Example #1 Solve $5+x=12.$

*Side-by-Side Comparison
*Multiple Methods
*Choral Response
*Syntax

Decomposition:

$5+x=12$

$5+x=5+7$

$\cancel{5}+x=\cancel{5}+7$

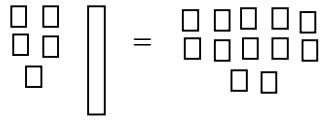
$x=7$

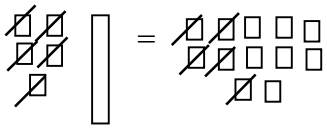
✪Choral Response✪ "Five plus a number is 12."

"What are we solving for?" [x]
"How can we get a five on both sides of the equation?" [Decompose 12, 5+7]
"Now can we take a positive 5 from both sides?" [Yes]
"What is the value of x?" [7]

Algebra Tiles: □ = 1, ■ = –1 , ▭ = x

$5+x=12$





$\square = \square\square\square\square\square$

$\therefore x=7$

✪Choral Response✪ "Five plus a number is 12."

"What are we solving for?" [x]

"Can I take positive 5 from both sides of the equation?" [Yes]

"What is the value of x?" [7]

Bar Model:

$5+x=12$

5	x
12	

$\cancel{5}$	x
$\cancel{5}$ + 7	

x
7

$\therefore x=7$

✪Choral Response✪ "Five plus a number is 12."

"What are we solving for?" [x]

"How can we decompose 12?" [5+7]

"Can I take positive 5 from both sides?" [yes]

"What is the value of x?" [7]

Inverse Operation:

$5+x=12$

$5-5+x=12-5$

$0+x=7$

$x=7$

✪Choral Response✪ "Five plus a number is 12."

"What are we solving for?" [x]
"What is the inverse operation of addition?" [Subtraction]
"SPOE tells us to subtract what value from both sides of the equation?" [5]
"What is the sum of x and zero?" [x]
"What is the value of x?" [7]

You Try #1 Solve $11 = x + 4$

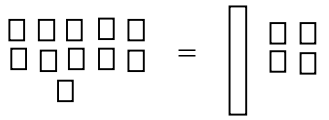
*Side-by-Side Comparison
*Multiple Methods
*You Try
*Syntax

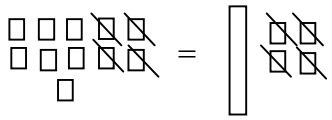
Decomposition:

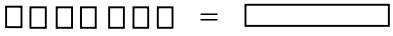
$$11 = x + 4$$
$$4 + 7 = x + 4$$
$$\cancel{4} + 7 = x + \cancel{4}$$
$$7 = x$$

Algebra Tiles:

$11 = x + 4$







$\therefore x = 7$

Bar Model:

$11 = x + 4$

x	4
11	

x	$\cancel{4}$
$7 + \cancel{4}$	

x
7

$\therefore x = 7$

Inverse Operation:

$$11 = x + 4$$
$$11 - 4 = x + 4 - 4$$
$$7 = x + 0$$
$$7 = x$$

Example #2 Solve $x-3=2.$

*Side-by-Side Comparison
*Multiple Methods
*Choral Response
*Syntax

Decomposition:

$x-3=2$

$x+(-3)=2$

$x+(-3)=2+\underbrace{3-3}_{\text{zero pair}}$

$x+(\cancel{-3})=2+3\cancel{-3}$

$x=2+3$

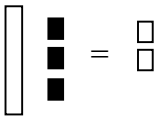
$x=5$

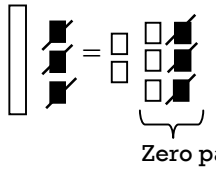
✪Choral Response✪ "A number minus 3 equals 2."

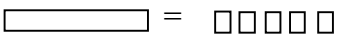
"What are we solving for?" [x]
"How can we get x isolated?" [Remove -3 from both sides of the equation]
"Do we have a -3 on both sides of the equation?" [No]
"How can I get -3 on the right side of the equation?" [Add a zero pair]
"Now what value can be removed from both sides of the equation?" [-3]
"What is the value of x?" [5]

Algebra Tiles:

$x-3=2$







$\therefore x=5$

✪Choral Response✪ "A number minus 3 equals 2."

