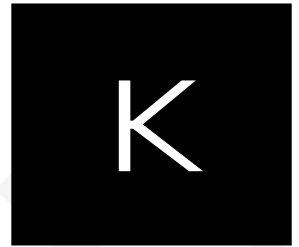


Name

RELEASED FORM

Algebra II

Form K



North Carolina Test of Algebra II

Public Schools of North Carolina
www.ncpublicschools.org
State Board of Education
Department of Public Instruction
Division of Accountability Services/North Carolina Testing Program
Raleigh, North Carolina 27699-6314



1. Which expression is equivalent to

$$\frac{2x+6}{x^2+2x-24} \cdot \frac{x^2+2x-24}{x^2-7x+12}?$$

- A $\frac{2}{x-4}$
- B $\frac{2(x+3)}{x-3}$
- C $\frac{2(x+3)}{(x-4)(x-3)}$
- D $\frac{2(x+3)}{(x+4)(x-3)}$

2. Which expression is equivalent to

$$\frac{x+3}{6x-3} \div \frac{x^2+2x-3}{2x-1}?$$

- A $3(x-1)$
- B $\frac{x-1}{3}$
- C $\frac{3}{x-1}$
- D $\frac{1}{3(x-1)}$

3. Multiply: $\sqrt[3]{12x^2} \cdot \sqrt[3]{126x^2}$

- A $6x(\sqrt[3]{7x})$
- B $6x(\sqrt[3]{21x})$
- C $6x^2(\sqrt[3]{42})$
- D $6x^2(\sqrt[3]{63})$

4. Which polynomial function has as zeros 3 and $4+i$?

- A $f(x) = x^3 - 11x^2 + 41x - 51$
- B $f(x) = x^3 - 5x^2 - 7x + 51$
- C $f(x) = x^3 + 5x^2 - 7x - 51$
- D $f(x) = x^3 + 11x^2 + 41x + 51$

5. If $h(x) = 2x$ and $g(x) = 3x^2 + 1$, what is $h(g(x))$?

- A $6x^2 + 1$
- B $6x^2 + 2$
- C $12x^2 + 1$
- D $12x^2 + 2$

6. What are the zeros of the polynomial $p(x) = x^3 - 2x^2 - 23x + 60$?

- A $\{-15, -2, 2\}$
- B $\{-5, 3, 4\}$
- C $\{2, 3, 10\}$
- D $\{1, 2, 30\}$

7. In 1950, a U.S. population model was $y = 151 \cdot (1.013)^{t-1950}$ million people, where t is the year. What did the model predict the U.S. population would be in the year 2000?

- A 247 million
- B 255 million
- C 263 million
- D 288 million

8. The following list shows the number of people (in millions) in the United States whose only means of getting to work was walking.

| Year (x) | Number (y) |
|-----------------|-------------------|
| 1940 | 7.6 |
| 1950 | 7.0 |
| 1960 | 6.4 |
| 1970 | 5.7 |
| 1980 | 5.4 |
| 1990 | 4.5 |

If $x = 0$ for the year 1940, which equation is the best-fit linear model for the data?

- A $y = -16.5x + 125$
- B $y = -0.06x + 7.6$
- C $y = 0.06x + 10$
- D $y = 7.6x - 0.06$

9. Given: $5x - 2y + z = 0$
 $2x - y + z = -3$
 $3x + 4y = 18$

What is the value of x in the solution of this system?

