

Bonfire Night maths activities for IGCSE and GCSE: answers

IGCSE Math Revision · IGCSE and GCSE (Higher and Extended) · 5 November · Teacher answers and notes

The starter is non-calculator. A calculator helps with the cone task.

Teacher notes

- Enjoy fireworks at an organised display; this pack is about the maths only.
- In the rocket task, ask why $t = 0$ is also a solution of $h = 0$ and what it means.
- For the quadratic sequence, students often halve the first difference instead of the second difference.

Starter

1. **29, 35**

- The terms go up by 6 each time.

2. **$6n - 1$**

- The difference is 6, so start with $6n$. The first term is $5 = 6 - 1$, so $6n - 1$.

3. **$x = 4$ or 5**

- $(x - 4)(x - 5) = 0$

4. **40**

- $60 - 20 = 40$

Task A: The rocket

a. **75 m**

- $40 \times 3 - 5 \times 9 = 120 - 45 = 75$

b. **8 seconds**

- $40t - 5t^2 = 0$ gives $5t(8 - t) = 0$, so $t = 0$ or 8 .

c. **80 m after 4 seconds**

- $-5(t^2 - 8t) = -5[(t - 4)^2 - 16] = 80 - 5(t - 4)^2$.
- The greatest value is 80, when $t = 4$.

d. **4 seconds**

- $40t - 5t^2 = 60$ gives $t^2 - 8t + 12 = 0$, so $(t - 2)(t - 6) = 0$.
- It is above 60 m from $t = 2$ to $t = 6$: 4 seconds.

Task B: Remember, remember: sparkler patterns

a. **$4n + 1$**

- The difference is 4 and $5 = 4 + 1$.

b. **201**

- $4 \times 50 + 1 = 201$

c. **No**

- $4n + 1 = 100$ gives $n = 24.75$, which is not a whole number.

d. **48; $n^2 + 2n$**

- First differences 5, 7, 9, 11; second difference 2, so start with n^2 .
- Subtract n^2 : 2, 4, 6, 8, 10, which is $2n$. So $n^2 + 2n$.
- Next term: $6^2 + 12 = 48$.

e. **The 12th**

- $n^2 + 2n = 168$ gives $(n + 14)(n - 12) = 0$, so $n = 12$.

Task C: The bonfire

a. **4.71 m³**

- $\frac{1}{3} \times \pi \times 1.5^2 \times 2 = 1.5\pi = 4.712\dots$

b. **2.5 m; 11.8 m²**

- $l = \sqrt{(1.5^2 + 2^2)} = \sqrt{6.25} = 2.5$
- $\pi \times 1.5 \times 2.5 = 3.75\pi = 11.78\dots$

Extension

1. **$t = 2.75$ s, at 72.2 m**

- Expand: $50t - 50 - 5t^2 + 10t - 5 = 60t - 55 - 5t^2$.
- Set equal to $40t - 5t^2$: the t^2 terms cancel, so $20t = 55$ and $t = 2.75$.
- Height = $40 \times 2.75 - 5 \times 2.75^2 = 72.1875$, so 72.2 m.

Every question is original and every answer was recomputed by computer before publishing.