



BISHOP WATTERSON
HIGH SCHOOL

Algebra I Next Level Advancement Test

Study Guide

The following problems are meant as a guide to help students prepare for the NLAT. The actual test is similar in format and rigor to the semester exams all Algebra I students at Bishop Watterson take each year. Please note that while the questions and format in the study guide will be similar to the actual test, it will NOT be identical. Multiple choice questions could be assessed as free response questions on the actual test and vice versa. The NLAT is a 90-minute exam consisting of 60 questions assessing the topics that would be covered in a traditional Algebra I course. The study guide is meant to give students an overview of the topics, but is not necessarily all inclusive of them. There are both multiple choice questions and free response questions on the NLAT. For free response questions students will be required to show supporting work to receive credit. Guess-and-check methods can be a useful strategy; however, they will not be considered correct supporting work for demonstrating mastery of a topic.

A non-graphing calculator is permitted, such as the TI-30 or TI-36. For students that do not own one, a scientific calculator will be provided on testing day. It is vital that students are able to demonstrate the understanding of these topics without the use of DESMOS or a graphing calculator. While these are important tools to develop mathematical understanding, they are not a substitute for the ability to solve, factor, or graph with pencil and paper. Students who start 9th grade in one of our Geometry levels are on pace to reach AP level math courses by their junior or senior year and a major part of AP tests are taken without a calculator. As a result, students need to have a mastery of these Algebra I topics without the aid of DESMOS or a graphing calculator. Test questions have been created in such a way that they can be solved without a graphing calculator.

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Multiple choice. Choose the letter that best answers each question. You do not need to show work.

- (1). What is the solution to the following system?

$$\begin{aligned} -2x + y &= 5 \\ x + y &= -1 \end{aligned}$$

- (A). $(2, -1)$
(B). $(-1, 2)$
(C). *no solution*
(D). $(-2, 1)$

- (3). If $g(x) = x^2 + x - 1$, find $g(2)$

- (A). 6
(B). 7
(C). 2
(D). 5

- (5). Find the axis of symmetry for the following quadratic equation.

$$x^2 + 6x + 12 = 0$$

- (A). $x = 0$
(B). $y = 0$
(C). $y = -3$
(D). $x = -3$

- (7). Simplify: $5\sqrt{12}$

- (A). $2\sqrt{3}$
(B). $20\sqrt{3}$
(C). $10\sqrt{3}$
(D). $15\sqrt{2}$

- (9). Simplify: $x^6 \cdot \frac{1}{x^2}$

- (A). x^3
(B). x^2
(C). $\frac{1}{x^6}$
(D). $\frac{1}{x^2}$
(E). x^4

- (11). Simplify: $\frac{60}{\sqrt{5}}$

- (A). $2\sqrt{3}$
(B). 12
(C). $60\sqrt{5}$
(D). 60
(E). $12\sqrt{5}$

- (2). If $f(x) = 2x^2 - x + 5$, find $f(-1)$

- (A). 8
(B). 2
(C). 4
(D). 6

- (4). Solve $2^x = 2^{3x-2}$

- (A). -4
(B). 2
(C). 1
(D). 0

- (6). Which exponential equation shows exponential decay with an initial value of 50 and a decay rate of 5%?

- (A). $y = 50^{-0.05x}$
(B). $y = 50(0.05)^x$
(C). $y = 50x^{0.05}$
(D). $y = 50(0.95)^x$

- (8). Simplify: $\sqrt{20}$

- (A). $5\sqrt{4}$
(B). $4\sqrt{5}$
(C). $2\sqrt{20}$
(D). $2\sqrt{5}$

- 10). Simplify: $\frac{x^{-10}}{x^{-9}}$

- (A). x
(B). $\frac{1}{x}$
(C). x^{90}
(D). x^{19}
(E). $\frac{1}{x^{19}}$

- (12). Solve the equation.