- A -4
- B -1
- C 2
- D 3

10. Which equation describes the circle with center $(5, -1)$ and radius 7?

- A $(x - 5)^2 + (y + 1)^2 = 7$
- B $(x - 5)^2 + (y + 1)^2 = 49$
- C $(x + 5)^2 + (y - 1)^2 = 7$
- D $(x + 5)^2 + (y - 1)^2 = 49$

11. Solve for x : $-\frac{1}{2}|2x + 6| + 2 = 0$

- A $x = 5$ or $x = 1$
- B $x = 5$
- C $x = -5$ or $x = -1$
- D $x = -1$

12. Which circle has the smallest area?

- A $x^2 + y^2 = 12$
- B $(x - 2)^2 + y^2 = 8$
- C $(x + 1)^2 + (y + 3)^2 = 6$
- D $(x + 8)^2 + (y - 9)^2 = 3$

13. Which matrix equation should be used to find the intersection of these two lines?

$$\begin{aligned} 3x &= 2 + 4y \\ 2y &= 6 - 5x \end{aligned}$$

- A $\begin{bmatrix} 3 & -4 \\ 2 & 5 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2 \\ 6 \end{bmatrix}$
- B $\begin{bmatrix} 3 \\ 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} -4 \\ 5 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2 \\ 6 \end{bmatrix}$
- C $\begin{bmatrix} 3 & -4 \\ 5 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2 \\ 6 \end{bmatrix}$
- D $\begin{bmatrix} 3 \\ 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} 5 \\ -4 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2 \\ 6 \end{bmatrix}$

14. The profit (P), in dollars, for a company is modeled by the function $P(x) = -750x^2 + 15,000x$, where x is the number of items produced. For which values of x will the company lose money?

- A $x < 2$
- B $2 < x \leq 10$
- C $10 \leq x < 20$
- D $x > 20$

15. In which direction is the graph of $f(x) = \frac{5}{x+b}$ translated when b increases?
- A left
- B right
- C up
- D down
16. A company that manufactures jeans estimates that the profit for selling a particular style is given by the equation:
- $$P = -250x^3 + 1,505x^2 - 300, \text{ for } 0 < x < 6$$
- where P is profit in tens of thousands of dollars and x is the advertising expense in tens of thousands of dollars. What does an x -intercept mean in the context of the problem?
- A the number of times the company spent zero dollars on advertising
- B the profit when the company spent zero dollars on advertising
- C the advertising expense when the company had the most profit
- D the advertising expense when the company's profit was zero dollars
17. Copper production increased at a rate of about 4.9% per year between 1988 and 1993. In 1993, copper production was approximately 1.801 billion kilograms. If this trend continued, which equation **best** models the copper production (P), in billions of kilograms, since 1993? (Let $t = 0$ for 1993.)
- A $P = 1.801(4.900)^t$
- B $P = 1.801(1.490)^t$
- C $P = 1.801(1.049)^t$
- D $P = 1.801(0.049)^t$

18. Divide:
- $$(6x^3 - 11x^2 - 47x - 20) \div (2x + 1)$$
- A $3x^2 - 7x - 20$
- B $3x^2 + 7x - 20$
- C $3x^2 - 4x - 20$
- D $3x^2 + 4x - 20$
19. By which matrix should both sides of the equation be multiplied to solve for $\begin{bmatrix} x \\ y \end{bmatrix}$?

$$\begin{bmatrix} 3 & 1 \\ 5 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 5 \\ 9 \end{bmatrix}$$

- A $\begin{bmatrix} 3 & 1 \\ 5 & 2 \end{bmatrix}$
- B $\begin{bmatrix} 3 & 5 \\ 5 & 9 \end{bmatrix}$
- C $\begin{bmatrix} 2 & -1 \\ -5 & 3 \end{bmatrix}$
- D $\begin{bmatrix} 2 & -5 \\ -1 & 3 \end{bmatrix}$

20. Which equation is equivalent to $\ln 7 + 3 \ln x = 5 \ln 2$?
- A $\ln 7x^3 = \ln 25$
- B $\ln 7x^3 = \ln 32$
- C $\ln 10x = \ln 10$
- D $\ln 21x = \ln 10$

