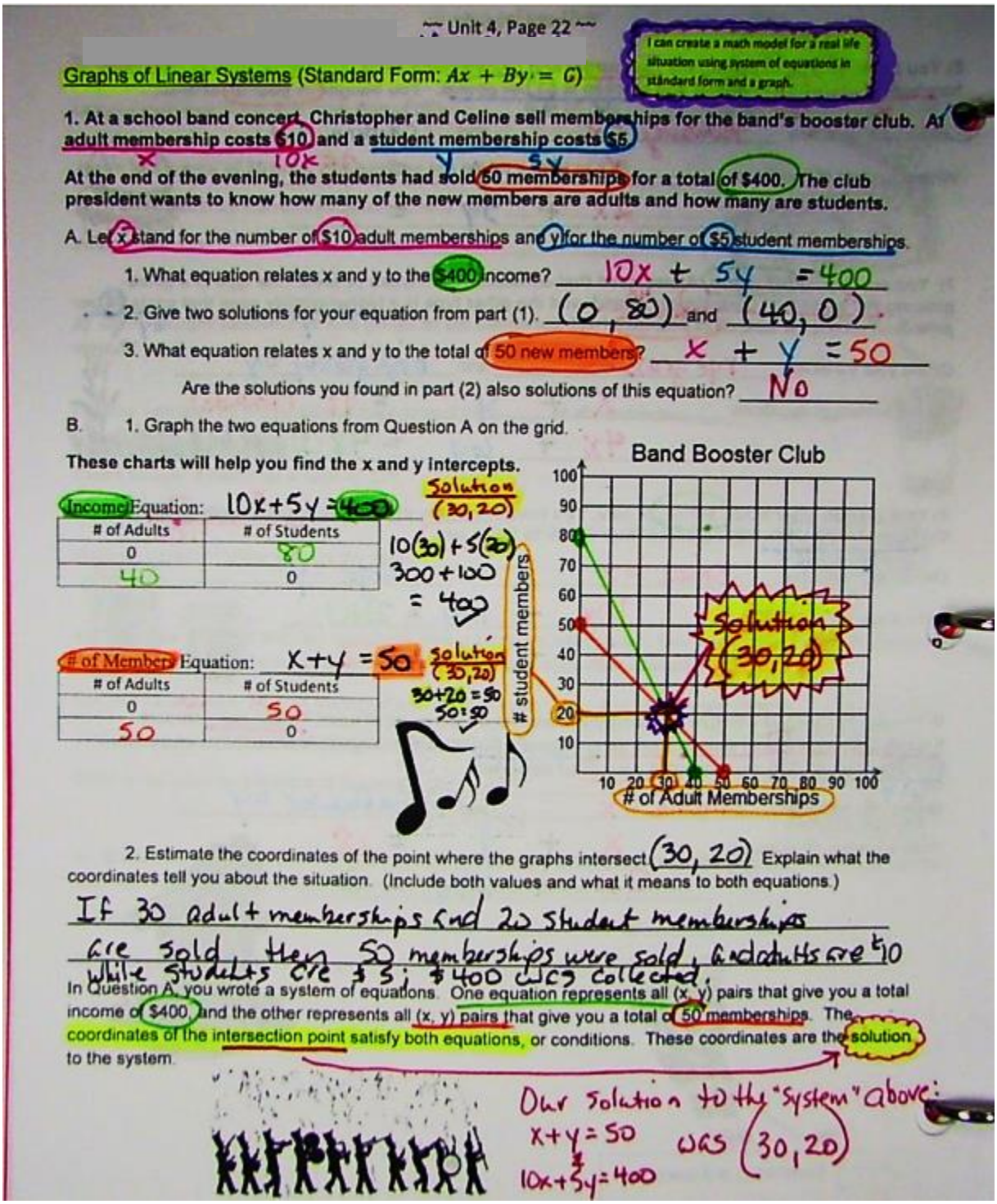
UNIT 4: Modeling Real-World Situations with a SYSTEM of Equations in [Ax+By=C] form.



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I can create a math model for a real life situation using system of equations in standard form and a graph.

Graphs of Linear Systems (Standard Form: $Ax + By = C$)

1. At a school band concert, Christopher and Celine sell memberships for the band's booster club. An adult membership costs $10 and a student membership costs $5. At the end of the evening, the students had sold 50 memberships for a total of $400. The club president wants to know how many of the new members are adults and how many are students.

A. Let x stand for the number of $10 adult memberships and y for the number of $5 student memberships.

1. What equation relates x and y to the $400 income? $10x + 5y = 400$
2. Give two solutions for your equation from part (1). (0, 80) and (40, 0)
3. What equation relates x and y to the total of 50 new members? $x + y = 50$

Are the solutions you found in part (2) also solutions of this equation? No

B. 1. Graph the two equations from Question A on the grid.

These charts will help you find the x and y intercepts.

Income Equation: $10x+5y=400$ Solution (30, 20)

# of Adults	# of Students
0	80
40	0

$10(30)+5(20)$
$300+100$
$= 400$ ✓

# of Members Equation: $x+y=50$ Solution (30, 20)

# of Adults	# of Students
0	50
50	0

$30+20=50$
$50=50$ ✓

Band Booster Club

student members

of Adult Memberships

2. Estimate the coordinates of the point where the graphs intersect (30, 20) Explain what the coordinates tell you about the situation. (Include both values and what it means to both equations.)

If 30 adult memberships and 20 student memberships are sold, then 50 memberships were sold, and adults are $10 while students are $5; $400 was collected.

