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CHAPTER 5: Linear Systems

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2	5.2 – Solving Linear Systems by Substitution	(Day 1) Page 209 – 211 #1aceg, 2ac, 3ac (Day 2) Page 209 – 211 #4 – 6, 11
3	5.3 – Solving Linear Systems by Elimination	Page 216 – 218 (Day 1) #1ace, 2ace, 3ac, 4ac (Day 2) #5, 6, 9
4	5.4 – Solving Problems Using Linear Systems	Page 223 – 225 #1 – 4, 6, 7
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7	**PERFORMANCE TASK**	
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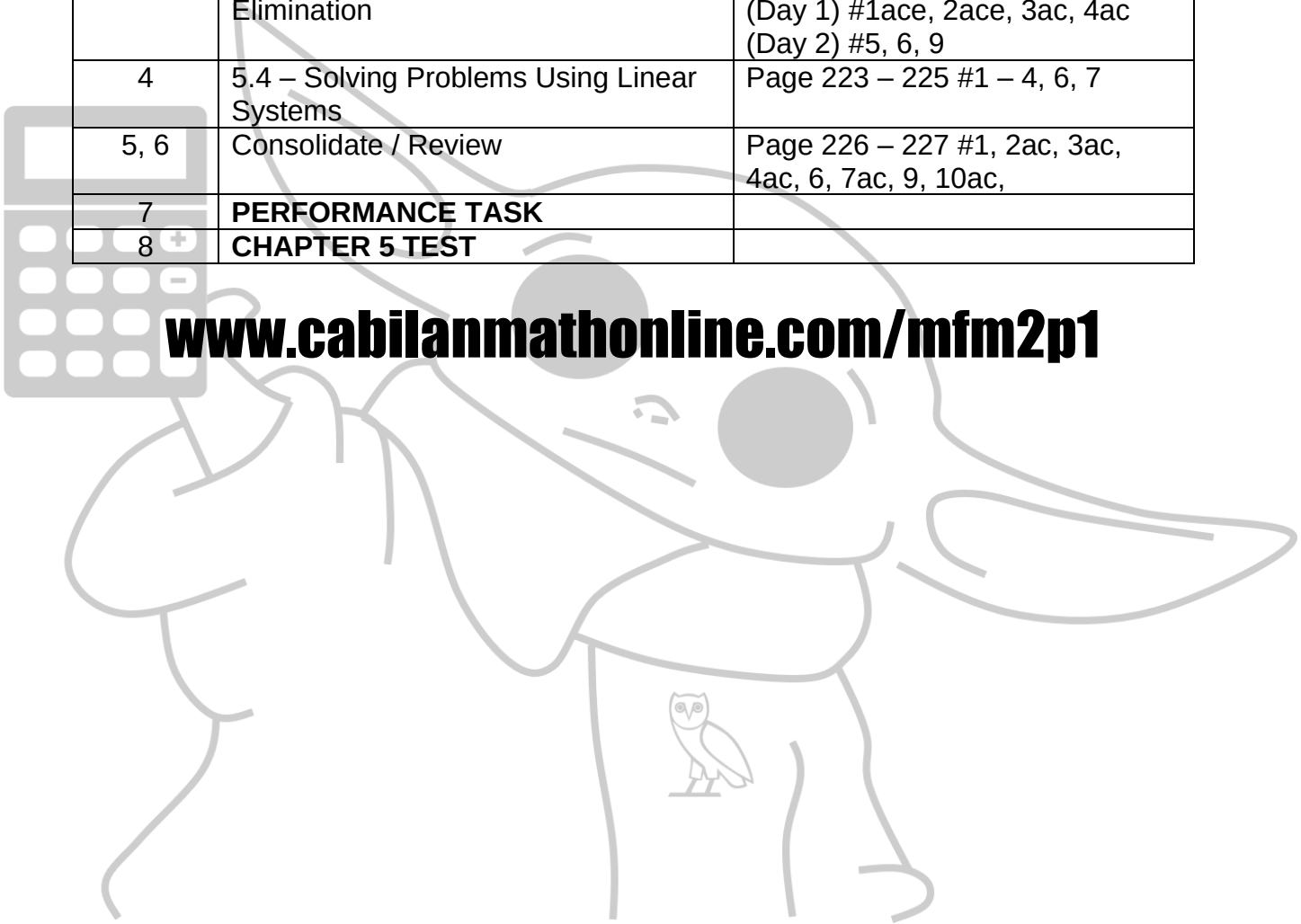

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5.1 – SOLVING LINEAR SYSTEMS BY GRAPHING

KEY CONCEPTS

A **linear system** is a set of two or more linear equations that are considered at the same
time
The **solution** to a linear system is the **point of intersection** of the lines.

