# North Carolina School of Science and Mathematics

## Admissions Math Assessment - Practice Test

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### Practice Test

**Instructions:** This 30-question practice test is designed to be representative of the NCSSM Admissions Math Assessment. This assessment is taken without a calculator. Select the best answer for each question.

1. Simplify the expression: $(7x - 3) - (4x + 2)$

   **A.** $3x - 1$
   **B.** $3x + 5$
   **C.** $3x - 5$
   **D.** $11x - 1$
   **E.** $11x - 5$

2. Simplify the expression: $3(a - 2b) - (a - 5b)$

   **A.** $2a - b$
   **B.** $2a - 11b$
   **C.** $2a + 3b$
   **D.** $4a - 11b$
   **E.** $4a + 3b$

3. Simplify the expression: $(5x^2 - x + 2) - 3x(x - 1)$

   **A.** $2x^2 - 2x + 2$
   **B.** $2x^2 + 2x + 2$
   **C.** $2x^2 - 4x + 2$
   **D.** $5x^2 - 4x + 2$
   **E.** $-15x^3 + 15x^2$

4. Evaluate the expression: $-(\frac{2}{3})^2 + \frac{4^2}{2^3}$

   **A.** $\frac{14}{9}$
   **B.** $\frac{22}{9}$
   **C.** $-\frac{22}{9}$
   **D.** $\frac{4}{3}$
   **E.** $\frac{10}{9}$

5. Evaluate the expression: $16^{\frac{1}{2}} + 8^{\frac{1}{3}}$

A. $6$
B. $8$
C. $10$
D. $12$
E. $24$

6. Simplify the expression: $(5x^3y^{-2})(3x^{-1}y^5)$

   A. $15x^2y^3$
   B. $15x^4y^{-10}$
   C. $8x^2y^3$
   D. $15x^3y^2$
   E. $\frac{15x^4}{y^{10}}$

7. Simplify the expression: $(2a^4b^{-1})^3(-3a^{-2}b^3)$

   A. $-24a^{10}b$
   B. $-6a^6$
   C. $-24a^{10}$
   D. $-6a^{10}$
   E. $\frac{-24a^{10}}{b}$

8. Simplify the expression, assuming no variables are zero: $\frac{(4m^3n^{-2})^2}{2m^2n^{-5}}$

   A. $8m^4n$
   B. $8m^4n^{-9}$
   C. $4m^4n$
   D. $8m^3n^{-1}$
   E. $\frac{2m^4}{n}$

9. Simplify the radical expression, assuming all variables represent positive numbers: $\sqrt{81x^8y^4z^{10}}$

   A. $9x^4y^2z^5$
   B. $9x^6y^2z^8$
   C. $81x^4y^2z^5$
   D. $9x^8y^4z^{10}$
   E. $9x^4y^2z^8$

10. Simplify the radical expression, assuming all variables represent positive numbers: $\sqrt{100a^{16}b^2c^6}$

   A. $10a^4bc^3$
   B. $100a^8bc^3$
   C. $10a^8bc^3$
   D. $10a^8b^2c^3$
   E. $50a^8bc^3$

11. Simplify the expression: $\frac{5}{x+2} - \frac{2}{x}$

**A.** $\frac{3}{x+2}$

**B.** $\frac{3x-4}{x^2+2x}$

**C.** $\frac{3x+4}{x^2+2x}$

**D.** $\frac{3}{2}$

**E.** $\frac{7x+4}{x^2+2x}$

12. Simplify the expression: $\frac{a}{a-1} + \frac{2}{a+3}$

**A.** $\frac{a^2+5a-2}{a^2+2a-3}$

**B.** $\frac{a+2}{2a+2}$

**C.** $\frac{a^2+3a+2}{a^2+2a-3}$

**D.** $\frac{a^2+5a+2}{a^2+2a-3}$

**E.** $\frac{3a-2}{a^2+2a-3}$

13. Determine the value of the expression $10a - 3b$ if $a = -1$ and $b = 4$.

**A.** $-22$

**B.** $22$

**C.** $14$

**D.** $-7$

**E.** $-120$

14. Determine the value of the expression $2x^2 - 5y$ if $x = 3$ and $y = -2$.

**A.** $8$

**B.** $13$

**C.** $26$

**D.** $28$

**E.** $-2$

15. Solve for $x$: $5x - 3 = 17$

**A.** $x = 4$

**B.** $x = \frac{14}{5}$

**C.** $x = 2$

**D.** $x = \frac{23}{5}$

**E.** $x = 5$

16. Solve for $x$: $\frac{3}{4}x - 5 = 10$

**A.** $x = 15$

**B.** $x = \frac{45}{4}$

**C.** $x = \frac{20}{3}$

**D.** $x = 10$

**E.** $x = 20$

17. Solve for $y$: $6y - 2 = 3y + 10$

- **A.** $y = 2$
- **B.** $y = 3$
- **C.** $y = 4$
- **D.** $y = \frac{8}{3}$
- **E.** $y = \frac{12}{5}$

