

ADVANCED ALGEBRA & TRIG HONORS SUMMER WORK

****THE WORK SHOWN IN THIS PACKET IS ONE METHOD. PLEASE USE ANOTHER METHOD IF IT IS MORE COMFORTABLE FOR YOU. You should complete the entire packet with limited calculator usage as the quiz will be a NO Calculator allowed quiz.**

*****PLEASE DO NOT RELY ON PHOTO MATH SINCE THESE SKILLS WILL BE ON A QUIZ!**

YOUR NAME: _____

Directions: The concepts covered in this packet are skills that students should have mastered in your previous Algebra course. If you are drawing a blank, please refer to the problems that have already been completed for you. **THIS WILL BE CHECKED IN ON THE FIRST FULL DAY OF SCHOOL FOR YOUR FIRST HOMEWORK GRADE.** There will be a quiz over these topics on the 3rd or 4th full day of school. The quiz will count as a homework grade as well.

Rationale: The math course you are starting in the fall has some high expectations. It is assumed you can...

- (1) follow order of operations appropriately in all situations
- (2) solve a variety of linear, absolute value, & quadratic equations and some inequalities
- (3) graph basic linear functions
- (4) factor, factor, factor
- (5) simplify square roots/radicals
- (6) follow the rules of exponents
- (7) use and understand basic function notation

To refresh on these topics, you'll need to practice these skills in the weeks leading up to the beginning of the 2023-24 school year.

Resources: For each even numbered problem you need to complete, there is an odd-numbered example problem worked out in detail. If that's not enough to guide your work, then we suggest you google the topic you are struggling with or go to one of the following websites & search the topic...

<https://www.desmos.com>

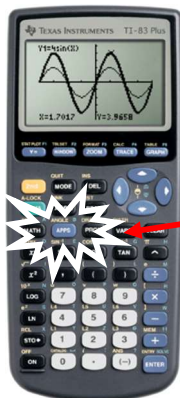
<https://www.khanacademy.org/>

<http://www.purplemath.com/>

<http://www.mathgoodies.com/students.html>

Requirement: A requirement of this course is that you purchase a graphing calculator. Although these can be expensive, we will use it in every chapter to supplement the content that is being learned. Below are *suggested* calculators that are appropriate to use in Advanced Algebra Honors and can be used in subsequent years through college level math courses.

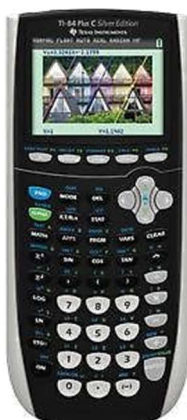
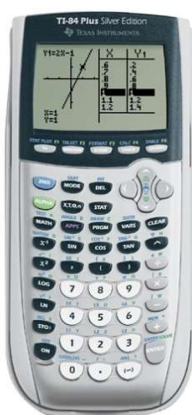
TI - 83+



If you purchase a TI - 83, it needs to be a plus (+) model. You will need the blue/purple “APPS” key.

This is the button we are looking for.

TI - 84/TI - 84+



These calculators come in various models, as they have been updated over the years. ANY TI - 84 is appropriate. It can be a plus (+) model, a C or CE model or a silver edition model. It can also have a black and white screen or a color screen. The most efficient calculators are the newest thinner calculators with a color screen.

It is highly recommended to purchase one of these calculators as soon as possible, as they do sell out quickly at the beginning of the school year. These versions of TI calculators are what will be used in class. It is not recommended that you buy a device that is not listed here. **A limited number of loan calculators are available to check out for the year once the school year begins. Your family must demonstrate a financial need to use the calculator loan program.

Thank you,

Mr. Strzelczyk
Mrs. Zwart

(Willowbrook - Advanced Algebra & Trig Honors Teachers 2023-24)

#1 - 10: Evaluate showing work. (No Calculator)

1. $4 + 3 \cdot 4 \div 2 - 9$ **PEMDAS**

$$\begin{aligned} &4 + 12 \div 2 - 9 \\ &4 + 6 - 9 \\ &10 - 9 \\ &\boxed{1} \end{aligned}$$

2. $18 - 12 \div 6 \cdot 2 - 10$

3. $4 + 3(5 - 6)^2$

$$\begin{aligned} &4 + 3(-1)^2 \\ &4 + 3(1) \\ &4 + 3 = \boxed{7} \end{aligned}$$

