

Math 109 - Review 1

Name key Score _____

These problems may help you review for Test 1. They are coded to match the course objectives from your syllabus. Your actual test will not be as long as this review packet. Unless otherwise indicated, you should simplify all answers by reducing fractions, simplifying radicals, and/or rationalizing denominators (as you've done on your ALEKS homework).

Objective: Recognize a single-variable equation as linear and solve it. (3)

1. Which one of these equations is NOT linear?

$$3x - 2 = 3x - 7, \quad 8(x + 2) = 7(x = 5) + x, \quad \frac{x}{5} + \frac{3}{7} = x, \quad 5x + \frac{5}{x} = 5$$

THE X IN THE DENOM.
IS THE PROBLEM

2. Solve for y : $3.5y - 10.4 = 1.5(y + 4)$

$$3.5y - 10.4 = 1.5y + 6$$

$$2y = 16.4 \rightarrow y = 8.2$$

3. Solve for r : $\frac{r}{3} - \frac{1}{2} = -4$

Mult by 6...

$$2r - 3 = -24$$

$$2r = -21$$

$$r = \frac{-21}{2}$$

4. Solve for z : $\frac{12 - 6z}{3} = 8$

$$12 - 6z = 24$$

$$-6z = 12$$

$$z = -2$$

5. Solve for x : $2.1(x - 3) - 1.1 = 4(1.5 - 0.9x) + 3$

$$2.1x - 6.3 - 1.1 = 6 - 3.6x + 3$$

$$2.1x - 7.4 = -3.6 + 9$$

$$5.7x = 16.4$$

$$x = \frac{16.4}{5.7}$$

6. Solve for x : $2x + 4 - 3(-2x - 2) = 4(x - 1)$

$$2x + 4 + 6x + 6 = 4x - 4$$

$$8x + 10 = 4x - 4$$

$$4x = -14 \rightarrow$$

$$x = \frac{-14}{4} = -\frac{7}{2}$$

7. Solve for r : $-\frac{7}{4}r - \frac{1}{3} = r - \frac{3}{2}$

MULT BY 12...

$$-21r - 4 = 12r - 18$$

$$14 = 33r \rightarrow$$

$$r = \frac{14}{33}$$

8. Solve for z : $2(z - 3) - 5z = -3(z + 3)$

$$2z - 6 - 5z = -3z - 9$$

$$-3z - 6 = -3z - 9$$

$$-6 = -9$$

CONTRADICTION.

No solution.

9. Solve for w : $4\left(-w + \frac{1}{3}\right) = \frac{4}{3} - 4w$

$$-4w + \frac{4}{3} = \frac{4}{3} - 4w$$

Identity!

All #s ARE SOLUTIONS.

Objective: Translate a problem situation into an equation and solve. (3)

10. Translate the sentence into an equation. Use x for your variable. Do not solve the equation.

$8x$
Three more than eight times a number is ten.

$$8x + 3 = 10$$

11. Translate the sentence into an equation. Use x for your variable. Do not solve the equation.

$5x$
Nine less than five times a number is eight.

$$5x - 9 = 8$$

12. TechWiz Electronics makes a profit of \$35 for each MP3 player sold and \$18 for each DVD player sold. Last week, TechWiz sold a combined total of 136 MP3 and DVD players. Let x be the number of MP3 players TechWiz sold last week. Using the single variable, x , write an expression for the combined total profit (in dollars) TechWiz made from MP3 and DVD players last week.

$x = \# \text{ of MP3 players}$

$136 \text{ TOTAL} \Rightarrow 136 - x = \# \text{ of DVD players}$

$$\text{TOTAL profit} = \text{MP3 profit} + \text{DVD profit} = 35x + 18(136 - x)$$

13. Let m be the middle number of three consecutive integers. Write an expression for the sum of these integers.

$$(m-1) + m + (m+1) \\ = 3m$$

14. Let e be the middle number of three consecutive **even** integers. Write an expression for the sum of these integers.

$$(e-2) + e + (e+2) \\ = 3e$$

Objective: Write inequalities corresponding to problem situations. (3)

15. Write an inequality to represent the problem situation.

Jon cannot spend more than \$50 at the store. Use x to represent the amount (in dollars) that Jon can spend.

$$x \leq 50$$

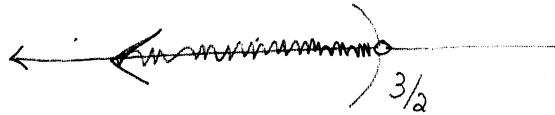
16. Write an inequality to represent the problem situation.