18. Find the solution $(x, y)$ to the system of equations: $y = 2x - 1$ and $3x + 2y = 12$
    - **A.** $(1, 1)$
    - **B.** $(2, 3)$
    - **C.** $(0, -1)$
    - **D.** $(3, 2)$
    - **E.** $(-2, -5)$

19. Find the solution $(x, y)$ to the system of equations: $4x - 3y = 5$ and $2x + 3y = 7$
    - **A.** $(1, 2)$
    - **B.** $(5, 1)$
    - **C.** $(2, 1)$
    - **D.** $(1, -1)$
    - **E.** $(2, 3)$

20. Find the solution to the system of equations: $y = 2x + 3$ and $4x - 2y = 8$
    - **A.** $(0, 3)$
    - **B.** $(2, 7)$
    - **C.** $(1, 5)$
    - **D.** Infinite solutions
    - **E.** No solution

21. Solve the inequality: $2x + 5 < 11$
    - **A.** $x > 3$
    - **B.** $x < 3$
    - **C.** $x < 8$
    - **D.** $x > 8$
    - **E.** $x < \frac{11}{2}$

22. Solve the inequality: $5x - 3 > 8x + 6$
    - **A.** $x > -3$
    - **B.** $x < 3$
    - **C.** $x > 3$
    - **D.** $x < -1$
    - **E.** $x < -3$

23. Find all solutions to the quadratic equation: $x^2 - 2x - 15 = 0$
    - **A.** $x = 5, x = -3$

**B.** $x = -5, x = 3$

**C.** $x = 5, x = 3$

**D.** $x = -5, x = -3$

**E.** $x = 15, x = -2$

24. Find all solutions to the quadratic equation: $3x^2 + 5x = 2$

    **A.** $x = -2, x = \frac{1}{3}$

    **B.** $x = 2, x = -\frac{1}{3}$

    **C.** $x = -1, x = \frac{2}{3}$

    **D.** $x = 1, x = -\frac{2}{3}$

    **E.** $x = -2, x = 1$

25. Find all solutions to the quadratic equation: $4x^2 - 25 = 0$

    **A.** $x = \frac{25}{4}$

    **B.** $x = 5, x = -5$

    **C.** $x = \frac{5}{2}$

    **D.** $x = \frac{5}{2}, x = -\frac{5}{2}$

    **E.** $x = \frac{2}{5}, x = -\frac{2}{5}$

26. Factor the expression completely: $6x^3y + 9xy^2$

    **A.** $3xy(2x^2 + 3y)$

    **B.** $3x^2y(2x + 3y)$

    **C.** $3xy(2x^2 + 3y^2)$

    **D.** $9xy(x^2 + y)$

    **E.** $3(2x^3y + 3xy^2)$

27. Factor the expression completely: $9a^2 - 16b^2$

    **A.** $(3a - 4b)^2$

    **B.** $(3a + 4b)^2$

    **C.** $(3a - 4b)(3a + 4b)$

    **D.** $(9a - 16b)(a + b)$

    **E.** $(3a - 8b)(3a + 2b)$

28. Factor the quadratic expression: $5x^2 - 13x - 6$

    **A.** $(5x + 3)(x - 2)$

    **B.** $(5x - 3)(x + 2)$

    **C.** $(5x - 2)(x + 3)$

    **D.** $(5x + 2)(x - 3)$

    **E.** $(x + 6)(5x - 1)$

29. If $\frac{3}{4}$ of a cup of sugar is needed for $\frac{1}{3}$ of a recipe, how many cups of sugar are needed for the entire recipe?

