# Constraints and Viable Solutions Worksheet

Algebra 1 · Common Core HSA-CED.A.3

> Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.

## Practice

Builds the skill step by step.

1. A bakery has 20 hours of oven time. Each cake c takes 2 hours and each pie p takes 1 hour. Which inequality shows the oven-time constraint?

   A. $2c + p \geq 20$

   B. $2c + p \leq 20$

   C. $c + 2p \leq 20$

   D. $c + 2p \geq 20$

2. Use the bakery's oven constraint. Is baking 6 cakes and 10 pies a viable plan?

   A. No, it needs 26 hours of oven time.

   B. Yes, it needs 16 hours of oven time.

   C. Yes, it needs exactly 20 hours of oven time.

   D. No, it needs 22 hours of oven time.

3. The bakery has 20 hours of oven time, with cakes taking 2 hours and pies 1 hour. If it bakes 7 cakes, what is the greatest number of pies it can bake?

4. A theater sells adult tickets for 10 dollars and child tickets for 6 dollars. It must take in at least 300 dollars. If it sells 18 adult tickets, what is the fewest number of child tickets it must sell?

5. A model for a ticket sale gives $c = 2.5$ child tickets. Why is this not a viable answer?

   A. You can't sell part of a ticket.

   B. Child tickets cost less than adult tickets.

   C. The number 2.5 is too small to be a solution.

   D. A solution must be an even number.

6. A boat can carry at most 1,200 pounds. Plan for 180 pounds per adult and 90 pounds per child. If 4 adults are on board, what is the greatest number of children who can ride?

7. Which inequality shows the constraint "the number of shirts $s$ cannot be negative"?

   A. $s \geq 0$

   B. $s > 0$

   C. $s \leq 0$

   D. $s < 0$

8. A club sold 30 tickets in all. Adult tickets cost 10 dollars and child tickets cost 6 dollars, and the club collected 236 dollars. How many adult tickets were sold?

9. Almonds cost 8 dollars a pound and peanuts cost 3 dollars a pound. Jo spends exactly 40 dollars and buys 2 pounds of almonds. How many pounds of peanuts does she buy?

10. A farmer has 100 feet of fence for a rectangular pen, so $2l + 2w \leq 100$. Which length and width (in feet) is NOT viable?

    A. $l = 30$, $w = 20$

    B. $l = 20$, $w = 25$

    C. $l = 30$, $w = 25$

    D. $l = 10$, $w = 35$

ALBERT

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## On Level

Grade-level practice.

1. A granola bar has 4 grams of protein and a yogurt cup has 12 grams. Lee wants at least 60 grams of protein. If Lee eats 3 yogurt cups, what is the fewest number of granola bars Lee needs?

2. Granola bars have 4 g of protein and cost 1 dollar each. Yogurt cups have 12 g of protein and cost 2 dollars each. Lee needs at least 60 g of protein and can spend at most 15 dollars. Which combination meets both constraints?

   A. 6 bars and 2 yogurts

   B. 9 bars and 4 yogurts

   C. 4 bars and 3 yogurts

   D. 3 bars and 4 yogurts

3. Chairs rent for 3 dollars each and tables for 15 dollars each. Each table needs 8 chairs, and the budget is 360 dollars. What is the greatest number of tables (with their chairs) that can be rented?

4. Rental Plan A costs 30 dollars plus 0.20 dollars per mile. Plan B costs 50 dollars plus 0.10 dollars per mile. At how many miles do the two plans cost the same?

5. A club earns 12 dollars profit on each shirt s and 8 dollars on each hat h. It wants at least 480 dollars profit and can sell at most 50 items. Which system models the constraints?

   A. $12s + 8h \leq 480$ and $s + h \geq 50$

   B. $8s + 12h \geq 480$ and $s + h \leq 50$

   C. $12s + 8h \geq 480$ and $s + h \leq 50$

   D. $12s + 8h \geq 480$ and $s + h \geq 50$

6. Use the club's constraints from the last problem. If the club sells 30 shirts, what is the fewest number of hats it must sell to reach its profit goal?

7. Use the club's constraints: $12s + 8h \geq 480$ and $s + h \leq 50$. Is selling 20 shirts and 35 hats a viable plan?

   A. Yes, it meets both constraints.

   B. No, it breaks the 50-item limit.

   C. No, it breaks both constraints.

   D. No, the profit is too low.

8. A store sold 40 bags of rice in all, some large (5 pounds) and some small (2 pounds), for a total of 128 pounds. How many large bags and how many small bags did it sell?

9. 50 people need rides to a game, and each car holds 4 people. What is the fewest number of cars needed?

10. A model says a field trip needs 3.2 buses. What is the best way to interpret this?

    A. Book 3.2 buses.

    B. Book 3 buses, since 3.2 rounds down to 3.

    C. Book 4 buses, since 3 buses can't carry everyone.

    D. Book 3 buses and leave some students behind.

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## Challenge

Multi-step and word problems that stretch it.

1. Food A has 200 calories and costs 2 dollars per serving. Food B has 300 calories and costs 1.50 dollars per serving. A hiker needs at least 1,500 calories and can spend at most 12 dollars. If she buys 3 servings of Food A, what is the fewest servings of Food B she needs?

2. Use the hiker's constraints from the last problem. With 3 servings of Food A, what is the greatest number of servings of Food B she can buy?

3. Use the hiker's constraints: at least 1,500 calories (Food A 200, Food B 300) and at most 12 dollars (Food A 2 dollars, Food B 1.50 dollars). Which choice meets both?

   A. 6 of A and 0 of B

   B. 1 of A and 4 of B

   C. 4 of A and 3 of B

   D. 0 of A and 5 of B

4. Notebooks cost 3 dollars and binders cost 5 dollars. Ella bought 12 items for 46 dollars. How many binders did she buy?

5. Jon models a sale with $n + b = 12$ and $3n + 5b = 45$, where n is notebooks and b is binders. He gets $n = 7.5$ and $b = 4.5$. What should he conclude?

   A. The store sold 7.5 notebooks and 4.5 binders.

   B. No whole-number mix of 12 items costs exactly 45 dollars, so the story's totals can't both be right.

   C. The store sold 7 notebooks and 5 binders.

   D. The store sold 8 notebooks and 4 binders.

6. A rectangular pen is built against a barn, so fence is used on only three sides: $2w + l = 60$ feet. The side along the barn can be at most 40 feet long, so $l \leq 40$. What is the smallest possible width w?

7. A factory makes products X and Y. Each X uses 2 hours of machine time and 1 hour of labor. Each Y uses 1 hour of machine time and 3 hours of labor. There are 40 machine hours and 45 labor hours. How many of each product use all of both?

8. A phone plan costs 15 dollars plus 10 dollars per GB of data, up to a 5 GB limit. Jay can spend at most 35 dollars. What is the most data he can use?

9. A choir needs at least twice as many sopranos s as altos a. Which inequality shows this?

   A. $a \geq 2s$

   B. $s \leq 2a$

   C. $2s \geq a$

   D. $s \geq 2a$

10. A choir needs at least twice as many sopranos as altos and can have at most 36 singers. It has 10 altos. What is the greatest number of sopranos it can have?