Family edition

Claw Game Maker: Is This Machine Fair?

Ages 11-14 · about 45 minutes, in one sitting

Your child finds out what a player's chances really are on a claw machine, in Claw Game Maker. The point is that a win rate comes from many plays, that twenty plays give a rough number, and that the operator's settings are what move it.

What you need

- A computer or Chromebook with a current browser.
- The lesson link: mytekdev.com/try/clawmaker?lesson=is-this-machine-fair&ref=fam-clawmaker-3. No account, no email and nothing to install.
- Optional: a coin to flip ten times first.

Before you start: try it once yourself

Open mytekdev.com/try/clawmaker?lesson=is-this-machine-fair&ref=fam-clawmaker-3. A claw machine in a room, seen the way a player sees it: a 70 cm box, three rubber-padded prongs parked closed over the chute, and a pile of bears, ducks and capsule balls.

1. **Guess.** Open `Test`. Under Robot players, type a guess out of twenty in My guess.
2. **Run.** Press `Run the robots`. Twenty plays come in one at a time, each a win or a loss, with the count and your guess beside it. The starter wins about two in five.
3. **Again.** Run twenty more. The count is different. The sheet asks why.
4. **The carry.** Open `Build`, `Claw`, and drag `Carry` down to 0.5 N. Run the robots: most prizes now fall on the way to the chute.
5. **The check.** On `Build`, `Share`, Run the honest machine check: at 0.5 N it fails and names the prize kinds that cannot be lifted.

> The robots aim at a prize near the top of the pile with a set wobble of a few centimeters, so the rate is a property of the machine and the pile. The pile itself is luck: the same machine filled differently can win anywhere from one play in ten to four in five, and the starter's pile sits near two in five.

The ideas, in plain words

A win rate is wins divided by plays, and it is only a good estimate when there are many plays. Twenty plays at a true rate of 40 percent will give anywhere from about 4 to 12 wins most of the time; sixty plays narrow that. The lesson has children see the spread for themselves before it says so.

A real claw machine's operator menu sets the grips for the grab, the lift and the carry separately, and machines are often set to ease off on the carry so that prizes fall near the chute. That is not a secret; it is why several states require that every prize on show be winnable with the claw as set. The app's honest machine check is modeled on that rule.

The robots are careful players, not perfect ones: they aim at a prize near the top of the pile with a set wobble. A child who aims well can do better than the robots; a child who aims badly will do worse. The rate measures the machine.

Do it together

1. Open mytekdev.com/try/clawmaker?lesson=is-this-machine-fair&ref=fam-clawmaker-3 together. Open Test. Guess how many of twenty robot players will win, type it, and press Run the robots.

   > **You'll know it worked when:** The count grows play by play.

2. Run twenty more.

   > **You'll know it worked when:** A different count. Ask which one is right.

3. Open Build, Claw, and drag the Carry grip down to 0.5 N. Run the robots again.

   > **If you get stuck:** Carry is the third grip slider, under The grips.
   >
   > **You'll know it worked when:** Far fewer wins: the prize falls on the way to the chute.

4. Talk about what a player at that machine would feel, and whether they could tell.

   > **You'll know it worked when:** Your child can say the rate belongs to the machine, and that one bad streak proves nothing.

Talk about it

Ask these while you work together. A child who has understood it can answer them without help:

- Your two runs gave different counts. Was one of them wrong?
- What would you expect from the next run?
- How many plays would you want before you said the rate was 40 percent?
- What did the carry grip do to the rate, and where did the prizes fall?
- Could a player at the machine tell the carry grip had been turned down? How?

> The first question is the real test: a child who says neither run is wrong, and both are samples of the same machine, has the idea.

For younger and older kids

Younger: For a younger child, flip a coin ten times, twice, and compare the counts of heads before running the robots.

Older: For a teenager, pool five runs and work out the rate from a hundred plays, then find the carry grip that halves it.

Keep going

- Pool the whole class's runs on the starter and find the rate from hundreds of plays.
- Find a carry grip at which the robots win about one play in ten, and say what a player would feel.
- Solve the Fair or not? puzzle under Puzzles.

Bring it into other subjects

- Math: pool everyone's runs on the starter. How does the rate from 400 plays compare with the single runs?
- Civics: read your state's rules on crane games and say what they require of an operator.
- Economics: at a dollar a play and a four dollar prize, what win rate makes the machine break even?
- English: write a short, fair sign for a machine that eases off on the carry.

For your records

Ready to copy into an hour log, a portfolio or a transcript.

LESSON	Claw Game Maker: Is This Machine Fair?
SUBJECTS	Math, Physical science
TIME	45 minutes
WHAT WE DID	Predicted and measured a win rate from repeated trials on a claw machine simulation, explained why samples differ, and measured what an operator setting does to the rate.
SKILLS PRACTICED	Probability from repeated trials; Comparing a prediction with data; Reading a setting

Activity sheet (optional)

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/clawmaker?lesson=is-this-machine-fair

Essential question: How can you tell what a player's chances are on a claw machine, and what does the operator control?

Warm-up: Twenty people play once each. How many win? Why? _____

1. **Vocabulary.** Trial, win rate, prediction, sample, carry grip: write each in your own words.

2. **The guide.** My guess: ____. First run: ____ of 20. Second run: ____ of 20.
3. **The runs table.** Three runs on the starter, three with the carry grip at 0.5 N: wins of 20, the rate of each, and the rate of each three together.

1. Your runs gave different counts. Which number is the best guess of the true rate, and why?

2. What did the carry grip do, and could a player tell?

Quick check

Name: _____

1. A win rate of 40 percent means (A) every fifth play wins (B) about 8 wins in 20 plays, give or take (C) you win after four losses

2. Two runs of twenty gave 7 and 11 wins. (A) One run was wrong (B) both are samples of the same machine (C) the machine changed

3. What does turning the carry grip down do, and what does the honest check say about it?

Answers

QUESTION	ANSWER	WHY
1	B	A rate is about the long run; any twenty plays land near it, not on it.
2	B	Small samples spread; more plays narrow the estimate.
3	Prizes fall on the way to the chute	The rate drops; the check names prize kinds that cannot be lifted at that grip. A full answer says the operator sets it.

If your state or umbrella school asks, this lesson covers Common Core Math 7.SP.C.6, Common Core Math 7.SP.C.7.

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The app this lesson uses is free and runs in the browser, with nothing to install and no account needed. It is at mytekdev.com.

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