    **A.** $\frac{1}{4}$

**B.** $\frac{4}{9}$

**C.** $2$

**D.** $\frac{9}{4}$

**E.** $3$

30. On a map, $2$ inches represents $15$ miles. How many miles does $5$ inches represent?

**A.** $30$ miles

**B.** $37.5$ miles

**C.** $45$ miles

**D.** $75$ miles

**E.** $6$ miles

## Answer Key

**1. C**

- *Explanation:* To subtract the polynomials, distribute the negative sign to each term in the second set of parentheses. This changes $(4x + 2)$ to $-4x - 2$.
- $(7x - 3) - (4x + 2) = 7x - 3 - 4x - 2$
- Next, combine the like terms (the $x$ terms and the constant terms): $(7x - 4x) + (-3 - 2) = 3x - 5$

**2. A**

- *Explanation:* First, distribute the $3$ into $(a - 2b)$ to get $3a - 6b$. Then, distribute the negative sign ($-1$) into $(a - 5b)$ to get $-a + 5b$.
- $3(a - 2b) - (a - 5b) = 3a - 6b - a + 5b$
- Combine like terms: $(3a - a) + (-6b + 5b) = 2a - b$

**3. B**

- *Explanation:* Distribute the $-3x$ to both terms in $(x - 1)$, which gives $-3x(x) - 3x(-1) = -3x^2 + 3x$.
- $(5x^2 - x + 2) - 3x(x - 1) = 5x^2 - x + 2 - 3x^2 + 3x$
- Combine like terms: $(5x^2 - 3x^2) + (-x + 3x) + 2 = 2x^2 + 2x + 2$

**4. A**

- *Explanation:* Evaluate the first term: $-(\frac{2}{3})^2 = -(\frac{2^2}{3^2}) = -\frac{4}{9}$.
- Evaluate the second term using exponent rules: $\frac{4^2}{2^3} = \frac{(2^2)^2}{2^3} = \frac{2^4}{2^3} = 2^{4-3} = 2^1 = 2$.
- $-\frac{4}{9} + 2$. To add, find a common denominator: $-\frac{4}{9} + \frac{18}{9} = \frac{14}{9}$.

**5. A**

- *Explanation:* A fractional exponent $x^{\frac{1}{n}}$ is the same as the $n^{th}$ root of $x$ ($\sqrt[n]{x}$).
- $16^{\frac{1}{2}} = \sqrt{16} = 4$.
- $8^{\frac{1}{3}} = \sqrt[3]{8} = 2$.
- $4 + 2 = 6$.

**6. A**

- *Explanation:* Use the product rule for exponents. Multiply the coefficients: $5 \cdot 3 = 15$.
- Add the exponents for $x$: $x^{3+(-1)} = x^2$.
- Add the exponents for $y$: $y^{-2+5} = y^3$.
- $(5x^3y^{-2})(3x^{-1}y^5) = 15x^2y^3$.

**7. C**

- *Explanation:* First, apply the power rule (raise to the $3^{rd}$ power) to the first term: $(2a^4b^{-1})^3 = 2^3(a^4)^3(b^{-1})^3 = 8a^{12}b^{-3}$.
- Now multiply this result by the second term: $(8a^{12}b^{-3})(-3a^{-2}b^3)$.

- Multiply coefficients: $8 \cdot -3 = -24$. Add exponents for $a$: $a^{12+(-2)} = a^{10}$. Add exponents for $b$: $b^{-3+3} = b^0 = 1$.
- The result is $-24a^{10}$.

**8. A**

- *Explanation:* Apply the power rule (squaring) to the numerator: $(4m^3n^{-2})^2 = 4^2(m^3)^2(n^{-2})^2 = 16m^6n^{-4}$.
- Now divide by the denominator: $\frac{16m^6n^{-4}}{2m^2n^{-5}}$.
- Divide coefficients: $\frac{16}{2} = 8$. Subtract exponents for $m$: $m^{6-2} = m^4$. Subtract exponents for $n$: $n^{-4-(-5)} = n^{-4+5} = n^1 = n$.
- The result is $8m^4n$.

**9. A**

- *Explanation:* To simplify the square root of a monomial, take the square root of the coefficient and divide each variable's exponent by 2.
- $\sqrt{81} = 9$. $\sqrt{x^8} = x^{8/2} = x^4$. $\sqrt{y^4} = y^{4/2} = y^2$. $\sqrt{z^{10}} = z^{10/2} = z^5$.
- Combine these: $9x^4y^2z^5$.

**10. C**

- *Explanation:* Take the square root of the coefficient and divide each variable's exponent by 2.
- $\sqrt{100} = 10$. $\sqrt{a^{16}} = a^{16/2} = a^8$. $\sqrt{b^2} = b^{2/2} = b^1 = b$. $\sqrt{c^6} = c^{6/2} = c^3$.
- Combine these: $10a^8bc^3$.

