



Math Olympiad and Problem Solving Programs

F130 - Advanced Problem Solving

Problem Set 16.1 - Chicken and Rabbits

Name:

Date:

Here is the general method for solving chicken and rabbits problems:

(a) Let's call the animal with more legs A (which has A legs) and the animal with less legs B (which has B legs).

(b) Multiply *# heads given in problem* \times B legs = some number we will call \heartsuit

(c) Subtract *# legs given in problem* $-\heartsuit$ = some number we will call \diamond

(d) Divide \diamond by the difference in number of legs between A and B, and the resulting number is the number of animal A.

Some of the problems don't have heads and legs. Some, like problem 6, have number of tickets and amounts of money. So we will call the amount of tickets "heads" and the amount of dollars "legs" for these other problems.

1.

2.

3. If there are 60 eyes, and we know each animal has 2 eyes, then we have $60 \div 2 = 30$ heads. Now we can do the problem like normal. Let's follow the steps stated above.

(a) The rabbit has 4 legs, so it is animal A. The chickens have 2 legs, so it is animal B.

(b) We are given there are 30 heads, and animal B has 2 legs, so we multiply $30 \times 2 = 60 = \heartsuit$.

(c) The problem says there are 86 feet, so we subtract $86 - \heartsuit = 86 - 60 = 26 = \diamond$.

(d) The difference in legs between A and B is $4 - 2 = 2$, so we divide $\diamond \div 2 = 26 \div 2 = 13 =$ number of animal A, or number of rabbits.

We know he has 13 rabbits, and 30 total animals, so he must have $30 - 13 =$ chickens.

4. This problem is most easily done with guess and check. We will guess by the number of rabbits, then find the number of chickens by doing $15 +$ rabbits (because the problem states she has 15 more chickens than rabbits), and then we will see how many total legs we have.

I'll start my guessing with 30 rabbits. If she has 30 rabbits, she has 45 chickens. Then she has $30 \times 4 = 120$ rabbit legs and $45 \times 2 = 90$ chicken legs, which is a total of $120 + 90 = 210$ legs. We are looking for 240 legs, so we under-guessed. We need more animals!

Try 40 rabbits. If she has 40 rabbits, she has 55 chickens. Then she has $40 \times 4 = 160$ rabbit legs and $55 \times 2 = 110$ chicken legs, which is a total of $160 + 110 = 270$ legs. We are looking for 240 legs, so we over-guessed. We need less animals, but more than our first guess!

Try 35 rabbits. If she has 35 rabbits, she has 50 chickens. Then she has $35 \times 4 = 140$ rabbit legs and $50 \times 2 = 100$ chicken legs, which is a total of $140 + 100 = 240$ legs. We did it! Therefore she has rabbits.

5.

6.

7.

8.



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9. 20

10. To change this into a chickens and rabbits problem, we will let the number of students be “heads” and the number of points be “legs.” First, let’s simplify the problem a little. We know that 15 students scored 1 point and 9 students scored 3 points, we know how 15 points + $9 \times 3 = 27$ points = 42 points have been assigned. So of the 132 points that were earned in total, we know how 42 have been assigned, so we need to know about the rest of the $132 - 42 = 90$ points are assigned. Also, we know what score $15 + 9 = 24$ of the students earned, so we need to figure out the scores for the remaining $50 - 24 = 26$ students.

So now we have a chicken and rabbits problem with 26 “heads” (students), 90 “legs” (points), and 3 types of “animals” (scores). Let’s finish the problem with guess and check. I guess that 8 students score a 2, so that means 8 students also score a 4 (because we have the same number of students who scored a 2 and a 4). This means that there are $26 - 8 - 8 = 10$ students who scored a 5. The total points scored is $8 \times 2 = 16$ for the 2-score, $8 \times 4 = 32$ for the 4-score, and $10 \times 5 = 50$ for the 5-score. The total then is $16 + 32 + 50 = 98$. However, we want a total of 90 points remaining, so we need to guess again.

I guess that 10 students score 2 (so that’s $2 \times 10 = 20$ points for them). This means that 10 students scored a 4 (which is $4 \times 10 = 40$ points for them), and there are $26 - 10 - 10 = 6$ students left over to score a 5. The 5-score students scored a total of $5 \times 6 = 30$ points, so the point total is $20 + 40 + 30 = 90$ points. We have our answer! So 10 students each scored 2 and 4, and 6 students scored a 5.

Let’s check our work. There are: 15 students scoring 1, 10 students scoring 2, 9 students scoring 3, 10 students scoring 4, and 6 students scoring 5. $15 + 10 + 9 + 10 + 6 = 50$, check. $15 \times 1 + 10 \times 2 + 9 \times 3 + 10 \times 4 + 6 \times 5 = 15 + 20 + 27 + 40 + 30 = 132$, check.