21. Simplify: $\frac{\frac{1}{y} - \frac{1}{x}}{\frac{1}{y} + \frac{1}{x}}$

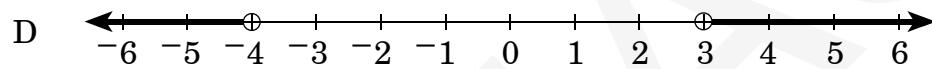
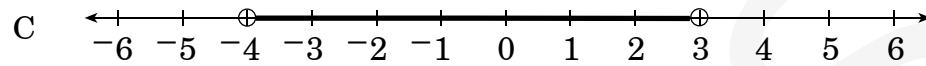
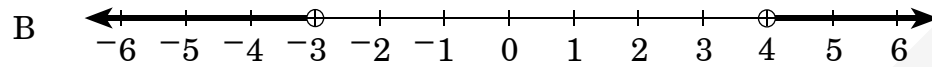
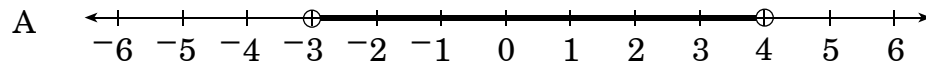
- A $\frac{x - y}{x + y}$
- B $\frac{x + y}{x - y}$
- C 0
- D -1

22. Let x and y be real numbers. If $(x + yi) - (2 - 3i) = -6 + 4i$, what are the values of x and y ?
- A $x = 8, y = 7$
- B $x = 8, y = 1$
- C $x = -4, y = 7$
- D $x = -4, y = 1$
23. If $f(x) = 2x + 1$ and $g(x) = x^3$, what is $f(g(3))$?
- A 343
- B 189
- C 55
- D 34
24. In which direction does the graph of $y = (x + 2)^{\frac{1}{2}} + c$ shift as c decreases?
- A right
- B left
- C up
- D down
25. What is the value of z in the solution of this system?
- $$\begin{aligned}x + y - z &= -5 \\2x + z + 1 &= -2y \\x - y &= 3z + 3\end{aligned}$$
- A -7
- B -1
- C 3
- D 5

26. What is the domain of $f(x) = -2x^3 + x^2 + 1$?
- A the set of all real numbers
- B $\{x \mid -3 < x < 2\}$
- C $\{x \mid -2 < x < 3\}$
- D the empty set
27. The population of a small town in North Carolina is 4,000, and it has a growth rate of 3% per year. Which expression can be used to calculate the town's population x years from now?
- A $3(4,000)^x$
- B $4,000(1.03)^x$
- C $4,000x^{1.03}$
- D $4,000x^3$
28. The graph of $f(x) = x^2 + 3$ is translated to produce the graph of $g(x) = (x + 2)^2 + 3$. In which direction was the graph of f translated?
- A up
- B down
- C left
- D right
29. Solve for x : $\frac{x-1}{x+5} = \frac{x}{2(x+5)}$
- A -5
- B 2
- C -5 or 2
- D 5 or -2

