Name: KEY

Final Exam Practice Pack – Section 3

The Addition Principle

- When Adding or Subtracting with a variable, perform the opposite operation to eliminate the value
- Trying to make 0

Example:

$r - 4 = 7$	$t + 5 = 2$
$r - 4 + 4 = 7 + 4$	$t + 5 - 5 = 2 - 5$
$r = 11$	$t = -3$

The Multiplication Principle

- When Multiplying or Dividing with a variable, perform the opposite operation to eliminate the value
- Trying to make 1

Examples:

$5x = 10$	$-3r = 27$
$\frac{5x}{5} = \frac{10}{5}$	$\frac{-3r}{-3} = \frac{27}{-3}$
$x = 2$	$r = -9$

Example:

$4a = 3$	$8n = 2$
$\frac{4a}{4} = \frac{3}{4}$	$\frac{8n}{8} = \frac{2}{8}$
$a = \frac{3}{4}$	$n = \frac{1}{4}$

Multiple Steps

Example:

$$3q - 8 = 10$$

$$3q - 8 + 8 = 10 + 8$$

$$3q = 18$$

$$\frac{3q}{3} = \frac{18}{3} \quad \rightarrow \quad q = 6$$

$$5x + 4 = -6$$

$$5x + 4 - 4 = -6 - 4$$

$$5x = -10$$

$$\frac{5x}{5} = \frac{-10}{5} \quad \rightarrow \quad x = -2$$

Getting Rid of Brackets – Water Bombing

Example:

$$4(s + 4) = 28$$

$$4s + 16 = 28$$

- Multiply in the 4 to both terms in the brackets

$$4s + 16 - 16 = 28 - 16$$

- Subtract 16 from both sides of the equation

$$4s = 12$$

$$\frac{4s}{4} = \frac{12}{4}$$

- Dive both sides by 4 to isolate the variable

$$s = 3$$

Getting Rid of Fractions – LCM

Example:

$$\frac{1}{2}x - \frac{2}{3} = \frac{1}{4}$$

$$\mathbf{12} * \frac{1}{2}x - \frac{2}{3} * \mathbf{12} = \frac{1}{4} * \mathbf{12}$$

$$\frac{12}{2}x - \frac{24}{3} = \frac{12}{4}$$

- Multiply every fraction by the LCM

$$6x - 8 = 3$$

- Remember the multiplication is with the numerator only

$$6x - 8 + 8 = 3 + 8$$

- Add 8 to both sides of the equation

$$6x = 11$$

- Simplify the fractions

$$\frac{6x}{6} = \frac{11}{6}$$

- Divide both sides by 6

$$x = \frac{11}{6}$$

Use the Addition and Subtraction Principle. ISOLATE THE VARIABLE, show steps.

1. $w + 6 = 7$

$-6 \quad -6$

$\boxed{w = 1}$

2. $x + 12 = -4$

$-12 \quad -12$

$\boxed{w = -16}$

3. $t - 7 = -4$

$+7 \quad +7$

$\boxed{t = 3}$

4. $t + 3 = -3$

$-3 \quad -3$

$\boxed{t = -6}$

5. $k - 12 = -8$

$+12 \quad +12$

$\boxed{k = 4}$

6. $w - 7 = -8$

$+7 \quad +7$

$\boxed{w = -1}$

7. $z - (-13) = 5$

$z + 13 = 5$

$-13 \quad -13$

$\boxed{z = -8}$

8. $-12 - j = 7$

$+j \quad +j$

$-12 = 7 + j$

$-7 \quad -7$

$\boxed{-19 = j}$

9. $r - (-7) = 12$

$r + 7 = 12$

$-7 \quad -7$

$\boxed{r = 5}$

10. $12 - l = -4$

$+l \quad +l$

$12 = -4 + l$

$+4 \quad +4$

$\boxed{16 = l}$

11. $15 - r = 12$

$+r \quad +r$

$15 = 12 + r$

$-12 \quad -12$

$\boxed{3 = r}$

12. $x + 23 = -7$

$-23 \quad -23$

$\boxed{x = -30}$

13. $j + 11 = -4$

$-11 \quad -11$

$\boxed{j = -15}$

14. $16 + f = -17$

$-16 \quad -16$

$\boxed{f = -33}$

15. $j + 3 = -11$

$-3 \quad -3$

$\boxed{j = -14}$

Use the Multiplication and Division Principle. ISOLATE THE VARIABLE, show steps.

