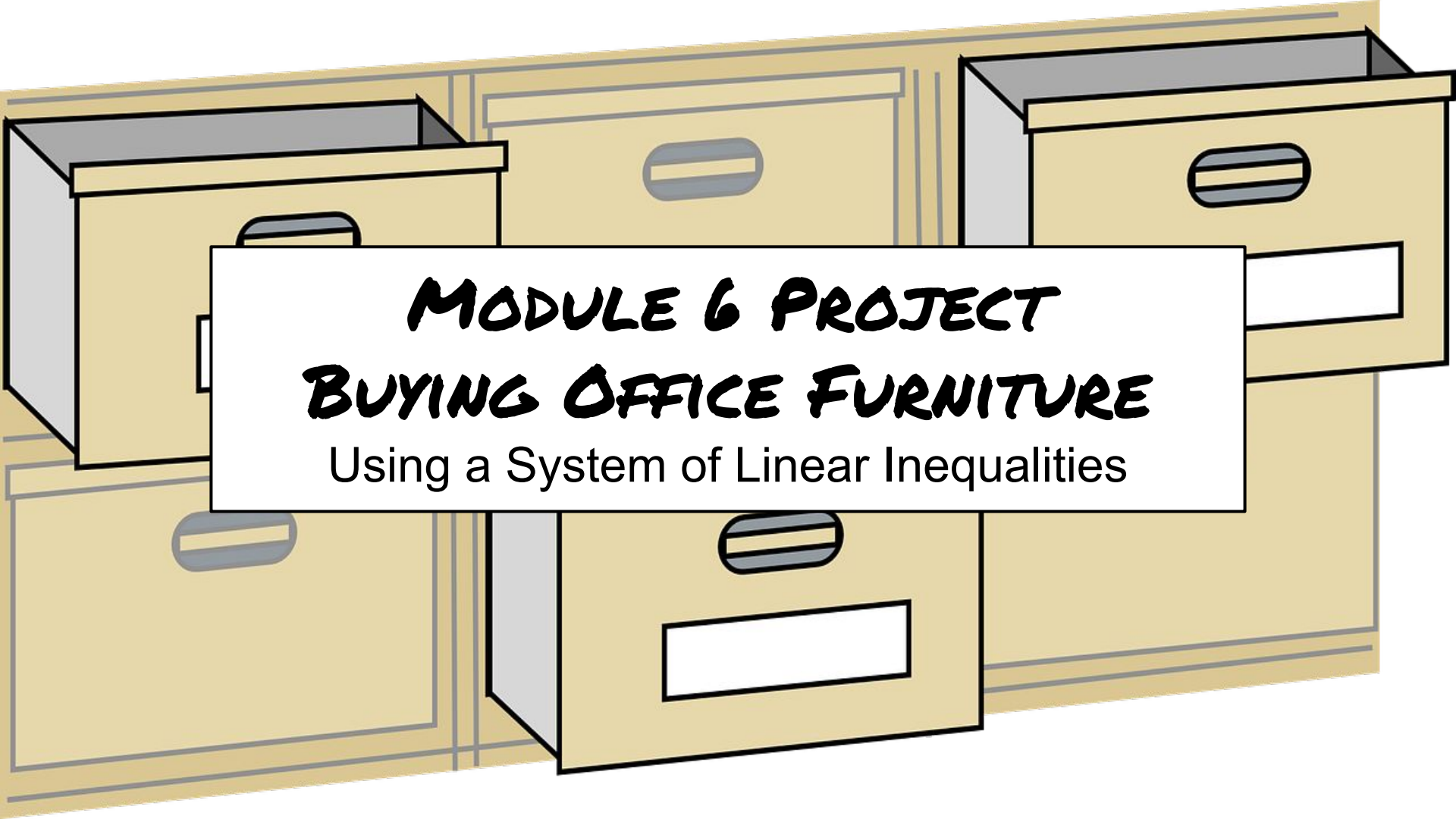


Module 6 Project
Buying Office Furniture

Using a System of Linear Inequalities

The Situation

You have been tasked to purchase your company some new filing cabinets with a budget of $140.

You have narrowed it down to two possible options and plan to buy a few of each.

- **Cabinet *X*** costs ***$10 per unit***, requires ***6 square feet*** of floor space, and holds ***8 cubic feet*** of files.

- **Cabinet *Y*** costs ***$20 per unit***, requires ***8 square feet*** of floor space, and holds ***12 cubic feet*** of files.

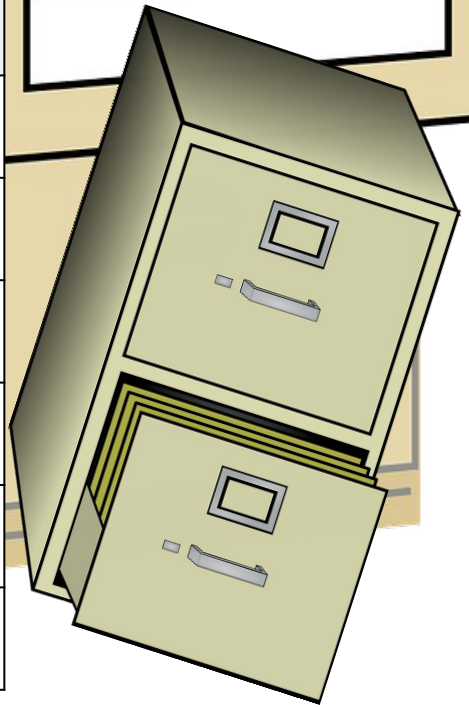
The office has room for no more than **72 square feet** of cabinets.

