Bonfire Night maths activities for IGCSE and GCSE: Beyond school

IGCSE Math Revision · Beyond school: for adults and maths fans · 5 November · Student sheet

Name _____ Class _____ Date _____

No calculator needed. Every answer works out exactly. Take $g = 10$ m/s^2.

Starter (5 minutes)

1. In how many orders can 3 identical rockets and 2 identical Roman candles be launched?

2. A firework bursts into a sphere of sparks of radius 30 m. Find the ratio of its surface area to its volume.

3. What is the 12th term of 1, 1, 2, 3, 5, …?

4. What is the remainder when 5^{11} is divided by 7?

Main activity (30 minutes)

Task A: The best launch angle

A firework is launched from the ground at speed u at angle θ above the horizontal. With no air resistance its range is $R = u^2 \sin 2\theta / g$.

a. Which angle θ between 0° and 90° gives the greatest range?

b. With $u = 20$ m/s, find the greatest range.

c. Find the two launch angles that give a range of 20 m.

Task B: Sparkler probability

A box holds 10 sparklers, and 2 of them are duds.

a. Three sparklers are taken at random. What is the probability that none is a dud?

b. All 10 are lit one at a time in a random order. What is the probability that the two duds are lit one straight after the other?

c. On average, how many good sparklers are lit before the first dud?

Extension

1. Fireworks stand at the 8 corners of a cube with edges of 1 m. How many different distances are there between pairs of fireworks, and what is the sum of the squares of all 28 distances?