"What are we solving for?" [x]

"Can we take -3 from both sides of the equation?" [No]

"How can we get -3 on the right side of the equation?" [Add zero pair]

"What value can be removed from both sides of the equation?" [-3]

"What is the value of x?" [5]

Bar Model:

$x-3=2$

x	-3
2	

x	-3
2 + 3	-3

Zero pair

x	$\cancel{-3}$
2 + 3	$\cancel{-3}$

x	$\cancel{-3}$
2 + 3	

x
5

$\therefore\ x=5$

✪Choral Response✪ "A number minus 3 equals 2."

"What are we solving for?" [x]

"In order to remove -3 what must we add?" [zero pair]

"What value can be removed from both sides?" [-3]

"What is the value of x?" [5]

Inverse Operation:

$x-3=2$

$x-3+3=2+3$

$x+0=5$

$x=5$

✪Choral Response✪ "A number minus 3 equals 2."

"What are we solving for?" [x]
"What is on the same side of the equation as x?" [-3]
"APOE tells us to add what value to each side of the equation?" [3]
"What is the value of x?" [5]

You Try #2 Solve $9 = x - 4$

*Side-by-Side Comparison
*Multiple Methods
*You Try
*Syntax

Decomposition:

$$9 = x - 4$$

$$9 \underbrace{+4 - 4}_{\text{zero pair}} = x - 4$$

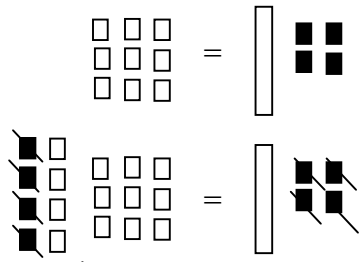
$$9 + 4 - 4 = x - 4$$

$$9 + 4 = x$$

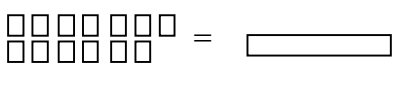
$$13 = x$$

Algebra Tiles:

$9 = x - 4$



Zero Pair



$\therefore \; 13 = x$

Bar Model:

$9 = x - 4$

x	-4
9	

x	~~-4~~
$9 + 4 - 4$	

Zero pair

x	~~-4~~
$9 + 4$	

x
13

$\therefore \; 13 = x$

Inverse Operation:

$$9 = x - 4$$

$$9 + 4 = x - 4 + 4$$

$$13 = x + 0$$

$$13 = x$$

Example #3 Solve $3x = 12$

*Side-by-Side Comparison
*Multiple Methods
*Choral Response
*Syntax

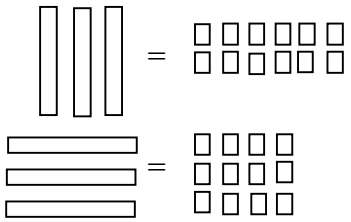
Decomposition:

$3x = 12$	$3x = 12$
$3 \bullet x = 3 \bullet 4$	$x + x + x = 12$
$\cancel{3} \bullet x = \cancel{3} \bullet 4$	$x + x + x = 4 + 4 + 4$
$x = 4$	$x = 4$

✪Choral Response✪
"Three times a number is 12."
"What are we solving for?" [x]
"What two factors of 12 could be used to decompose 12?" [$3 \bullet 4$]
"What factor can be removed from both sides of the equation?" [3]
"What is the value of x?" [4]

Algebra Tiles:

$3x = 12$



$\therefore \ x = 4$

✪Choral Response✪ "Three times a number is 12."

"What are we solving for?" [x]

"How many constants will each of the three $x's$ receive?" [4]

"What is the value of $1x$?" [4]

Bar Model:

$3x = 12$

x	x	x
12		

x	x	x
4 + 4 + 4		

$\therefore \ x = 4$

✪Choral Response✪ "Three times a number is 12."

"What are we solving for?" [x]

"Using repeated addition, decompose 12." [4+4+4]

"What is the value of $1x$?" [4]

✱Inverse Operation:

$3x = 12$

$\frac{\cancel{3}x}{\cancel{3}} = \frac{12}{3}$

$1x = \frac{\cancel{3} \bullet 4}{\cancel{3}}$

$x = 4$

✪Choral Response✪ "Three times a number is 12."