4. $20 - (7 + (-9))^2 \cdot 3$

5. $(2x)^2 - y$ when $x = 3$, $y = 17$

$$\begin{aligned} &(2 \cdot 3)^2 - 17 \\ &6^2 - 17 \\ &36 - 17 \\ &\boxed{19} \end{aligned}$$

6. $3x - 4y^3$ when $x = 7$, $y = -1$

7. $\frac{1}{2}(x - 7) - 3x$ when $x = -11$

$$\begin{aligned} &\frac{1}{2}(-11 - 7) - 3(-11) \\ &\frac{1}{2}(-18) - 3(-11) \\ &-9 + 33 \\ &\boxed{24} \end{aligned}$$

8. $b^2 - 4ac$ when $a = 2$, $b = -3$, $c = -1$

9. $\frac{3b - a}{b + a}$ when $a = 3$, $b = -4$

$$\begin{aligned} &\frac{3(-4) - 3}{(-4) + 3} \\ &\frac{-12 - 3}{-1} \\ &\frac{-15}{-1} = \boxed{15} \end{aligned}$$

10. $\frac{4b + 2a}{2b}$ when $a = 3$, $b = -4$

#11 - 18: Simplify each expression showing work. (No Calculator)

11. $x - x^2 + 3x^2 + 5x$

$$\begin{array}{r} -x^2 + x \\ + 3x^2 + 5x \\ \hline 2x^2 + 6x \end{array}$$

12. $4x^2 - 3x + 5x - 6x^2$

13. $6y - 2(3y - 8) + 2y$

$$\begin{array}{r} 6y - 6y + 16 + 2y \\ 2y + 16 \end{array}$$

14. $5m - 3m(m + 2) + 5m^2$

15. $(4 + x)(x - 3)$

$$\begin{array}{r} x^2 + 4x - 3x - 12 \\ x^2 + x - 12 \end{array}$$

16. $(3x - 4)(2x + 1)$

17. $(2 + 3x)^2$

**write it out*

$$\begin{array}{r} (2 + 3x)(2 + 3x) \\ 4 + 6x + 6x + 9x^2 \\ 9x^2 + 12x + 4 \end{array}$$

18. $(2x - 5)^2$

#19 - 40: Solve each equation showing algebraic work. (No Calculator)

19. $4x - 3 = 9$

$$\begin{array}{r} +3 \quad +3 \\ \hline 4x = 12 \\ \frac{4x}{4} = \frac{12}{4} \\ x = 3 \end{array}$$

Use a solution set to show your answer(s) when solving.

$\{3\}$

20. $3 - 5x = 16$

21. $3x - 6 = 5x + 12$

$$\begin{array}{r} -3x \quad -12 \quad -3x \quad -12 \\ \hline -18 = 2x \\ \frac{-18}{2} = \frac{2x}{2} \\ -9 = x \end{array}$$

$\{-9\}$

22. $16 - 8x = 4x + 6$

23. $-3(2x + 5) = 20$

$$\begin{array}{r} -6x - 15 = 20 \\ +15 \quad +15 \\ \hline -6x = 35 \\ \frac{-6x}{-6} = \frac{35}{-6} \\ \{-\frac{35}{6}\} \end{array}$$

$x = -\frac{35}{6}$

Simplified Improper fractions are okay!

24. $4(3x - 7) = -40$

$$25. \quad 2(4-x) = 16+2x$$

$$\begin{array}{r} 8-2x = 16+2x \\ -16+2x \quad -16+2x \\ \hline -8 = 4x \\ \frac{-8}{4} = \frac{4x}{4} \end{array}$$

$$-2 = x \quad \{-2\}$$

$$26. \quad 5x-20 = 6(2x+1)$$

$$27. \quad 4-3(4x+6) = 1$$

$$4-12x-18 = 1$$

$$\begin{array}{r} -12x-14 = 1 \\ +14 \quad +14 \\ \hline -12x = 15 \end{array}$$

$$\begin{array}{r} -12x = 15 \\ -12 \quad -12 \\ \hline x = -\frac{5}{4} \quad \{-\frac{5}{4}\} \end{array}$$

