8 - 1 Properties of Operations

Order of Operations (1)

Instruction A stationary shop had 50 pencils. Last month 10 pencils were sold, and 15 pencils were sold in this month. How many pencils does the shop have left? Make a single math sentence.

Two students thought as follows:

Student A

$50 - 10 = 40$
$40 - 15 = 25$

Answer 25 pencils

$50 - 10 - 15 = 25$

Student B

$10 + 15 = 25$
$50 - 25 = 25$

Answer 25 pencils

② ①
$50 - (10 + 15) = 25$

Total Number of pencils − Number of pencils sold = Number of pencils remaining

Any math equations inside ( ) are calculated first.

Example A cake shop had 40 cakes. 20 cakes were sold in this morning and 15 cakes were sold in this afternoon. How many cakes does the shop have left?

Subtract the total number of cakes sold from 100.

Math sentence

$40 - (20 + 15) = 40 - 35 = 15$ Answer 15 cakes

1 An electronics store had 20 TVs at a special price. Eight TVs were sold yesterday and 11 TVs were sold today. How many TVs does the store have left?

Math sentence

Answer _____

2 Calculate the following.

1. $70 - (30 + 25) =$ ☐
2. $80 - (15 + 40) =$ ☐
3. $50 - (40 - 10) =$ ☐
4. $60 - (86 - 55) =$ ☐

8 - 2 Properties of Operations

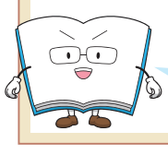
Order of Operations (2)

Instruction Cakes can be packed into a box 2 deep and 3 wide. How many boxes do you need to hold 60 cakes? Make a single math sentence.

Number of cakes	÷	Number of cakes that one box can hold	=	Number of boxes

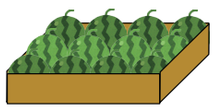
② ①

60 ÷ (2 × 3) = 10



When there are ( ) in a math sentence, the part of ( ) is calculated first.

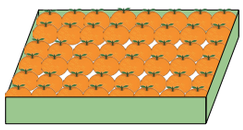
Example Watermelons can be packed into a box 3 deep and 4 wide. How many boxes do we need to hold 48 watermelons? Make a single math sentence.



Divide 180 by the number of watermelons packed into one box.

Math sentence 48 ÷ (3 × 4) = 48 ÷ 12 = 4 Answer 4 boxes

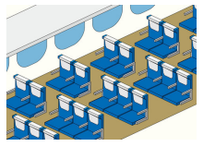
1 Oranges can be packed into a box 6 deep and 8 wide. How many boxes do we need to hold 480 oranges?



Math sentence

Answer _____

2 The seats on a train seat 2 people on one side of the aisle and 3 people on the other. How many rows of seats are needed to seat 25 people?



Math sentence

Answer _____

3 Calculate the following.

1. 420 ÷ (12 + 30) = ☐
2. 560 ÷ (8 × 7) = ☐
3. (165 − 45) ÷ 8 = ☐
4. 480 ÷ (95 − 55) = ☐

8 - 3 Properties of Operations

Order of Operations (3)

Example 1 I bought a pencil that costs 80 zeds* and 4 pieces of paper each of which costs 15 zeds*. What is the total price? ("zed(s)" is the fictional currency unit.)

The total price of pencils 80 (zeds)
The total price of paper $15 \times 4 = 60$ (zeds)

$80 + 15 \times 4$ (zeds)

How to calculate "$80 + 15 \times 4$".

In any math equation, from left to right, multiplication and division must be calculated first. If there are both multiplication and division in an equation, you can calculate from left to right. Then from left to right addition and subtraction must be calculated next.

① ② ③
$80 + 15 \times 4$
$= 80 + 60$
$= 140$

1 Write the formula for calculations and find the answers.

1. $30 + 70 \times 4$
2. $15 + 25 \times 3$
3. $45 + 30 \div 5$
4. $90 - 48 \div 6$

Example 2 My friend bought an eraser that costs 80 zeds for two and 3 piece of paper each of which costs 15 zeds. What is the total price? ("zed(s)" is the fictional currency unit.)