Cost of cabinets

Create an **inequality** in two variables representing your financial constraints (budget).

# of cabinets, *x*	Total Cost of Cabinets
x	10x
1	10
3	30
5	50
7	70
11	1100

# of cabinets, *y*	Total Cost of Cabinets
y	20y
1	20
3	60
5	100
7	140
11	2200

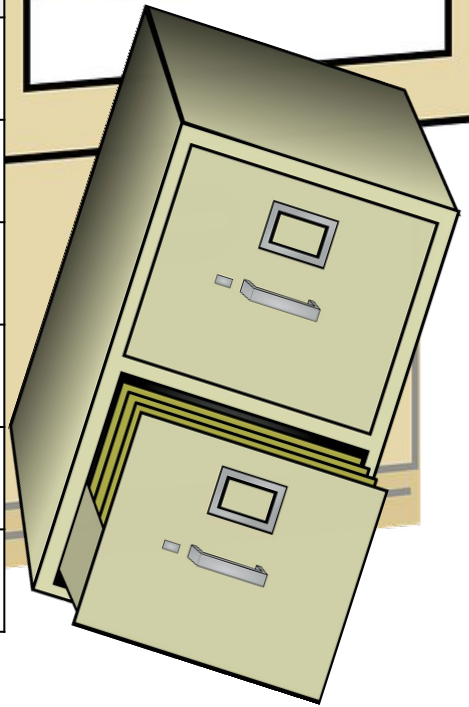


AREA OF CABINETS

Create an **inequality** in two variables representing your area constraints (space).

# of cabinets, *x*	Total area of cabinets
x	6x
1	6
3	18
5	30
7	42
11	66

# of cabinets, *y*	Total area of cabinets
y	8y
1	8
3	24
5	40
7	56
11	88



Cost Linear Inequality (from #3)

Show work here.

X: number of $10 cabinets
Y: number of $20 cabinets
Maximum budget: $140

$10x + 20y \leq 140$

$20y \leq 140 - 10x$

$y \leq 70 - 0.5x$

$y \leq -0.5x + 70$

Area Linear Inequality (from #6)

Show work here.

X: number of 6 ft^2 cabinets
Y: number of 8 ft^2 cabinets
Maximum floor space: 72 ft^2

$6x + 8y \leq 72$

Storage volume V

X: number of 8 ft^3 cabinets
Y: number of 12 ft^3 cabinets

$8x + 12y = v$

Cost Linear Inequality (from #3)

Show work here.

X: number of $10 cabinets
Y: number of $20 cabinets
Maximum budget: $140

$10x + 20y \leq 140$

$20y \leq 140 - 10x$

$y \leq 7 - 0.5x$

$y \leq -0.5x + 7$

Area Linear Inequality (from #6)

Show work here.

X: number of 6 ft^2 cabinets
Y: number of 8 ft^2 cabinets
Maximum floor space: 72 ft^2