$$(x - 3)^2 = 36$$

- (A). 39
(B). no solution
(C). 9 and -3
(D). 9 and 6
(E). -9 and -6

(13). Solve the equation.

$$9(x + 5)^2 = -81$$

- (A). 4 and -14
- (B). 4 and 14
- (C). all real numbers
- (D). no real solution
- (E). 0

(15). Simplify: $(6x)^{-1}$

- (A). $-6x$
- (B). $\frac{-6}{x}$
- (C). $\frac{1}{6x}$
- (D). $\frac{6}{x}$
- (E). $\frac{-1}{6x}$

(17). Simplify: $x^{-3} \cdot x^3$

- (A). 0
- (B). $\frac{1}{x^9}$
- (C). 1
- (D). x
- (E). $-x^9$

(19). Simplify: $5x^{-2}$

- (A). $\frac{1}{5x^2}$
- (B). $\frac{5}{x^2}$
- (C). $-5x^2$
- (D). $-25x^2$
- (E). $\frac{-5}{x^2}$

(21). Which of the following is a cubic monomial?

- (A). $-4x^3$
- (B). $3x^2 - 6x + 12$
- (C). $2x + 3$
- (D). $6x^4$
- (E). $x^3 + 5x - 1$

(14). Solve the equation.

$$2w^2 - 13 = -11$$

- (A). 1 and 0
- (B). 1 and -1
- (C). no solution
- (D). all real numbers
- (E). 2 and -2

(16). Simplify: $8x^{-5} \cdot 6x^3$

- (A). $\frac{48}{x^{15}}$
- (B). $-48x^2$
- (C). $-96x$
- (D). $\frac{48}{x^2}$
- (E). $-48x^{15}$

(18). Which of the following is a quadratic binomial?

- (A). $3x^4 - 5x$
- (B). $9x^2 + 4x - 2$
- (C). $5x^2 - x$
- (D). $4x^3 - x^2 + 8x + 3$
- (E). $7x^4 + 8x^2 - 10$

(20). Simplify: $(x + 3)^2$

- (A). $x^2 + 6$
- (B). $x^2 + 9$
- (C). $8x + 9$
- (D). $x^2 + 6x + 9$
- (E). $2x + 9$

(22). Which of the following is a quartic trinomial?

- (A). $-9x^3$
- (B). $3x^2 - 5x + 8$
- (C). $7x^4 + 3$
- (D). $4x^3 - 2x^2 - x - 9$
- (E). $7x^4 + 8x - 2$

(23) Which of the following is the correct factored form of $x^2 - 16$?

- (A). $(x + 8)(x - 8)$
- (B). $(x - 4)^2$
- (C). $(x - 8)(x + 2)$
- (D). $(x - 4)(x + 4)$
- (E). $x(x - 16)$

(25). Solve: $x^2 - 4 = 0$

- (A). no solution
- (B). 1 and -1
- (C). 2 and -2
- (D). 4 and -4
- (E). 2

(27). Multiply and simplify: $(2x - 9)(x - 4)$

- (A). $2x^2 + 36$
- (B). $-15x + 36$
- (C). $2x^2 - 17x + 36$
- (D). $2x^2 - x + 36$
- (E). $3x^2 - 17x + 36$

(29) Does the following function have a minimum or maximum? What is the min. or max.?

$$f(x) = -x^2 + 2x + 1$$

- (A). minimum, 1
- (B). minimum, 2
- (C). maximum, 1
- (D). maximum, 2
- (E). neither

(31). Evaluate $(4x)^2$ when $x = 3$

- (A). 144
- (B). 36
- (C). 24
- (D). 48

(24). What would be added to the equation to complete the square?

$$x^2 + 2x = 3$$

- (A). 4
- (B). -4
- (C). 1
- (D). -1

(26). Which of the following is the correct factored form of $3x^2 - 7x - 20$

- (A). $(3x - 5)(x + 4)$
- (B). $(3x + 10)(x - 2)$
- (C). $(3x - 10)(x + 2)$
- (D). $(3x + 5)(x - 4)$
- (E). $(3x + 5)(3x - 4)$