30. Which graph shows the solution set for the following inequality?

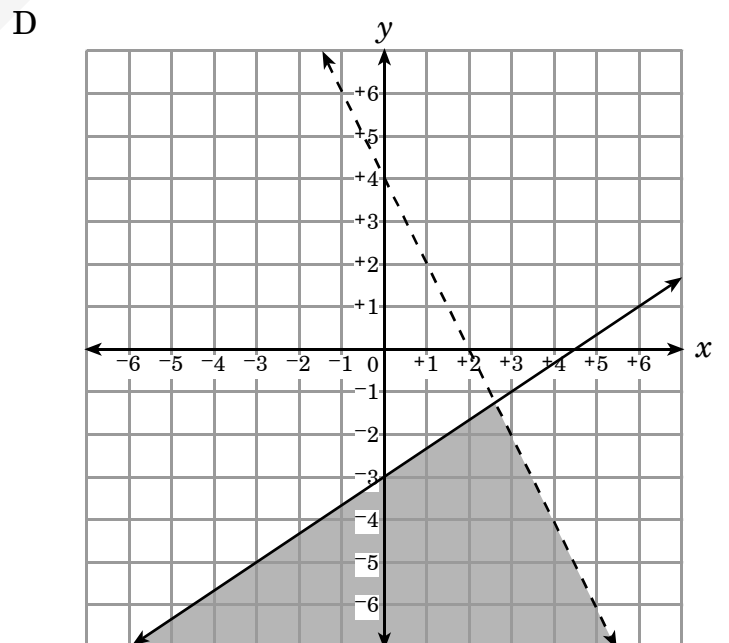
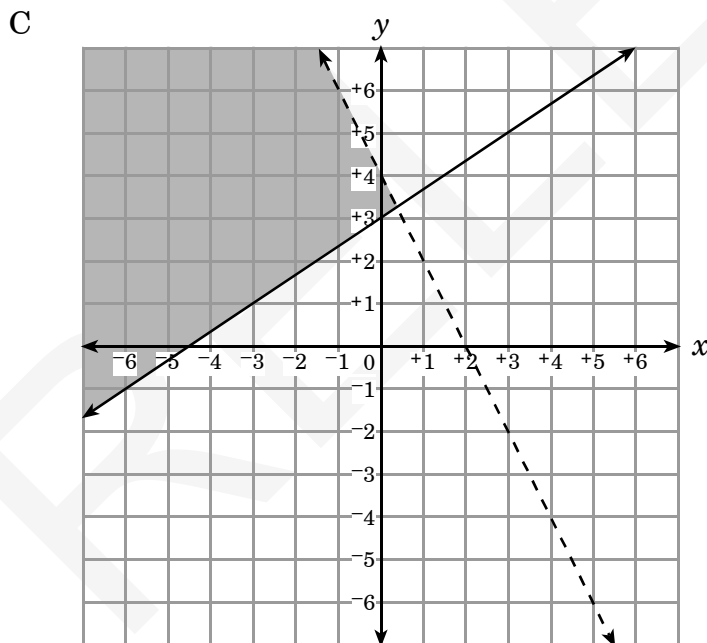
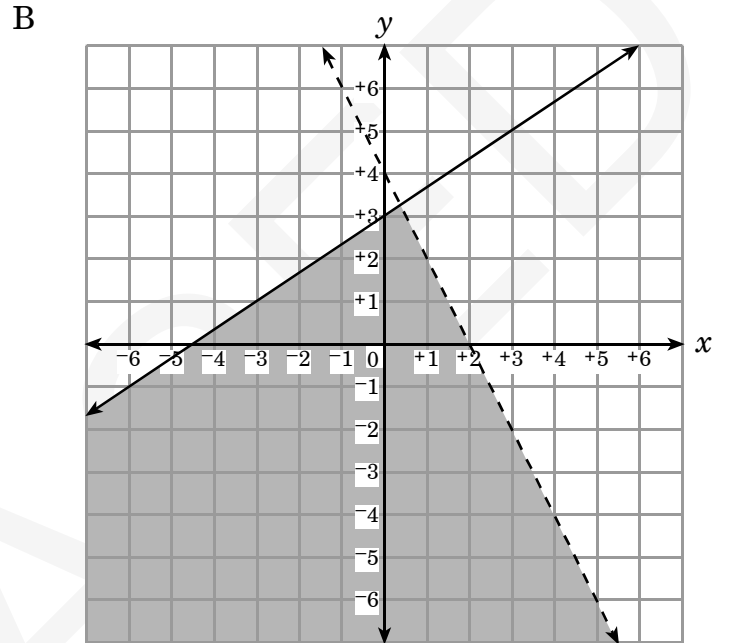
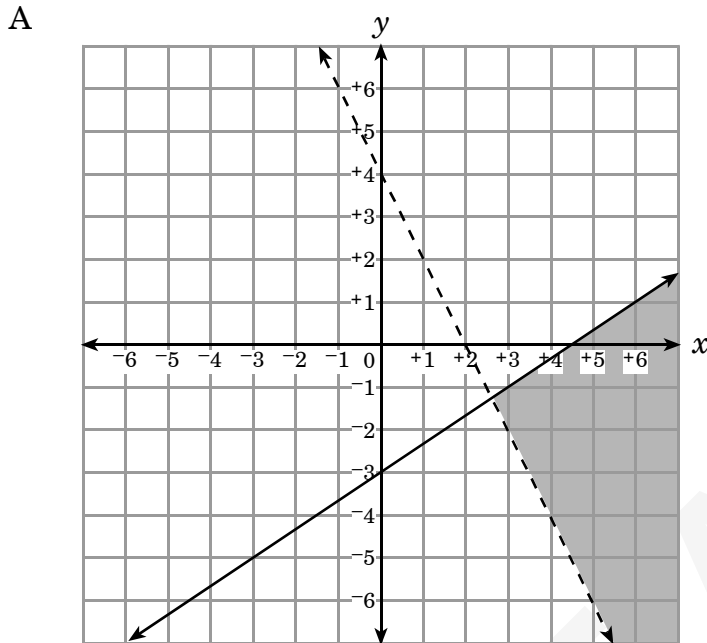
$$x^2 > x + 12$$