You cannot drive slower than 45 mph and you cannot drive faster than 70 mph on the interstate. Use x to represent the speed (in mph) that you can drive.

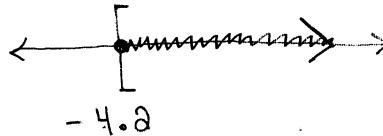
$$45 \leq x \leq 70$$

Objective: Write an interval using inequalities and graph it. (3)

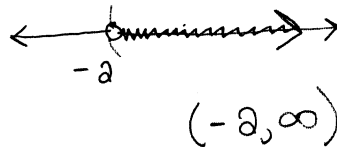
17. Graph the inequality on a number line: $x < 3/2$



18. Graph the inequality on a number line: $y \geq -4.2$



19. All points to the right of $x = -2$ (but not the point at $x = -2$) are shaded on a number line. What inequality is described by that graph?



$$x > -2$$

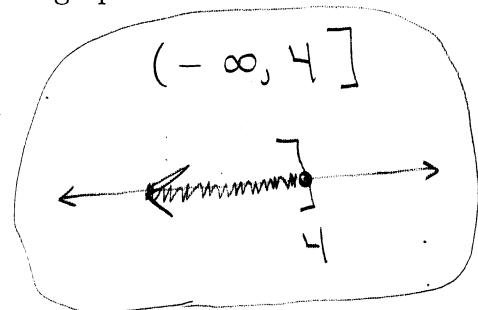
20. What inequality describes the set of all x -values in the interval $(-\infty, 5]$?

$$x \leq 5$$

Objective: Solve linear inequalities. (3)

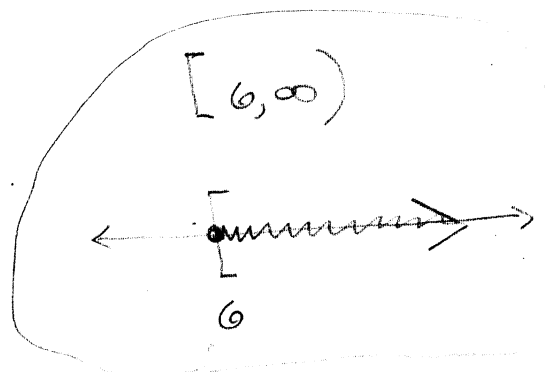
21. Solve for z . Write your solution set in interval notation, and graph it on a number line.

$$\begin{aligned} -3z - 9 &\geq -21 \\ -3z &\geq -12 \\ z &\leq 4 \end{aligned}$$



22. Solve for x . Write your solution set in interval notation, and graph it on a number line.

$$\begin{aligned} 5x - 6 &\leq 9x - 30 \\ 24 &\leq 4x \\ 6 &\leq x \\ x &\geq 6 \end{aligned}$$



23. Solve for y . Write your solution set in interval notation, and graph it on a number line.

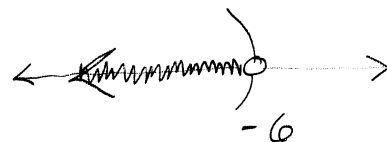
$$9y - 22 > -2(2 - 6y)$$

$$9y - 22 > -4 + 12y$$

$$-18 > 3y$$

$$-6 > y$$

$$y < -6$$



$$(-\infty, -6)$$

24. Solve for w : $4(5w + 3) \leq 20w + 12$

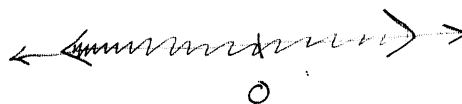
$$20w + 12 \leq 20w + 12$$

SAME!

ALWAYS TRUE!

All #'s ARE SOLUTIONS.

$$(-\infty, \infty)$$



25. Solve for w : $-2(w + 7) + 29 < 2(6 - w)$

$$-2w - 14 + 29 < 12 - 2w$$

$$15 < 12$$

Never!

