

CHAPTER 4 Equations
4.5 Modelling With Algebra
Using Algebraic Modelling to Solve Problems

Example:

a) A prize of \$162 has been donated by local math teachers for the playoff game between the Marshville and Canal City baseball teams. Each team has 9 players. The prize must be distributed such that each player on the winning team receives twice as much as each player on the losing team. Use algebraic modelling to determine how much each player will receive.

b) The surface area of a spherical balloon is calculated using the expression $SA = 4\pi r^2$, where r is the radius of the balloon. Josh calculates that the surface area of one of his birthday balloons is 1200 cm^2 . By how much must the radius be increased to double the surface area?



Solution:

a) Let the amount received by each player on the losing team be represented by x . The amount received by each player on the winning team is $2x$.

$$\begin{aligned}9(2x) + 9x &= 162 \\18x + 9x &= 162 \\27x &= 162 \\\frac{27x}{27} &= \frac{162}{27} \\x &= 6\end{aligned}$$

Each player on the losing team receives \$6. Each player on the winning team receives \$12.

b) Find the radius of the original balloon and of a balloon with twice the surface area:

For the original balloon:

$$\begin{aligned}SA &= 4\pi r^2 \\\frac{SA}{4\pi} &= \frac{4\pi r^2}{4\pi} \\\frac{SA}{4\pi} &= r^2 \\r &= \sqrt{\frac{SA}{4\pi}} \\&= \sqrt{\frac{1200}{4\pi}} \\&= 9.8\end{aligned}$$

For the larger balloon:

$$\begin{aligned}r &= \sqrt{\frac{SA}{4\pi}} \\&= \sqrt{\frac{2400}{4\pi}} \\&= 13.8\end{aligned}$$

The increase in radius is $13.8 \text{ cm} - 9.8 \text{ cm}$, or 4.0 cm .

Practice:

1. At a family gathering, Andelko notices that he is twice as old as Beatrice, Beatrice is twice as old as Celine, Celine is twice as old as Dan, and Dan is twice as old as Eustice. The sum of all of their ages is 62 years. How old is each person?

2. Wanda is an instructor at a parachuting club. She is paid \$12/h, plus \$20 for every tandem jump that she makes with a customer. On a holiday weekend, she worked a total of 24 h, and earned \$588. How many tandem jumps did she make?



Answers:

1. Andelko is 32, Beatrice is 16, Celine is 8, Dan is 4 and Eustice is 2.

2. Wanda made 15 tandem jumps.