Bonfire Night maths activities for IGCSE and GCSE: SL / AS

IGCSE Math Revision · A Level Maths (Year 12 and Year 13) · 5 November · Student sheet

Name _____ Class _____ Date _____

The starter is non-calculator. A calculator is needed for the main activity. Take g = 9.8 m s^{-2}.

Starter (5 minutes)

1. Find the sum of the first 10 terms of 3, 7, 11, …

2. Find the sum to infinity of 8 + 4 + 2 + …

3. A spark is thrown straight up at 14 m s^{-1}. How long does it take to reach its highest point? (g = 9.8 m s^{-2})

4. Solve $4.9t^2 - 19.6t = 0$.

Main activity (35 minutes)

Task A: The firework projectile

A firework is launched from ground level at 35 m s^{-1} at 60° above the horizontal. Model it as a particle moving freely under gravity.

a. Find the time to reach the highest point and the greatest height, each to 3 significant figures.

b. The firework explodes at its highest point. How far has it travelled horizontally? Give 3 significant figures.

c. If it did not explode, how far from the launch point would it land? Give 3 significant figures.

d. For how long is the firework at least 30 m above the ground? Give 3 significant figures.

Task B: The rocket motor (Year 13)

A rocket rises vertically from the ground. Its velocity is $v = 24t - 3t^2$ m s^{-1} for $0 \le t \le 8$.

a. Find when the acceleration is zero, and the greatest velocity.

b. Find the height of the rocket when $t = 8$.

Task C: Remember, remember: series

A display fires 5 fireworks in the first minute, 8 in the second, 11 in the third, and so on.

a. How many fireworks are fired in the 20th minute, and in the first 20 minutes altogether?

b. The display has 1000 fireworks. After how many whole minutes have they all been fired?

c. On 5 November one person shares a photo with 5 friends. The next day each of them shares it with 5 new people, and so on. How many people (not counting the first) have received it after 5 rounds?

d. After how many rounds have more than one million people received it?

Extension

1. Show that the path of the firework in task A is $y = \sqrt{3}x - (2/125)x^2$.

2. The same firework is launched from the top of a 20 m high hill, at the same speed and angle. How long is it in the air, and how far away horizontally does it land? Give 3 significant figures.