No solution

$$\emptyset$$

26. Solve for k . Write your solution set in interval notation, and graph it on a number line.

$$3(k - 4) + 2k > 3 \quad \text{or} \quad 7 - 2k \geq 13$$

$$3k - 12 + 2k > 3$$

$$-2k \geq 6$$

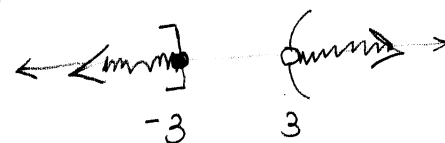
$$5k > 15$$

$$k \leq -3$$

$$k > 3$$

or

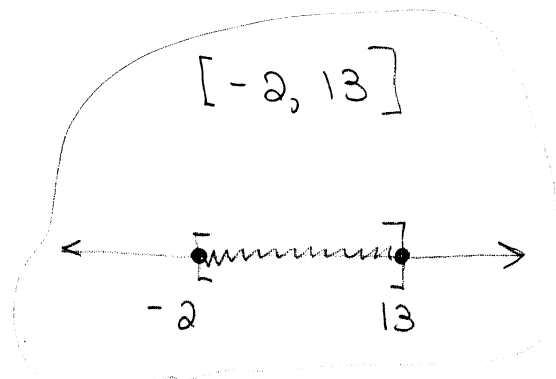
$$(-\infty, -3] \cup (3, \infty)$$



$$(3, \infty) \cup (-\infty, -3]$$

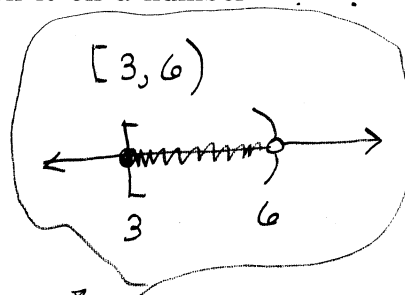
27. Solve for y . Write your solution set in interval notation, and graph it on a number line.

$$\begin{aligned} -4 &\leq \frac{2y-8}{3} \leq 6 \\ -12 &\leq 2y-8 \leq 18 \\ -4 &\leq 2y \leq 26 \\ -2 &\leq y \leq 13 \end{aligned}$$



28. Solve for u . Write your solution set in interval notation, and graph it on a number line.

$$\begin{aligned} 2(u+2)-3 &< u+7 \quad \text{and} \quad 7-2u \leq 1 \\ 2u+4-3 &< u+7 \quad \& \quad 7 \leq 1+2u \\ 2u+1 &< u+7 \quad \& \quad 6 \leq 2u \\ u &< 6 \quad \text{AND} \quad 3 \leq u \end{aligned}$$



$$u < 6 \quad \text{AND} \quad u \geq 3$$

Objective: Solve application problems involving linear inequalities. (3)

29. It cost Steve \$85 to make a bunch of mango salsa. He intends to sell jars of his salsa at a farmer's market for \$6.50 each. How many jars must he sell in order to make a profit of at least \$150?

To cover costs, STEVE MUST BRING IN $85+150 = 235$.

LET $x = \#$ OF JARS HE MUST SELL

$$6.5x \geq 235$$

$$x \geq \frac{235}{6.5} \approx 36.15$$

\Rightarrow 37 or more JARS

30. That big turkey on campus needs more than 35 grams of protein per day. It gets 15 grams by eating grains and nuts, and it plans to eat crickets to get the rest. Each cricket has about 0.5 grams of protein. Let x be the number of crickets that the turkey must eat. Write an inequality involving x that describes the turkey's protein requirements. You need not solve the inequality.

$$0.5x + 15 > 35$$

OR $0.5x > 20$

Objective: Recognize an expression as rational. (9)

31. Which one of these equations IS NOT rational?

$$x + \frac{3}{x} = 5x^2 + \frac{1}{x^2}, \quad \frac{8(x+2)}{5} = \frac{x-5}{x+3}, \quad \boxed{\frac{x}{5} + \frac{3}{7} = \sqrt{x}}, \quad 5x + \frac{5}{x} = 5$$

\sqrt{x} IS THE PROBLEM.

