Pen color key: CLS+ EB cognates Teacher moves Exemplary student responses

24-25 Unit 1: Linear Equations and Inequalities
1.1.2 Solving Multi-Step Equations

Name: SWE **Date:**

Objectives:
- Solve linear multi-step equations using inverse operations. (operaciones inversas)
- Use linear multi-step equations to solve real world problems.

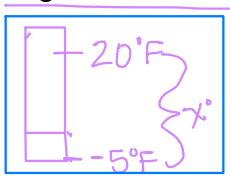
Essential Question: How can you solve a multi-step equation to solve real-life problems?

Do First

8min 6min solo; 2min partner

1. Write and solve an equation to answer the question.

The temperature at 5:00pm is $20°\text{F}$. The temperature at 10:00pm is $-5°\text{F}$. How many degrees did the temperature fall? *Hint: Draw a picture.*



$20-(-5)=x$

$25°=x$

The temperature fell 25°F from 5pm to 10pm.

provide picture for CLS+

★ Look for unique drawings & share

2. SAT PRACTICE PROBLEM

$$4x+5=165$$

What is the solution to the given equation?

$x=40$

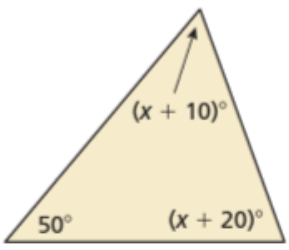
$4x+5=165$
$-5 \quad -5$
$4x=160$
$\frac{4x}{4}=\frac{160}{4}$
$x=40$

check: $4(40)+5 \stackrel{?}{=} 165$
$160+5 \stackrel{?}{=} 165$
$165=165$ ✓

★ remind to check

Explore: 10min

The sum, S, of the measures of the interior angle measures of a polygon with n sides can be found using the formula $S=180(n-2)$. Write and solve an equation to find each value of x. Justify the steps in your solution. Then, find the angle measures for each angle in the polygon. How can you check the reasonableness of your answers?



# of sides 3

① $S=180(3-2)$
$S=180°$ ✓
$50+(x+10)+(x+20)=180$
$2x+80=180$
$-80 \quad -80$
$\frac{2x}{2}=\frac{100}{2}$
$x=50°$

② $50°$
$(50+10)=60°$
$(50+20)=70°$
$50+60+70$
$180°$ ✓

You can check the reasonableness by finding the sum of the angles & comparing it to S from step 1.

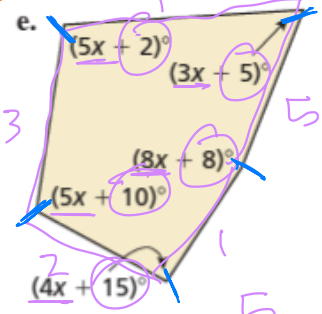
For Explore: Students count off 1, 2, 1, 2... - Work in pairs on same question (6min) → T/W 2min first - match & explain your work to other partner (2min each)

★ while circulating, ask reasonableness question. Choose ST to share out whole group to close explore

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e.



# of sides _____

① $S = 180(5-2)$
$S = 540°$ ✓

$25x + 40 = 540$
$-40 \quad -40$
$\frac{25x}{25} = \frac{500}{25}$
$x = 20$

② $5(20)+2 = 102°$
$3(20)+5 = 65°$
$8(20)+8 = 168°$
$5(20)+10 = 110°$
$4(20)+15 = 95°$
$540°$ ✓

provide tick marks @ vertices for CLST

35min total

Explain

Key Point 1: Choral reading; ask to circle unknown terms

To solve a multi-step equation, simplify each side of the equation, if necessary. Then use inverse operations to isolate the variable.