The *point of intersection* the point at which two lines cross
The coordinates of the point of intersection satisfies both equations

A linear system can be solved by **graphing the lines**, then **reading the point of intersection** from the graph.

To check the solution to a linear system, **substitute** the coordinates of the point of intersection into the original equations.

EXAMPLE 1 *Solve a Linear System by Graphing*

(i) For the following linear system: (1) $2x + y = 2$

(2) $y = \frac{-5}{4}x - 1$

(a) Re-arrange the equations into **slope y-intercept form (y = mx + b)**

EQUATION (1) **EQUATION (2)**

m = ____ m = _____

b = ____ b = _____

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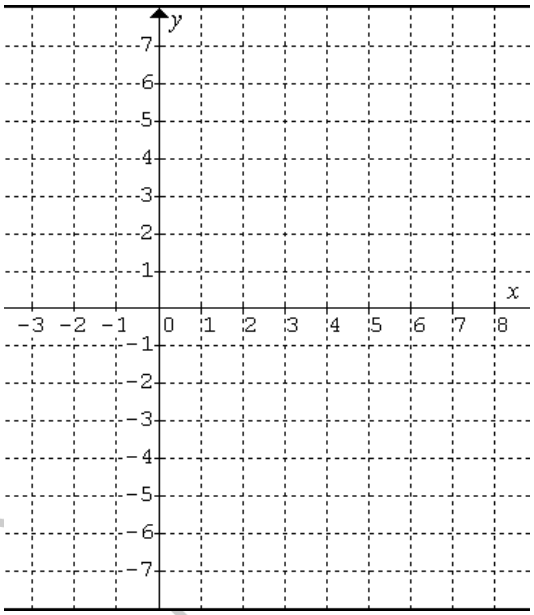
(b) Graph both lines on the same grid. Draw and label the point of intersection.



POINT OF INTERSECTION: _____

(c) Check your solution into **both** original equations

EQUATION (1) **EQUATION (2)**

(ii) For the following linear system: (1) $x - 2y = 4$

(2) $y = \frac{3}{4}x - 4$

(a) Re-arrange the equations into **slope y-intercept form (y = mx + b)**

EQUATION (1) **EQUATION (2)**

m = ____ m = _____

b = ____ b = _____

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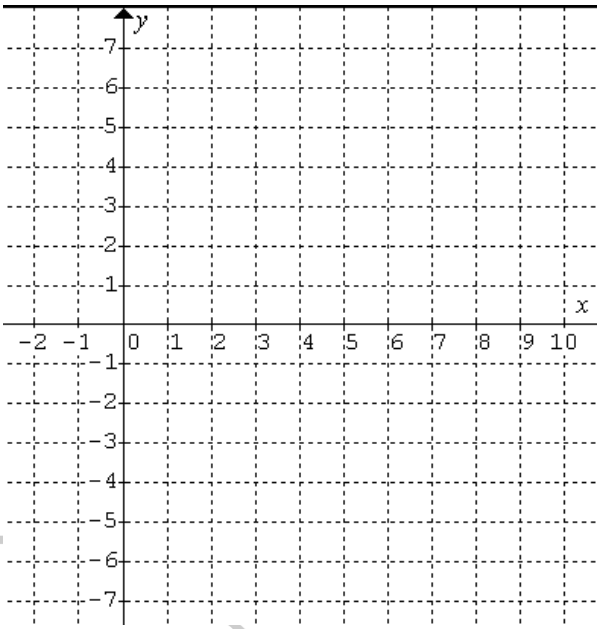
(b) Graph both lines on the same grid.
Draw and label the point of intersection.



POINT OF INTERSECTION: _____

(c) Check your solution into **both** original equations

EQUATION (1) **EQUATION (2)**

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EXAMPLE 2

Guido's Pizza charges **$9** for a medium pizza plus **$2** for each topping.