(28). Subtract the polynomials and simplify:
 $(5x^3 + 7x^2 - 9x) - (8x^3 - 3x^2 - 2x - 1)$

- (A). $-3x^3 + 10x^2 - 7x + 1$
- (B). $-3x^3 + 4x^2 - 11x + 1$
- (C). $-3x^6 + 10x^4 - 7x^2 + 1$
- (D). $-3x^3 + 10x^2 + 11x - 1$
- (E). $-3x^6 + 4x^4 - 11x^2 + 1$

(30). Which of the following is a zero of the equation $x^2 + 3x + 2 = 0$?

- (A). (2, 0)
- (B). (-2, 0)
- (C). (0, -2)
- (D). (0, 2)
- (E). (0, 0)

(32). Simplify: $(8x^3)^2$

- (A). $16x^6$
- (B). $64x^5$
- (C). $16x^5$
- (D). $64x^9$
- (E). $64x^6$

(33). What is the slope of a horizontal line?

- (A). undefined
- (B). 1
- (C). 0
- (D). y

(35). Evaluate $10 - x^3$ for $x = -2$

- (A). 16
- (B). 18
- (C). 4
- (D). 2

(37). In which quadrant is the point $(5, -3)$ located?

- (A). quadrant I
- (B). quadrant II
- (C). quadrant III
- (D). quadrant IV

(39). Solve the equation: $5 - 8x = -4(2x + 1)$

- (A). no solution
- (B). $x = \frac{1}{16}$
- (C). $x = \frac{9}{16}$
- (D). $x =$ all Real numbers

(41) Find the median of the data below.

55, 42, 51, 66, 88, 102, 86

- (A). 66
- (B). none
- (C). 70
- (D). 490
- (E). 0

(43) Evaluate the expression $12x^3 - 3x$ when $x = -2$

- (A). -90
- (B). 10
- (C). -102
- (D). -66

(45). Find the slope of a line through the points $(12, 8)$ and $(7, 8)$

- (A). $\frac{19}{17}$
- (B). undefined
- (C). $\frac{16}{5}$
- (D). 0

(34). What is the slope of a vertical line?

- (A). 0
- (B). undefined
- (C). 1
- (D). x

(36). Simplify: $5(8x - 1)$

- (A). $40x - 5$
- (B). $35x$
- (C). $40x - 6$
- (D). $40x - 4$

(38). In which quadrant is the point $(-1, -2)$ located?

- (A). quadrant I
- (B). quadrant II
- (C). quadrant III
- (D). quadrant IV

(40). Find the slope of the line through the points $(8, 12)$ and $(8, 7)$

- (A). $\frac{5}{16}$
- (B). undefined
- (C). $\frac{19}{16}$
- (D). 0

(42). Find the mean of the data below.

55, 42, 51, 66, 88, 102, 86

- (A). 66
- (B). none
- (C). 70
- (D). 490
- (E). 0

(44) Find the mode of the data below.

55, 42, 51, 66, 88, 102, 86

- (A). 66
- (B). none
- (C). 70
- (D). 490
- (E). 0

(46). Evaluate the expression $n m^3$ when $n = 18$ and $m = -5$

- (A). -107
- (B). 2197
- (C). -270
- (D). -2250

(47). the inequality: $2(3x + 1) > 2 + 6x$

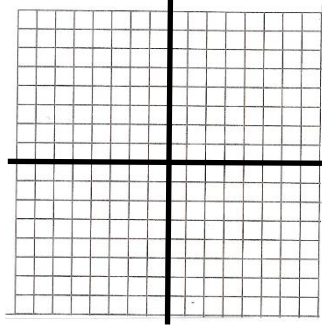
- (A). no solution
- (B). $x = 0$
- (C). $x = -\frac{1}{3}$
- (D). $x =$ all Real numbers