The total price of pencils $80 \div 2 = 40$ (zeds)
The total price of paper $15 \times 3 = 45$ (zeds)

$80 \div 2 + 15 \times 3$ (zeds)

How to calculate "$80 \div 2 + 15 \times 3$".

① ② ③
$80 \div 2 + 15 \times 3$
$= 40 + 45$
$= 85$

2 Write the formula for calculations and find the answers.

1. $60 \div 3 + 25 \times 2$
2. $36 \div 4 + 5 \times 7$
3. $20 \times 8 - 40 \div 4$
4. $50 \times 3 - 81 \div 9$

8 - 4 Properties of Operations

Order of Operations (4)

Example Solve the following equations.

1 $6 \times 8 - 4 \div 2$ 2 $6 \times (8 - 4) \div 2$ 3 $6 \times (8 - 4 \div 2)$

1 ① ② ③
$6 \times 8 - 4 \div 2$
$= 48 - 2$
$= 46$

2 ① ② ③
$6 \times (8 - 4) \div 2$
$= 6 \times 4 \div 2$
$= 24 \div 2$
$= 12$

3 ① ② ③
$6 \times (8 - 4 \div 2)$
$= 6 \times (8 - 2)$
$= 6 \times 6$
$= 36$

The order of operations requires that calculations are done in this order.

- Calculate from left to right.
- Calculates inside the ( ) are done first.
- × and ÷ must be calculated before + and − .

Solve the following equations. Show your work by following the order of operations.

1 $7 \times 8 - 6 \div 2$

2 $7 \times (8 - 6) \div 2$

3 $7 \times (8 - 6 \div 2)$

4 $(7 \times 8 - 6) \div 2$

5 $8 \times 20 - 12 \div 4$

6 $8 \times (20 - 12) \div 4$

7 $8 \times (20 - 12 \div 4)$

8 $(8 \times 20 - 12) \div 4$

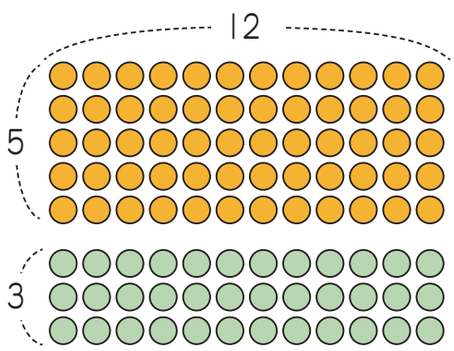
9 $6 \times 9 - 15 \div 3$

10 $6 \times (9 - 15 \div 3)$

8 - 5 Properties of Operations

Properties of Operations (1)

Instruction How to calculate the total number of dots.



Two students thought as follows:

Student A

$(5 + 3) \times 12$
$= 8 \times 12$
$= 96$

Answer 96 dots

Student B

$5 \times 12 + 3 \times 12$
$= 60 + 36$
$= 96$

Answer 96 dots

The properties of operations that apply to math sentences with ( ) include the following:

This is called the distributive property.

$(\blacksquare + \bullet) \times \blacktriangle = \blacksquare \times \blacktriangle + \bullet \times \blacktriangle$

$(\blacksquare - \bullet) \times \blacktriangle = \blacksquare \times \blacktriangle - \bullet \times \blacktriangle$

$(\blacksquare + \bullet) \div \blacktriangle = \blacksquare \div \blacktriangle + \bullet \div \blacktriangle$

$(\blacksquare - \bullet) \div \blacktriangle = \blacksquare \div \blacktriangle - \bullet \div \blacktriangle$

Example Simplifying larger numbers can make calculations easier using the distributive property.

$109 \times 5 = (100 + 9) \times 5 = 100 \times 5 + 9 \times 5 = 500 + 45 = 545$

Think about how to solve the problem (4)!

Calculate the following by making the calculation simpler.

1. $103 \times 8 =$
2. $104 \times 6 =$
3. $105 \times 7 =$
4. $99 \times 4 =$

8 - 6 Properties of Operations

Properties of Operations (2)

Instruction There are two more properties of operations:

■ + ● = ● + ■

■ × ● = ● × ■

This is called the commutative property.

(■ + ●) + ▲ = ■ + (● + ▲)

(■ × ●) × ▲ = ■ × (● × ▲)

This is called the associative property.

Example Use the communicative or associative property to solve.