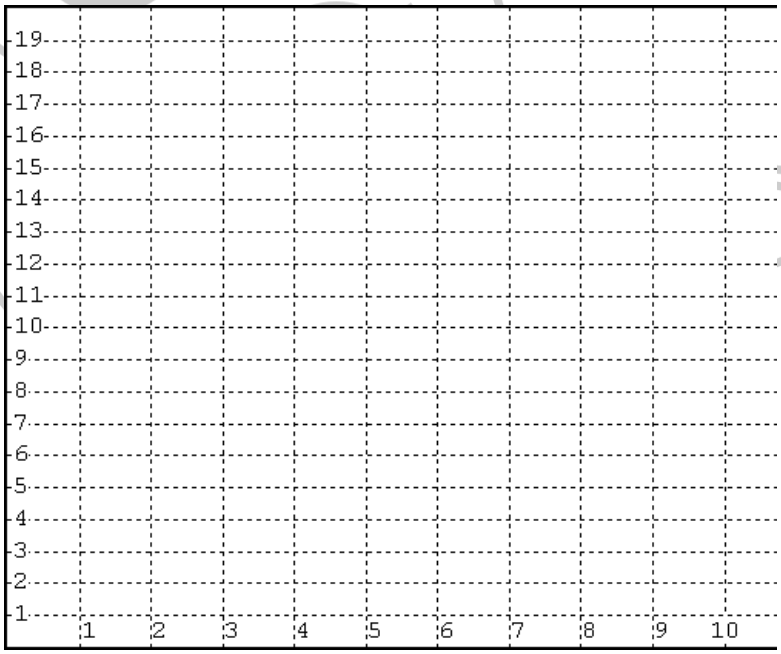
Giovanni's Pizza charges **$6** for a medium pizza plus **$3** for each topping.

(a) If *x* represents the **number of toppings** and *y* represents the **total cost**

(i) Write an equation to represent the **total cost** at *Guido's Pizza*

(ii) Write an equation to represent the **total cost** at *Giovanni's Pizza*

(b) Graph the equations from (i) and (ii) on the same grid



(c) What is the point of intersection?

What does this represent in this situation?

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5.2 – SOLVING LINEAR SYSTEMS BY SUBSTITUTION

KEY CONCEPTS

A system of linear equations can be solved *algebraically* using the **substitution** method.

To solve a linear system by substitution, **one equation is solved for one variable**, then that value is *substituted* into the other equation.

The **break-even point** is the point at which the cost to produce an item is equal to its selling price.

STEPS
1. **Isolate** one of the variables in one of the equations
2. **Substitute** the expression for the variable found above into the *opposite* equation
3. **Solve** for the remaining variable
4. **Substitute** this back into (1) or (2)
5. **Solve** for the *other* variable

Solve the following system of linear equations by **substitution**.

(a) (1) $2x + y = 17$

(2) $x = 12 - y$

(b) (1) $-3x + y = 10$

(2) $x + 2y = -1$

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EXAMPLE 2 *Ages*

Hakeem is **3 times** older than Jamal.

The sum of their ages is **40**.

How old are Hakeem and Jamal?

EXAMPLE 3 *Break-Even Points*

Henry is selling jackets to raise money for his football team. The supplier charges a one-time set-up fee of **$270** plus **$9** for each jacket. Henry is planning to sell the jackets for **$15**.

(a) Using *C* to represent total cost and *j* to represent the number of jackets:

(i) Write out the equation which represents the **total cost to the supplier**

(ii) Write out the equation which represents the **total costs for selling the jackets**

(b) Use the equations and the method of **substitution** to determine **how many jackets** must be sold for Henry to break even.

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(Day 1) Page 209 – 211 #1aceg, 2ac, 3ac (Day 2) Page 209 – 211 #4 – 6, 11

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5.3 – SOLVE LINEAR SYSTEMS BY ELIMINATION

KEY CONCEPTS

A system of linear equations can be solved *algebraically* using the **elimination** method.

To solve a linear system by *elimination*, the equations are added or subtracted to eliminate one variable.

When each term in an equation is **multiplied by a constant**, the resulting equation produces the same line when graphed.