(48). Solve $|2x - 4| + 1 = 5$

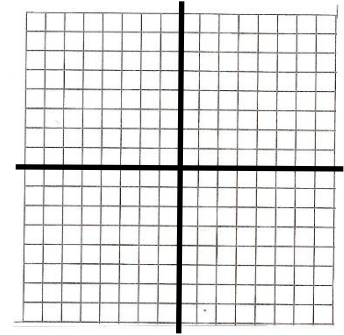
- (A). 4 and 0
- (B). 4
- (C). 4 and -1
- (D). 4.5 and -0.5

Graphing: On all grids, the increments along both axes are one unit. Do not change this increment size or add on to the grid. Graph each equation/inequality on the grid provided.

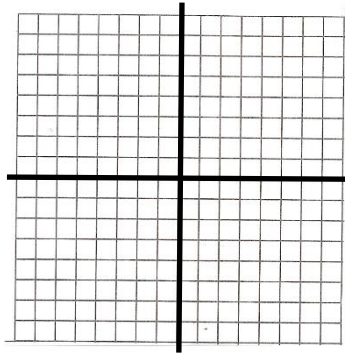
(49). $y < x - 5$



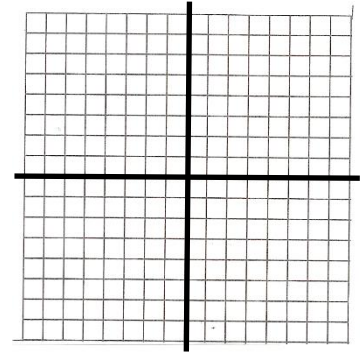
(50). $y \leq 2x - 4$



(51). $y = -3x + 4$

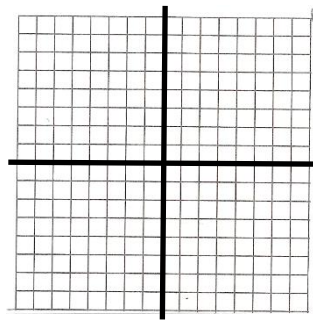


(52). $-3x + 4y = 12$



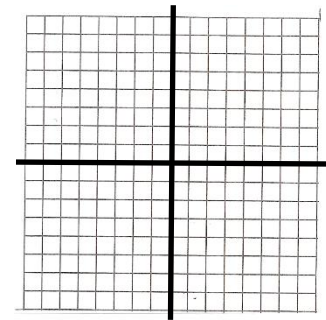
(53) Graph the quadratic by finding the axis of symmetry, vertex and 4 other points.

$$f(x) = x^2 - 4$$



(54). Graph the quadratic by finding the axis of symmetry, vertex and 4 other points.

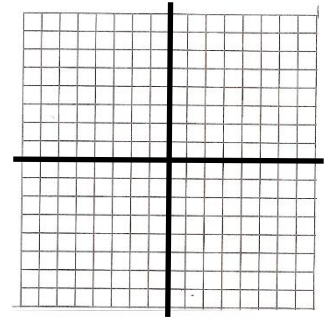
$$f(x) = (x - 3)^2 - 1$$



(55). Graph both lines on the grid provided. Then state the solution to the system on the answer line provided. Be sure to show all work supporting your graph. Write the solution as an ordered pair.

$$x - 3y = -6$$

$$y = -x - 2$$



(56). Classify each given number by placing a check in each column that corresponds to a group to which that number belongs.

Number	Natural number	Whole number	Integer	Rational number	Irrational number	Real number
$\sqrt{25}$						
$-4\frac{3}{5}$						
16						
$\sqrt{14}$						
$8.\bar{3}$						
-12						

Functions: Determine if each given relation is a function. Answer “yes” or “no.” Then explain the reason.

(57).

input	output
-2	-4
-1	-1
2	-2
2	5

ans: _____

explain:

(58).

input	output
-3	0
0	2
1	1
3	1

ans: _____

explain:

Complete each free response question. Remember to show supporting work. **NO DECIMALS!** Express all decimal answers as fractions in lowest terms or as a radical in simplest radical form.

