



# AUSTRALIAN MATHS TRUST

**Challenge Problems**  
**Middle Primary: Years 3–4**  
**Practice Problem**

## **MP5: Kimmi Dolls**

Suriya decides to give her collection of 33 Kimmi dolls to her four little sisters.

**a.** Show how Suriya could give out the dolls so that the girl who receives the most has only one more than anyone else.

Suriya decides to give out the dolls so that the difference between the largest number of dolls any girl receives and the smallest number of dolls any girl receives is at most 4.

**b.** Show how this could be done if one girl receives 11 dolls.

**c.** Explain why no girl can receive more than 11 dolls.

**d.** What is the smallest number of dolls any girl can receive? Explain why a smaller number is not possible.

## Solutions

**a. Alternative i**

Since  $33 \div 4 = 8$  with a remainder of 1, three girls could get 8 dolls each and the fourth girl 9 dolls. 1

**Alternative ii**

If one girl gets 7 or fewer dolls, then each of the other three girls gets at most 8 dolls. This means the total number of dolls can't be any more than  $7 + 8 + 8 + 8 = 31$ , which is not enough.

So every girl must get at least 8 dolls. Since  $4 \times 8 = 32$ , which is 1 less than 33, Suriya must give 8 dolls to each of 3 sisters and 9 dolls to the fourth sister.

- b.** If one girl gets 11 dolls, each of the other three girls must get at least 7 dolls. Since  $11 + 7 + 7 + 7 = 32$ , which is 1 less than 33, two girls get 7 dolls each and one girl gets 8.

**c. Alternative i**

If one girl gets 12 or more dolls, the other three must get at least 8 each. Then the total number of dolls would have to be at least  $12 + 8 + 8 + 8 = 36$ , which is too many. So no girl can get 12 or more dolls. 1

**Alternative ii**

If one girl gets 12 or more dolls, then there are at most 21 dolls for the other three girls. This means that one girl gets at most 7 dolls, which is 5 less than 12. So no girl can get 12 or more dolls.

- d.** In Part **b** we saw how it's possible for at least one girl to get 7 dolls. So we need to see if we can give one girl less than 7 dolls.

Suppose one girl gets 6 dolls. This leaves 27 dolls for the other three girls. If each of them gets 9, all the dolls are used up and Suriya's rule is satisfied.

If one girl gets 5 or fewer dolls, then each of the other girls gets at most 9. This means the total number of dolls can't be any more than  $5 + 9 + 9 + 9 = 32$ , which is not enough. So no girl can get 5 dolls.

(Alternatively, if one girl gets 5 or fewer dolls, then there are at least 28 dolls for the other three girls. This means that one girl gets at least 10 dolls, which is 5 more than 5. So no girl can get 5 dolls.)

Therefore 6 is the least number of dolls that any girl can get