$6x + 8y \leq 72$

$8y \leq 72 - 6x$

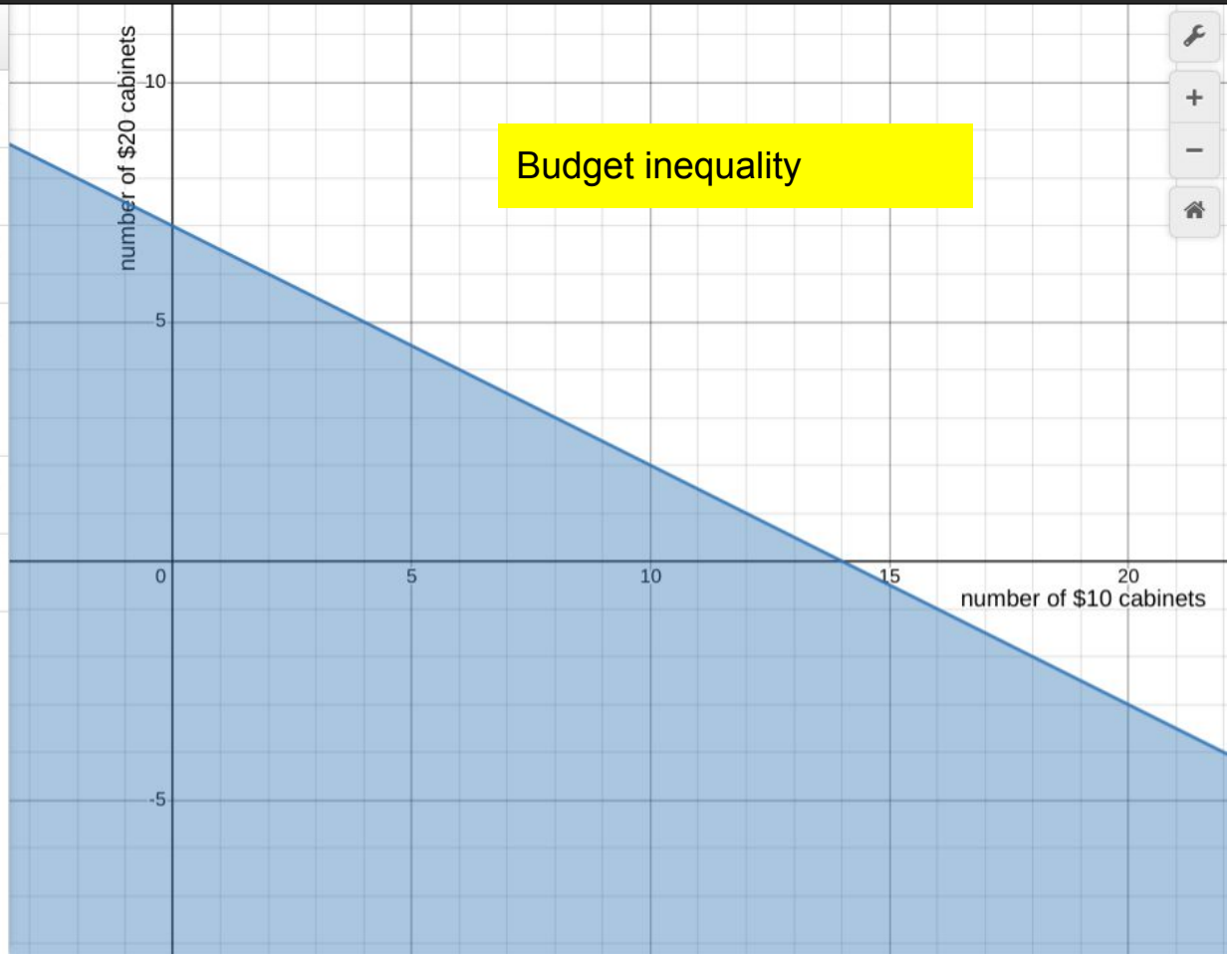
$y \leq 9 - (6/8)x$

$y \leq 9 - (3/4)x$

$y \leq -0.75x + 9$

Cost inequality algebra | Save | desmos | Austin

1. $10x + 20y \leq 140$
2. $20y \leq 140 - 10x$
3. $y \leq 7 - 0.5x$
4. COST INEQUALITY
   x: number of $10 cabinets
   y: number of $20 cabinets
   budget $140
5.
6.
7.



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Cost inequality algebra | Save | desmos | Austin