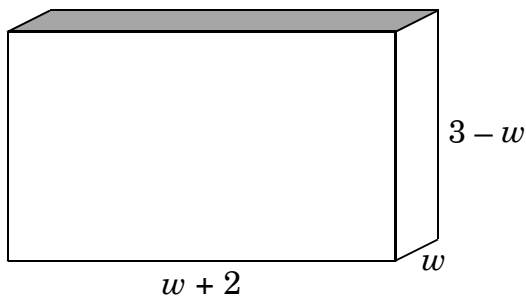
31. Which graph represents the system of inequalities below?

$$2x - 3y \geq 9$$

$$4x + 2y < 8$$



32. The dimensions of this rectangular prism are given algebraically.



What is the **approximate** width (w) that will maximize the volume?

- A 1 unit
- B $1\frac{1}{2}$ units
- C $1\frac{3}{4}$ units
- D 2 units

33. A single microscopic organism divides into two organisms every 3 days. Use the formula $N(t) = N_0(2)^{\frac{t}{3}}$, where t is the time in days, $N(t)$ is the number of organisms at t days, and N_0 is the number of organisms at $t = 0$.

Approximately how long would it take one organism to produce a population of about 10,000 organisms?

- A 1,667 days
- B 333 days
- C 126 days
- D 40 days

34. What is an equation of the circle that has center $(-2, 3)$ and passes through $(-1, 1)$?

- A $(x + 2)^2 + (y - 3)^2 = 5$
- B $(x - 2)^2 + (y + 3)^2 = 5$
- C $(x + 2)^2 + (y - 3)^2 = 25$
- D $(x - 2)^2 + (y + 3)^2 = 25$

35. Simplify:

$$\left(x^{\frac{3}{4}}\right)^3$$

A $x^{\frac{27}{64}}$

B $x^{\frac{9}{4}}$

C $x^{\frac{9}{12}}$

D $x^{\frac{15}{4}}$

36. The area of a rectangular window is $(4x^2 - 21x - 18)$. Both the length and the width are polynomials with integer coefficients. Which of the following could represent the length of the window?