**11. B**

- *Explanation:* To subtract fractions, find a common denominator, which is $x(x+2)$.
- Multiply the first fraction by $\frac{x}{x}$: $\frac{5}{x+2} \cdot \frac{x}{x} = \frac{5x}{x(x+2)}$.
- Multiply the second fraction by $\frac{x+2}{x+2}$: $\frac{2}{x} \cdot \frac{x+2}{x+2} = \frac{2(x+2)}{x(x+2)} = \frac{2x+4}{x(x+2)}$.
- Subtract the numerators: $\frac{5x-(2x+4)}{x(x+2)} = \frac{5x-2x-4}{x^2+2x} = \frac{3x-4}{x^2+2x}$.

**12. A**

- *Explanation:* The common denominator is $(a-1)(a+3)$.
- Multiply the first fraction by $\frac{a+3}{a+3}$: $\frac{a(a+3)}{(a-1)(a+3)} = \frac{a^2+3a}{a^2+2a-3}$.
- Multiply the second fraction by $\frac{a-1}{a-1}$: $\frac{2(a-1)}{(a-1)(a+3)} = \frac{2a-2}{a^2+2a-3}$.
- Add the numerators: $\frac{(a^2+3a)+(2a-2)}{a^2+2a-3} = \frac{a^2+5a-2}{a^2+2a-3}$.

**13. A**

- *Explanation:* Substitute the given values into the expression.
- $10a - 3b = 10(-1) - 3(4)$.
- Multiply first: $-10 - 12$.
- Subtract: $-22$.

**14. D**

- *Explanation:* Substitute the given values. Remember order of operations (exponents first).
- $2x^2 - 5y = 2(3)^2 - 5(-2)$.
- Evaluate the exponent: $2(9) - 5(-2)$.
- Multiply: $18 - (-10)$.
- Subtracting a negative is addition: $18 + 10 = 28$.

**15. A**

- *Explanation:* To solve for $x$, first add $3$ to both sides.
- $5x - 3 + 3 = 17 + 3 \to 5x = 20$.
- Divide by $5$: $\frac{5x}{5} = \frac{20}{5} \to x = 4$.

**16. E**

- *Explanation:* To isolate the $x$ term, add $5$ to both sides.
- $\frac{3}{4}x - 5 + 5 = 10 + 5 \to \frac{3}{4}x = 15$.
- To solve for $x$, multiply both sides by the reciprocal of $\frac{3}{4}$, which is $\frac{4}{3}$.
- $x = 15 \cdot (\frac{4}{3}) = \frac{15 \cdot 4}{3} = \frac{60}{3} = 20$.

**17. C**

- *Explanation:* Collect the variable terms on one side and constant terms on the other. Subtract $3y$ from both sides.
- $6y - 3y - 2 = 3y - 3y + 10 \to 3y - 2 = 10$.
- Add $2$ to both sides: $3y - 2 + 2 = 10 + 2 \to 3y = 12$.
- Divide by $3$: $y = 4$.

**18. B**

- *Explanation:* Use substitution. Since $y = 2x - 1$, replace $y$ in the second equation with $(2x - 1)$.
- $3x + 2(2x - 1) = 12$. Distribute the $2$: $3x + 4x - 2 = 12$.
- Combine like terms: $7x - 2 = 12$. Add $2$ to both sides: $7x = 14$.
- Divide by $7$: $x = 2$.
- Substitute $x = 2$ back into $y = 2x - 1$: $y = 2(2) - 1 = 4 - 1 = 3$. The solution is $(2, 3)$.

**19. C**

- *Explanation:* Use elimination. The $y$ terms ($-3y$ and $+3y$) are opposites, so add the two equations together.
- $(4x - 3y) + (2x + 3y) = 5 + 7 \to 6x = 12$.
- Divide by $6$: $x = 2$.
- Substitute $x = 2$ into the second equation: $2(2) + 3y = 7 \to 4 + 3y = 7$.
- Subtract $4$: $3y = 3$. Divide by $3$: $y = 1$. The solution is $(2, 1)$.

**20. E**

- *Explanation:* Use substitution. Replace $y$ in the second equation with $(2x + 3)$.

- $4x - 2(2x + 3) = 8$. Distribute the $-2$: $4x - 4x - 6 = 8$.
- Combine the $x$ terms: $0x - 6 = 8 \rightarrow -6 = 8$.
- This is a false statement. The variables canceled out, leaving a contradiction. This means there is no solution. (The lines are parallel).