"What are we solving for?" [x]
"What is the inverse operation of multiplication?" [Division]
"DPOE tells us to divide both sides of the equation by?" [3]
"Factor 12 to create an equivalent form of one" [$3 \bullet 4$]
"What is the value of $1x$?" [4]

Multiplicative Inverse:

$3x = 12$

$\frac{1}{3}\left(\frac{3x}{1}\right) = \frac{1}{3}\left(\frac{12}{1}\right)$

$\frac{\cancel{3}x}{\cancel{3}} = \frac{12}{3}$

$1x = \frac{\cancel{3} \bullet 4}{\cancel{3}}$

✪Choral Response✪ "Three times a number is 12."

"What are we solving for?" [x]
"What is the Multiplicative Inverse/Reciprocal of 3?" [$\frac{1}{3}$]
"What is the product of $\frac{1}{3} \bullet \frac{3}{1}$?" [1]
"Factor 12 to create and equivalent form of one" [$3 \bullet 4$]
"What is the value of $1x$?" [4]

You Try #3 Solve $4x = 16.$

*Side-by-Side Comparison
*Multiple Methods
*You Try
*Syntax

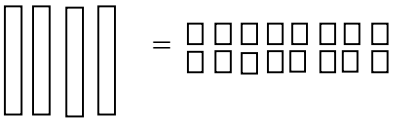
Decomposition:

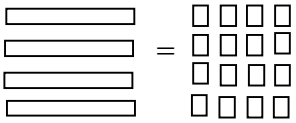
$$4x = 16$$
$$\frac{4}{4} \bullet x = \frac{4}{4} \bullet 4$$
$$x = 4$$

$$4x = 16$$
$$x + x + x + x = 4 + 4 + 4 + 4$$
$$x = 4$$

Algebra Tiles:

$$4x = 16$$





$\therefore \; x = 4$

Bar Model:

$$4x = 16$$

x	x	x	x
16			

x	x	x	x
4	4	4	4

x
4

$\therefore \; x = 4$

Inverse Operation:

$$4x = 16$$
$$\frac{4x}{4} = \frac{16}{4}$$
$$1x = \frac{4 \bullet 4}{4}$$
$$x = 4$$

Multiplicative Inverse:

$$4x = 16$$
$$\frac{1}{4}\left(\frac{4x}{1}\right) = \frac{1}{4}\left(\frac{16}{1}\right)$$
$$\frac{4x}{4} = \frac{16}{4}$$
$$1x = \frac{4 \bullet 4}{4}$$
$$x = 4$$

Example #4 Solve $\frac{x}{4}=5.$

*Side-by-Side Comparison
*Multiple Methods
*Choral Response
*Syntax

Decomposition:

$\frac{x}{4}=5$ or $\frac{1}{4}x=5$ ← (Two ways to write the equation)

$$\frac{1}{4}x=5$$

$$\frac{1}{4}x+\frac{1}{4}x+\frac{1}{4}x+\frac{1}{4}x=5+5+5+5$$

$$\frac{4}{4}x=20$$

$$1x=20$$

$$x=20$$

✪Choral Response✪ "A number divided by 4 equals 5."

"What are we solving for?" [x]

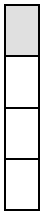
"How many $\frac{1}{4}$'s are in one whole?" [4]

"So if there are 4 - $\frac{1}{4}$'s, how many 5's do we need?" [4]

"What is the value of $1x$?" [20]

Algebra Tiles:

$\frac{x}{4}=5$



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"What are we solving for?" [x]

"What do we know about x?" [$\frac{1}{4}$ of x equals 5]

"What does $\frac{2}{4}$ of x equal?" [10]

□□□□□
□□□□□
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□□□□□

"What does $\frac{3}{4}$ of x equal?" [15]

"What does $\frac{4}{4}$ or all of x equal?" [20]

$\therefore\ x=20$

Bar Model:

$\frac{x}{4}=5$

x

$\frac{1}{4}x$	$\frac{1}{4}x$	$\frac{1}{4}x$	$\frac{1}{4}x$

$\frac{1}{4}x$	$\frac{1}{4}x$	$\frac{1}{4}x$	$\frac{1}{4}x$
5	5	5	5

$\therefore\ x=20$

✪Choral Response✪ "A number divided by 4 equals 5."

