

LESSON 18

Rocket Lander

60 minutes

Digital Creation Lab

WHAT THIS LESSON DOES

In this lesson, you'll explore the innovative SpaceX Falcon 9 rocket and create a game to pilot its landing. Follow step-by-step instructions to program gravity, control movements, and simulate a realistic landing experience using Scratch.

WHAT STUDENTS SHOULD BE ABLE TO DO

- Understand the concept of vertical rocket landing and its challenges.
- Develop a game using Scratch, simulating a rocket landing scenario.
- Implement gravity and movement controls in the game using code blocks.
- Create and use costumes to animate rocket thrust and explosion.
- Introduce and manage a fuel limit for added complexity in the game.

BEFORE THE LESSON

- Open and test the Scratch starter project link on a pupil device before class: <https://scratch.mit.edu/projects/786678852/editor>
- One device per pupil (or per pair) with Scratch access and green-flag sound available if you show any Falcon 9 clips
- Confirm pupils can edit sprites, costumes and variables in Scratch

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HOW THE LESSON RUNS

The Space X Falcon 9

Open the starter project

Program gravity

Program booster

Paint the rocket thrust

Show the rocket thrust

Move left

Move right

Program the ship sprite

Land on the ship

Explode

Crash into the sea

Fuel

Wrap up

TEACHING MOVES

- 1. The Space X Falcon 9. Frame vertical landing as hard and rare. Stress that early flights failed and were unmanned so pupils expect trial and error in their own game.
- 2. Open the starter project. Have everyone open the shared starter so the background, Falcon 9 rocket and ship are already present before any coding.
- 3. Program gravity. Build the green-flag stack together: go to top centre, point direction 0, forever change y by -5. Run it so the fall is obvious.
- 4. Program booster. Add the up-arrow forever loop with move 8 steps. Let them feel that 8 beats the -5 gravity so the rocket can slow or climb.
- 5. Paint the rocket thrust. Guide rename to normal, duplicate to thrust, convert to vector, and paint flame at the base. Switch to normal under green flag and in the fall loop.
- 6. Show the rocket thrust. Place switch costume to thrust just above move 8 in the up-arrow branch. Test so flame appears only while boosting.
- 7. Move left. Add left-arrow control: thrust costume, turn ccw 3 degrees, move 4 steps. Test a gentle left lean, not a spin.
- 8. Move right. Mirror left but turn cw 3 degrees. Point out the cw versus ccw difference so right and left stay distinct.
- 9. Program the ship sprite. On the ship: green flag, random x, y -160, forever move 0.25 and if on edge bounce. Check the slow horizontal patrol.
- 10. Land on the ship. Make angle variable, set it to direction each loop. On touching ship, only stop all if angle is between -5 and 5.
- 11. Explode. Duplicate normal into explode-1, explode-2 and more with growing fire. Make a custom explode block that steps through those costumes.
- 12. Crash into the sea. Above the gravity change, if touching sea colour then call explode. Use the backdrop sea colour in the touching-colour block.
- 13. Fuel. Set fuel to 60 on green flag. Gate up, left and right boosters with fuel greater than 0 and decrease fuel on each boost.
- 14. Wrap up. Celebrate the full loop: gravity, controls, costumes, landing rule, crash and fuel. Invite one small extra challenge only if time allows.

WHAT TO WATCH FOR

- Pupils treat move steps like change y, so left and right boosters feel random or the rocket drifts the wrong way. Remind them the sprite faces its direction: turn first, then move, while gravity only changes y.
- They stop the game on any ship touch, even when the rocket is tilted. Show the angle variable live and insist both touching ship and angle between -5 and 5 before stop all.
- Boosters still fire at fuel 0, or fuel never drops, so the limit never matters. Check each arrow script has fuel greater than 0 in the if and a change fuel by negative amount inside.

DIFFERENTIATION

- Emerging: Pair them and complete gravity plus up-arrow booster first so the rocket falls and can slow before adding costumes. Have them explain aloud: fall every frame, boost only while the key is held.
- Developing: Keep them on the lesson order: thrust costume, then left and right, then ship, before landing logic. Ask them to test landing only when the rocket looks nearly upright and watch the angle value.
- Proficient: Once fuel works, challenge them to tune start fuel or booster strength for a tighter landing window. Invite extra explode costumes or a clearer success stop, still using only this project's sprites and blocks.