32. Which one of these equations IS rational?

$$\sqrt{x-7} = 49, \quad \boxed{1 + \frac{x+2}{x+3} = \frac{x-5}{x-3}}, \quad x^{5/3} = 2, \quad \sqrt[5]{2x+1} = -4$$

Objective: Determine the values of the variable that are restricted from a rational expression. (1,9)

33. Determine the value of r that is restricted from the following expression: $\frac{2r-4}{7r+14}$

$$7r+14=0$$

$$r = -2$$

34. Determine the values of w that are restricted from the following expression:

$$\frac{w}{w^2-2w-3}$$

$$w^2-2w-3=0$$

$$(w-3)(w+1)=0$$

$$w=3 \text{ or } w=-1$$

35. Determine the values of x that are restricted from the following expression:

$$\frac{x^2-1}{x(3x-2)(x+1)}$$

$$\text{Denom} = 0 \Rightarrow$$

$$x=0, x=\frac{2}{3},$$

$$\text{or } x=-1$$

36. Which values of x are restricted from being possible solutions? Do not actually solve.

$$4 - \frac{x}{x-1} = \frac{7}{(x-1)(x-13)}$$

$$x=1, x=13$$

Objective: Solve special cases of rational equations that reduce to linear equations. (3,9)

37. Solve for x : $\frac{21}{x} = \frac{30}{x+3}$

$$30x = 21(x+3)$$

$$30x = 21x + 63$$

$$9x = 63$$

$$x = 7$$

38. Solve for v : $4 + \frac{7}{v-7} = \frac{v}{v-7}$

$$4(v-7) + 7 = v$$

$$4v - 28 + 7 = v$$

$$3v = 21$$

$$v = 7, \text{ but } 7 \text{ is a}$$

RESTRICTED VALUE.

No solution

39. Solve for x : $\frac{x+8}{x+3} = \frac{10}{\underbrace{2x+6}_{2(x+3)}}$

Clear fractions by mult by $2(x+3)$...

$$2(x+8) = 10$$

$$2x + 16 = 10$$

$$2x = -6$$

$$x = -3$$

$$\text{But } -3 \text{ is a}$$

RESTRICTED VALUE.

No solution

40. Solve for v : $-\frac{4}{v-2} = \frac{8}{\underbrace{5v-10}_{5(v-2)}} - 3$

Mult by $5(v-2)$...

$$-20 = 8 - 3(5)(v-2)$$

$$-20 = 8 - 15v + 30$$

$$15v = 58$$

$$v = \frac{58}{15}$$

Objective: Solve quadratic equations by factoring. (7)

41. Solve for x : $5x(3x - 1) = 0$

$$5x = 0 \text{ or } 3x - 1 = 0$$

$$x = 0 \text{ or } x = \frac{1}{3}$$

42. Solve for x : $5(x - 7)(5x + 3) = 0$

$$x - 7 = 0 \text{ or } (5x + 3) = 0$$

$$x = 7 \text{ or } x = -\frac{3}{5}$$

43. Solve for x : $3x(x + 8)(x - 2)(4x + 7) = 0$

$$3x = 0 \text{ or } x + 8 = 0 \text{ or } x - 2 = 0 \text{ or } 4x + 7 = 0$$

$$x = 0, x = -8, x = 2, \text{ or } x = -\frac{7}{4}$$

44. Solve for x : $x^2 - 4x = 21$

$$x^2 - 4x - 21 = 0$$

$$(x - 7)(x + 3) = 0$$

$$x = 7 \text{ or } x = -3$$

45. Solve for x : $x^2 - 30 = x$

$$x^2 - x - 30 = 0$$

$$(x - 6)(x + 5) = 0$$

$$x = 6, x = -5$$

46. Solve for x : $6x^2 - 32x - 24 = 0$

$$3x^2 - 16x - 12 = 0$$

$$pq = -36$$

$$p + q = -16$$

$$-18, 2$$

$$3x^2 - 18x + 2x - 12 = 0$$

$$3x(x - 6) + 2(x - 6) = 0$$

$$(3x + 2)(x - 6) = 0$$

$$x = -\frac{2}{3} \text{ or } x = 6$$

Objective: Solve quadratic equations by square roots. (7)