$$28. \quad 18 = 10-2(2x+3)$$

$$29. \quad 5(3x-2)+10 = 2(5-6x)$$

$$\begin{array}{r} 15x-10+10 = 10-12x \\ +12x \quad \quad \quad +12x \\ \hline 27x = 10 \end{array}$$

$$\begin{array}{r} 27x = 10 \\ 27 \quad 27 \\ \hline x = \frac{10}{27} \quad \{\frac{10}{27}\} \end{array}$$

$$30. \quad 20+8(3+4x) = -3(6x-5)$$

$$31. \quad 15\left(\frac{2}{3}m+5 = \frac{2}{5}m-9\right) \quad \begin{array}{l} \text{x multiply} \\ \text{an Equation} \\ \text{to eliminate} \\ \text{fractions.} \end{array}$$

$$\begin{array}{r} 10m+75 = 6m-135 \\ -6m-75 \quad -6m-75 \\ \hline 4m = -210 \end{array}$$

$$\begin{array}{r} 4m = -210 \\ 4 \quad 4 \\ \hline m = -\frac{105}{2} \quad \{-\frac{105}{2}\} \end{array}$$

$$32. \quad 4 - \frac{5}{6}x = \frac{1}{2}x + 2$$

$$33. \quad \text{Solve for } b_1: 2 \cdot A = \frac{h(b_1+b_2)}{2} \cdot 2$$

$$\frac{2A}{h} = \frac{h(b_1+b_2)}{h}$$

$$\begin{array}{r} \frac{2A}{h} = b_1+b_2 \\ -b_2 \end{array}$$

$$\boxed{b_1 = \frac{2A}{h} - b_2}$$

$$34. \quad \text{Solve for } h: A = \frac{h(b_1+b_2)}{2}$$

$$35. |x+3|=5$$

① Isolate !!
② Set up 2 equations

$$|5|=5 \quad |-5|=5$$

$$x+3=5 \text{ or } x+3=-5$$

$$x=2 \quad x=-8$$

$$\{-8, 2\}$$

$$36. |x-6|=12$$

$$37. |3-2x|=13$$

$$3-2x=13 \text{ or } 3-2x=-13$$

$$-2x=10 \quad -2x=-16$$

$$x=-5 \quad x=8$$

$$\{-5, 8\}$$

$$38. 22=|5-4x|$$

$$39. 4|2x-1|+2=22$$

$$4|2x-1|=20$$

$$\{-2, 3\}$$

$$2x-1=5 \text{ or } 2x-1=-5$$

$$2x=6$$

$$x=3$$

$$2x=-4$$

$$x=-2$$

$$41. 3+2|x-6|=13$$

$$2|x-6|=10$$

$$|x-6|=5$$

$$x-6=5 \text{ or } x-6=-5$$

$$x=11$$

$$x=1$$

$$\{1, 11\}$$

$$42. -2|2x+5|-6=22$$

#43-52: Solve and graph on a number line. No Calculator.

$$43. 2x+5 \leq -9$$

\leq or \geq closed point

$$44. 4+3x \geq 19$$

$$2x \leq -14$$

$$x \leq -7$$

$<$ or $>$ open point



$$45. 3-x < 6$$

$$-x < 3$$


$$x > -3$$

If you \times or \div by a negative #, then the $</>$ flips.

$$46. 2-3x \geq 14$$




47. $5x - 6 < 3x + 18$

$$\begin{aligned} 2x &< 24 \\ x &< 12 \end{aligned}$$



48. $3x + 5 > 6x - 12$

49. $5 < 3 + 2x \leq 11$

$$\begin{aligned} -3 & \quad -3 & -3 \\ \frac{2}{2} & < \frac{2x}{2} \leq \frac{8}{2} \\ 1 & < x \leq 4 \end{aligned}$$


50. $19 > 5 - 2x > -7$

51. $4 + 2x < 12$ or $5 - 2x < -11$

$$\begin{aligned} 2x &< 8 \text{ or } -2x < -16 \\ x &< 4 \text{ or } x > 8 \end{aligned}$$


52. $3 - 6x > 15$ or $5x - 3 \geq 12$

#53-64: The following questions are all about lines on the coordinate plane. No Calculator.