COST INEQUALITY
x: number of $10 cabinets
y: number of $20 cabinets
budget $140

$10x + 20y \leq 140$

rearrange to isolate y-variable on left

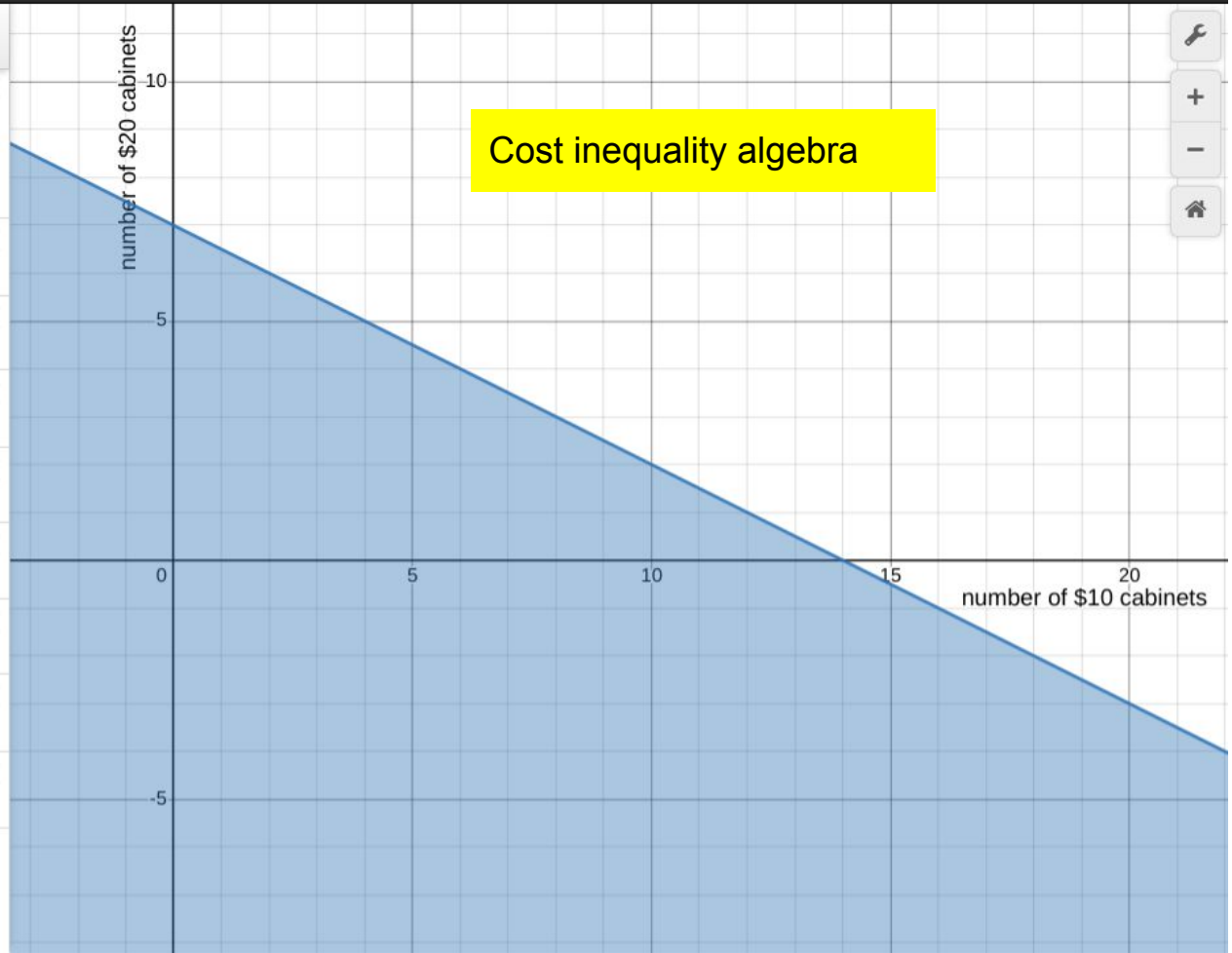
$20y \leq 140 - 10x$

divide both sides by 20

$y \leq 7 - 0.5x$

rearrange to slope-intercept form, y = mx + b

$y \leq -0.5x + 7$



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[Copy of] Office Cabinet St… Save desmos Austin

9 SPACE INEQUALITY
x: number of 6 sq ft cabinets
y: number of 8 sq ft cabinets
Maximum floor space is 72 square feet

10 $6x + 8y \leq 72$

11 rearrange with y variable on left

12 $8y \leq 72 - 6x$

13 divide both sides by 8

14 $y \leq 9 - 0.75x$

15 SLOPE-INTERCEPT FORM (rearrange)

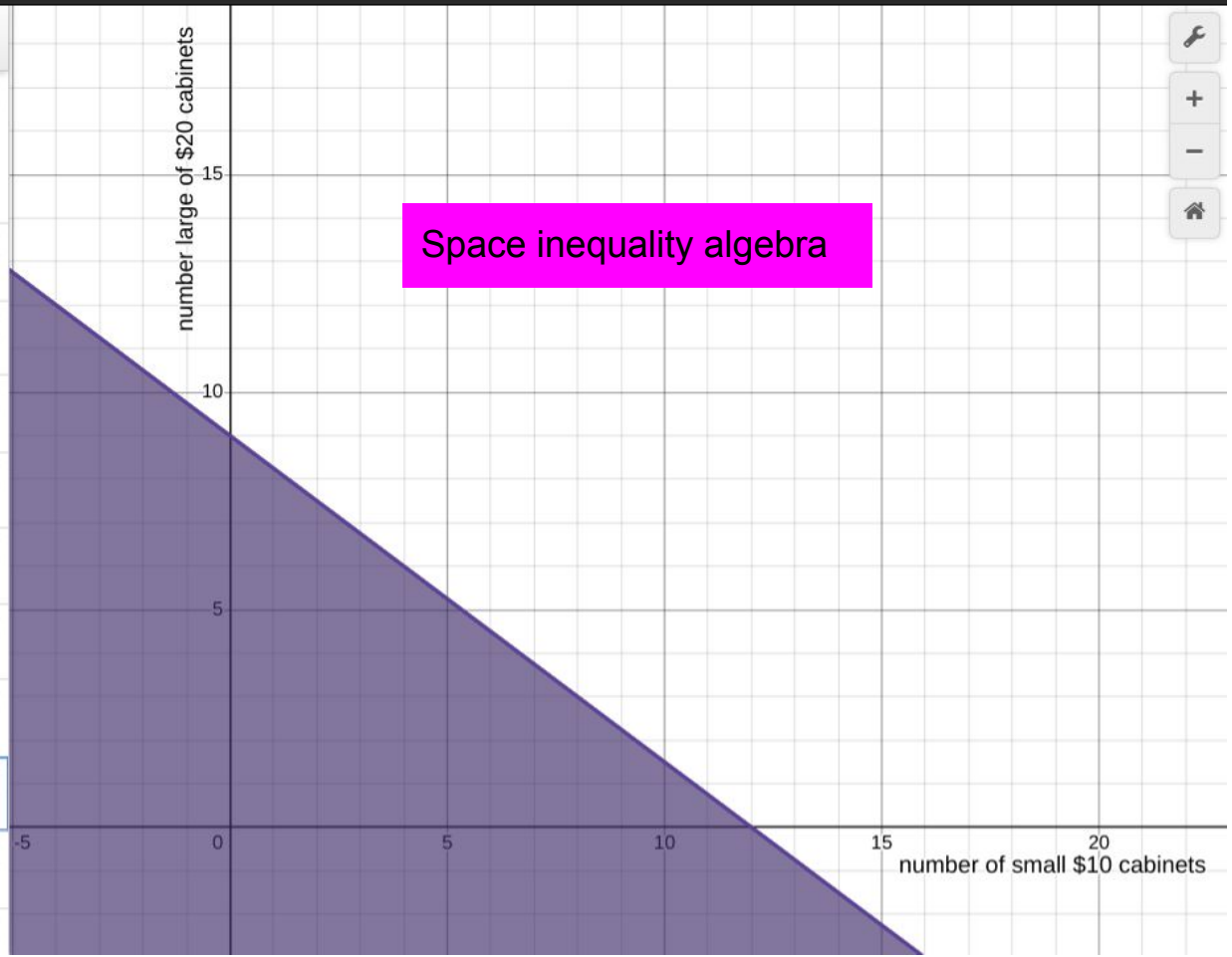
16 $y \leq -0.75x + 9$

17 TOTAL STORAGE VOLUME

18 $8x + 12y = v$

total cubic feet storage volume v (green line)