47. Solve for x . Write your solution(s) in exact form, simplified as much as possible.

$$(x-2)^2 = 8$$

$$x-2 = \pm\sqrt{8} = \pm 2\sqrt{2}$$

$$x = 2 \pm 2\sqrt{2}$$

48. Solve for x . Write your solution(s) in exact form, simplified as much as possible.

$$(3x-1)^2 = 9$$

$$3x-1 = \pm 3$$

$$3x = 1 \pm 3$$

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

$$x = \frac{4}{3} \text{ or } x = -\frac{2}{3}$$

49. Solve for x . Write your solution(s) in exact form, simplified as much as possible.

$$(3x-6)^2 - 75 = 0$$

$$3x-6 = \pm\sqrt{75} = \pm 5\sqrt{3}$$

$$3x = 6 \pm 5\sqrt{3}$$

$$x = \frac{6 + 5\sqrt{3}}{3}$$

or

$$x = \frac{6 - 5\sqrt{3}}{3}$$

Objective: Solve quadratic equations by using the quadratic formula. (7)

50. Use the discriminant to determine number of real of the solutions. Do not solve the equation.

$$5x^2 - 13x + 1 = 0$$

$$(-13)^2 - 4(5)(1) = 169 - 20 = 149$$

TWO REAL
SOLUTIONS

51. Use the discriminant to determine number of real of the solutions. Do not solve the equation.

$$x^2 - 4x + 4 = 0$$

$$(-4)^2 - 4(1)(4) = 16 - 16 = 0$$

ONE REAL
SOLUTION

52. Given the quadratic equation $3 - 6x^2 = -13x$, determine the value of the discriminant.

$$6x^2 - 13x - 3 = 0$$

$$(-13)^2 - 4(6)(-3)$$

$$= 169 + 72 = 241$$

53. Suppose you correctly solved a quadratic equation, and you found that it has exactly one real solution. What can you say about the value of the discriminant?

$$\text{Disc} = 0$$

54. Solve for x . Write your solution(s) in exact form, simplified as much as possible.

$$3x^2 - 2x - 7 = 0$$

$$X = \frac{2 \pm \sqrt{4 - 4(3)(-7)}}{2(3)} = \frac{2 \pm \sqrt{88}}{6} = \frac{2 \pm 2\sqrt{22}}{6}$$

$$X = \frac{1 \pm \sqrt{22}}{3}$$

55. Solve for x . Write your solution(s) in exact form, simplified as much as possible.

$$2x^2 - 3x - 4 = 0$$

$$X = \frac{3 \pm \sqrt{9 - 4(2)(-4)}}{2(2)} = \frac{3 \pm \sqrt{41}}{4}$$

$$X = \frac{3 \pm \sqrt{41}}{4}$$

56. Solve for x . Write your answer(s) in decimal form, rounded to the nearest hundredth.

$$5x^2 - x - 3 = 0$$

$$X = \frac{1 \pm \sqrt{1 - 4(5)(-3)}}{2(5)} = \frac{1 \pm \sqrt{61}}{10}$$

$$X = \frac{1 + \sqrt{61}}{10} \approx 0.88 \quad \text{or} \quad X = \frac{1 - \sqrt{61}}{10} \approx -0.68$$

Objective: Solve special cases of rational equations that reduce to linear or quadratic equations. (3,7,9)