(59) Solve the equation: $32 = 17 - \frac{5}{6}x$

(60). Solve the equation: $2(x - 4) - 3 = -7$

(61). Solve the equation: $2x - 5(x - 9) = 29 - x$

(63). Solve the equation: $\frac{9}{x} = \frac{10}{x-1}$

(65). Simplify the expression: $-3(3x + 2) + 4$

(67). Evaluate the expression $9x^3 + 2y^2$ for
 $x = -4$ and $y = -5$

(69). Find the slope of the line that line perpendicular to
the line that passes through
the points $(-12, 2)$ and $(3, -1)$.

(62). Solve the equation: $8 + \frac{x}{6} = 26$

(64). Simplify the expression: $9(-x + 7) - (5x - 8)$

(66). Find the slope of the line with equation
 $8x + 14y = -35$

(68). Find the slope of the line that passes through the
points $(-8, 3)$ and $(-2, 7)$

(70). Find the coordinate point of the vertex of the
quadratic equation.

$$y = x^2 - 12x + 2$$

(71). Solve using the quadratic formula.

$$x^2 - 2x - 15 = 0$$

(73). Solve for x: $2x^2 + 3x - 4 = 0$

(75). Solve for x: $25x^2 - 6 = 10$

(77). Solve the system of equations using the substitution method:

$$3x - y = -1$$

$$2x + 3y = 25$$

(72). Simplify. $\sqrt{75}$

(74). Solve for x: $x^2 - 5x = 24$

(76). Solve for x: $3x^2 - 12 = -5x$

(78). Solve the system of equations using the elimination method:

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

$$2x - 3y = 24$$

(79). Simplify: $(3x^4y^3)(-x^2y)$

(80). Simplify: $(4w^3xy^5)^2$

(81). Simplify: $\frac{8w^{-4}xy^{-1}}{24w^{-9}x^3y^5}$

(82). Multiply. Write the final answer polynomial in standard form:

$$(x + 2)(x^2 + 4x - 5)$$

Multiply or factor each of the following. Supporting work is **NOT** required but encouraged. Combine all like terms in final answer when applicable

(83). Multiply. Write the final answer polynomial in standard form:

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

(84). Multiply. Write the final answer polynomial in standard form:

$$-4xy^2(-5x^3y + 2x^2y^2 - 9xy^3)$$

(85). Factor the polynomial: $x^2 - 36$

(86). Factor the polynomial: $2x^2 + 7x - 15$

(87). Factor the polynomial: $2x^3 - 20x^2 + 48x$

(89). Factor the polynomial: $x^2 + 11x + 30$

(91). Factor the polynomial: $5x^2 - 45$

(93). Factor the polynomial: $x^2 - 10x + 25$

(88). Factor the polynomial: $2x^3 - 3x^2 + 14x - 21$

(90). Factor the polynomial: $2x^2 + 9x + 4$

(92). Factor the polynomial: $5x^3 - 2x^2 - 20x + 8$

(94). Factor the polynomial: $49x^2 - 16$

For each problem, define the variables. Write two equations in terms of those variables to represent the problem. Solve using either the substitution method or elimination method. Complete supportive work must be shown. Write each final answer on the answer line provided.

- (95). Tickets to a play cost \$9 for adults and \$4 for children. A total of 600 tickets were sold for \$3040. How many adult tickets were sold and how many child tickets were sold?

number of adult tickets: _____ number of child tickets: _____

- (96). At Preston's Burger Palace, the Galvin family has 6 burger platters and 4 colas for \$62. The Bateman family has 5 burger platters and 2 colas for \$49. Find the price of one burger platter and the price of one cola.

price of one burger platter: _____ price of one cola: _____

- (97). Midas has a collection of coins, all dimes and quarters, worth \$10. He has 16 more dimes than quarters. How many of each type of coin does he have?

number of dimes: _____ number of quarters: _____