## Algebra

## Systems of Equations

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## Outline for Review Class

- Linear Equations Review
- Solving Systems of Equations Involving Substitution and Elimination
- Solving Systems of Equations Involving 2 and 3 Variables


## Review for Linear Equations

## Using Algebra Tiles

fixample 1
holve $2 x+1=5$.

## solution

Atep 1 Model the equation using tiles.


$$
2 x+1=5
$$

Step 2 To isolate the term containing the variable, add negative unit tiles to both sides until the unit tiles are brought to zero on one side.


Step 3 Simplify.


Step 4 Isolate the variable.


Step 5 Verify your answer.
Substitute your answer into the original equation, $2 x+1=5$.

$$
\text { LS } \begin{aligned}
2 x+1 & =2(2)+1 \quad \text { RS } \quad 5 \\
& =4+1 \\
& =5
\end{aligned}
$$

## Solve:

$20+4 p=60$

## Solving a Worded Problem Using an Equation

- Margo rented a bus to take the math students to Don Cherry's in Clarenville for last-class celebrations.
- The basic cost of renting the bus is $\$ 300$
- The driver charges an additional $\$ 1.50$ per kilometre
- The final bill of the bus ride was $\$ 570$

How Far did the bus travel?

The initial cost (cost to set up the machine) of binding a book in a cover is $\$ 5.00$. There is also a charge of $\$ 0.01$ per page. The total cost to bind the book is $\$ 9.80$. How many pages does the book have?

## Like Terms

- Like Terms: Terms that have the same variable or variables and the same exponent.
- It follows the form $a x+b x=(a+b) x$

$$
\begin{aligned}
7 x+4 x & =(7+4) x \\
& =11 x
\end{aligned}
$$

## Distributive Property

To solve some equations you will need to know the distributive property

$$
\begin{aligned}
a(b+c) & =a b+a c \\
3(y+2) & =3 \times y+3 \times 2 \\
& =3 y+6
\end{aligned}
$$

## Solve

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

- An outdoor swimming pool opens for 14 weeks each year. There are two payment choices:
- You can pay \$3 each visit
- You can buy a season pass for $\$ 80$ and pay $\$ 1$ per visit.
For what number of visits would both payment plans cost the same amount?
$y=m x+b$
- To find the slope, m:
- Find the run of the graph as you move from left to right
- Find the rise of the graph as you move up or down.
- Find the ratio of rise/run.
- Another way to think of the slope-y-intercept form
- $y=m x+b$

Or

- $y=$ (growth rate $x$ time that growth rate occurs) + initial value
- So all students should now be able to express an equation in slope-y-intercept form, and graph it. This means taking an equation like $3 x-4 y-12=0$ and expressing it as
$y=3 / 4 x-3$.

The rates for Internet providers Company A and Company C are shown on the graph.


- Company A equation is $\mathrm{c}=20+2 \mathrm{~h}$
- Company C equation is $\mathrm{c}=10+2.5 \mathrm{~h}$
- If we were asked to find out when two equations are equal, we could display them on a graph.
- Given

$$
\begin{aligned}
& 6 y-2 x-30=0 \\
& 4 y-4 x-8=0
\end{aligned}
$$

We would express the two equations in slope-$y$-intercept form:

$$
\begin{aligned}
& y=1 / 3 x+5 \\
& y=x+2
\end{aligned}
$$



## Solving Systems of Equations Using Two Variables

$$
\begin{aligned}
& Y=3 x-2 \\
& Y=-x-6
\end{aligned}
$$

- Linear Equation (involving two variables) - An equation whose graph is a straight line
- Example: $6 x-2 y=4$
- Systems of Equations - A set of two or more equations for which you are looking for a common solution
- Example: $5 x-3 y=47$

$$
6 x-y=7
$$

Coefficient - The constant value by which a variable is multiplied in an equation.

- Example: 3 is the coefficient of $x$ in $3 x+4 y=7$
- Solving Systems of Equations by Substitution Replacing a portion of a system of equation by isolating one variable in another system and then plugging it back into the original equation


## Example

- Use substitution to solve the following systems of equations

$$
\begin{aligned}
& 1.5 s-3 r=-1.5 \\
& 3 s+1.5 r=-29.25
\end{aligned}
$$

## Example

- Use substitution to find the cost when both health club membership plans cost the same
- \$32 a month and \$2 an hour for usage, or $\$ 18$ a month and $\$ 5.50$ an hour for usage


## Example

Christie, Edith, and Ann all bought milk and eggs at the same store on the same day. Keith said he didn't believe them when they told him what they spent. Do you agree with Keith? Explain

|  | Number of <br> cartons of milk | Number of <br> cartons of eggs | Amount (\$) |
| :---: | :---: | :---: | :---: |
| Christie | 4 | 2 | 14.74 |
| Edith | 1 | 1 | 4.68 |
| Ann | 2 | 3 | 11.75 |

- Solving Systems of Equations by Elimination Replacing a system of equations by an equivalent system of equations, one of which has been reduced to one variable


## , Example

- Use elimination to solve the following system of equations

$$
\begin{aligned}
& 1.2 s-3 r=-7.2 \\
& 3.6 s+5 r=-4.8
\end{aligned}
$$

## Example

- A landscaping company placed two orders with a nursery. The first order was for 13 bushes and 4 trees, and totaled $\$ 487$. The second order was for 6 bushes and 2 trees, and totaled $\$ 232$. The receipts do not list the per-item price.
- What were the costs of one bush and one tree?


## Example

A music store had a sale on CDs and cassette tapes. Tony, Lili, and Ana all purchased items

|  | Number of CDs | Number of tapes | Amount (before <br> taxes) $(\$)$ |
| :---: | :---: | :---: | :---: |
| Tony | 3 | 5 | 104.92 |
| Lili | 6 | 3 | 125.91 |
| Ana | 2 | 10 | 149.88 |

a) How much did the store charge for the CDs?
b) How much did they charge for tapes?

## Solving Systems of Equations Using Three Variables

- Example
- Use elimination to solve this system of equations

$$
\begin{gathered}
z-x+y=9 \\
2 z+x-y=12 \\
-2 z-x-3 y=-8
\end{gathered}
$$

- Example
- Use substitution to solve the system of equations
$-3 x+2 y-6 z=6$
$5 x+7 y-5 z=6$
$x+4 y-2 z=8$

