Solutions

2.1

- $\Theta(n \log n)$ ✓.
- Dominant term wins; constants and $2n$ dropped ✓.

2.2

- 10 iterations: $2^{10} = 1024$ ✓.

2.3

- 3, 7, 10 ✓.

3.1

- $2n^2 = 100n$ gives $n = 50$: B first overtakes A there ✓.
- A is $\Theta(n)$ (linear); B is $\Theta(n^2)$ – the dominant terms decide ✓.
- At $n = 10$: A 1 000, B 200 – run B ✓.
- At $n = 1000$: A 100 000, B 2 000 000 – run A ✓.

3.2

- The halving loop contributes $\log_2 n$ iterations; the inner loop n each time ✓.
- Product: $\Theta(n \log n)$ ✓.
- At $n = 1024$: $n \log_2 n = 1024 \times 10 = 10\,240$ against $n^2 = 1024^2 = 1\,048\,576$ – about 102 times more ✓.
- Each iteration halves the input, so the count of steps to reach 1 is the number of halvings – the logarithm ✓.

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