16. $\frac{3x}{3} = \frac{-15}{3}$

$\boxed{x = -5}$

17. $\frac{2x}{2} = \frac{36}{2}$

$\boxed{x = 18}$

18. $\frac{4t}{4} = \frac{-11}{4}$

$\boxed{t = -11/4}$

19. $\frac{-3t}{-3} = \frac{-7}{-3}$

$\boxed{t = 7/3}$

20. $\frac{-4r}{-4} = \frac{144}{-4}$

$\boxed{r = -36}$

21. $\frac{-12m}{-12} = \frac{120}{-12}$

$\boxed{m = -10}$

22. $\frac{3t}{3} = \frac{-22}{3}$

$\boxed{t = -22/3}$

23. $\frac{-x}{-1} = \frac{-6}{-1}$

$\boxed{x = 6}$

24. $\frac{7h}{7} = \frac{-3}{7}$

$\boxed{h = -3/7}$

25. $7 \cdot \frac{z}{7} = -9 \cdot 7$

$\boxed{z = -63}$

26. $6 \cdot \frac{k}{6} = -3 \cdot 6$

$\boxed{k = -18}$

27. $8 \cdot \frac{t}{8} = 12 \cdot 8$

$\boxed{t = 96}$

28. $3 \cdot \frac{r}{3} = -6 \cdot 3$

$\boxed{r = -18}$

29. $-4 \cdot \frac{j}{-4} = -1(-4)$

$\boxed{j = 4}$

30. $6 \cdot \frac{r}{6} = 14 \cdot 6$

$\boxed{r = 84}$

31. $-2 \cdot \frac{t}{-2} = 7 \cdot -2$

$\boxed{t = -14}$

32. $7 \cdot \frac{a}{7} = 0 \cdot 7$

$\boxed{a = 0}$

33. $-7 \cdot -\frac{w}{7} = -5 \cdot -7$

$\boxed{w = 35}$

Use two-step processes to solve the following

34. $3x - 12 = 3$

$+12 \quad +12$

$\frac{3x}{3} = \frac{15}{3}$

$\boxed{x = 5}$

35. $-2x + 9 = -4$

$-9 \quad -9$

$\frac{-2x}{-2} = \frac{-13}{-2}$

$\boxed{x = \frac{13}{2}}$

36. $-4r - 7 = -9$

$+7 \quad +7$

$\frac{-4r}{-4} = \frac{-2}{-4}$

$\boxed{r = \frac{1}{2}}$

37. $-6x + 8 = -12$
$-8 \quad -8$
$\frac{-6x}{-6} = \frac{-20}{-6}$
$\boxed{x = \frac{10}{3}}$

38. $3x - 6 = -12$
$+6 \quad +6$
$\frac{3x}{3} = \frac{-6}{3}$
$\boxed{x = -2}$

39. $2x + 3 = -4$
$-3 \quad -3$
$\frac{2x}{2} = \frac{-7}{2}$
$\boxed{x = -7/2}$

40. $-2r - 8 = 19$
$+8 \quad +8$
$\frac{-2r}{-2} = \frac{27}{-2}$
$\boxed{r = -\frac{27}{2}}$

41. $6x + 13 = -5$
$-13 \quad -13$
$\frac{6x}{6} = \frac{-18}{6}$
$\boxed{x = -3}$

42. $12x - 48 = 16$
$+48 \quad +48$
$\frac{12x}{12} = \frac{64}{12}$
$x = \frac{64}{12} = \boxed{\frac{16}{3}}$

43. $-7q - 4 = 9$
$+4 \quad +4$
$\frac{-7q}{-7} = \frac{13}{-7}$
$\boxed{q = -\frac{13}{7}}$

44. $-3r + 12 = -7$
$-12 \quad -12$
$\frac{-3r}{-3} = \frac{-19}{-3}$
$\boxed{r = 19/3}$