Space inequality algebra



Office Cabinet Storage Vol... Save desmos Austin

1 $10x + 20y \leq 140$

2 Maximum budget $140.
Small 8 cubic foot cabinet cost $10
12 cubic foot cabinet cost $20
Large

3 $6x + 8y \leq 72$

4 Maximum floor space is 72 square feet

5 $8x + 12y = v$

6 $v = 84$
0 200

7 Total storage volume v in cubic feet

8

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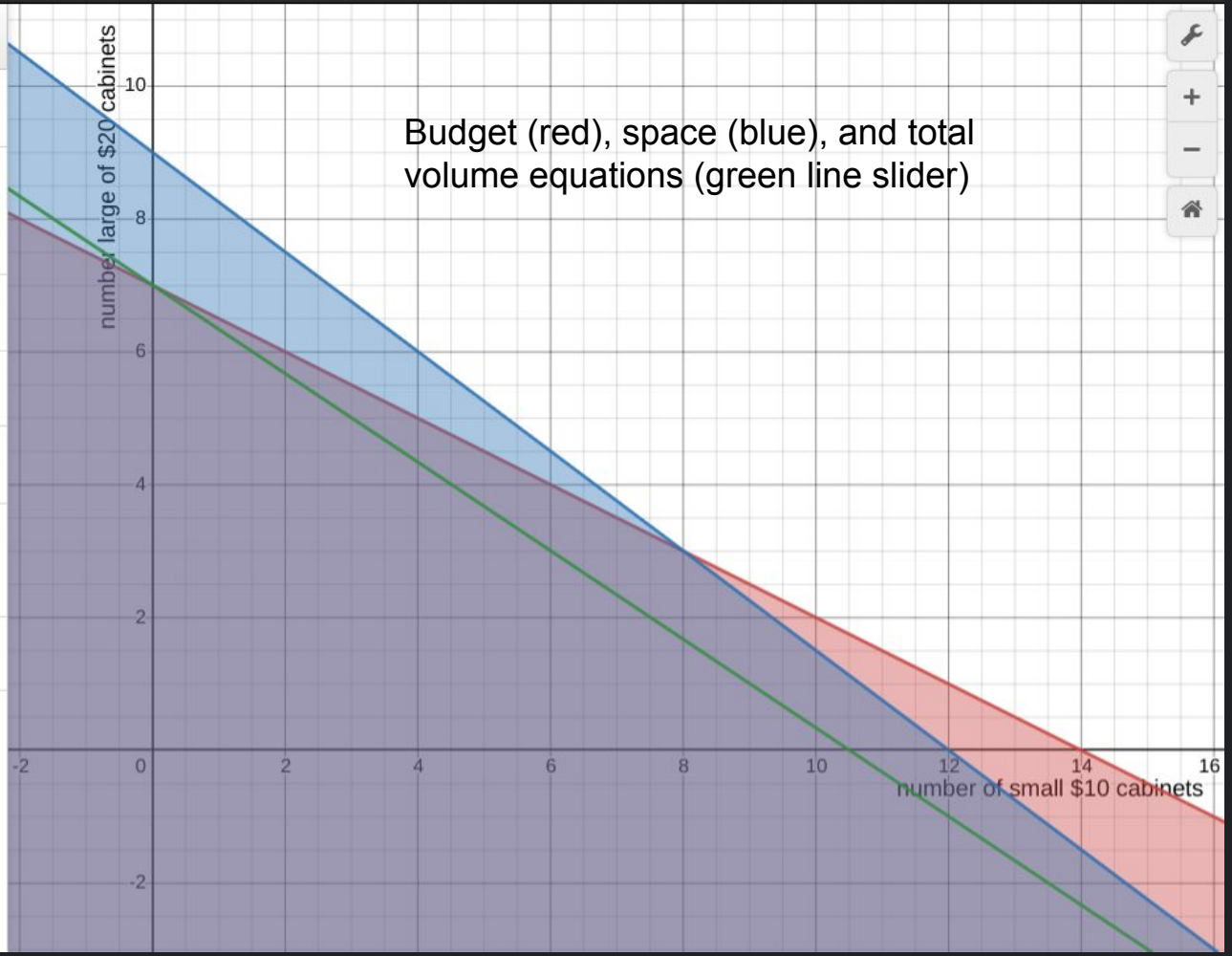