53. Find the slope between (3,4) & (-2,5)

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - 4}{-2 - 3} = \frac{1}{-5} \text{ or } \boxed{-\frac{1}{5}}$$

54. Find the slope between (-6,7) & (3,-5)

55. Find the slope between (5,7) & (5,-9)

$$\frac{7 - (-9)}{5 - 5} = \frac{16}{0}$$

*If the 0 is under the line, the value is undefined

Undefined

56. Find the slope between (-4,7) & (8,7)

57. Write the equation of the line in #55

$$x = 5$$

(It is a vertical line)

58. Write the equation of the line in #56

59. Write in slope-intercept form: $y = mx + b$

$$\begin{aligned} 3x - 2y &= 4x - 7 \\ -3x & \quad -3x \\ \hline -2y &= x - 7 \\ \frac{-2y}{-2} &= \frac{x}{-2} - \frac{7}{-2} \end{aligned}$$

$$\boxed{y = -\frac{1}{2}x + \frac{7}{2}}$$

60. Write in slope-intercept form:

$$4y - 6x = 5y - 12$$

#61-62: Determine the slope, then write the coordinates of the x-intercept and y-intercept of the line.

61. $3x + 2y = 12$

Slope
 $\frac{2y}{2} = \frac{-3x+12}{2}$
 $y = -\frac{3}{2}x + 6$
 $m = -\frac{3}{2}$

x-int $*y=0$
 $3x+2(0)=12$
 $3x=12$
 $x=4$
 $(4,0)$

y-int
 $y = -\frac{3}{2}x + 6$
 $(0,6)$

62. $4x - 6y = -20$

#63-64: Determine the slope of the line parallel and the slope of the line perpendicular to the given line.

63. $3x - 2y = 6$

$-2y = -3x + 6$
 $y = \frac{3}{2}x - 3$
 $m = \frac{3}{2}$ $m_{||} = \frac{3}{2}$ $m_{\perp} = -\frac{2}{3}$

64. $5 - 7x - 5y = 7$

#65-84: Factor each expression completely. No Calculator

65. $\frac{21xy}{7x} - \frac{14xz}{7x}$ GCF
 $7x(3y - 2z)$

66. $18a^3 + 4a^2$

67. $\frac{4x^2y^2z}{2xz} + \frac{6xz^2}{2xz}$
 $2xz(2xy^2 + 3z)$

68. $24x^4y^5 - 8x^3y^7 + 4x^2y^8$

69. $x^2 + 6x + 8$ * Guess & check
 $(x+4)(x+2)$
 $\checkmark x^2 + 4x + 2x = 8$

70. $x^2 + 11x + 28$

71. $x^2 - 8x + 12$

$$(x-6)(x-2)$$

$$\checkmark x^2 - 6x - 2x + 12$$

72. $x^2 - 11x + 24$

73. $x^2 - 6x - 16$

$$(x-8)(x+2)$$

$$\checkmark x^2 - 8x + 2x - 16$$

74. $x^2 - 3x - 10$

75. $2x^2 + 7x + 3$

$$(2x+1)(x+3)$$

$$\checkmark 2x^2 + 6x + x + 3$$

76. $3x^2 + 7x + 2$

77. $4x^2 - x - 3$

$$(4x+3)(x-1)$$

$$\checkmark 4x^2 - 4x + 3x - 3$$

78. $4x^2 + 5x - 6$

79. $5x^2 - 125y^2$ ① GCF
 $5(x^2 - 25y^2)$ ② Difference of squares pattern
 $5(x-5y)(x+5y)$

80. $3h^2 - 27m^2$

81. $4x^2 - 9$

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

82. $81y^2 - 49$

83. $4x^2 - 12x + 9$

$$(2x-3)(2x-3)$$

$$(2x-3)^2 \leftarrow \text{write this way when duplicate factors}$$

84. $9x^2 - 30x + 25$

#85-94: Solve each quadratic equation showing algebraic work and exact answers (integers, simplified ratios, or simplified radicals). You may use any appropriate method. Suggested methods: factoring, square root method, or the quadratic formula. If you do not know the quadratic formula, then Google it please. We expect you to know the quadratic formula. No Calculator.

