Inequalities in the Real World

A constraint is an inequality: the total, the sign, the limit. Shade the region of allowed combinations, read answers from it, keep only whole-number points when the things are whole, and see where two regions overlap.

Name _____ Date _____

Words we use

say the math word, then the plain English

WORD	PLAIN ENGLISH	WHAT YOU DO
Constraint	A limit the answer must obey, written as an inequality.	At most means ≤. At least means ≥. Write the cost or total, then the sign, then the limit.
Feasible	Allowed: inside the region (or on a solid boundary).	Find the point, or put the numbers in and read the sentence.
Boundary in a story	Using the limit exactly: spending all $20, using all the fencing.	The most you can do. Solid when the exact amount is allowed.
Discrete constraint	Only whole things (hot dogs, tickets, people), so only whole-number points count.	The answer is a set of dots inside the region.
Continuous constraint	Any amount is real (pounds, hours, gallons).	The whole shaded patch is real combinations.
Overlap	Where two shaded regions cover the same points: combinations that obey both constraints.	Unit 6.

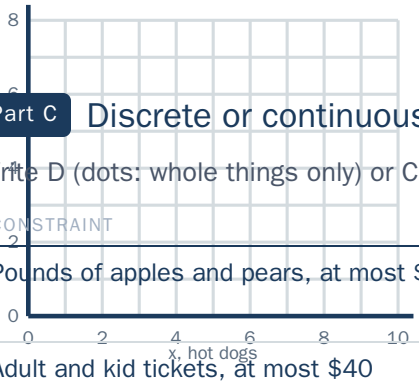
Part A Write the constraint

Name x and y, write the total, choose the sign from the words, write the limit.

STORY	X AND Y	CONSTRAINT
Pens $2, notebooks $3, at most $18		
Cookies $1, brownies $2, raise at least $30		
Van holds at most 7 people: adults and kids		
A pen of length x and width y with at most 24 feet of fence around it		

Part B Graph the budget and read it

$2x + 3y \leq 20$ (hot dogs $2, drinks $3). Solve for y, draw the boundary (solid), shade, and mark the whole-number points. Then answer.



1. Is 4 hot dogs and 3 drinks allowed? Show the sentence.

Part C Discrete or continuous?

Write D (dots: whole things only) or C (solid patch: any amount), and why.

2. Is 7 and 3?

CONSTRAINT	D OR C	WHY
Pounds of apples and pears, at most $12		
Adult and kid tickets, at most $40		
Hours of babysitting and hours of tutoring, at least $60		
Number of cars and buses in a parking lot of 30 spaces		

3. Is 10 and 0? Where is it on the picture?

4. Why are only the dots real answers?

Part D Two limits at once

Budget $2x + 3y \leq 20$ and carrying limit $x + y \leq 8$. Check each combination against both.

COMBINATION	BUDGET?	ITEMS?	ALLOWED?
(5, 2)			
(2, 6)			
(9, 0)			
(1, 6)			

Where on the picture are the allowed combinations?

Part E In your own words

1. What is a constraint, and what does its region show?

2. What does the boundary line mean in a budget story?

3. Why does a whole-things constraint turn the region into dots?

Part F Exit ticket

1. Pens $2, notebooks $3, at most $18: the constraint.

2. 3 pens and 4 notebooks: allowed? 6 and 3?

3. What happens with two limits at once?

Answer key

Part A. $2x + 3y \leq 18$. $x + 2y \geq 30$. $x + y \leq 7$. $2x + 2y \leq 24$ (or $x + y \leq 12$).

Part B. $y \leq -2/3\ x + 20/3$, solid, shaded toward (0, 0). 1. $8 + 9 = 17 \leq 20$, yes. 2. 23, no. 3. $20 \leq 20$, yes, on the boundary. 4. Whole hot dogs and drinks only.

Part C. C (pounds can be any amount). D (whole tickets). C (hours can be any amount). D (whole vehicles).

Part D. (5, 2): 16 yes, 7 yes, allowed. (2, 6): 22 no, allowed by items but not budget: not allowed. (9, 0): 18 yes, 9 no: not allowed. (1, 6): 20 yes, 7 yes, allowed. Allowed combinations are in the overlap of the two regions.

Part E. 1. A limit the answer must obey; every combination allowed. 2. Spending exactly the budget, the most you can buy. 3. Only whole-number points are real combinations.

Part F. 1. $2x + 3y \leq 18$. 2. (3, 4): 18, yes, on the boundary. (6, 3): 21, no. 3. Shade both; the answers are in the overlap.