

Math 5: Handout 3

Algebraic Expressions and Word Problems

Today's material

Today we discussed more rules for algebraic operations, involving subtraction:

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

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

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

We also talked more about solving word problems using equations. Here are two examples of problems solved using equations:

Problem: An apple cost 9 cents, and an orange 15 cents. Elena bought some apples and oranges, 20 fruit in all, and paid \$2.64. How many apples and how many oranges did she buy?

Solution: Let a =number of apples; then number of oranges is $20 - a$. Thus, the total cost is $9a + 15(20 - a)$ cents. So we have an equation

$$9a + 15(20 - a) = 264$$

$$9a + 15 \times 20 - 15a = 264$$

$$300 + 9a - 15a = 264$$

$$300 - 6a = 264$$

$$300 - 264 = 6a$$

$$36 = 6a$$

$$a = 6$$

Problem: A messenger is sent from one city to another; he can travel 40 km a day. Next day, another messenger is sent, who can travel 45 km a day. When will he overtake the first messenger?

Solution: after x days, the first messenger has traveled $40x$ km, and the second one has travelled $45(x - 1)$ km (he started one day later!). Thus, we have an equation

$$40x = 45(x - 1)$$

$$40x = 45x - 45$$

$$0 = 45x - 40x - 45$$

$$45 = 45x - 40x = 5x$$

$$x = 9$$

Homework problems on back

Homework

Please try to do as many of the problems below as you can, and bring completed solutions with you to next class (do not forget to put your name on it!). Some of these problems are similar to those we have discussed in class; some are new. It is OK if you can not solve some problem — but do not give up before making an effort, maybe putting the problem away and coming back to it later — which means you have to start the homework early.

Please always write solutions on a separate sheet of paper. Solutions should include explanations. I want to see more than just an answer: I also want to see how you arrived at this answer, and some justification why this is indeed the answer. So **please include sufficient explanations**, which should be clearly written so that I can read them and follow your arguments.

1. Simplify the following expressions

- | | |
|---------------------|---------------------------|
| a. $3(2x - 1)$ | d. $3(2x - 1) + x$ |
| b. $2 - (1 - x)$ | e. $2a(a - 2) - a(a - 1)$ |
| c. $7x - (3x + 15)$ | f. $(2x - 1)(x + 1)$ |

2. A dog weighs 2 pounds more than a cat. 3 cats and 4 dogs together weigh 43 pounds. How much does a dog weigh? A cat?
3. A father is twice as old as his son. The sum of their ages is 48 years. How old is each of them?
4. a. Show that $(a + 1)(a - 1) = a \cdot a - 1$
b. Without using a calculator, compute 199999×200001
5. An orange costs 2 cents more than an apple. A grapefruit costs as much as 3 oranges. A fruit basket consists of 10 apples, 5 oranges, and a grapefruit.
a. If the price of an apple is a , what is the price of an orange? a grapefruit? Simplify your expressions!
b. If the fruit basket costs \$1.96, how much each of the fruits cost?
6. John and Sally together have 93 cents; John and Mina together have 104 cents; Sally and Mina together have 95 cents. How much money does each of them have?
7. A pet store sells parrots and canaries, A canary costs twice as much as a parrot. One customer bought 5 canaries and 3 parrots, while the other bought 3 canaries and 5 parrots. One of the customers paid \$20 more than the other. How much does each bird cost?

8. The list below shows some dates written in Swahili:

tarehe tatu Disemba jumamosi;
tarehe pili Aprili jumanne;
tarehe nne Aprili jumanne;
tarehe tano Octoba jumapili;
tarehe tano Octoba jumatatu;
tarehe tano Octoba jumatano.

Here are their English translations (in a different order!):

October 5, Monday
April 2, Tuesday
October 5, Wednesday
October 5, Sunday
December 3, Saturday
April 4, Tuesday

Write the following dates in Swahili: April 3, Wednesday; December 2, Sunday; December 5, Monday.