45. $-x - 4 = 13$
$+4 \quad +4$
$-x = 17$
$\boxed{x = -17}$

46. $\frac{3}{2} \cdot \frac{2}{3}x = 7 \cdot \frac{3}{2}$
$\boxed{x = \frac{21}{2}}$

47. $\frac{-5}{2} \cdot \frac{-2}{5}x = -4\left(\frac{-5}{2}\right)$
$x = \frac{20}{2} = \boxed{10}$

48. $r \cdot \frac{2}{r} = 8 \cdot r$
$\frac{2}{8} = \frac{8r}{8}$
$\boxed{\frac{1}{4} = r}$

49. $\left(-\frac{7}{3}\right) - \frac{3}{7}x = -2\left(-\frac{7}{3}\right)$
$\boxed{x = \frac{14}{3}}$

50. $\left(\frac{7}{6}\right) - \frac{6}{7}x = 1\left(-\frac{7}{6}\right)$
$\boxed{x = -\frac{7}{6}}$

51. $\frac{5}{2} \cdot \frac{2}{5}t = 15 \cdot \frac{5}{2}$
$\boxed{t = \frac{75}{2}}$

Combine the Like Terms

52. $5\ Apple + 3\ Apples =$

8 Apples

53. $3\ Bananas - 8\ Bananas =$

−5 Bananas

54. $7\ Cookies + 1\ Cookies =$

8 Cookies

55. $3x + 7x =$

$\boxed{10x}$

56. $5x^2 - 26 =$

$\boxed{5x^2 - 26}$

57. $2x - 12x =$

$\boxed{-10x}$

58. $-2x + 8x =$

$\boxed{6x}$

59. $-5x^2 - 17x^2 =$

$\boxed{-22x^2}$

60. $-4x^2 + 5x - 5x =$

$\boxed{-4x^2}$

61. $-3xy - 11xy =$

$\boxed{-14xy}$

62. $2t^2 - 4r^2 + 3t^2 - r^2 =$

$\boxed{5t^2 - 5r^2}$

63. $3r - 5r + 8r =$

$\boxed{6r}$

Combine the LIKE TERMS and solve for the variable.

64. $14x - 7 - 2x + 8 = -11$

$12x + 1 = -11$

$12x = -12$

$\boxed{x = -1}$

65. $-4r + 6 + 3r - 5 = -2r + 8$

$-r + 1 = -2r + 8$

$+2r \qquad +2r$

$r + 1 = 8$

$-1 \quad -1$

$\boxed{r = 7}$

66. $9k - 3 + 7 - 4k = k - 12 + 2k - 4$

$5k + 4 = 3k - 16$

$-3k \qquad -3k$

$2k + 4 = -16$

$-4 \quad -4$

$2k = -20$

$\boxed{k = -10}$

67. $-8t - 3 + 5t + 5 = 2t - 9$

$-3t + 2 = 2t - 9$

$+3t \qquad +3t$

$2 = 5t - 9$

$+9 \qquad +9$

$11 = 5t \rightarrow \boxed{\frac{11}{5} = t}$

68. $5z + 12 - 6z = -z + 4$

$-z + 12 = -z + 4$
$+z \qquad +z$

$12 = 4$

$\boxed{\text{NO SOLUTION}}$

69. $5 - 3s + 6 = 4s - 4$

$-3s + 11 = 4s - 4$
$-4s \qquad -4s$

$-7s + 11 = -4$
$-11 \quad -11$

$-7s = -15$

$\boxed{s = \frac{15}{7}}$

70. $2x + 3 + 4x = 7 + 2x - 4 + 4x$

$6x + 3 = 3 + 6x$

Equal

Infinite Solutions

71. $-2t + 6 = -2t - 6$
$+2t \qquad +2t$

$6 = -6$

$\boxed{\text{NO SOLUTIONS}}$

72. $4t + 7 = -4t - 8$
$+4t \qquad +4t$

$8t + 7 = -8$
$-7 \quad -7$

$8t = -15$

$\boxed{t = \frac{-15}{8}}$

73. $3f + 7 - 8f = 5 + 3f$

$-5f + 7 = 5 + 3f$
$+5f \qquad +5f$

$7 = 5 + 8f$

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

$\boxed{\frac{1}{4} = f}$

Eliminate the Brackets (WATERBOMB) – Distributive Property – Then solve for the unknown