In Question A, you wrote a system of equations. One equation represents all (x, y) pairs that give you a total income of $400, and the other represents all (x, y) pairs that give you a total of 50 memberships. The coordinates of the intersection point satisfy both equations, or conditions. These coordinates are the solution to the system.

Our solution to the "system" above:
$x+y=50$
$10x+5y=400$
was (30, 20)

In other words, if you ***substitute*** the x and y coordinates of the solution where **x = 30** and **y = 20** both equations are TRUE!

Equation 1: $x + y = 50$
$(30) + (20) = 50$ memberships and

Equation 2: $10x + 5y = 400$
$\$10(30) + \$5(20) = \$300 + \$100 = \$400$

Solution
(100, 150)
x = 100
y = 150

3(**100**)+2(**150**) = 600
300 + 300 = 600
600 = 600
TRUE!

(**100**) + (**150**) = 250
250 = 250
TRUE!

Solution
(20, 50)
x = 20 quarters
y = 50 dimes

.25(**20**)+.1(**50**) = 10
5 + 5 = 10
10 = 10
TRUE!

(**20**) + (**50**) = 70
70 = 70
TRUE!

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2. For a fundraiser, students sell calendars and posters. Each calendar will profit them $3 and each poster will profit them $2. Their goal is to earn $600. 250 items have been donated by a generous corporation.

a. Write an equation to represent earning the $600. $3x + 2y = 600$

b. Write an equation to represent the donation of 250 items. $x + y = 250$

p = #of posters (y)
c = # of calendars (x)

c. Graph both equations on the same coordinate grid. (c, p) Use an interval of 25 on the x-axis and 50 on the y-axis.

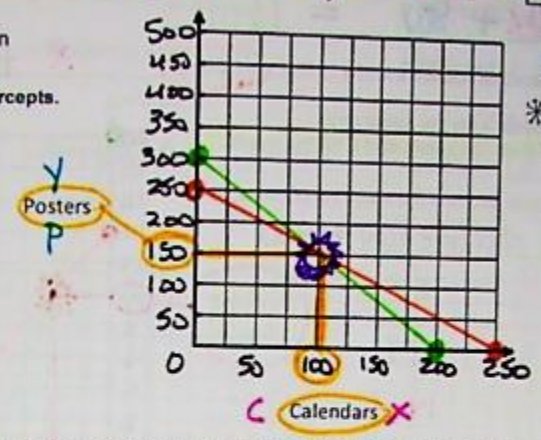
These charts will help you find the x and y intercepts.

Value Equation: $3x + 2y = 600$

x	y
0	300
200	0

# of Items Equation: $x + y = 250$

x	y
0	250
250	0



d. State the coordinates of intersection. Explain what these coordinates tell you about the situation. (Include both values and what it means to both conditions.) (100, 150) (c, p)

If 100 calendars are sold for $3 each and 150 posters at $2 each, 250 items were sold for $600.

3. Neema has a collection of quarters and dimes. She has a goal of $10. Suppose she collects 70 coins.

a. Write an equation that relates q and d to her goal of $10. $.25x + .1y = 10$

b. Write an equation that relates q and d to the 70 coins that she collected. $x + y = 70$

q = #of quarters (x)
d = # of dimes (y)

c. Graph both equations on the same grid. (q, d) Use an interval of 10 on both axes

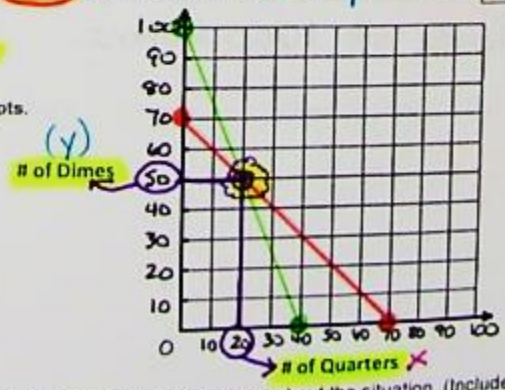
These charts will help you find the x and y intercepts.

Value Equation: $.25x + .1y = 10$

x (q)	y (d)
0	100
40	0

# of Items Equation: $x + y = 70$

x (q)	y (d)
0	70
70	0



d. State the coordinates of intersection. Explain what these coordinates tell you about the situation. (Include both values and what it means to both conditions.)

(20, 50) 20 quarters worth .25 each plus 50 dimes worth .10 each equals 70 coins whose value is $10

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4. Student's in Eric's gym class must cover a distance of 1,600 meters by running or walking. Most students run part of the way and walk part of the way. Eric can run at an average speed of 200 meters per minute and walk an average of 80 meters per minute. He will spend a total of 14 minutes exercising. (time spent running = x, time spent walking = y)

200x 80y

a. Write an equation that relates the time Eric spends running and walking to his goal of covering 1,600 meters.

$200x + 80y = 1600$

b. Write an equation that relates x and y to Eric's total time. $x + y = 14$

c. Graph both equations on the same grid.
Use an interval of 2 on the x-axis and 2 on the y axis.

These charts will help you find the x and y intercepts.

Distance Equation: $200x + 80y = 1600$

x	y
0	20
8	0

Time Equation: $x + y = 14$

x	y
0	14
14	0

Walking Minutes

Solution (4, 10) in $200x + 80y = 1600$

$4(200) + 80(10) = 1600$

$800 + 800 = 1600$

$1600 = 1600$ ✓

$x + y = 14$

$(4) + (10) = 14$

$14 = 14$ ✓

d. State the coordinates of intersection. Explain what these coordinates tell you about the situation. (Include both values and what it means to both conditions.)

(4, 10) 4 minutes running at 200 m/min plus 10 minutes walking at 80 m/min results in 14 minutes and a distance of 1600 meters.