## 1.4: Write Equations and Inequalities

Goals: *Translate verbal sentences into equations or inequalities
*Decide if a given value is a solution to an equation or inequality

Open sentence: two algebraic expressions compared by $=,>,<, \geq$, or $\leq$.

Equation: An open sentence with an equals sign

Inequality: An open sentence with an inequality sign.

$$
\begin{array}{ll}
\text { IS }= & <\text { Is less than } \\
\text { The same as } & >\text { Is greater than } \\
& \geq \begin{array}{l}
\text { "Is greater than or equal to" } \\
\text { "At least," "No less than" }
\end{array} \\
& \leq \begin{array}{c}
\text { "Is less than or equal to" } \\
\text { "At most," "No more than" }
\end{array}
\end{array}
$$

Translate the following phrases into equations or inequalities:
Ex: The difference of twice a number $k$ and 8 is 12

$$
2 k-8=12
$$

Ex: The product of 6 and a number is at least 24

$$
6 x \geq 24
$$

Ex: The quotient of a number $p$ and 12 is at least 30

$$
\frac{p}{12} \geq 30
$$

Ex: The sum of twice a number $r$ and 3 is 11

$$
2 r+3=11
$$

Ex: The quotient of a number and 2 is at most 16

$$
\frac{x}{2} \leq 16
$$

Ex: Your math grade, $g$, needs to be at least a 75
$g \geq 75$

## Combining inequalities:

Ex: $x$ is greater than 3 and less than 9
Start with: $x>3$ and $x<9$
Write as one sentence that you can read left to right: $3<x<9$

Ex: A number $y$ is no less than 5 and no more than 13

$$
5 \leq y \leq 13
$$

Ex: A number $q$ is at least 5 and less than 17

$$
5 \leq q \leq 17
$$

Solution (of an equation or inequality): The value of the variable that makes an equation or inequality true!

Check whether 3 is a solution to the equation or inequality. Yes or No.

Ex: $8-2 x=2$

$$
\begin{aligned}
8-2(3) & =2 \\
8-6 & =2 \\
2 & =2 \text { YES }
\end{aligned}
$$

Ex: $2 z+5>12$

$$
\begin{aligned}
2(3)+5 & >12 \\
6+5 & >12 \\
11 & >12 \quad \text { NO! }
\end{aligned}
$$

Ex: $4 x-5=6$

$$
\begin{aligned}
4(3)-5 & =6 \\
12-5 & =6 \\
7 & =6 \mathrm{NO}!
\end{aligned}
$$

Ex: $5+3 n \leq 20$

$$
\begin{aligned}
5+3(3) & \leq 20 \\
5+9 & \leq 20 \\
14 & \leq 20 \text { YES }!
\end{aligned}
$$

## Check whether 5 is a solution to the equation or inequality. Yes or No.

Ex: $24-3 d=9$
$9=9$
Yes
Ex: $2 w-7 \leq 3$
$3 \leq 3$
Yes

Ex: $3 x+4=18$
$19=18$
No
Ex: $4+3 p>19$
$19>19$
No

Check whether the given number is a solution: (the number given comes after the semi-colon)
Ex: $9-x=4 ; 5$
$9-5=4$
$4=4$
Yes
Ex: $b+5<15 ; 7$
$7+5<15$
$12<15$
Yes

Ex: $2 n+3 \geq 21 ; 9$
$\underset{\text { Yes }}{21 \geq 21}$
Yes
Ex: The last time you and 3 friends went to a mountain bike park, you had a coupon for $\$ 10$ off the total purchase and paid $\$ 17$ for 4 tickets. What is the regular price for the 4 tickets? What is the regular price of 1 ticket?

$$
\begin{array}{ll}
4 x-10=17 & \text { The total cost should have been } \$ 27 \text { without the coupon for } 4 \text { tickets } \\
\text { Which means each ticket costs } \$ 6.75
\end{array}
$$

Ex: A basketball player scored 351 points last year. There are 18 games in the season.
a. Write an inequality to represent the situation if the player's goal is to beat last year's total. (Be sure to identify a variable)

$$
18 x>351 \quad x \text { is the points per game the player can score }
$$

b. Will an average of 20 points per game be enough to beat least year's total?

$$
\begin{array}{ll}
18(20)>351 & \text { Ched } \\
360>351 & \text { Yes }
\end{array}
$$

Ex: Tyler would like to make no less than $\$ 610$ selling coffee mugs online. He has made 28 mugs.
a. Write an inequality to represent this situation.

$$
28 x \geq 610 \quad x: \text { Cost per mug }
$$

b. If he sells all 28 mugs for $\$ 22$ each, will he achieve his goal?

$$
\begin{aligned}
& 28(22) \geq 610 \\
& 616 \geq 610 \quad \text { Yes }
\end{aligned}
$$