85. $x^2 + 15x + 54 = 0$ **OPTION 1**
 ① = 0 ② Factor
 $(x+9)(x+6) = 0$
 $x+9=0$ $x+6=0$
 $x=-9$ $x=-6$
 $\{-9, -6\}$

OPTION 2: Quad Form
 $x = \frac{-15 \pm \sqrt{(15)^2 - 4(1)(54)}}{2}$
 $x = \frac{-15 \pm \sqrt{9}}{2}$
 $x = \frac{-15 \pm 3}{2}$
 $\{-9, -6\}$

87. $6x^2 + x - 35 = 0$ 88. $12x^2 - 26x + 12 = 0$

$(2x+5)(3x-7) = 0$
 $2x+5=0$ $3x-7=0$
 $x = -\frac{5}{2}$ $x = \frac{7}{3}$
 $\{-\frac{5}{2}, \frac{7}{3}\}$

89. $20x^2 + 19x = 6$ 90. $2x^2 - 2x - 9 = -5$

$20x^2 + 19x - 6 = 0$
 $(4x-1)(5x+6) = 0$
 $4x-1=0$ $5x+6=0$
 $x = \frac{1}{4}$ $x = -\frac{6}{5}$
 $\{-\frac{6}{5}, \frac{1}{4}\}$

91. $4x^2 - 6 = 194$ $\sqrt{\text{method}}$ 92. $2x^2 + 18 = 108$

$4x^2 = 200$
 $\sqrt{x^2 = 50}$ \pm when solving
 $x = \pm 5\sqrt{2}$ by $\sqrt{}$
 $\{\pm 5\sqrt{2}\}$

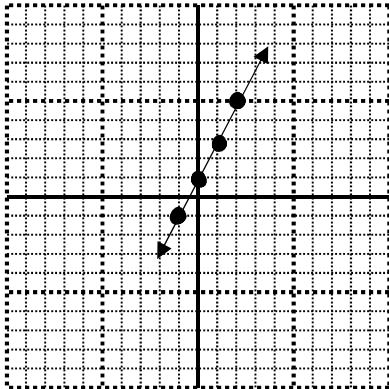
93. $2x^2 - 22 = -4x$ 94. $2x^2 - 8x + 12 = 11$

$2x^2 + 4x - 22 = 0$ \star Not factorable
 $2(x^2 + 2x - 11) = 0$ so use Quad Form.
 $x = \frac{-2 \pm \sqrt{(2)^2 - 4(1)(-11)}}{2}$
 $x = \frac{-2 \pm \sqrt{48}}{2} \rightarrow x = \frac{-2 \pm 4\sqrt{3}}{2} \rightarrow x = -1 \pm 2\sqrt{3}$
 simplify $\{-1 \pm 2\sqrt{3}\}$

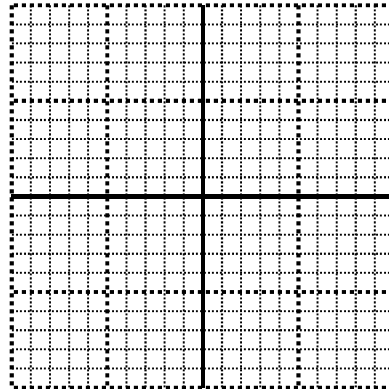
#95-104: Graph each line showing at least 2 points. No Calculator.

95. $y = 2x + 1$

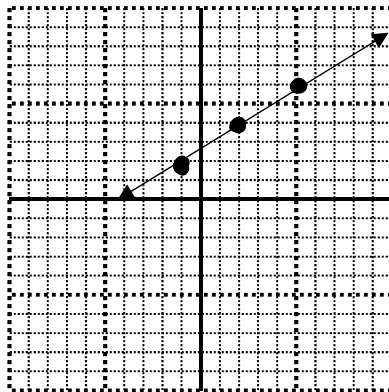
y -int $(0, 1)$
 $m = \frac{2}{1}$



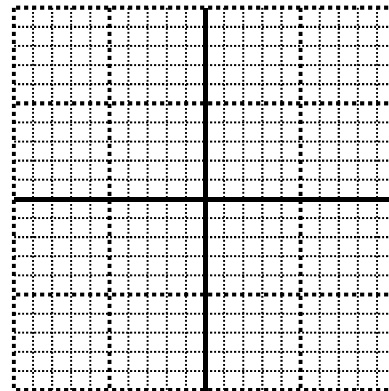
96. $y = -\frac{2}{3}x - 2$



97. $y - 2 = \frac{2}{3}(x + 1)$ start pt $(-1, 2)$
Pt. Slope $y - y_1 = m(x - x_1)$ $m = \frac{2}{3}$

