6.2 Solving linear equations containing brackets

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6.2 SOLVING LINEAR EQUATIONS CONTAINING BRACKETS

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A) WORKING WITH BRACKETS

We will look at **2 DIFFERENT METHODS** to solve linear equations that contain brackets.
After trying each method it is up to you to decide which you prefer to use.

when solving for x... use REVERSE BEDMAS

METHOD 1: THE DISTRIBUTIVE PROPERTY

1 Expand the brackets ***using the distributive property.***
2 Then solve the equation as before…

Example #1
Solve. $5(x-3)=10$

$5x-15=10$
$+15 \quad +15$
$\frac{5x}{5}=\frac{25}{5}$
$x=5$

Distributive Property

Let a, b and c be real numbers.

ADDITION:
$a(b+c)=ab+ac$ $\quad 3(x+5)=3x+15$
$(b+c)a=ba+ca$ $\quad (x+5)3=3x+15$

SUBTRACTION:
$a(b-c)=ab-ac$ $\quad 3(x-5)=3x-15$
$(b-c)a=ba-ca$ $\quad (x-5)3=3x-15$

PRACTICE

91. Solve. $4(m+3)=40$

Expand the left side.
$4m+12=40$
Subtract 12 from both sides
$4m+12-12=40-12$
$4m=28$
Divide both sides by 4.
$\frac{4m}{4}=\frac{28}{4}$
$m=7$
Check your answer by substituting m=7 into the original equation.
$4(7+3)=40$
m=7 is the solution

92. $3(m-5)=25$
$3m-15=25$
$+15 \quad +15$
$\frac{3m}{3}=\frac{40}{3}$
$m=13.3$

93. $-5(m-1)=20$
$m=-3$

94. $6(m-5)=-6$
$m=4$

95. $-2(m+5)=25$
$-2m+10=25$
$-10 \quad -10$
$\frac{-2m}{-2}=\frac{15}{-2}$
$m=-7.5$

a) Solve. $2(5x+7)=94$
$10x+14=94$
$-14 \quad -14$
$\frac{10x}{10}=\frac{80}{10}$
$x=8$

b) Check using substitution.
$2(5x+7)=94$
$2(5(8)+7)=94$
$2(40+7)=94$
$2(47)=94$
$94=94$ ✓

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METHOD 2 : DIVIDE FIRST!

1 Divide by the coefficient (the number) in *front of the brackets*.

2 Solve the equation like we have in section 6.0 and 6.1.

Example #2

Solve. $5(x - 3) = 10$

coefficient

$\frac{5(x-3)}{5} = \frac{10}{5}$

$x - 3 = 2$

$+3 \quad +3$

$x = 5$

*drop the brackets!

PRACTICE

a) Solve. $\frac{2(7b+2)}{2} = \frac{-94}{2}$

$7b + 2 = -47$

$-2 \quad -2$

$7b = -49$

$\div 7 \quad \div 7$

$b = -7$

b) Check using substitution.

$2(7(-7)+2) = -94$

$2(-49+2) = -94$

$2(-47) = -94$

$-94 = -94$ ✓

c) $5(3 - 2x) = 30$

$x = -\frac{3}{2}$

d) $\frac{3(2x-4)}{3} = \frac{8}{3}$

$2x - 4 = \frac{8}{3}$

$+4 \quad +4$

$2x = \frac{8}{3} + \frac{4}{1}$ (×3)

$2x = \frac{8}{3} + \frac{12}{3} = \frac{20}{3}$

$\frac{2x}{2} = \frac{20}{3} \div 2$ (* multiply by the reciprocal (FLIP))

$x = \frac{20}{3} \times \frac{1}{2}$

$x = \frac{20}{6} = \frac{10}{3}$

e) $22 - 3x = 2(x + 6)$

f) $7x + 2 = 5(x - 2)$

$7x + 2 = 5x - 10$

$+10 \quad +10$

$7x + 12 = 5x$

$-7x \quad -7x$

$12 = -2x$

$\div -2 \quad \div -2$

$-6 = x$

B) WORKING WITH FRACTIONS

We have worked with fractions already in section 6.1. In this section they look a bit different but the same principles apply. We will look at **TWO DIFFERENT METHODS** to work with fractions.

X method ② not good here

e) $\frac{22-3x}{2} = \frac{2(x+6)}{2}$

$\frac{22}{2} - \frac{3x}{2} = x + 6$

$11 - \frac{3}{2}x = x + 6$

$-6 \quad -6$

$5 - \frac{3}{2}x = x$

$+\frac{3}{2}x \quad +\frac{3}{2}x$

$5 = 1x + \frac{3}{2}x$

$5 = \frac{1}{1}x + \frac{3}{2}x$ (×2) need a common denominator

$5 = \frac{2}{2}x + \frac{3}{2}x$

$\times 2 \quad 5 = \frac{5}{2}x \quad \times 2$

$\frac{10}{5} = \frac{5x}{5}$

$2 = x$

✓ method ① better.

e) $22 - 3x = 2(x + 6)$

$22 - 3x = 2x + 12$

$-22 \quad -22$

$-3x = 2x - 10$

$-2x \quad -2x$

$-5x = -10$

$\div -5 \quad \div -5$

$x = 2$

METHOD 1 : MULTIPLY BOTH SIDES BY THE DENOMINATOR (OR LCM)

1 Multiply both sides of the equation by the denominator
2 Then work with the integers to solve the equation.

Bottom number

Example #1

Solve. $\frac{2x+1}{3} = 6$

multiply by BOTH sides!