A $4x + 6$

B $4x + 3$

C $x + 6$

D $x + 3$

37. Which binomial is a factor of $(x^3 - x^2 + 3x - 3)$?

A $x - 3$

B $x + 1$

C $x^2 - 1$

D $x^2 + 3$

38. If 5 tractors can plow a field in 4 hours, how many hours will it take 3 tractors to plow the field?

A $6\frac{2}{3}$

B $6\frac{1}{2}$

C $5\frac{2}{3}$

D $5\frac{1}{2}$

39. Solve: $3x - 7\sqrt{x} + 2 = 0$

A $x = \frac{1}{9}, x = 4$

B $x = \frac{1}{3}, x = 4$

C $x = \frac{1}{9}, x = -\frac{1}{3}$

D $x = \frac{1}{3}, x = \frac{1}{9}$

40. What is the **approximate** value of the greatest zero of $f(x) = x^3 - 6x^2 - x + 3$?

A -0.75

B 2.84

C 6.08

D 6.31

41. What are the vertical asymptotes of the function $f(x) = \frac{4x^2 - 100}{2x^2 + x - 15}$?

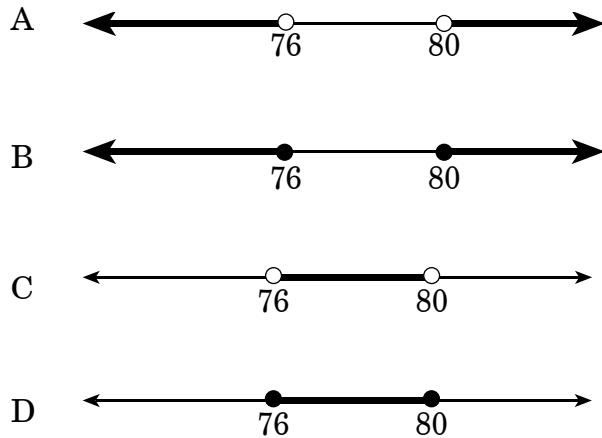
A $x = -5, x = 5$

B $x = -5, x = 4, x = 5$

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

D $x = -3, x = \frac{5}{2}, x = \frac{20}{3}$

42. A poll shows that it is likely that, with a margin of error of ± 2 percentage points, 78% of those randomly selected from a population would vote for a particular candidate. This situation can be described by the inequality $|x - 78| \leq 2$. Which graph shows the percentage of voters (according to the inequality) who favor the candidate?



43. Which equation represents the graph of $y = x^2$ translated 1 unit right and 2 units down?

- A $y = -(x - 1)^2 - 2$
- B $y = (x - 1)^2 - 2$
- C $y = -(x + 1)^2 + 2$
- D $y = (x + 1)^2 - 2$

44. Which is the solution set of the equation $x + 2 = \frac{4}{x - 2}$?

- A $\{\pm 2\sqrt{2}\}$
- B $\{2\sqrt{2}\}$
- C $\left\{\frac{-1 \pm \sqrt{17}}{2}\right\}$
- D $\left\{\frac{-1 + \sqrt{17}}{2}\right\}$

45. When interest is compounded n times a year, the accumulated amount (A) after t years is given by the formula

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

where P is the initial principal and r is the annual rate of interest.

Approximately how long will it take \$2,000 to double at an annual interest rate of 5.25% compounded monthly?

- A 13.98 years
B 13.71 years
C 13.23 years
D 13.08 years
46. Alan has just started a job that pays a salary of \$21,500. At the end of each year of work, he will get a 5% salary increase. What will his salary be after getting his fifth increase?
- A \$22,631
B \$24,889
C \$26,133
D \$27,440

47. In the function $f(x) = a(x - 4)^2$, where $a > 0$, what happens to the graph of f as the value of a increases?

- A The graph narrows.
B The graph widens.
C The graph shifts up.
D The graph shifts right.

48. Which is the inverse of the function $f(x) = x - 9$?

- A $f^{-1}(x) = \frac{1}{x + 9}$
B $f^{-1}(x) = x + 9$
C $f^{-1}(x) = 9 - x$
D $f^{-1}(x) = \frac{1}{x - 9}$

49. What are the zeros of $f(x) = x^2 + 7x + 5$?

A $\left\{ \frac{7 \pm 2\sqrt{5}}{2} \right\}$

B $\left\{ \frac{-7 \pm 2\sqrt{5}}{2} \right\}$

C $\left\{ \frac{7 \pm \sqrt{29}}{2} \right\}$

D $\left\{ \frac{-7 \pm \sqrt{29}}{2} \right\}$

50. The table below shows the number of families living in the city of Sunnyvale from 1965 to 2000.

| Year (after 1900) | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 |
|-----------------------------------|------|------|------|------|------|------|------|------|
| Number of Families (thousands) | 31.1 | 30.5 | 30.1 | 28.7 | 27.1 | 25.7 | 23.2 | 20.3 |

According to the best-fit quadratic model, *approximately* how many families will live in Sunnyvale in 2010?