1. 29 + 17 + 3 = 29 + (17 + 3) = 29 + 20 = 49
2. 73 × 4 × 25 = 73 × (4 × 25) = 73 × 100 = 7300

We can calculate much easier if using this property.

Use the communicative or associative property to solve.

1. 45 + 88 + 12 =
2. 67 + 76 + 24 =
3. 38 + 53 + 47 =
4. 16 × 4 × 25 =
5. 42 × 25 × 4 =
6. 25 × 39 × 4 =

8 - 7 Properties of Operations

Order of Operations (3)

Example 1 When a number is a multiple of 10, it can be simplified to make calculations easier to solve. Find the answer based on $3 \times 6 = 18$.

1 3×60

$= 3 \times (6 \times 10)$

$= 3 \times 6 \times 10$

$= 18 \times 10$

$= 180$

2 3×60

$= (3 \times 10) \times (6 \times 10)$

$= 3 \times 6 \times 10 \times 10$

$= 18 \times 100$

$= 1800$

$3 \times 6 = 18$
↓ 10 times ↓ 10 times
$3 \times 60 = 180$

$3 \times 6 = 18$
↓ 10 times ↓ 10 times ↓ 100 times
$30 \times 60 = 1800$

- In multiplication, when the multiplier becomes 10 times as much, the product will also become 10 times as much.
- Also, if both multiplicand and multiplier become 10 times as much, the product becomes 100 times as much.

1 Find the answers based on $8 \times 7 = 56$.

1 $80 \times 7 =$ ＿＿＿＿

2 $8 \times 70 =$ ＿＿＿＿

3 $80 \times 70 =$ ＿＿＿＿

Example 2 Find the answer based on $6 \times 7 = 42$

$6 \times 35 =$ $6 \times (7 \times 5) = (6 \times 7) \times 5 = 42 \times 5 = 210$

2 Find the answers based on $4 \times 5 = 20$.

1 $4 \times 45 =$ ＿＿＿＿

2 $5 \times 28 =$ ＿＿＿＿

8 – 8 Properties of Operations

Properties of Operations (4)

Example Write the correct math symbols (+ , − , × , ÷) to make the following math sentences correct.

1. 4 ◯ 3 ◯ 2 ◯ 1 = 0 ➡ $4 \times (3 - 2 - 1) = 0$
2. 4 ◯ 3 ◯ 2 ◯ 1 = 1 ➡ $(4 - 3) \times (2 - 1) = 1$

Write the correct math symbols (+ , − , × , ÷) in the ◯ to make the math sentence correct. Use ( ) if needed.

How many problems can you solve? Let's think about various cases.

1. 4 ◯ 3 ◯ 2 ◯ 1 = 2 ➡
2. 4 ◯ 3 ◯ 2 ◯ 1 = 3 ➡
3. 4 ◯ 3 ◯ 2 ◯ 1 = 4 ➡
4. 4 ◯ 3 ◯ 2 ◯ 1 = 5 ➡
5. 4 ◯ 3 ◯ 2 ◯ 1 = 6 ➡
6. 4 ◯ 3 ◯ 2 ◯ 1 = 7 ➡
7. 4 ◯ 3 ◯ 2 ◯ 1 = 8 ➡
8. 4 ◯ 3 ◯ 2 ◯ 1 = 9 ➡

8 - 9 Properties of Operations

Review

1 Read the following questions. Write out the math sentence and solve.

1 An electronics store had 30 mobile phones for sale. Sixteen mobile phones were sold yesterday and 11 mobile phones were sold today. How many mobile phones remain for sale at the electronics store?

Math sentence

Answer _____

2 Melons can be packed into a box 4 deep and 5 wide. How many boxes do we need to hold 80 melons?

Math sentence

Answer _____

2 Solve the problem. Show your work by following the order of operations.

1 $50 + 40 \times 3$

2 $200 - 72 \div 8$

3 $20 \times 3 + 24 \div 6$

4 $36 \div 4 - 20 \div 5$

3 Simplify the problems and then calculate them.

1 $68 \times 4 \times 25 =$

2 $25 \times 53 \times 4 =$

3 $103 \times 9 =$

4 $108 \times 7 =$

5 $89 + 56 + 44 =$