Teacher Model 1 – Combining Like Terms to Solve an Equation

stamp like terms meaning

Directions: What is the solution to the equation? Check the solution.

remind to include sign

3min

verifica

1a. $9x - 6x + 15 = -12$ Check: ⑤

① $3x + 15 = -12$
$-15 \quad -15$

② $\frac{3x}{3} = \frac{-27}{3}$

③ $x = -9$

④ $9(-9) - 6(-9) + 15 \stackrel{?}{=} -12$
$-81 + 54 + 15 \stackrel{?}{=} -12$
$-12 \stackrel{✓}{=} -12$

Cold call step by step after model to recap

3min

CFU 1: $-2x - 10x + 12 = 18$

$-12x + 12 = 18$
$-12 \quad -12$
$\frac{-12x}{-12} = \frac{6}{-12}$
$x = -\frac{1}{2}$

Check:
$-2(-\frac{1}{2}) - 10(-\frac{1}{2}) + 12 \stackrel{?}{=} 18$
$1 + 5 + 12 \stackrel{?}{=} 18$
$18 \stackrel{✓}{=} 18$

⚠ must check in ~~ORIGINAL~~ equation

1min recap

Teacher Model 2 – Solving Multi-Step Equations Using the Distributive Property

3min

Directions: What is the solution to the equation? Check the solution.

3min

show students finish & check

2a. $2(1 - x) + 3 = -8$

$2 - 2x + 3 = -8$
$-2x + 5 = -8$
$-5 \quad -5$
$\frac{-2x}{-2} = \frac{-13}{-2}$
$x = \frac{13}{2}$ ← leave as a fraction!

Check:
$2(1 - \frac{13}{2}) + 3 \stackrel{?}{=} -8$
$-11 + 3 \stackrel{?}{=} -8$
$-8 \stackrel{✓}{=} -8$

CFU 2: $3(x + 1) + 6 = -9$

$3x + 3 + 6 = -9$
$3x + 9 = -9$
$-9 \quad -9$
$\frac{3x}{3} = \frac{-18}{3}$
$x = -6$

Check:
$3(-6+1) + 6 \stackrel{?}{=} -9$
$3(-5) + 6 \stackrel{?}{=} -9$
$-15 + 6 = -9$
$-9 \stackrel{✓}{=} -9$

Show me
- backwards hands for −6

CFS:
→ identify like terms/distribution
→ show all steps
→ check from original equation

posted on slide/board

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Teacher Model 3 – Solving Equations With Fractions

5min

LCM: mínimo común múltiplo

Key Point 2:

When solving equations or inequalities (desigualdades) with fractions, multiply each term in the equation by the least common denominator to *clear out the fractions*.

Calculate with integers

Consider the equation $\frac{2}{3}x - 7 = \frac{1}{2}$.

Ask: when have you used this skill before? Answer: Add/Subt fraction

1. What is the least common multiple for the denominators of all the fractions? 2: 2, 4, 6, 8, 10 ... 3: 3, 6, 9, 12 ... LCM = 6 provide list w/ empty ☐ for CLS+	In Desmos, find the least common multiple by typing lcm(,) $\text{lcm}(3,2)$ $= 6$
2. Multiply each term by the LCM. Rewrite your "new" equation? can also be shown as: $6\left(\frac{2}{3}x - 7 = \frac{1}{2}\right)$ connect to 2a	$6\left(\frac{2}{3}x\right) - 6(7) = 6\left(\frac{1}{2}\right)$ $4x - 42 = 3$
3. Solve the equation using inverse operations. release students to solve & check Check: $\frac{2}{3}\left(\frac{45}{4}\right) - 7 \stackrel{?}{=} \frac{1}{2}$ $\frac{15}{2} - 7 \stackrel{?}{=} \frac{1}{2}$ $\frac{15}{2} - \frac{14}{2} \stackrel{?}{=} \frac{1}{2}$ $\frac{1}{2} \stackrel{\checkmark}{=} \frac{1}{2}$	$4x - 42 = 3$ $+42 \quad +42$ $\frac{4x}{4} = \frac{45}{4}$ $x = \frac{45}{4}$

★ ask if 12 or 18 could have been used. If students are unsure, allow them to try. Ask what's easier for them and why.

Lap 1: LCM
Lap 2: Distribute to All terms
Lap 3 - solve & check

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Name:_____ **Date:**_____

CFU 3 4min

What is the solution to the equations $\frac{1}{2}x - \frac{1}{5}x = 3$?

