

$4(3 + 3)$



$3 \times 4 = 7$



$4(3 + 3)$



FUN AND GAMES

FIREWORKS

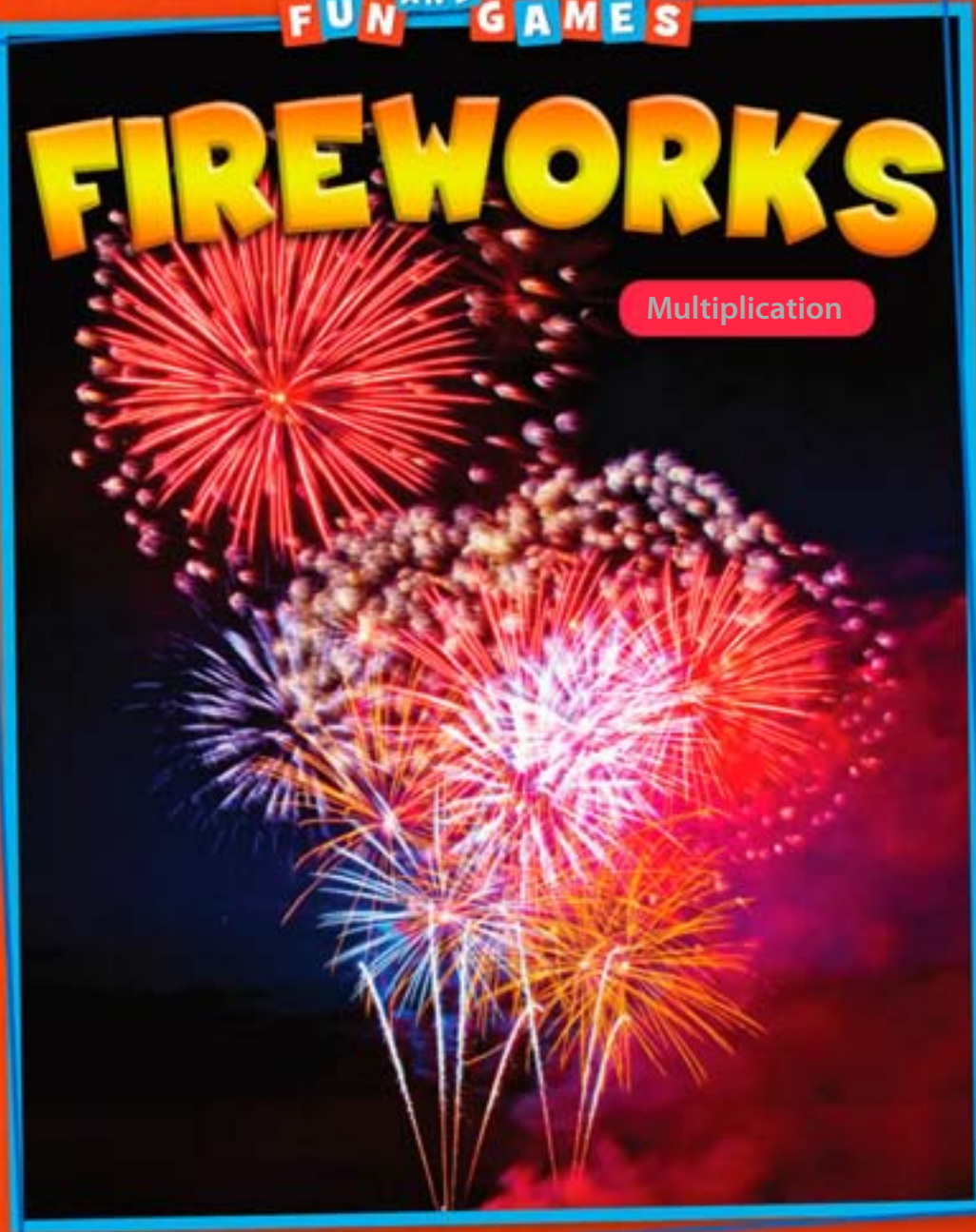
Multiplication

Jay Hwang

FUN AND GAMES

FIREWORKS

Multiplication



Jay Hwang

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Boom! Bang! Bored?

Bang! Whoosh! Pop! Stella has a gigantic smile on her face as the glow from an orange burst erupts in the night sky. *Hiss! Snap!* The sound of a silver whistling whirl delights Stella's ears. *Boom!* Silence. *Bang!* A giant, blue flower explodes in the air. Stella cheers along with the crowd. Her father's fireworks sure are impressive. Behind the scenes, though, away from the crowd, Stella knows that her father is bored and unhappy.

Stella's father is a **pyrotechnician**. He sets off fireworks for a living, and it is his job to dazzle audiences with his firework show. But lately, Stella's father has become bored. He feels that he knows everything about fireworks. He can identify the exact **proportion** of ingredients needed to make any type of explosion. Barium is used for green fireworks and lithium for red fireworks. Shells loaded with many small, round pieces of metal called **stars** will create one large explosion. Adding more black powder to the **lift charge** at the bottom part of the firework will propel it higher into the sky, and changing the length of the **fuse** will **detonate** the firework at precisely the right time. To him, fireworks are simply careful calculations and measurements, which achieve a consistent, predictable result in color and sound. He feels that he has nothing left to learn.



Pyrotechnicians prepare for a firework show.



LET'S EXPLORE MATH

Professional pyrotechnicians plan for 2 hours to produce 1 minute of a firework show.

1. How many minutes of planning time is this?
2. How many minutes does it take to plan a 30 minute show?

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