Combination of cabinets **fits** budget ***and*** space

5 X Cabinets + 2 Y Cabinets

$10x + 20y \leq 140$

$10(5) + 20(2) \leq 140?$

$50 + 40 \leq 140?$

$90 \leq 140$ **TRUE**

Meets $140 Budget

$6x + 8y \leq 72$. Let $x=5$, $y=2$

$6(5) + 8(2) \leq 72?$

$30 + 16 \leq 72?$

$46 \leq 72$ **TRUE**

Meets 72 ft^2 space limit

Combination of cabinets **doesn't fit** budget ***and*** space

10 X Cabinets + 2 Y Cabinets

$10x + 20y \leq 140$

$10(10) + 20(2) \leq 140?$

$100 + 40 \leq 140?$

$140 \leq 140$ **TRUE**

Meets $140 Budget

4 X Cabinets + 4 Y Cabinets

$6x + 8y \leq 72$. Let $x=10$, $y=2$

$6(10) + 8(2) \leq 72?$

$60 + 16 \leq 72?$

$76 \leq 72$ **FALSE**

FAILS 72 ft^2 space limit

Maximum budget $140.
Small 8 cubic foot cabinet cost $10 Large
12 cubic foot cabinet cost $20

$6x + 8y \leq 72$

Maximum floor space is 72 square feet

$8x + 12y = v$

$v = 84$

0 200

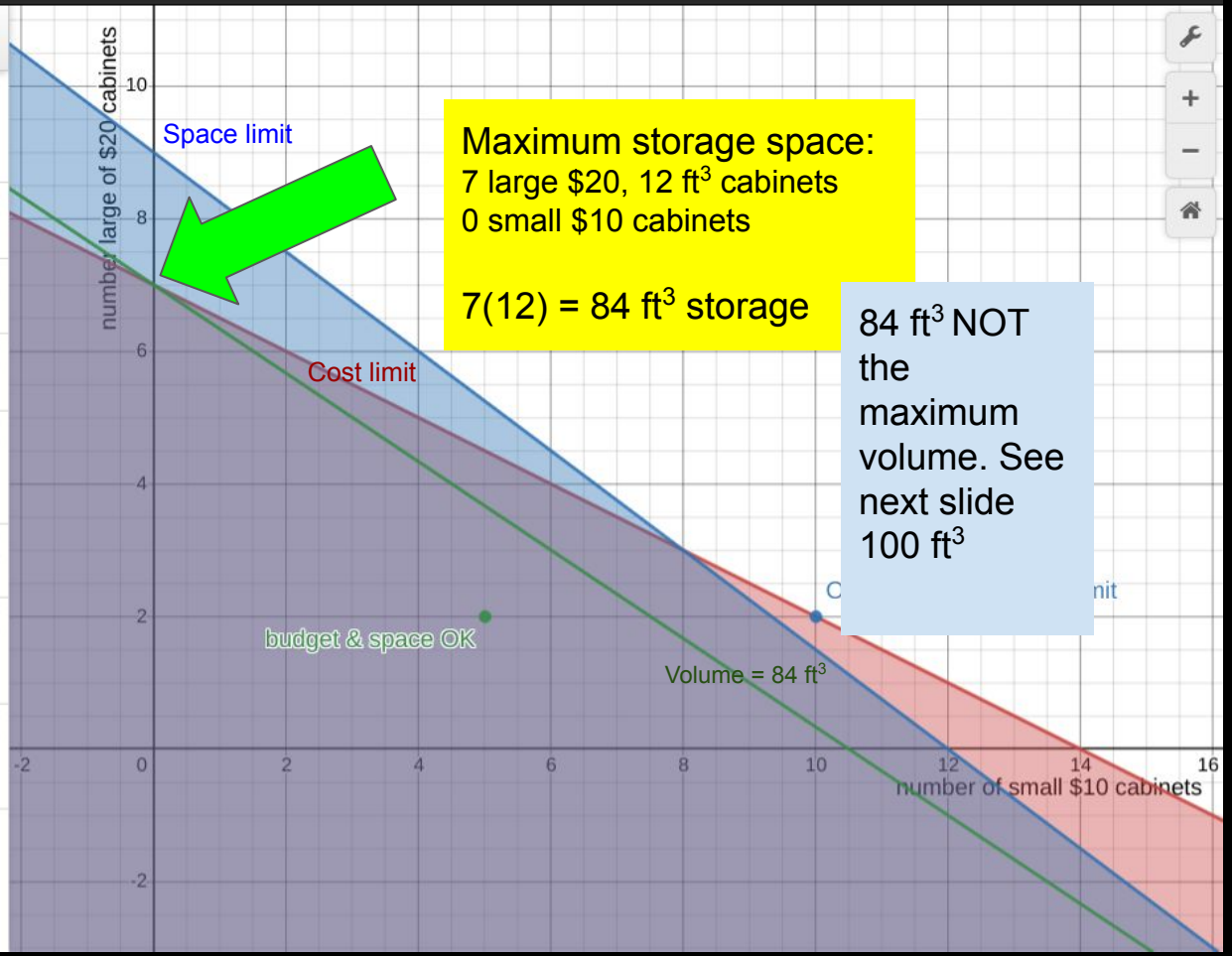
Total storage volume v in cubic feet

$(10,2)$

Label: On budget, fails space limit

$(5,2)$

Label: budget & space OK




Office Cabinet Storage Vol…
Save
desmos
Austin
$10x + 20y \le 140$
Maximum budget $140.
Small 8 cubic foot cabinet cost $10
12 cubic foot cabinet cost $20
Large
$6x + 8y \le 72$
Maximum floor space is 72 square feet
$8x + 12y = v$
$v = 100$
0
200
Total storage volume v in cubic feet
$(10,2)$
Label: On budget, fails space limit
$(5,2)$
Label: budget & space OK
number large of $20 cabinets
number of small $10 cabinets
3 12-ft^3 cabinets
8 8-ft^3 cabinets
BIGGEST total
VOLUME 100 ft^3

