 1/2 LCM = 6

6/1(-13/6) = 6/1(2/3(x – 5)) + 6/1(1/2)

-13 = 4(x – 5) + 3

-13 = 4x – 20 + 3

4x – 17 = -13

4x = 4

X = 1

Challenges

1. 2/5x + 4/5 = 10 (answer: 23)
2. 8 – 2/7(2a – 2) = -4 (answer: -22)
3. ¾ = 1/6y + 5/4 (answer: -3)
4. 3m + 2/3(m – 4) = -1/6 (answer: 15/22)
5. ¾(x + 4) – 1/3(2x + 1) = 19/6 (answer: 6)

LITERAL EQUATIONS