$2x+1 = 6 \cdot 3$

$2x+1 = 18$

$-1 \quad -1$

$\frac{2x}{2} = \frac{17}{2}$

$x = \frac{17}{2} = 8.5$

PRACTICE

c) Solve $\frac{10x-4}{12} = 8$

$\times 12$

$10x - 4 = 8 \cdot 12$

$10x - 4 = 96$

$+4 \quad +4$

$\frac{10x}{10} = \frac{100}{10}$

$x = 10$

d) Check using substitution.

$\frac{10(10)-4}{12} = 8$

$\frac{100-4}{12} = 8$

$\frac{96}{12} = 8$

$8 = 8$ ✓

METHOD 2 : BREAK INTO FRACTIONS

1. Break the equation into fractions.
2. Find a common denominator
3. Then work with the fractions to solve for the unknown value.

Example #2

Solve. $\frac{2x+1}{3} = 6$

$\Rightarrow \frac{2x}{3} + \frac{1}{3} = \frac{6}{1}$ $\times 3$

need a common denominator

$\frac{2x}{3} + \frac{1}{3} = \frac{18}{3}$

$-\frac{1}{3} \quad -\frac{1}{3}$

$\frac{2x}{3} = \frac{18}{3} - \frac{1}{3}$

$\frac{2x}{3} = \frac{17}{3}$ $\times 3 \Rightarrow$

$\frac{2x}{2} = \frac{17}{2}$

$x = \frac{17}{2} = 8.5$

PRACTICE

a) Solve. $\frac{3x-5}{2} = 8$

$\frac{3x}{2} - \frac{5}{2} = \frac{8}{1}$ $\times 2$

$\frac{3x}{2} - \frac{5}{2} = \frac{16}{2}$

$+\frac{5}{2} \quad +\frac{5}{2}$

$\frac{3x}{2} = \frac{16+5}{2}$

$\frac{3x}{2} = \frac{21}{2}$ $\times 2$

$\frac{3x}{3} = \frac{21}{3}$

$x = 7$

b) Check using substitution.

$\frac{3(7)-5}{2} = 8$

$\frac{21-5}{2} = 8$

$\frac{16}{2} = 8$

$8 = 8$ ✓

C) APPLYING EQUATIONS TO GEOMETRY AND REAL-LIFE ACTIVITIES

Example #1

A regular pentagon has side length of x cm. If each side is 3 cm more than double its original length, the perimeter is 56.2 cm. What is the value of x?

x $\times 2$ $+3$

Perimeter is sum of all sides

$P = 56.2$ = 5 sides

$2x+3$ = side length $\times 5$

(1) $5(2x+3) = 56.2$

$10x + 15 = 56.2$

$-15 \quad -15$

$\frac{10x}{10} = \frac{41.2}{10}$

$x = 4.12$

or (2) $5(2x+3) = 56.2$

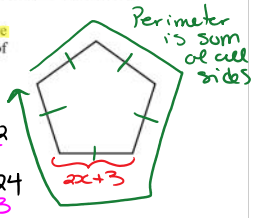
$\frac{5}{5} \quad \frac{5}{5}$

$2x+3 = 11.24$

$-3 \quad -3$

$\frac{2x}{2} = \frac{8.24}{2}$

$x = 4.12$



Example #2

The amount of food energy recommended per day when on an orienteering trip in the mountains can be calculated using the formula $E = \frac{125}{4}(96 - T)$, where E is a measure of the amount of food energy, in Calories (Cal), and T is the outside temperature in degrees Celsius. At what outside temperature would the food energy requirement be:

a) 3000 Cal? $E = \frac{125}{4}(96-T)$

$3000 = \frac{125}{4}(96-T)$ $\times 4$

$12000 = 125(96-T)$

$12000 = 12000 - 125T$

$-12000 \quad -12000$

$\frac{0}{-125} = \frac{-125T}{-125}$

$0 = T \Rightarrow$ 0°C need 3000 Cal

b) 4000 Cal?

$4000 = \frac{125}{4}(96-T)$ $\times 4$

$16000 = 125(96-T)$

$16000 = 12000 - 125T$

$-12000 \quad -12000$

$\frac{4000}{-125} = \frac{-125T}{-125}$

$-32 = T$

at -32°C you need 4000 cal.

Homework	Required	Extra Practice	Extension
Assignment #6.2 pg 221 - 225	#1aceg, 2, 3, 4ab, 5, 6, 7abc, 8, 9, 10ace, 11, 12, 13,	#1bdfh, 4c, 7d, 10bd, 14, 18, 19, 22b	20, 21

Homework	Required	Extra Practice	Extension
Assignment #6.2 pg 221 - 225	#1aceg, 2, 3, 4ab, 5, 6, 7abc, 8, 9, 10ace, 11, 12, 13, 15, 17, 22a	#1bdfh, 4c, 7d, 10bd, 14, 18, 19, 22b	20, 21

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