Office Cabinet Storage Vol… Save desmos Austin

6 $v = 81$

0 200

7 Total storage volume v in cubic feet

8 $(10,2)$

Label: On budget, fails space limit

9 $(5,2)$

Label: budget & space OK

10 total number of cabinets

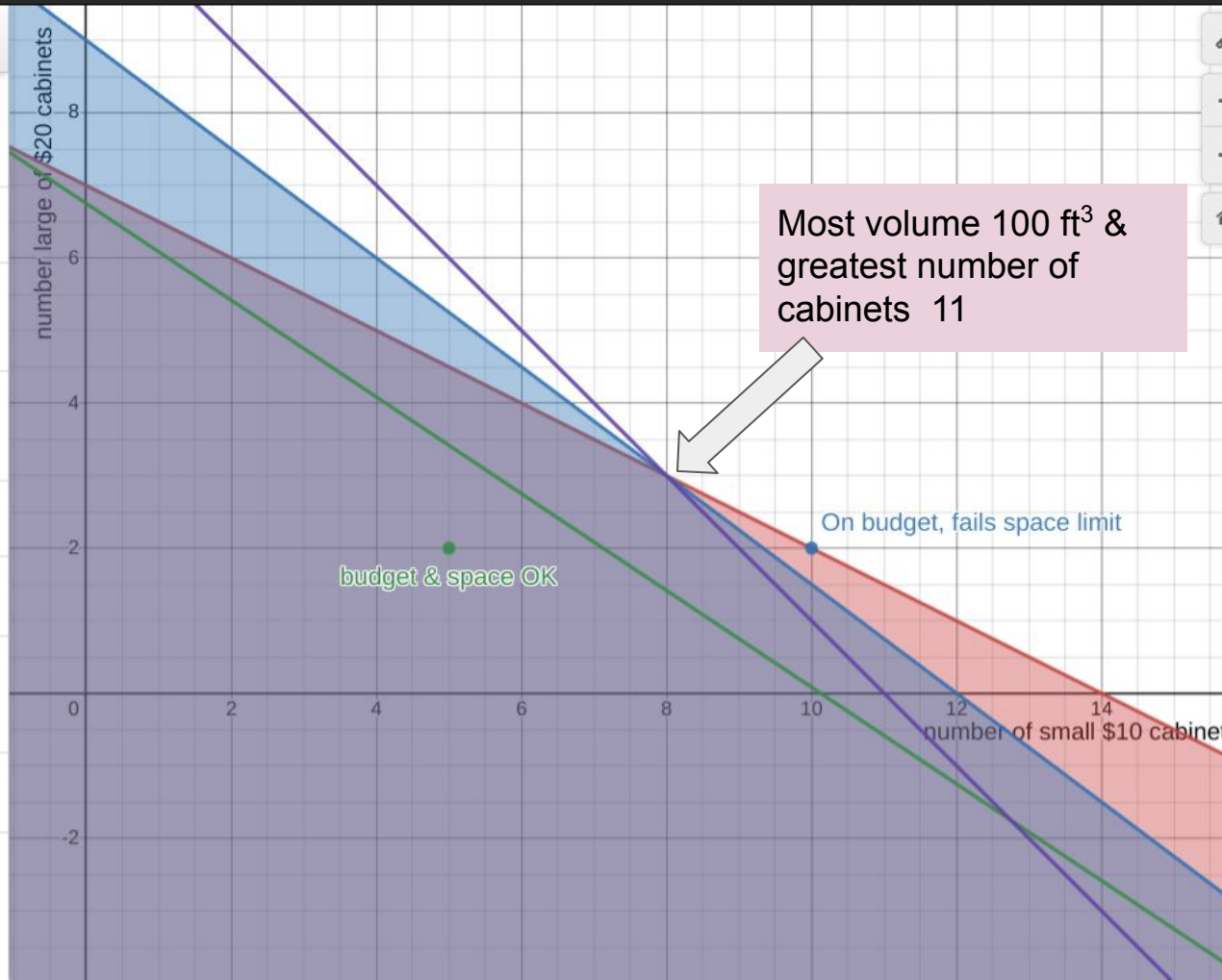
11 $x + y = t$

12 $t = 11$

0 100

13

14



Most volume 100 ft^3 & greatest number of cabinets 11

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Office Cabinet Storage Vol… Save desmos Austin

