



Advanced Level Age Problems

In this chapter we will continue to analyze and solve age-related word problems, but the ones in the following pages are more complicated than the ones we solved previously. Therefore, we will have to spend more time to analyze and understand what the question is and how we can set up the equation, or sometimes two equations, that will help us to come up with an answer.

As before, these problems involve age differences between one child and another, between a child and an adult, or more than two persons, and we will have to read the problems carefully in order to calculate the ages of these persons now, or in a given number of years.

By setting up tables that list the facts and then generating equations from these tables, we will be able to solve the problems and come up with the correct answers. At the end of the chapter we will learn how to set up quadratic equations needed to solve certain kinds of problems.

Example:

Alan is 5 years older than Bert. If, in 3 years, Alan's age will be twice Bert's, how old are Alan and Bert now?

If Bert's age is x , then Alan's age is $x + 5$. Set up a table:

Name	Age now	Age in 3 years
Alan	$x + 5$	$x + 5 + 3 = x + 8$
Bert	x	$x + 3$

Alan's age is twice (2 times) Bert's.

$$\text{Equation: } x + 8 = 2(x + 3)$$

$$x + 8 = 2x + 6$$

$$2 = x$$

Bert's age is 2 and Alan's age is $2 + 5 = 7$

$$\text{Check: In 3 years } 2 + 3 = 5$$

$$7 + 3 = 10$$

$$2 \times 5 = 10$$

This problem could also have been solved with Alan's age as x , but keep in mind that if Alan is older than Bert, then Bert is younger than Alan. Therefore:

Name	Age now	Age in 3 years
Alan	x	$x + 3$
Bert	$x - 5$	$x - 5 + 3 = x - 2$

$$\text{Equation: } x + 3 = 2(x - 2)$$

$$x + 3 = 2x - 4$$

$$7 = x$$

Alan is 7 and Bert is $7 - 5 = 2$.

Example:

Elsa is 7 years younger than Thor. The sum of their ages is 35. How old are they?

If Thor is x , then Elsa is $x - 7$.

Together they are $x + x - 7$ or 35.

Equation: $x + x - 7 = 35$

$$2x = 35 + 7$$

$$2x = 42$$

$$x = 21$$

Thor is 21 and Elsa is 14.

Practice Problems:

- 3.1 Do the previous exercise with Elsa's age as x .
- 3.2 When I was born, my father was 41 years old. Eight years ago he was 3 times as old as I will be in 5 years. How old am I?
- 3.3 Lyn's father is 4 times as old as Lyn. Five years ago the father was 7 times as old as Lyn. How old is Lyn now?
- 3.4 Ed and Carl are brothers. The sum of their ages and their father's age is 61 years. Ed is 5 years older than Carl and their father is 6 times as old as Carl. How old is Carl?
- 3.5 A 40-year-old man has three daughters, ages 6, 3, and 1. In how many years will the combined ages of his daughters equal 80% of his age?

Example:

The sum of Tom's and Lou's age is 41 and the difference is 31. How old are they?

Here we work with both x and y . Let x stand for Tom's age and y stand for Lou's age.

$$\text{Equations:} \quad x + y = 41$$

$$\quad \quad \quad \underline{x - y = 31}$$

$$\text{Add the equations:} \quad 2x = 72$$

$$\quad \quad \quad x = 36$$

Tom is 36 years old and Lou is $41 - 36 = 5$ years old.

Now, if the problem were stated differently: The sum of Lou's age and his father's is 41 and the difference is 31, we must realize that the father is older. If we call Lou's age x and the father's age y , we get:

$$x + y = 41$$

$$\text{and } y - x = 31$$

$$2y = 72$$

$$y = 36$$

The father is 36 years old and Lou is 5 years old.

Practice Problems:

Use two variables for practice.

- 3.6 The difference in age between Brita and her daughter Eva is 30 years. The sum of their ages is 118. How old is Eva?
- 3.7 Jack is 3 years older than Susan. The sum of their ages is 27. Find their ages.
- 3.8 Glenn is 6 years older than Carla. The sum of twice Glenn's age and Carla's is 57 years. Find their ages.
- 3.9 Chris is 7 years younger than Mary. Chris's age subtracted from three times Mary's age is 43. Find their ages.
- 3.10 Ray is 2 years younger than Sig. Three times Sig's age subtracted from 5 times Ray's age equals Sig's age. How old are the boys?

Example:

The ratio of John's age to David's age is 6:5. In 7 years the ratio will be 7:6. What are their ages now?

A ratio is a comparison of two numbers by division. 6:5 is the same ratio as 12:10, 18:15, etc. Since the ratio is 6:5, we can call the ages $6x$ and $5x$. (See also Ratio problems in Chapter 5.)

Set up a table:

Name	Age now	Age in 7 years
John	$6x$	$6x + 7$
David	$5x$	$5x + 7$

The ratio of the ages is then 7:6 and we can set up an equation:

$$\frac{6x+7}{5x+7} = \frac{7}{6}$$

This is a proportion (two equal ratios), so we can cross multiply:

$$\begin{aligned} 6(6x + 7) &= 7(5x + 7) \\ 36x + 42 &= 35x + 49 \\ x &= 7 \end{aligned}$$

John is $6(7) = 42$ years old and David is $5(7) = 35$ years old.

