Program: hw5.cpp

- This program is a game that simulates landing a rocket ship. The player is trying to land a spacecraft on the moon safely (as close to 0 ft/sec as possible) when beginning at 1000 ft above the lunar surface and a given velocity of 50 ft/S. At 1 second intervals, the player is permitted to burn fuel which changes the speed of descent of the spacecraft. The amount of available fuel is 150 lbs.
- Basic flow of program:
  1. Report spacecraft status.
  2. If there is fuel left, ask the user how much they would like to burn.
  3. If there is no fuel left, output a message notifying this.
  4. Update values of height and velocity.
  5. Add one (second) to elapsed time.
  6. Repeat steps 1-5 while lander is off the ground (height is greater than 0).
  7. Once lander has landed, recalculate exact impact time and velocity
  8. Output final analysis message based on impact velocity.
- In flight calculations:
  - f '= f – b
  - v' = v + G – b
  - h' = h – (v' + v) / 2
  - where:
    - f' = new fuel remaining
    - f = old fuel remaining
    - b = burn amount
    - v' = new velocity
    - v = old velocity
    - G = acceleration due to gravity (5)
    - h' = new height
    - h = old height
- **Note positive velocity is in the downward direction. Also note that this implies that with a burn amount of 5 units, the net effect on the velocity is 0.
- Impact calculations:
  - $\Delta = \frac{\sqrt{v^2+h(10-2b)}-v}{5-b}$
  - t' = (t – 1) + Δ
  - v' = v + (G – b)Δ
  - h' = 0
  - where:
    - t' = exact time at impact
    - t = pre-impact time
    - v' = exact velocity at impact
    - v = pre-impact velocity
    - G = acceleration due to gravity
    - b = burn amount

- Δ = fraction of second needed to reach lunar surface
- h' = height at impact
- h = pre-impact height

- The damage values are shown in the following table:

Velocity (ft/sec)	Analysis
0	*Congratulations! A perfect landing!!* *Your license will be renewed...later.*
0–2	*A little bumpy.*
2–5	*You blew it!!!!!!* *Your family will be notified...by post.*
5–10	*Your ship is a heap of junk !!!!!* *Your family will be notified...by post.*
10–30	*You blasted a huge crater !!!!!* *Your family will be notified...by post.*
30–50	*Your ship is a wreck !!!!!* *Your family will be notified...by post.*
>=50	*You totaled an entire mountain !!!!!* *Your family will be notified...by post.*