1 Maximum budget $140.
Small 8 cubic foot cabinet cost $10 Large
12 cubic foot cabinet cost $20

2 $10x + 20y \leq 140$

3 $6x + 8y \leq 72$

4 Maximum floor space is 72 square feet

5 $8x + 12y = v$

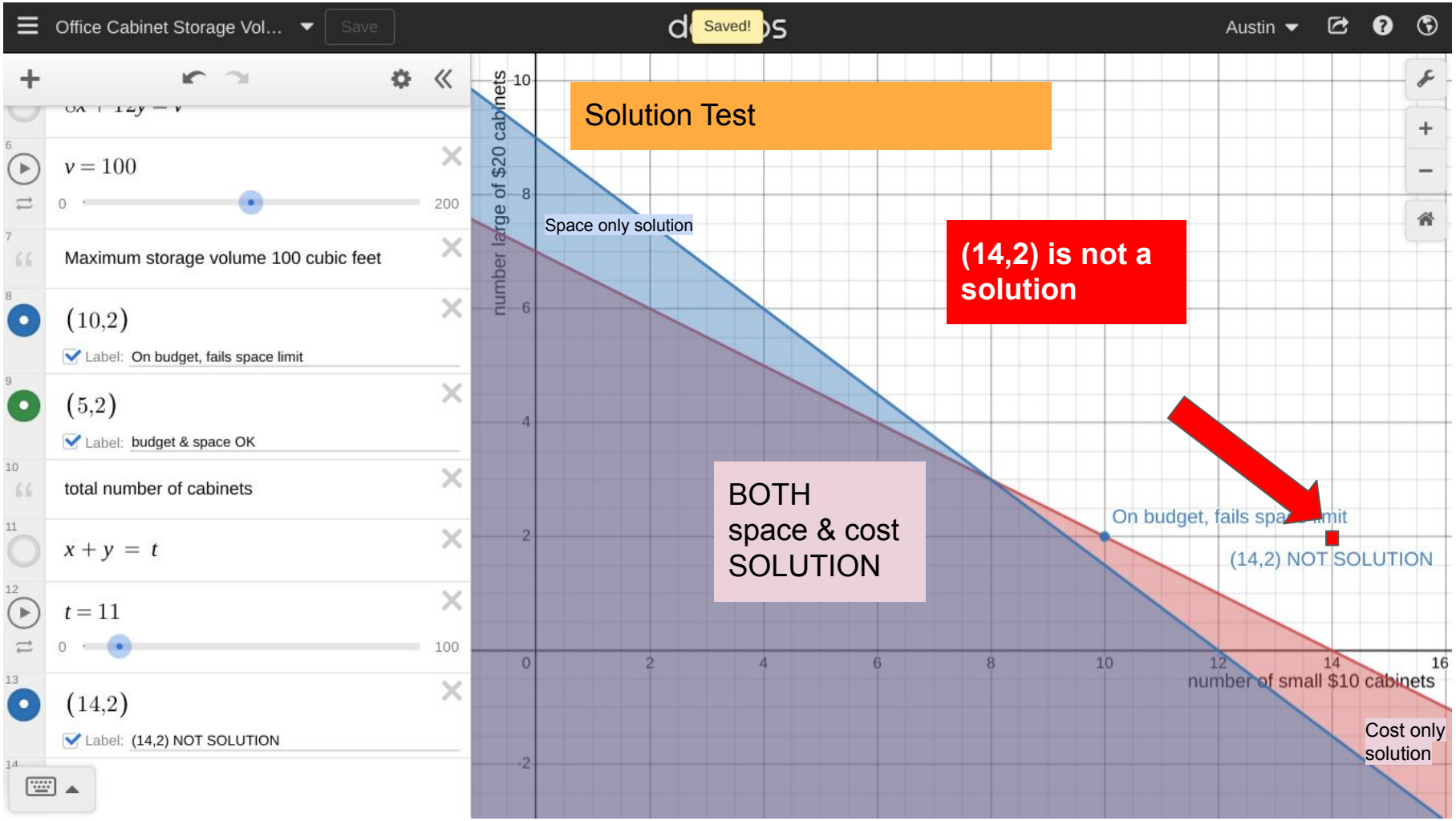
6 $v = 100$
0 200

7 Maximum storage volume 100 cubic feet

8 $(10,2)$
Label: On budget, fails space limit

9 $(5,2)$
Label: budget & space OK

total number of cabinets


Office Cabinet Storage Vol…
Save
Saved!
Austin
$v = 100$
0
200
Maximum storage volume 100 cubic feet
(10,2)
Label: On budget, fails space limit
(5,2)
Label: budget & space OK
total number of cabinets
$x + y = t$
$t = 11$
0
100
(14,2)
Label: (14,2) NOT SOLUTION
Solution Test
number large of $20 cabinets
Space only solution
(14,2) is not a solution
BOTH space & cost SOLUTION
On budget, fails space limit
(14,2) NOT SOLUTION
number of small $10 cabinets
Cost only solution

Honors Only Slide

Great news! Your boss approved more square footage and more money to get cabinets!

If you buy 16 X cabinets and 2 Y cabinets, 18 X cabinets and 1 Y cabinet, or 20 X cabinets and 0 Y cabinets, you will have maxed out your budget, exactly.

If you buy 12 X cabinets and 5 Y cabinets, 16 X cabinets and 2 Y cabinets, or 0 X cabinets and 14 Y cabinets, you will have maxed out your area, exactly.

Create a new page on your Jamboard (or use paper & pencil) to ***show all algebraic work*** to find the new area constraint and the new budget constraint.

Hint 1: "maxed out exactly" mean these combinations lie on the boundary line of your inequality's graph.

Hint 2: Notice that when our original inequalities are in standard form, we see the area and budget constraints as the constant.