STEPS:
1. Choose a variable to eliminate
→ Choose a variable where both co-efficients are the same
2. If necessary, **multiply** the equations by a factor to make the co-efficients the same
3. **Add** or **subtract** the equations to eliminate the variable
4. Solve for the remaining variable
5. Substitute this variable into **(1)** or **(2)** to solve for the other
6. State the solution

EXAMPLE 1 *Solving Linear Systems by Adding or Subtracting*

(a) Solve the following system of linear equations. Check your solution.

(1) $x + y = 1$

(2) $x + 3y = -1$

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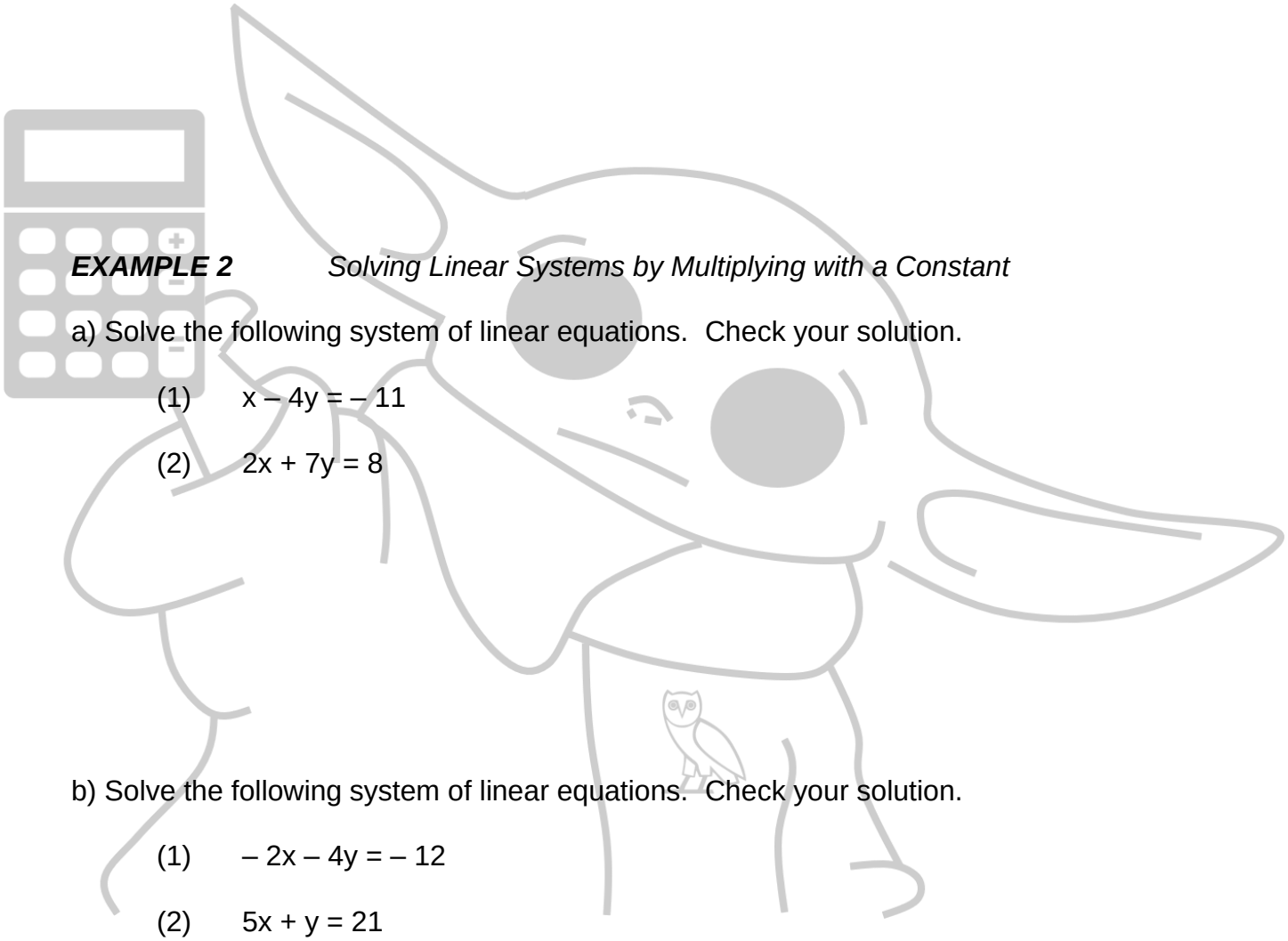
(b) Solve the following system of linear equations.