"What are we solving for?" [x]

"Divide x into fourths." [$\frac{1}{4}x+\frac{1}{4}x+\frac{1}{4}x+\frac{1}{4}x$]

"What is the value of $\frac{1}{4}$ of x?" [5]

"What is the value of $\frac{2}{4}$ of x?" [10]

"What is the value of $\frac{3}{4}$ of x?" [15]

"What is the value of $\frac{4}{4}$ or all of x?" [20]

Inverse Operation:

$$\frac{x}{4}=5$$

$$4\left(\frac{x}{4}\right)=4(5)$$

$$1x=20$$

$$x=20$$

✪Choral Response✪ "A number divided by 4 equals 5."

"What are we solving for?" [x]

"What is the inverse operation of division?" [Multiplication]

"MPOE tells us to multiply both sides of the equation by?" [4]

"What is the value of $1x$?" [20]

✱Multiplicative Inverse:

$$\frac{1}{4}x=5$$

$$\frac{4}{1}\left(\frac{1}{4}x\right)=\frac{4}{1}(5)$$

$$\frac{1x}{1}=\frac{20}{1}$$

$$1x=20$$

$$x=20$$

✪Choral Response✪ "A number divided by 4 equals 5."

"What are we solving for?" [x]

"What is the Multiplicative Inverse/Reciprocal of $\frac{1}{4}$?" [$\frac{4}{1}$]

"What is the product of $\frac{1}{4}\bullet\frac{4}{1}$?" [1]

"What is the value of $1x$?" [20]

You Try #4 Solve $\frac{1}{3}x = 4.$

*Side-by-Side Comparison
*Multiple Methods
*You Try
*Syntax

Decomposition:

$$\frac{1}{3}x = 4$$
$$\frac{1}{3}x + \frac{1}{3}x + \frac{1}{3}x = 4 + 4 + 4$$
$$\frac{3}{3}x = 12$$
$$1x = 12$$
$$x = 12$$

Algebra Tiles:

$\frac{1}{3}x = 4$

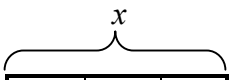
$=$ □□□□

$=$ □□□□
$=$ □□□□
$=$ □□□□

$\therefore\ x = 12$

Bar Model:

$\frac{1}{3}x = 4$



$\frac{1}{3}x$	$\frac{1}{3}x$	$\frac{1}{3}x$

$\frac{1}{3}x$	$\frac{1}{3}x$	$\frac{1}{3}x$
4	4	4

x
12

$\therefore\ x = 12$

Inverse Operation:

$$\frac{x}{3}=4$$

$$3\left(\frac{x}{3}\right)=3(4)$$

$$1x=12$$

$$x=12$$

Multiplicative Inverse:

$$\frac{1}{3}x=4$$

$$\frac{3}{1}\left(\frac{1}{3}x\right)=\frac{3}{1}(4)$$

$$\frac{3x}{3}=\frac{12}{1}$$

$$1x=12$$

$$x=12$$

Example #5:

$$41x=328$$

$$41\bullet x=2\bullet 2\bullet 2\bullet 41$$

$$41\bullet x=2\bullet 2\bullet 2\bullet 41$$

$$x=2\bullet 2\bullet 2$$

$$x=8$$

$$328=\ 300+20+8$$

$$\overbrace{2\bullet 164}\quad 150+10+4$$

$$\overbrace{2\bullet 82}\quad 75+5+2$$

$$\overbrace{2\bullet 41}\quad 40+1$$

$$\therefore 328=2\bullet 2\bullet 2\bullet 41$$

*Side-by-Side Comparison
*Multiple Methods
*Choral Response
*Syntax

You Try #5:

$$33x=264$$

$$3\bullet 11\bullet x=2\bullet 2\bullet 2\bullet 3\bullet 11$$

$$3\bullet 11\bullet x=2\bullet 2\bullet 2\bullet 3\bullet 11$$

$$x=2\bullet 2\bullet 2$$

$$x=8$$

$$264=\ 200+60+4$$

$$\overbrace{2\bullet 132}\quad 100+30+2$$

$$\overbrace{2\bullet 66}\quad 50+15+1$$

$$\overbrace{2\bullet 33}$$

$$\overbrace{3\bullet 11}$$

$$\therefore 264=2\bullet 2\bullet 2\bullet 3\bullet 11$$

*Side-by-Side Comparison
*Multiple Methods
*You Try
*Syntax