74. $3(x + 4) = 12$

$3x + 12 = 12$

$3x = 0$

$\boxed{x = 0}$

75. $-(s - 7) = -11$

$-s + 7 = -11$
$-7 \quad -7$

$-s = -18$

$\boxed{s = 18}$

76. $-4(t+2) = 2(t-3)$

$-4t - 8 = 2t - 6$
$-2t \qquad -2t$
$-6t - 8 = -6$
$+8 \qquad +8$
$-6t = 2$

$t = -2/6$

$\boxed{t = -\frac{1}{3}}$

77. $5(6-z) = 3(z-4)$

$30 - 5z = 3z - 12$
$-3z \qquad -3z$
$30 - 8z = -12$
$-30 \qquad -30$
$-8z = -42$

$z = 42/8$

$\boxed{z = 21/4}$

78. $2(-4t+54) = -3(-t-5)$

$-8t + 108 = 3t + 15$
$-3t \qquad -3t$
$-11t + 108 = 15$
$-108 \qquad -108$
$-11t = -93$

$\boxed{t = \frac{93}{11}}$

79. $-3(3q-4) = 2(4q-5)$

$-9q + 12 = 8q - 10$
$+9q \qquad 8q$
$12 = 17q - 10$
$+10 \qquad +10$
$22 = 17q$

$\boxed{q = \frac{22}{17}}$

80. $3(4r+3) = 5(-2r-6) + 2$

$12r + 9 = -10r - 30 + 2$

$12r + 9 = -10r - 28$
$-12r \; +28 \qquad -12r \; +28$

$37 = -22r$

$\boxed{r = -\frac{37}{22}}$

81. $-8(3t-12) = 12t$

$-24t + 96 = 12t$
$+24t \qquad +24t$

$96 = 36t$

$t = 96/36 = \boxed{\frac{8}{3}}$

Eliminate the fractions, using LCM, then solve for the unknown.

82. $\left(\frac{5t}{6} + \frac{1}{3} = \frac{1}{2}\right)^{6}$

$5t + 2 = 3$

$5t = 1$

$\boxed{t = \frac{1}{5}}$

83. $\left(\frac{7}{8}x - \frac{3}{16} + \frac{3}{4}x = \frac{1}{4} + x\right)^{16}$

$14x - 3 + 12x = 4 + 16x$

$26x - 3 = 4 + 16x$
$-16x \qquad -16x$
$10x - 3 = 4$

$10x = 7$

$\boxed{x = \frac{7}{10}}$

84. $\left(\frac{2}{3}x - \frac{1}{4}x = \frac{1}{2}x + 2\right)$ 12

$8x - 3x = 6x + 24$

$5x = 6x + 24$
$-6x \quad -6x$

$-x = 24$

$\boxed{x = -24}$

85. $\left(\frac{7}{2}q - 2q = -\frac{9}{2}q + \frac{7}{2} + \frac{5}{2}q\right)$ 2

$7q - 4q = -9q + 7 + 5q$

$3q = 7 - 4q$

$7q = 7$ $\boxed{q = 1}$

86. $\left(1 + \frac{2}{5}y = \frac{2}{3}y + \frac{7}{5}\right)$ 15

$15 + 6y = 10y + 21$
$-21 \quad -6y \quad -6y \quad -21$

$15 - 21 = 10y - 6y$

$-6 = 4y$

$y = -6/4 = \boxed{-3/2}$

87. $\left(-\frac{4}{5}x - \frac{1}{2}x = -\frac{3}{10}x + 4\right)$ 10

$-8x - 5x = -3x + 40$

$-13x = -3x + 40$
$+3x \quad +3x$

$-10x = 40$

$\boxed{x = -4}$

Eliminate the decimals, using factors of 10, solve for the unknown.

