LESSON MAKER PRO

# Plan Check Systems

*Build systems, then test which plans work.*

**HIGH SCHOOL · MA.912.AR.9.7**

**MA.912.AR.9.7** "Given a real-world context, represent constraints as systems of linear and non-linear equations or inequalities. Interpret solutions to problems as viable or non-viable options."

NAME _____ DATE _____

## PLAN CHECK SYSTEMS

Turn each limit into an equation or inequality. Use nonnegative integers for counts. A plan is viable only when it meets every constraint, including any nonlinear rule.

### WORKED EXAMPLE

A club sells x basic passes at $5 and y VIP passes at $9. It sells 28 passes and earns $196. Find each number of passes.

1. x + y = 28 and 5x + 9y = 196.
2. Multiply x + y = 28 by 5: 5x + 5y = 140.
3. Subtract to get 4y = 56, so y = 14.
4. x = 28 - 14 = 14.

**Answer: 14 basic passes and 14 VIP passes**

## PRACTICE 5 problems

**1** x regular items and y premium items total at most 18. Regular items cost $3, premium items cost $6, and spending is at most $72. Write a system.

**ANSWER** _____

**2** Find all nonnegative whole-number solutions: x + y = 11 and xy = 24.

**ANSWER** _____

**3** Is (6, 3) viable for x + y <= 15 and $x^2$ + y <= 42?

**ANSWER** _____

**4** A shipment has x, y, and z item types. It holds at most 20 items and has weight at most 48 units. Type x weighs 2 units, y weighs 3 units, and z weighs 6 units. Write a system.

**ANSWER** _____

**5** Find the nonnegative whole-number solution: x + y = 10 and $y = 2x^2$.

**ANSWER** _____

## APPLY IT Show your work

**1** A gaming club orders x hoodies and y caps. It needs exactly 10 items. Hoodies cost $11, caps cost $3, and the order must cost exactly $54. A display score $x^2 + y$ must be at most 18. Write a system and find the viable order.

WORK SPACE

**ANSWER** _____

**2** For a club sale, x cookie boxes, y keychains, and z sticker packs are ordered. Cookie boxes cost $3, keychains cost $2, and sticker packs cost $1. The club can order at most 10 items, spend at most $20, and keep a design score $x^2 + y$ at most 12. Write a system, then identify the viable proposals: A = (3, 6, 1), B = (2, 6, 2), C = (3, 3, 3).

WORK SPACE

**ANSWER** _____

## CHALLENGE One step up

A team must choose nonnegative whole numbers x and y. It needs $x + y = 17$ and $3x + 2y = 40$. A processing limit requires $x^2 + y <= 47$. Find the plan and explain whether it is viable.

WORK SPACE AND ANSWER

**ANSWER KEY**

# Plan Check Systems

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## PART 1 · PRACTICE

| # | PROBLEM | ANSWER |
|---|---|---|
| 1 | x regular items and y premium items total at most 18. Regular items cost $3, premium items cost $6, and spending is at most $72. Write a system. | **x + y <= 18; 3x + 6y <= 72; x,y are nonnegative integers.** |
| 2 | Find all nonnegative whole-number solutions: x + y = 11 and xy = 24. | **(3, 8) and (8, 3)** |
| 3 | Is (6, 3) viable for x + y <= 15 and $x^2$ + y <= 42? | **Viable, because 6 + 3 <= 15 and $6^2$ + 3 = 39 <= 42.** |
| 4 | A shipment has x, y, and z item types. It holds at most 20 items and has weight at most 48 units. Type x weighs 2 units, y weighs 3 units, and z weighs 6 units. Write a system. | **x + y + z <= 20; 2x + 3y + 6z <= 48; x,y,z are nonnegative integers.** |
| 5 | Find the nonnegative whole-number solution: x + y = 10 and y = $2x^2$. | **(x, y) = (2, 8)** |

## PART 2 · APPLY IT

1. **x + y = 10; 11x + 3y = 54; $x^2$ + y <= 18; x,y are nonnegative integers. The viable order is (3, 7), or 3 hoodies and 7 caps.** Solve the first two equations to get x = 3 and y = 7. The score is $3^2$ + 7 = 16, so the order is viable.
2. **x + y + z <= 10; 3x + 2y + z <= 20; $x^2$ + y <= 12; x,y,z are nonnegative integers. B and C are viable.** Check total items, cost, and design score for each proposal. A fails the cost and score limits, while B and C meet all conditions.

## CHALLENGE

**x = 6 and y = 11. The plan is viable because $6^2$ + 11 = 47, which meets the limit.**

Accept equivalent systems with terms reordered. For count contexts, require nonnegative integer values and require every constraint to be checked before calling a plan viable.