(1) $3x + y = 17$

(2) $x + y = 9$



EXAMPLE 2 *Solving Linear Systems by Multiplying with a Constant*

a) Solve the following system of linear equations. Check your solution.

(1) $x - 4y = -11$

(2) $2x + 7y = 8$

b) Solve the following system of linear equations. Check your solution.

(1) $-2x - 4y = -12$

(2) $5x + y = 21$

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EXAMPLE 3

Cody was at the music store and purchased a total of **13** CDs and DVD.

Cody spent **$5** for each CD and **$10** for each DVD for a total of **$110**.

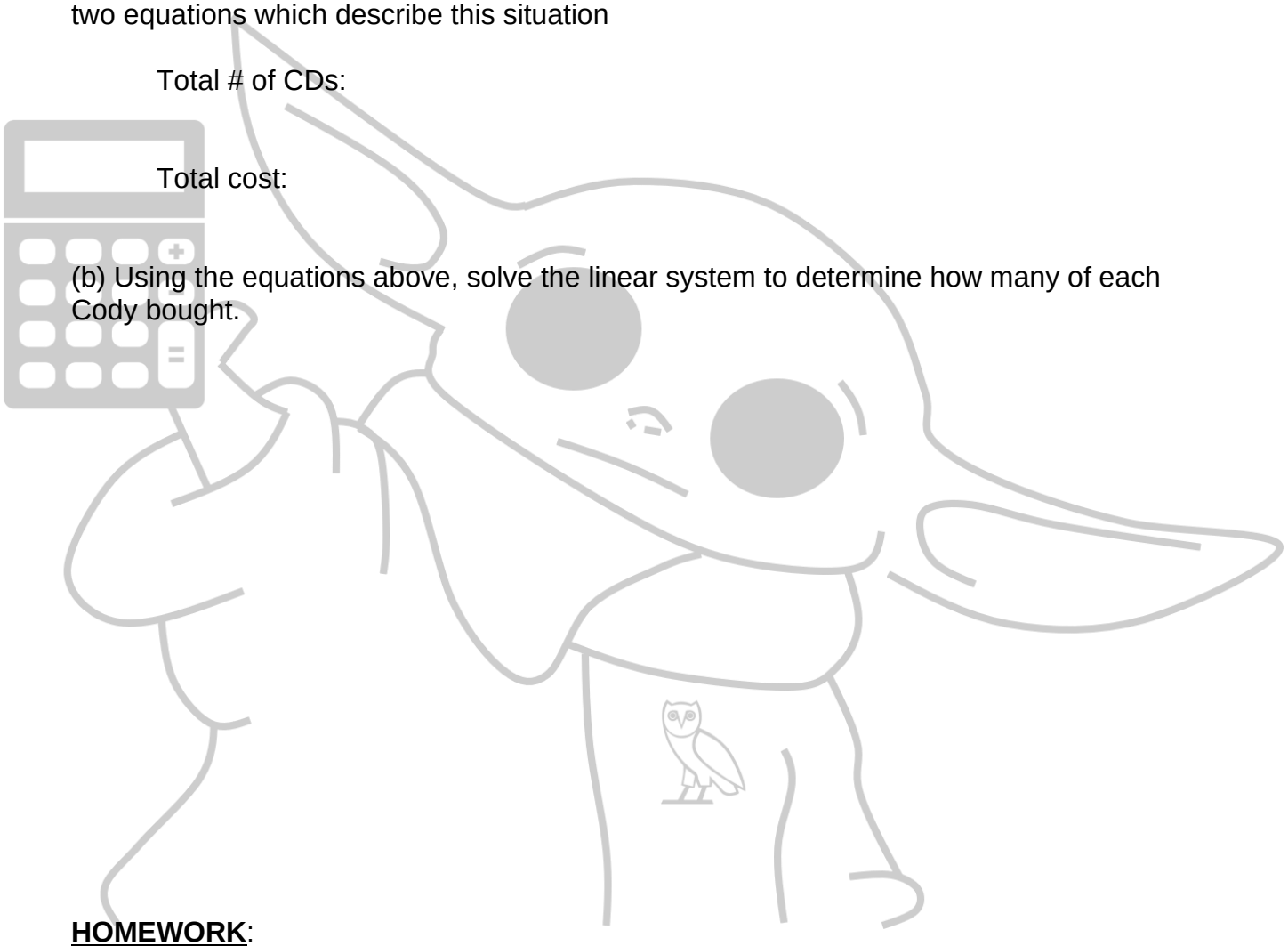
How many of each did Cody buy?