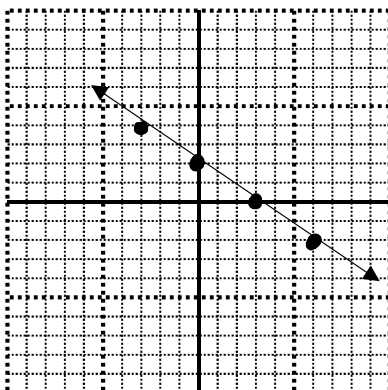


98. $y + 3 = -\frac{3}{4}(x - 4)$

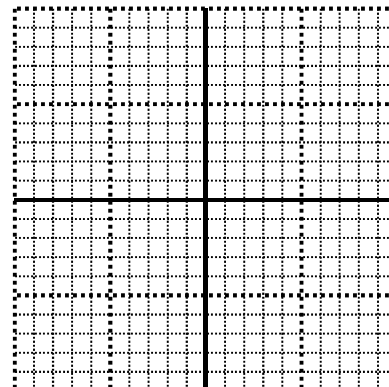


99. $2x + 3y = 6$

$\frac{3y}{3} = \frac{-2x + 6}{3}$ $y = -\frac{2}{3}x + 2$
 y -int $(0, 2)$
 $m = -\frac{2}{3}$

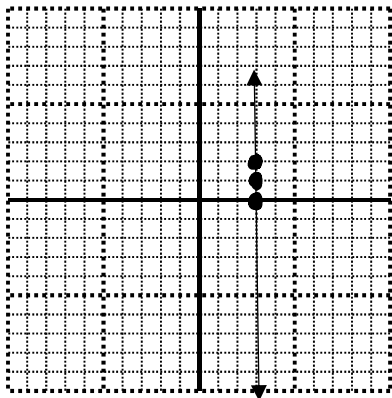


100. $3y + 4x = -12$

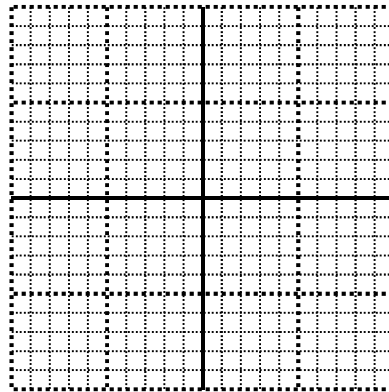


101. $x = 3$

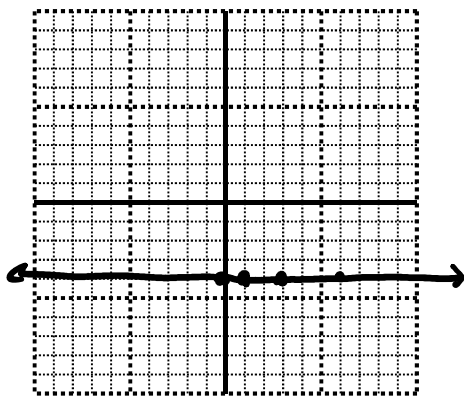
$$\begin{array}{r|l} x & y \\ 3 & 0 \\ 3 & 1 \\ 3 & 2 \end{array}$$



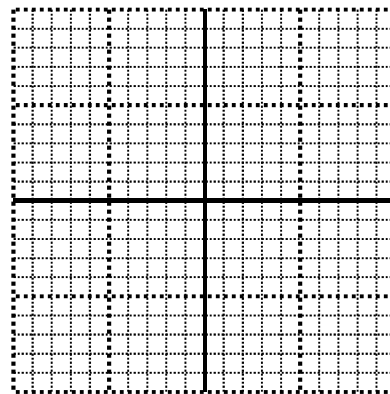
102. $x = -5$



103. $y = -4$ **All coordinates have -4 as y.*



104. $y = 7$



#105 - 110: Simplify the square root. No Calculator.

