

Higher or Lower Task Cards

Print double-sided, flipping on the long edge. Cut along the frames.

1

One of you is the **thinker**. The other is the **guesser**.

The thinker writes a whole number from 1 to 100 where the guesser cannot see it. The guesser says a number. The thinker says **higher**, **lower** or **right**. Tally the guesses on the board until the guesser is right. Swap roles. Play three or four rounds.

2

Play one more round. This time the guesser must guess **1, then 2, then 3**, and so on, in order.

What is the **most** guesses this could ever take for a number from 1 to 100?

3

Back to playing however you like.

What is the **best first guess**?

Why that number?

4

Describe your strategy in **one sentence** that another group could follow without asking you anything.

Write it on the board.

5

Using your strategy, what is the **most** guesses you could ever need for a number from **1 to 10**?

Be sure. Not how many you needed today. The worst it could *ever* be.

6

Now for a number from **1 to 100**.

Write down how many numbers are still possible after each guess, starting from 100.

What is the **most** guesses you could ever need?

Higher or Lower Task Cards — Backs

Answers for the cards on the other side of this sheet.

2 — answer

100 guesses, if the number is 100.

1 — answer

No answer. Keep your tallies on the board.

4 — answer

Guess the middle of the numbers still possible. Throw away the half that is ruled out. Repeat.

3 — answer

50 or 51. Whatever the answer, about half the numbers are ruled out.

6 — answer

$100 \rightarrow 50 \rightarrow 25 \rightarrow 12 \rightarrow 6 \rightarrow 3 \rightarrow 1$
7 guesses.

5 — answer

4 guesses.

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7

Now for a number from **1 to 1000**.

What is the **most** guesses you could ever need?

Add a row to your table: 1 to 10, 1 to 100, 1 to 1000.

8

Look at your table.

Each row has **ten times** as many numbers as the row above.

About how many **more guesses** does each row cost?

9

Without playing it, predict the **most** guesses you could ever need for a number from **1 to 1,000,000**.

Explain how you got your prediction.

10

Try **doubling** instead.

What is the most guesses you could ever need for **1 to 20**? For **1 to 200**?

Compare with 1 to 10 and 1 to 100. What does doubling the numbers cost?

11

New rule. The thinker only ever says **right** or **wrong**. Never higher or lower.

What happens to your strategy?

What is the **most** guesses you could ever need now for 1 to 100?

Bonus

A guesser playing 1 to 100 says they have a strategy, but they need about 10 guesses every single round.

What might they be doing wrong?

Suggest one change that gets them to 7 or fewer.

Higher or Lower Task Cards — Backs

Answers for the cards on the other side of this sheet.

8 — answer

About 3 more guesses
each time (4, 7, 10).

7 — answer

10 guesses.

10 — answer

1 to 20: 5 guesses. 1 to 200: 8 guesses.
Doubling costs exactly one more guess.

9 — answer

20 guesses. Three more rows of
“times ten” past 1 to 1000, so about
 $10 + 3 \times 3 = 19$, and a little more.

Bonus — answer

They are not guessing the middle,
so each guess throws away less than
half. Guess the middle of what is left.

11 — answer

The strategy stops working. “Wrong”
rules out one number at a time, so it
could take 100 guesses, just like card 2.