1. What is the least common multiple for all of the denominators? 2: 2, 4, 6, 8, 10, 12 ... 5: 5, 10, 15 ...	10
2. Multiply each term by the LCM. Rewrite your "new" equation? provide empty boxes & seperated terms for CLS+	$10(\frac{1}{2}x) - 10(\frac{1}{5}x) = 10(3)$ $5x - 2x = 30$
3. Solve the equation using inverse operations. Check: $\frac{1}{2}(10) - \frac{1}{5}(10) \stackrel{?}{=} 3$ $5 - 2 \stackrel{?}{=} 3$ $3 \stackrel{\checkmark}{=} 3$	$5x - 2x = 30$ $\frac{3x}{3} = \frac{30}{3}$ $x = 10$

Students solo read. Cold call for telling story in own words. What does "mean" mean? How do we find it?

Teacher Model 4 - Solving Real-Life Problems 4min

average → mean [Promedio]

Directions: Use the table to find the number of miles x you need to bike on Friday so that the mean number of miles biked per day is 5. Write an equation to model the real-life problem. Then, find the value of x.

Day	Miles
Monday	3.5
Tuesday	5.5
Wednesday	0
Thursday	5
Friday	x

$\text{average} = \frac{\text{total miles}}{\#\text{days}}$

$5 = \frac{3.5 + 5.5 + 0 + 5 + x}{5}$

$5\left[5 = \frac{14 + x}{5}\right]$

$25 = 14 + x$
$-14 \quad -14$
$11 = x$

Check:
$5 \stackrel{?}{=} \frac{3.5+5.5+0+5+11}{5}$
$5 \stackrel{?}{=} \frac{25}{5} \rightarrow 5 \stackrel{\checkmark}{=} 5$

PUSH: Interpret the value of x.

11 miles is needed on Friday to have an average of 5 miles for the week.

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TWPS

CFU 4 5min

Your school's drama club charges $4 per person for admission to a play. The club borrowed $400 to pay for costumes and props. After paying back the loan, the club has a profit of $100. How many people attended the play?

CLS+ version on last page

profit = earned − cost

$100 = 4p - 400$

$+400 \quad +400$

$\frac{500}{4} = \frac{4p}{4}$

$125 = p$

Check:

$100 \stackrel{?}{=} 4(125) - 400$

$100 \stackrel{?}{=} 500 - 400$

$100 \stackrel{\checkmark}{=} 100$

125 people attended the play

- 90sec to read, draw, make meaning
- 1min partner share of meaning
- 150 sec to solve
- check answer w/ partner

Elaborate I 10min

Directions: Solve each equation. Check the solution.

negative fraction coeff.! only? like it

1. $15 = 5 + 4(2d - 3)$	2. $-\frac{1}{2}(5x - 8) - 1 = 6$
$15 = 5 + 8d - 12$ $15 = -7 + 8d$ $+7 \quad +7$ $\frac{22}{8} = \frac{8d}{8}$ $\frac{11}{4} = d$ Check: $15 \stackrel{?}{=} 5 + 4(2\frac{11}{4} - 3)$ $15 \stackrel{?}{=} 5 + 4(\frac{11}{2} - 3)$ $15 \stackrel{?}{=} 5 + 10$ $15 = 15$	$-\frac{5}{2}x + 4 - 1 = 6$ $-\frac{5}{2}x + 3 = 6$ $-3 \quad -3$ $-\frac{5}{2}x = 3$ $(-\frac{2}{5})(-\frac{5}{2}x) = (3)(-\frac{2}{5})$ $x = -\frac{6}{5}$ Check: $-\frac{1}{2}(5(-\frac{6}{5}) - 8) - 1 \stackrel{?}{=} 6$ $-\frac{1}{2}(-14) - 1 \stackrel{?}{=} 6$ $6 \stackrel{\checkmark}{=} 6$
3. $33 = 12r - 3(9 - r)$	4. $7 + 3(2y - 6) = -29$
$33 = 12r - 27 + 3r$ $33 = 15r - 27$ $+27 \quad +27$ $\frac{60}{15} = \frac{15r}{15}$ $4 = r$ Check: $33 \stackrel{?}{=} 12(4) - 3(9 - 4)$ $33 \stackrel{?}{=} 48 - 3(5)$ $33 \stackrel{\checkmark}{=} 33$	$7 + 6y - 18 = -29$ $6y - 11 = -29$ $+11 \quad +11$ $\frac{6y}{6} = \frac{-18}{6}$ $y = -3$ Check: $7 + 3(2(-3) - 6) \stackrel{?}{=} -29$ $7 + 3(-12) \stackrel{?}{=} -29$ $-29 \stackrel{\checkmark}{=} -29$