105. $\sqrt{50}$

$$\sqrt{25 \cdot 2} = 5\sqrt{2}$$

**Look for the largest perfect square that divides into 50.*

106. $\sqrt{98}$

107. $\sqrt{90}$

$$\sqrt{9 \cdot 10} = 3\sqrt{10}$$

108. $\sqrt{132}$

109. $\sqrt{72}$

$$\sqrt{36 \cdot 2} = 6\sqrt{2}$$

110. $\sqrt{675}$

#111-118: Use the properties/rules of exponents to simplify the expression. No Calculator.

111. $3x^2 \cdot 7x^5$

$21x^7$

$x^n \cdot x^m = x^{n+m}$

$(x^n)^m = x^{nm}$

$\frac{x^n}{x^m} = x^{n-m}$

(-) exponent \rightarrow reciprocal

112. $10x^3 \cdot 4x^{-1}$

113. $(x^{-3}y^3)^2$

$\frac{x^{-6}y^6}{x^6} \rightarrow \frac{y^6}{x^6}$
moves here

114. $(x^4y^{-1})^5$

115. $\frac{x^7y^3}{x^5y^6}$

$\rightarrow x^{7-5} y^{3-6} = x^2 y^{-3} = \frac{x^2}{y^3}$

x's win the battle in the numerator.
y's win the battle in the denominator.

116. $\frac{y^3z^6}{yz^2}$

117. $\left(\frac{3a^4b^3}{c^7}\right)^{-2}$

$\rightarrow \frac{3^{-2}a^{-8}b^{-6}}{c^{-14}}$

*All values move due to (-) exponent

$\frac{c^{14}}{3^2a^8b^6} \rightarrow \frac{c^{14}}{9a^8b^6}$

118. $\left(\frac{2a^4b^{-1}}{c^2}\right)^{-3}$

#119-126: Perform the given operations for the functions...

$f(x) = 3x - 5$ $g(x) = -x^2 + 2x - 7$ and $h(x) = -2x + 1$

119. $2f(x) + 3g(x)$

$2(3x-5) + 3(-x^2+2x-7)$
 $6x-10 -3x^2+6x-21$
 $-3x^2+12x-31$

120. $g(x) + 2h(x)$

121. $2h(x) - g(x)$

$2(-2x+1) - (-x^2+2x-7)$
 $-4x+2+x^2-2x+7$
 x^2-6x+9

122. $4g(x) - 3f(x)$

$$f(x) = 3x - 5 \quad g(x) = -x^2 + 2x - 7 \text{ and } h(x) = -2x + 1$$

123. $f(x) \cdot g(x)$ ***Distribute twice**

$$\begin{array}{r} (3x-5)(-x^2+2x-7) \\ -3x^3 + 6x^2 - 21x \\ + 5x^2 - 10x + 35 \\ \hline -3x^3 + 11x^2 - 31x + 35 \end{array}$$

124. $f(x) \cdot h(x)$

125. Evaluate: $f(-3) = 3(-3) - 5$

$$f(-3) = -9 - 5$$

$$f(-3) = \boxed{-14}$$

Let $x = -3$

126. Evaluate: $g(-5)$

KEY to even answers

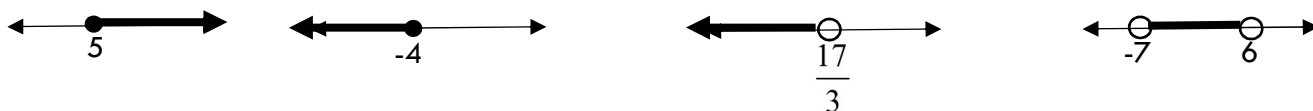
2. 4 4. 8 6. 25 8. 17 10. $\frac{5}{4}$ 12. $-2x^2 + 2x$ 14. $2m^2 - m$

16. $6x^2 - 5x - 4$ 18. $4x^2 - 20x + 25$ 20. $\left\{-\frac{13}{5}\right\}$ 22. $\left\{\frac{5}{6}\right\}$ 24. $\{-1\}$

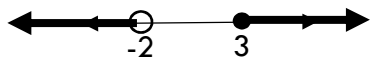
26. $\left\{-\frac{26}{7}\right\}$ 28. $\left\{-\frac{7}{2}\right\}$ 30. $\left\{-\frac{29}{50}\right\}$ 32. $\left\{\frac{3}{2}\right\}$ 34. $h = \frac{2A}{b_1 + b_2}$