57. Solve for x : $\frac{21}{x} = \frac{30}{x+3}$

SAME AS #37

58. The reciprocal of a number, x , is 5 more than twice the number.
Determine the number x .

$$\frac{1}{x} = 2x + 5 \Rightarrow 1 = 2x^2 + 5x$$

$$2x^2 + 5x - 1 = 0$$

$$x = \frac{-5 \pm \sqrt{25 - 4(2)(-1)}}{2(2)} = \frac{-5 \pm \sqrt{33}}{4}$$

59. Solve for v : $4 + \frac{7}{v-7} = \frac{v}{v-7}$

SAME AS #38

60. Solve for x : $\frac{x+8}{x+3} = \frac{10}{2x+6}$

SAME AS #39

61. Solve for v : $-\frac{4}{v-2} = \frac{8}{5v-10} - 3$

SAME AS #40

62. Solve for x : $x + \frac{21}{x} = \frac{57}{x}$

Mult By
 $x \dots$

$$x^2 + 21 = 57$$

$$x^2 = 36$$

$$x = \pm 6$$

63. Solve for u : $\frac{2}{(u-1)(u-2)} = 3 + \frac{2}{u-2}$

Mult By

$(u-1)(u-2) \dots$

$$2 = 3(u-1)(u-2) + 2(u-1)$$

$$2 = 3u^2 - 9u + 6 + 2u - 2$$

$$3u^2 - 7u + 2 = 0$$

$$(3u-1)(u-2) = 0$$

$$u = \frac{1}{3}$$

$$u = 2$$

RESTRICTED

64. Solve for x : $\frac{3}{x-5} + \frac{2}{x^2-25} = \frac{1}{x+5}$

Mult By

$(x-5)(x+5) \dots$

$$3(x+5) + 2 = x-5$$

$$3x + 15 + 2 = x - 5$$

$$2x = -22$$

$$x = -11$$

Objective: Solve equations using odd roots. (9)

65. Solve for x : $(x-7)^3 = 27$

$$x-7 = 3$$

$$x = 10$$

66. Solve for x . Write your solution(s) in exact form, simplified as much as possible.

$$(x-1)^3 - 5 = 11$$

$$(x-1)^3 = 16$$

$$x-1 = \sqrt[3]{16} = 2\sqrt[3]{2}$$

$$x = 1 + 2\sqrt[3]{2}$$

67. Solve for x . Round your answer(s) to the nearest hundredth.

$$(2x)^3 - 25 = 0$$

$$2x = \sqrt[3]{25}$$

$$x = \frac{\sqrt[3]{25}}{2} \approx 1.46$$

68. Solve for x : $(x-3)^5 = -32$

$$x-3 = -2$$

$$x = 1$$

Objective: Solve radical equations. (9)

69. Solve for x : $\sqrt{x-7} = -3$

$$\sqrt{} = \text{NON NEG}$$

No solution

70. Solve for r : $-1 + \sqrt{r-12} = 7$

$$\sqrt{r-12} = 8$$

$$r-12 = 64$$

$$r = 76$$

71. Solve for u : $u = \sqrt{5u+14}$

$$u^2 = 5u+14$$

$$u^2 - 5u - 14 = 0$$

$$(u-7)(u+2) = 0$$

$$u = 7 \text{ or } u = -2$$

72. Solve for w : $\sqrt[4]{w} = -4$

$$\sqrt[4]{} = \text{NON NEG}$$

No solution

Objective: Solve equations involving rational exponents. (9)

73. Solve for w : $w^{1/4} = -5$

$$\sqrt[4]{w} = -5$$

$$\sqrt[4]{} = \text{NON NEG}$$

No solution

74. Solve for r : $r^{1/4} = 3$

$$r = 3^4 = 81$$

75. Solve for u : $(6u + 4)^{1/3} + 3 = 7$

$$(6u + 4)^{1/3} = 4$$

$$6u + 4 = 4^3$$

$$6u = 64 - 4 = 60$$

$$u = 10$$

76. Solve for z : $(z + 2)^{3/2} = 3$

$$z + 2 = 3^{2/3}$$

$$z = -2 + 3^{2/3} = -2 + \sqrt[3]{9}$$

Objective: Solve equations that are quadratic in form. (9)

77. Solve for y : $(y^2 - 4)^2 - 10(y^2 - 4) + 25 = 0$

Let $u = y^2 - 4$, $u^2 - 10u + 25 = 0$

$(u - 5)(u - 5) = 0$

$u = 5$

$y^2 - 4 = 5$

$y^2 = 9$

$y = \pm 3$

78. In order to solve the following equation, what substitution would be most helpful?

$(x^2 - 1)^2 + 5(x^2 - 1) + 6 = 0$

$u = x^2 - 1$

79. Use a substitution to solve for w : $2w^{2/3} = 3w^{1/3} + 20$

$u = w^{1/3}$, $2u^2 - 3u - 20 = 0$

$(2u + 5)(u - 4) = 0$

$u = -\frac{5}{2}$ or $u = 4$

$w = -\frac{125}{8}$, $w = 64$