Mark pages
✓: correct
*: distrib error

1 CLS+

2 CLS+

3 CLS+

2 CLS+

*look for to most missed to go over

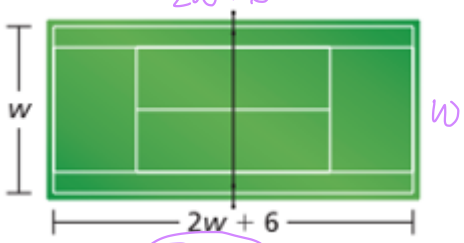
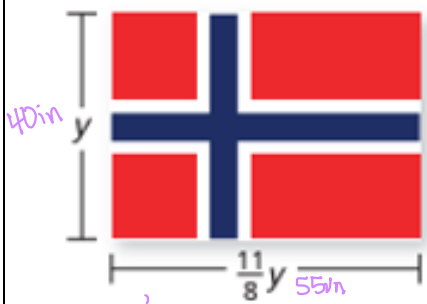
could x2 to convert to integers

CFS:
→ identify like terms/distribution
→ show all steps
→ check from original equation

posted on slide/board

24-25 Unit 1: Linear Equations and Inequalities
1.1.2 Solving Multi-Step Equations

Name:_____ **Date:**_____

5.	Write and solve an equation to answer the question. $P = 2L + 2w$ The perimeter of the tennis court is 228 feet. ~~What~~ are the dimensions of the court?  $2w + b = L$ $2w + 2(2w+6) = 228$ $2w + 4w + 12 = 228$ $6w + 12 = 228$ $-12 \quad -12$ $\frac{6w}{6} = \frac{216}{6}$ $w = 36ft$ $L = 2(36) + 6$ $L = 78ft$ 78ft × 36ft	6.	Write and solve an equation to answer the question. The perimeter of the Norwegian flag is 190 inches. What are the dimensions of the flag?  $2y + 2(\frac{11}{8}y) = 190$ $[2y + \frac{11}{4}y = 190]\ 4$ $8y + 11y = 760$ $19y = 760$ $\frac{19}{19} \quad \frac{19}{19}$ $y = 40in$ $\frac{11}{8}(40) = 55in$ 40in × 55in

Evaluate 5min

1.	$-4(2m + 5) - 3m = 35$ $-8m - 20 - 3m = 35$ $-11m - 20 = 35$ $+20 \quad +20$ $\frac{-11m}{-11} = \frac{55}{-11}$ $m = -5$ Check: $-4(2(-5)+5) - 3(-5) \stackrel{?}{=} 35$ $-4(-5) + 15 \stackrel{?}{=} 35$ $35 \stackrel{✓}{=} 35$	2.	$2(y - 4) + 3y = 12$ $2y - 8 + 3y = 12$ $5y - 8 = 12$ $+8 \quad +8$ $\frac{5y}{5} = \frac{20}{5}$ $y = 4$ Check: $2(4-4) + 3(4) \stackrel{?}{=} 12$ $0 + 12 \stackrel{?}{=} 12$ $12 \stackrel{✓}{=} 12$

Transition Time to the Final 20

Elaborate II 20min

IXL Practice		
IXL Skill Code: **28N – Solve multi-step linear equations** 2/2 start here	IXL Skill Code: (8th grade skill) **55K – Solve multi-step equations (with distributive property)** 1/2 start here	IXL Skill Code: (8th grade skill) **8RP - Solve equations with the distributive property** Intervention Group 0/2 w/Jam guided.

🎭 CFU 4: Drama Club Fundraiser

Problem:

The drama club charges **$4** per person.

They borrowed **$400**.

After paying it back, they made **$100** in profit.

Question:

How many people came to the play?

Visual Support:

💵 Income from Tickets – 💸 Cost (Loan) = ✅ Profit