A 14,000

B 15,000

C 18,000

D 19,000

51. What is the solution set of the system below?

$$\begin{aligned}x &= 2y \\ x - y^2 &= -2y\end{aligned}$$

- A $\{(0, 0)\}$
- B $\{(0, 4)\}$
- C $\{(0, 0), (4, 0)\}$
- D $\{(0, 0), (8, 4)\}$



End of Algebra II Test

North Carolina Test of Algebra II
Form K RELEASED Fall 2009
Answer Key

| Item Number | Correct Answer | Goal |
|-------------|----------------|---------------------------|
| 1 | C | 1 — Number and Operations |
| 2 | D | 1 — Number and Operations |
| 3 | A | 1 — Number and Operations |
| 4 | A | 1 — Number and Operations |
| 5 | B | 2 — Algebra |
| 6 | B | 2 — Algebra |
| 7 | D | 2 — Algebra |
| 8 | B | 2 — Algebra |
| 9 | C | 2 — Algebra |
| 10 | B | 2 — Algebra |
| 11 | C | 2 — Algebra |
| 12 | D | 2 — Algebra |
| 13 | C | 2 — Algebra |
| 14 | D | 2 — Algebra |
| 15 | A | 2 — Algebra |
| 16 | D | 2 — Algebra |
| 17 | C | 2 — Algebra |
| 18 | A | 1 — Number and Operations |
| 19 | C | 1 — Number and Operations |
| 20 | B | 1 — Number and Operations |
| 21 | A | 1 — Number and Operations |
| 22 | D | 1 — Number and Operations |
| 23 | C | 2 — Algebra |
| 24 | D | 2 — Algebra |
| 25 | C | 2 — Algebra |
| 26 | A | 2 — Algebra |
| 27 | B | 2 — Algebra |
| 28 | C | 2 — Algebra |
| 29 | B | 2 — Algebra |
| 30 | B | 2 — Algebra |
| 31 | D | 2 — Algebra |
| 32 | C | 2 — Algebra |
| 33 | D | 2 — Algebra |
| 34 | A | 2 — Algebra |
| 35 | B | 1 — Number and Operations |
| 36 | B | 1 — Number and Operations |
| 37 | D | 1 — Number and Operations |
| 38 | A | 1 — Number and Operations |
| 39 | A | 2 — Algebra |
| 40 | C | 2 — Algebra |
| 41 | C | 2 — Algebra |
| 42 | D | 2 — Algebra |

North Carolina Test of Algebra II
Form K RELEASED Fall 2009
Answer Key

| | | |
|----|---|-------------|
| 43 | B | 2 — Algebra |
| 44 | A | 2 — Algebra |
| 45 | C | 2 — Algebra |
| 46 | D | 2 — Algebra |
| 47 | A | 2 — Algebra |
| 48 | B | 2 — Algebra |
| 49 | D | 2 — Algebra |
| 50 | A | 2 — Algebra |
| 51 | D | 2 — Algebra |

**North Carolina Test of Algebra II
Form K RELEASED Fall 2009
Raw to Scale Score Conversion**

| Raw Score | Scale Score |
|------------------|--------------------|
| 0 | 127 |
| 1 | 127 |
| 2 | 128 |
| 3 | 128 |
| 4 | 129 |
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**North Carolina Test of Algebra II
Form K RELEASED Fall 2009
Raw to Scale Score Conversion**

| | |
|----|-----|
| 42 | 163 |
| 43 | 164 |
| 44 | 165 |
| 45 | 166 |
| 46 | 167 |
| 47 | 169 |
| 48 | 170 |
| 49 | 172 |
| 50 | 175 |
| 51 | 177 |