36. $\{-6, 18\}$ 38. $\left\{-\frac{17}{4}, \frac{27}{4}\right\}$ 40. $\{-16, 32\}$ 42. No Solution

44. $x \geq 5$ 46. $x \leq -4$ 48. $x < \frac{17}{3}$ 50. $-7 < x < 6$



52. $x < -2$ or $x \geq 3$ 54. $-\frac{4}{3}$ 56. 0 58. $y = 7$ 60. $y = -6x + 12$



62. $m = \frac{2}{3}$ x -int = $(-5, 0)$ y -int = $(0, \frac{10}{3})$ 64. $m \parallel = -\frac{7}{5}$ $m \perp = \frac{5}{7}$

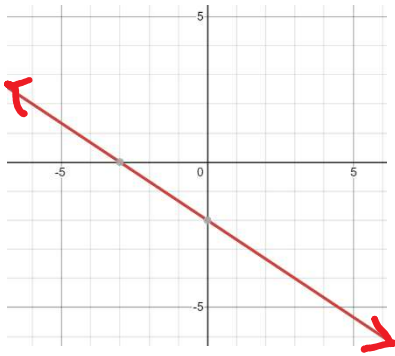
66. $2a^2(9a + 2)$ 68. $4x^2y^5(6x^2 - 2xy^2 + y^3)$ 70. $(x + 7)(x + 4)$ 72. $(x - 8)(x - 3)$

74. $(x - 5)(x + 2)$ 76. $(3x + 1)(x + 2)$ 78. $(4x - 3)(x + 2)$ 80. $3(h + 3m)(h - 3m)$

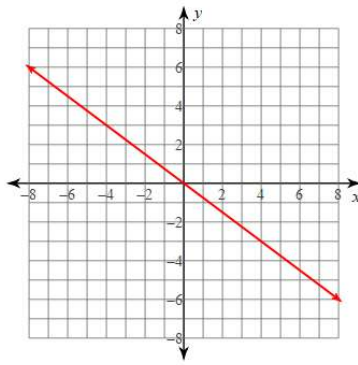
82. $(9y + 7)(9y - 7)$ 84. $(3x - 5)^2$ 86. $\{-11, 6\}$ 88. $\left\{\frac{2}{3}, \frac{3}{2}\right\}$

90. $\{-1, 2\}$ 92. $\{\pm 3\sqrt{5}\}$ 94. $\left\{2 \pm \frac{\sqrt{14}}{2}\right\}$

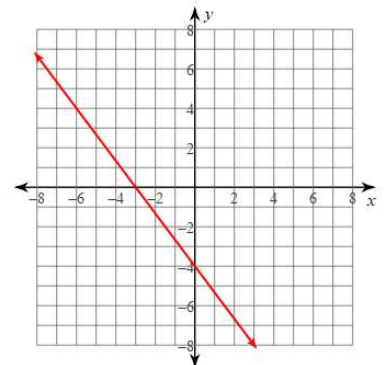
96.



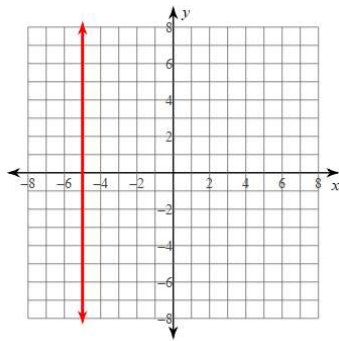
98.



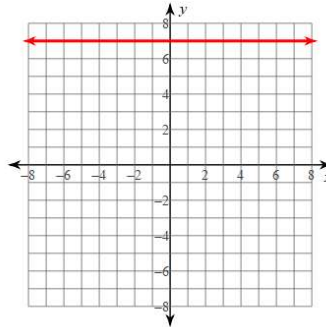
100.



102.



104.

106. $7\sqrt{2}$ 108. $2\sqrt{33}$ 110. $15\sqrt{3}$ 112. $40x^2$ 114. $\frac{x^{20}}{y^5}$ 116. y^2z^4 118. $\frac{b^3c^6}{8a^{12}}$ 120. $-x^2 - 2x - 5$ 122. $-4x^2 - x - 13$ 124. $-6x^2 + 13x - 5$ 126. -42