(a) Using **c** to represent the # of CDs and **d** to represent the number of DVDs, write the two equations which describe this situation

Total # of CDs:

Total cost:

(b) Using the equations above, solve the linear system to determine how many of each Cody bought.



HOMEWORK:
Page 216 – 218
(Day 1) #1ace, 2ace, 3ac, 4ac
(Day 2) #5, 6, 9

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5.4 – SOLVING PROBLEMS USING LINEAR SYSTEMS

KEY CONCEPTS

A linear system can be solved by graphing or algebraically
→Solving linear systems algebraically gives us the *exact* answers and the typical problems involved with graphing lines are avoided

Depending on the form of both equations, one algebraic method is typically better than the other
→ If *one* (or both) of the equations already has a variable isolated, **substitution** is the more efficient method
→ If *both* equations are in the form of Ax + By = C, **elimination** is the more efficient method

In this lesson, we will look at different types of questions and based on the form of the equations, we will determine which method would work best.

EXAMPLE 1 *Goals*

Sara and Tara both play on the National Hockey Team

Sara has **3 times** as many goals as Tara.

The sum of Sara and Tara's goals scored is **16**.

How many goals did each player score?

Using **s** to represent the number of **Sara's goals** and **t** to represent the number of **Tara's goals**, the linear system is defined by the equations below

Sara's goals: **(1)** s = 3t

Total goals: **(2)** s + t = 16

(a) Based on the form of the equations, which method would be best suited to solve this linear system? _____ Explain

(b) Using the above linear system, determine the **number of goals** that Sara and Tara scored

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EXAMPLE 2 *How Many Cars?*

Billionaire Ted collects BMWs and Mercedes-Benz cars and has a total of **10 cars**.

Next year, Ted would like to have *double* the amount of BMWs and by this time, he will have a total of **16 cars**.

How many of each car does Ted have now?

Using **b** to represent the **number of BMWs** and **m** to represent the **number of Mercedes-Benz** cars, the two equations which model this situation are

Total # of cars now: **(1)** $b + m = 10$

Total # of cars next year: **(2)** $2b + m = 16$

Using the equations above, solve the linear system to determine how many of each car Ted has now.

(a) Based on the form of the equations, which method would be best suited to solve this linear system? _____ Explain

(b) Using the above linear system, determine **how many of each car** Ted has today.

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EXAMPLE 3 *Breaking Even*

"Breaking even" is when the level of production at which the costs of production is equal to the revenues for a product (there is no profit or loss).

The school athletic council is planning to sell hoodies for **$45** each.

The costs to produce the hoodies is **$25 each** plus a one-time set up fee of **$7000**.

How many hoodies does the athletic council have to sell in order to break even?

Using **C** to represent the **total cost** and **h** to represent the **number of hoodies**, the linear system that models this problem are below

Selling costs: **(1)** C = 45h

Production costs: **(2)** C = 25h + 7000

(a) Based on the form of the equations, which method would be best suited to solve this linear system? _____ Explain

(b) Using the above linear system, determine **how many hoodies** the athletic council has to sell to break even.

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EXAMPLE 4 *Buying Stuff*

Arnold is a sneakerhead and decided to buy pairs of Jordans and Yeezys.

On StockX, a pair of Jordans cost **$300** each and a pair of Yeezys cost **$500** each. Arnold spent a total of **$7600**.

Arnold purchased a total of **20 sneakers**.

How many of each sneaker did Arnold buy?

Using **j** to represent the **number of Jordans** and **y** to represent the **number of Yeezys**, the linear system that models this problem are below

Money spent: **(1)** $300j + 500y = 7600$

Total number of sneakers: **(2)** $j + y = 20$

(a) Based on the form of the equations, which method would be best suited to solve this linear system? _____ Explain

(b) Using the above linear system, determine **how many of each sneaker** Arnold purchased.

Homework:
Page 223 – 225 #1 – 4, 6, 7