88. $(0.02k = 0.8)$ 100

$2k = 80$

$\boxed{k = 40}$

89. $(0.02x + 0.22x = 0.84)$ 100

$2x + 22x = 84$

$24x = 84$ $\rightarrow$ $x = \frac{84}{24}$

$\boxed{x = 21/6}$

90. $(1.05y - 2.8 = 5.6)$ 100

$105y - 280 = 560$

$105y = 840$

$y = \frac{840}{105} = \boxed{8}$

91. $(3.4 + 10 - 1.62w = 0.4w + 4.68)$ 100

$340 + 1000 - 162w = 40w + 468$

$1340 - 162w = 40w + 468$
$-468 \quad +162w \quad +162w \quad -468$

$872 = 202w$ $w = \frac{872}{202} = \boxed{\frac{\cancel{463}\ 436}{101}}$

92. $(0.6 + 0.8x = 0.4 - 0.5x)$ 10

$6 + 8x = 4 - 5x$

$13x = -2$

$\boxed{x = -\frac{2}{13}}$

93. $(0.02 - 0.25x = 0.05 - 0.25x)$ 100

$2 - 25x = 5 - 25x$

$2 = 5$ $\boxed{\text{NO SOLUTION}}$

94. $(-0.6x - 0.01 = -0.02x + 0.29)$ 100

$-60x - 1 = -2x + 29$

$-58x = 30$

$x = -\frac{30}{58} = \boxed{-\frac{15}{29}}$

95. $(1.05 + 0.62x = 0.85 + 0.22x)$ 100

$105 + 62x = 85 + 22x$

$40x = -20$

$x = -\frac{20}{40}$ $\boxed{x = -\frac{1}{2}}$

Solve for the unknown

96. $\left[\frac{1}{3}(4x - 2) + \frac{1}{2}(3 - 4x) = \frac{1}{4}(-3x - 2)\right]$ 12

$4(4x-2) + 6(3-4x) = 3(-3x-2)$

$16x - 8 + 18 - 24x = -9x - 6$

$-8x + 10 = -9x - 6$
$+9x \qquad +9x$

$x + 10 = -6$

$\boxed{x = -16}$

97. $-\frac{2}{3}\left(\frac{7}{8}-\frac{x}{4}\right)-\frac{3}{8}=\frac{5}{8}$

$\left[-\frac{14}{24}+\frac{2x}{12}-\frac{3}{8}=\frac{5}{8}\right]^{24}$

$-14+4x-9=15$

$4x-23=15$

$4x=38$

$x=\frac{38}{4}=\boxed{\frac{19}{2}}$

98. $-\frac{1}{4}(8x+4)+17=\frac{1}{2}(4x-8)$

$-1(8x+4)+68=2(4x-8)$

$-8x-4+68=8x-16$

$-8x+64=8x-16$

$-16x=-80$

$x=\frac{80}{16}=\boxed{5}$

99. $0.25(8y-4)-17=0.5(4y+8)$

$25(8y-4)-1700=50(4y+8)$

$200y-100-1700=200y+400$

$-1800=400$

$\boxed{\text{NO SOLUTION}}$

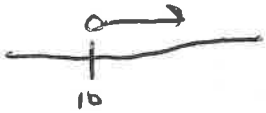
Solve the Inequalities, graph the results by hand on a number line

- **Remember to flip the inequality when you multiply or divide the equation by a negative!**

100. $x - 3 > 7$

$+3 \quad +3$

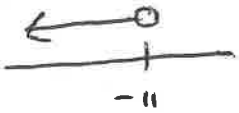
$\boxed{x > 10}$



101. $t + 7 < -4$

$-7 \quad -7$

$\boxed{t < -11}$



102. $\frac{3x}{3} \leq \frac{-12}{3}$

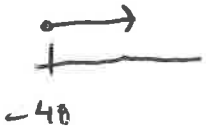
$\boxed{x \leq -4}$

103. $\frac{-5q}{-5} \geq \frac{-13}{-5}$

$\boxed{q \leq 13/5}$ Flip

104. $-\frac{x}{4} \leq 12$ (-4

$\boxed{x \geq -48}$

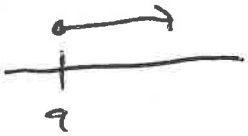


105. $3(d - 4) \geq 15$

$3d - 12 \geq 15$

$3d \geq 27$

$\boxed{d \geq 9}$



106. $\left(\frac{2}{3}t - \frac{1}{4} < -2\right)^{12}$

$8t - 3 < -24$

$8t < -21$

$\boxed{t < -21/8}$

107. $(0.8z + 0.4z \geq 1.2)^{10}$

$8z + 4z \geq 12$

$12z \geq 12$

$z \geq 1$

108. $-\frac{2}{3}\left(\frac{1}{4}-\frac{1}{6}t\right) \geq -\frac{1}{3}$

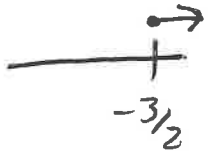
$-2\left(\frac{1}{4}-\frac{1}{6}t\right) \geq -1$