**21. B**

- *Explanation:* To solve for $x$, subtract $5$ from both sides.
- $2x + 5 - 5 < 11 - 5 \rightarrow 2x < 6$.
- Divide by $2$: $\frac{2x}{2} < \frac{6}{2} \rightarrow x < 3$.

**22. E**

- *Explanation:* Subtract $8x$ from both sides: $5x - 8x - 3 > 8x - 8x + 6 \rightarrow -3x - 3 > 6$.
- Add $3$ to both sides: $-3x - 3 + 3 > 6 + 3 \rightarrow -3x > 9$.
- Divide by $-3$. **Remember to flip the inequality sign** when multiplying or dividing by a negative number.
- $\frac{-3x}{-3} < \frac{9}{-3} \rightarrow x < -3$.

**23. A**

- *Explanation:* To factor $x^2 + bx + c$, find two numbers that multiply to $c$ $(-15)$ and add to $b$ $(-2)$.
- The numbers are $-5$ and $3$ (since $-5 \times 3 = -15$ and $-5 + 3 = -2$).
- The factored form is $(x - 5)(x + 3) = 0$.
- Set each factor to zero: $x - 5 = 0 \rightarrow x = 5$. And $x + 3 = 0 \rightarrow x = -3$.

**24. A**

- *Explanation:* First, set the equation to zero: $3x^2 + 5x - 2 = 0$. Use factoring by grouping (or ”ac method”).
- Find two numbers that multiply to $a \cdot c$ $(3 \cdot -2 = -6)$ and add to $b$ $(5)$. The numbers are $6$ and $-1$.
- Rewrite the middle term: $3x^2 + 6x - 1x - 2 = 0$.
- Factor by grouping: $3x(x + 2) - 1(x + 2) = 0$.
- $(3x - 1)(x + 2) = 0$. Set each factor to zero: $3x - 1 = 0 \rightarrow x = \frac{1}{3}$. And $x + 2 = 0 \rightarrow x = -2$.

**25. D**

- *Explanation:* This is a ”difference of two squares,” which factors as $a^2 - b^2 = (a - b)(a + b)$.
- $4x^2 - 25 = (2x)^2 - (5)^2 = 0$.
- Factor: $(2x - 5)(2x + 5) = 0$.
- Set each factor to zero: $2x - 5 = 0 \rightarrow 2x = 5 \rightarrow x = \frac{5}{2}$. And $2x + 5 = 0 \rightarrow 2x = -5 \rightarrow x = -\frac{5}{2}$.

**26. A**

- *Explanation:* Find the Greatest Common Factor (GCF) of both terms. The GCF of $6$ and $9$ is $3$. The GCF of $x^3$ and $x$ is $x$. The GCF of $y$ and $y^2$ is $y$.

- The overall GCF is $3xy$.
- Factor out $3xy$: $3xy(2x^2) + 3xy(3y) = 3xy(2x^2 + 3y)$.

**27. C**

- *Explanation:* This is a "difference of two squares," $a^2 - b^2 = (a - b)(a + b)$.
- $9a^2 - 16b^2 = (3a)^2 - (4b)^2$.
- This factors to $(3a - 4b)(3a + 4b)$.

**28. D**

- *Explanation:* Use factoring by grouping. Find two numbers that multiply to $a \cdot c$ ($5 \cdot -6 = -30$) and add to $b$ ($-13$). The numbers are $-15$ and $2$.
- Rewrite the middle term: $5x^2 - 15x + 2x - 6$.
- Factor by grouping: $5x(x - 3) + 2(x - 3)$.
- The factored form is $(5x + 2)(x - 3)$.

**29. D**

- *Explanation:* Let $x$ be the total cups of sugar needed for $1$ whole recipe. We can set up a proportion: $\frac{\text{cups of sugar}}{\text{portion of recipe}}$.
- $\frac{3/4}{1/3} = \frac{x}{1}$.
- To solve for $x$, we just evaluate the fraction: $x = \frac{3/4}{1/3}$. This is $\frac{3}{4} \div \frac{1}{3}$.
- To divide by a fraction, multiply by its reciprocal: $\frac{3}{4} \cdot \frac{3}{1} = \frac{9}{4}$.

**30. B**

- *Explanation:* Let $x$ be the unknown number of miles. Set up a proportion of $\frac{\text{inches}}{\text{miles}}$.
- $\frac{2}{15} = \frac{5}{x}$.
- Cross-multiply: $2 \cdot x = 15 \cdot 5 \rightarrow 2x = 75$.
- Divide by $2$: $x = \frac{75}{2} = 37.5$ miles.