Mockingjay Mathematics

The Hunger Games is [. . .] a great source of mathematical inspiration, perhaps the best such source we have seen from popular culture in some time. (Michael A. Lewis)

"The Hunger Games" is a series of popular science-fiction books/movies in which a group of teenage heroes struggle for their life. . . and do some math along the way.

It becomes a matter of life and death for the main character, Katniss, to perform arithmetic operations correctly (as she determines the number of adversaries who are left). She has to think strategically, which involves logical deductions and an intuitive evaluation of probabilities. Together with some allies, she has to understand the periodicity of certain phenomena (the Hunger Games Arena in 'Catching Fire'). Moreover, she is puzzled by the number of bread rolls that are given as a present (see Chapter 24 of 'Catching Fire'): this number and the kind of bread convey a coded message. Not to mention the Hunger Games lottery, which seems to exist for the purpose of illustrating probability theory.

In an inspiring article in MTMS, Sarah B. Bush and Karen S. Karp have developed activities for middle-grade students based on the Hunger Games lottery (with some additional questions about combinatorics). The lottery is also discussed in an article by Michael A. Lewis: there he additionally introduces game theory, with the question of whether it makes sense to trust competitors. More activities related to combinatorics and probability with a Hunger Games flavor have been developed by Lance Mangham. Going in a different direction, a statistical analysis on the survival rates in the Hunger Games can be found in an article by Brett Keller.

"Twenty-four" he says.
"An even two dozen, then?"' says Beetee.
"Twenty-four on the nose", says Finnick.
"How should we divide them?"
"Let's each have three, and whoever is still alive at breakfast
can take a vote on the rest", says Johanna.

In the activity sheet below, some arithmetic problems are presented. They take their cue from the book/movie "The Hunger Games" (Activities 1 and 4) and from the book "Catching Fire" (Activities 2 and 3).

The problems fit with the Grade 6 curriculum according to the Common Core State Standards Initiative (CCSS.Math.Content.6.NS.B):

- Activity 1 is about understanding a number that is one less than a multiple of 25.
- Activity 2 is about remarking that 42×2 is not divisible by 5.
- Activity 3 is finding a number that has the correct greatest common divisor with 6.
- Activity 4 is about counting the 15 integer partitions of the number 7.

There is more than one good answer in Activity 3. So one can praise "originality", if someone chooses a number that nobody else took.

References

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Mockingjay Mathematics Activity sheet

1. **Katniss first participates in the 74th Hunger Games.**

   • Why 74, and not for example 72 or 77? Which numbers would have been possible?

   The Hunger Games happen every year after a rebellion took place. After 25 years from the rebellion, and every 25 years, there is a special edition of the Games (called Quarter Quell). It is important for the story that the next year Katniss participates in a Quarter Quell (which, by the way, is the very last Hunger Games ever).

2. **Katniss and her 4 allies receive 24 bread rolls. Each of them eats 3. The day after they receive 24 bread rolls and each of them eats 3. On the third day they again receive 24 bread rolls.**

   • On the third day, if they again all eat the same amount of bread rolls there must be bread rolls left. Why?
   Would it help cutting the bread rolls into two halves and distributing those instead?

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3. **Katniss thinks that receiving a number of bread rolls that cannot be equally divided means that her group should not split up.**

   Suppose that you are to send 20 to 30 bread rolls to a group of 6 people.

   • How many bread rolls would you send to convey the message that the group
   . . . must stay united? _____
   . . . must split into two groups? _____
   . . . must split into three groups? _____
   . . . must split completely? _____

4. **Katniss and the other participants of the Hunger Games form alliances. One person may stay alone or join a group.**

   Suppose that there are 7 participants. One possibility for the alliances is for example three pairs and a singleton.

   • How many kinds of groupings are possible? _____