$\left(-\frac{2}{4}+\frac{2}{6}t \geq -1\right)^{12}$

$-6+4t \geq -12$

$4t \geq -6$

$t \geq -\frac{6}{4}$ $\quad t \geq -\frac{3}{2}$



109. $\left(\frac{1}{2}\left(\frac{2}{3}+\frac{4}{7}t\right) \geq -\frac{1}{3}\right)^{6}$

$3\left(\frac{2}{3}+\frac{4}{7}t\right) \geq -2$

$\frac{6}{3}+\frac{12}{7}t \geq -2$

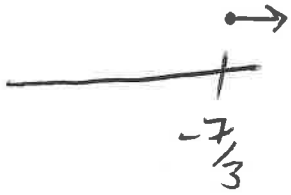
$\left(2+\frac{12}{7}t \geq -2\right)^{7}$

$14+12t \geq -14$

$12t \geq -28$

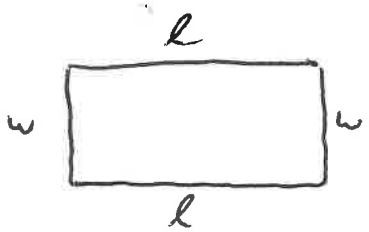
$t \geq \frac{-28}{12}$

$\boxed{t \geq -\frac{7}{3}}$



Word Problems

110. The perimeter of a rectangle in $28cm$. The length is $2cm$ less than three times the width. Determine the length and width.



$\ell = 3w - 2$

w

$2\ell + 2w = P$

$2(3w-2) + 2w = 28$

$6w - 4 + 2w = 28$

$8w = 32$

$w = \boxed{4}$

$\ell = 3(4) - 2 = \boxed{10}$

111. Ellie is 6 and her dad is 37. How long will it be before her dad is twice as old as she is?

$37 + x = (6+x)2$

$37 + x = 12 + 2x$

$25 = x$

$\boxed{25 \text{ years}}$

in 25 years Ellie will be 31 ✓
Dad will be 62

112. Two numbers differ by 5. Three less than four times the smaller number minus three times the greater number is 11. Find the numbers.

$x - y = 5$

smaller

$x = 5 + y$

$(4y - 3) - 3x = 11$

$(4y - 3) - 3(5 + y) = 11$

$4y - 3 - 15 - 3y = 11$

$y - 18 = 11$

$\boxed{y = 29}$

$\boxed{x = 34}$

113. The second angle of a triangle is twice the measure of the first angle. The third angle is 12° more than the measure of the first angle. Find the three angles.

Angle add to 180°

$1^{st} = x$

$2^{nd} = 2x$

$3^{rd} = x + 12$

$x + 2x + x + 12 = 180$

$4x + 12 = 180$

$4x = 168$

$x = \frac{168}{4}$

$\boxed{x = 42°}$

$\boxed{2^{nd} = 84°}$

$\boxed{3^{rd} = 54°}$

114. One number is 14 greater the another number. When the smaller number is subtracted from twice the larger number the difference is 97. Find each number.

$x = y + 14$

smaller

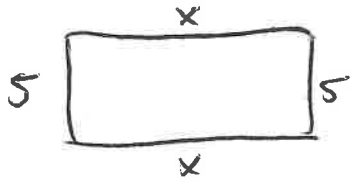
$2x - y = 97$

$2(y + 14) - y = 97$

$2y + 28 - y = 97$

$\boxed{y = 69}$ $\boxed{x = 83}$

115. The width of a rectangle is five centimeters. What length will make the perimeter at least 30 centimeters (inequality).



$P \geq 30$

$10 + 2x \geq 30$

$2x \geq 20$

$\boxed{x \geq 10}$