Check: In 7 years John will be 49 years old and David 42.

$$\text{Ratio: } 49:42 = 7:6$$

Alternate solution:

Name	Age now	Age in 7 years
John	x	$x + 7$
David	y	$y + 7$

Equations: $\frac{x}{y} = \frac{6}{5}$
 $\frac{x+7}{y+7} = \frac{7}{6}$

Cross multiply both equations:

$$5x = 6y \text{ or } 5x - 6y = 0 \qquad 6(x+7) = 7(y+7)$$

$$\qquad \qquad \qquad 6x + 42 = 7y + 49$$

$$\qquad \qquad \qquad \text{or } 6x - 7y = 7$$

We now have two equations:

$$5x - 6y = 0 \text{ Multiply by } 7: \qquad 35x - 42y = 0$$

$$6x - 7y = 7 \text{ Multiply by } 6: \qquad 36x - 42y = 42$$

Subtract the first equation from the second: $x = 42$

$$5(42) = 6y$$

$$35 = y$$

Practice Problems:

- 3.11 Adam and Victor are together 15 years old. Victor's age is 50% of his brother Adam's age. Find the ages of the boys.
- 3.12 The ages of the girls Ina, Mina, and Mo are in a ratio of 4:6:7. Combined the girls are 102 years old. What are their ages?
- 3.13 Mark and Mindy are together 84 years old. Three times Mark's age equals 4 times Mindy's age. How old are they?
- 3.14 The ages of Jim and Jon are in the ratio 3:7. If you multiply Jim's age by 4, you get the same result as when you add 40 to Jon's age. How old are Jim and Jon?

- 3.15 Six years ago, David's mother was 13 times as old as David. Now she is only 4 times as old as David. How old is David now?

Example:

Twice Lydia's age plus 1 equals 3 times her age less 4. How old is Lydia now?

If Lydia's age is x , then $2x + 1 = 3x - 4$
 $5 = x$

Lydia is 5 years old.

Check: $2(5) + 1 = 10 + 1 = 11$
 $3(5) - 4 = 15 - 4 = 11$

Practice Problems:

- 3.16 A mother is now 28 years older than her daughter. In 4 years the mother will be 3 times as old as the daughter. How old is the mother now?
- 3.17 Five years ago, Ellen's mother was 7 times as old as Ellen. Five years from now, she will be only 3 times as old as Ellen will be then. How old is Ellen now?
- 3.18 Ed is 8 years older than his brother John. Five years ago, Ed was 3 times as old as John. Find their present ages.
- 3.19 Carl is twice as old as Ginger. If Carl were 2 years younger and Ginger were 3 years older, the difference of their ages would be 3. How old is Ginger?
- 3.20 Ron is 6 years older than his wife, Bev. In 4 years, twice his age plus 1 will be 3 times Bev's age 3 years ago. How old are they now?

Example:

When Ralph asked his math teacher how old she was, she answered: “Ten years ago, my age was equal to the square of my daughter’s age. In 14 years, I will be twice as old as my daughter.”

Call the teacher’s age x and her daughter’s age y .

Make a table:

Name	Age now	Age 10 years ago	Age in 14 years
Teacher	x	$x - 10$	$x + 14$
Daughter	y	$y - 10$	$y + 14$

$$\text{Equations: } x - 10 = (y - 10)^2 \rightarrow x - 10 = y^2 - 20y + 100$$

$$x + 14 = 2(y + 14) \rightarrow x + 14 = 2y + 28 \rightarrow x = 2y + 14$$

Substitute x in the top equation with the expression for x in the second equation:

$$2y + 14 - 10 = y^2 - 20y + 100$$

$$\text{Simplify: } y^2 - 20y + 100 = 2y + 14 - 10$$

$$y^2 - 22y + 96 = 0$$

$$\text{Factor: } (y - 6)(y - 16) = 0$$

$$y - 6 = 0 \quad y - 16 = 0$$

$$y = 6 \quad y = 16$$

We must reject $y = 6$ because 10 years ago, the daughter would be -4 .

We find the teacher’s age by substituting in one of the original equations.

$$x - 10 = (16 - 10)^2$$

$$x - 10 = 36$$

$$x = 46$$

The teacher is 46 years old.

Check: In 14 years the teacher will be 60 years old and her daughter 30 years old.

Practice Problems:

- 3.21 The product of the ages of Dora and Phil is 243. Phil is 3 times as old as Dora. How old is Phil?
- 3.22 Liz is 2 years older than Ronald. The product of their ages is 440. How old are they?
- 3.23 Five years ago, the sum of the ages of Charlotte's daughters was 22. Five years from now, the older daughter will be exactly twice as old as the younger daughter. How old is the older daughter now?
- 3.24 A mathematician was asked how old she was. She answered: "I'll be x years old in the year x^2 ." How old will she be in the year 2006?
Hint: Use your calculator to find perfect squares in the years 2000 and later.
- 3.25 Susan is 5 years older than her sister Lucy. The sum of the square of Lucy's age and twice the age of Susan's is 58. How old is Lucy?