PRACTICE EXAM 47:NY REGENTS ALGEBRA I SIMULATION — 35 QUESTIONS

Recommended Time: 3 Hours

Required Tools: Graphing Calculator, Straightedge

Directions: Answer all 35 questions. For Part I, record answers on your answer sheet. For Parts II, III, and IV, show all work in the space provided. Partial credit is available on Parts II–IV.

PART I — Multiple Choice (Questions 1–24)

Each correct answer is worth 2 credits. No partial credit. No penalty for guessing.

1. Solve the equation $(x - 1)/2 = (x + 3)/4$ for x.

A. $x = 5$

B. $x = 2$

C. $x = -5$

D. $x = 1$

2. If $g(x) = 4 - x^2$, what is the value of $g(-3)$?

A. $g(-3) = 13$

B. $g(-3) = 5$

C. $g(-3) = -5$

D. $g(-3) = -13$

3. What is the slope of the line that passes through the points $(1, -2)$ and $(5, 6)$?

A. -2

B. 2

C. 1/2

D. 4

4. Which expression is the factored form of $x^2 - 49$?

A. $(x - 7)^2$

B. $(x + 7)^2$

C. $(x - 49)(x + 1)$

D. $(x - 7)(x + 7)$

5. The function f(x) = 1200(1.25)^x represents exponential growth. What is the growth rate?

A. 1.25%

B. 125%

C. 25%

D. 12.5%

6. What are the solutions to the equation $x^2 + 7x + 12 = 0$?

A. $x = -3$ and $x = -4$

B. $x = 3$ and $x = 4$

C. $x = -6$ and $x = -2$

D. $x = 6$ and $x = 2$

7. An arithmetic sequence is defined by $a_n = 5 + 3(n - 1)$. What is the value of a_{10}?

A. $a_{10} = 35$

B. $a_{10} = 30$

C. $a_{10} = 53$

D. $a_{10} = 32$

8. Solve the inequality $2(x - 3) \leq 10$.

A. $x \geq 8$

B. $x \leq 8$

C. $x \leq 2$

D. $x \geq 2$

9. What is the solution to the system $y = 3x$ and $x + y = 8$?

A. (6, 2)

B. (2, 4)

C. (2, 6)

D. (8, 0)

10. The table below shows values of a function.

x: 0, 1, 2, 3

y: −1, 2, 5, 8

Which type of function is represented?

A. Linear, with a rate of change of 3

B. Exponential, with a common ratio of 3

C. Quadratic, with constant second differences

D. Linear, with a rate of change of −1

11. Which expression is equivalent to $(4x^2 + x - 6) + (-2x^2 + 3x + 1)$?

A. $2x^2 - 2x - 5$

B. $2x^2 + 4x - 5$

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

D. $2x^2 + 4x - 7$

12. Which statement best describes the transformation from $f(x) = x^2$ to $g(x) = x^2 + 7$?

A. The graph of f(x) is shifted horizontally right 7 units

B. The graph of f(x) is shifted horizontally left 7 units

C. The graph of f(x) is shifted vertically down 7 units

D. The graph of f(x) is shifted vertically up 7 units

13. Which equation represents a line perpendicular to $y = (1/2)x + 1$ that passes through the origin?

A. $y = (1/2)x$

B. $y = 2x$

C. $y = -2x$

D. $y = -(1/2)x$

14. What are the coordinates of the vertex of $f(x) = x^2 + 4x + 1$?

A. $(-2, -3)$

B. $(2, -3)$

C. (−2, 3)

D. (−4, 1)

15. Which statement is true about the number √64?

A. It is irrational because it contains a radical sign

B. It is irrational because 64 is an even number

C. It is undefined because 64 is too large to simplify

D. It is rational because it is equal to the integer 8

16. A data set consists of the values 4, 5, 6, 7, and 50. Which statement is true?

A. The mean is less than the median of the data set

B. The mean is greater than the median because of the outlier

C. The mean and the median of the data set are equal

D. The data set contains no outliers of any kind

17. A data set shows that as one variable increases, the other shows no consistent change, with points scattered randomly. Which correlation coefficient best fits this data?

A. $r = 0.95$

B. $r = -0.85$

C. $r = 0.05$

D. $r = -1.00$

18. Which system of equations has no solution?

A. $y = 2x + 1$ and $y = 3x + 1$

B. $2x + y = 5$ and $4x + 2y = 10$

C. $y = x$ and $y = -x$

D. $y = 4x - 1$ and $y = 4x + 6$

19. What are the x-intercepts of the graph of $y = x^2 - x - 6$?

A. (3, 0) and (−2, 0)

B. (−3, 0) and (2, 0)

C. (6, 0) and (−1, 0)

D. (3, 0) and (2, 0)

20. What is the average rate of change of $f(x) = 3x + 2$ over any interval?

A. 2

B. 3

C. 5

D. it varies depending on the interval chosen

21. A bank account is modeled by $A(t) = 500(1.02)^t$. What is the account value after 2 years, rounded to the nearest cent?

A. $510.00

B. $1,040.40

C. $520.20

D. $502.00

22. The equation $x^2 - 8x + 16 = 0$ has how many distinct real solutions?

A. zero distinct real solutions

B. two distinct real solutions

C. three distinct real solutions

D. exactly one distinct real solution

23. What is the value of the expression $|-6| + |3 - 8|$?

A. 9

B. 11

C. 1

D. -11

24. Function f is given by the table below, and function g is defined as $g(x) = 2x + 1$. Which function has the greater y-intercept?

x: 0, 1, 2

f(x): 5, 7, 9

A. Function f, with a y-intercept of 5

B. Function g, with a y-intercept of 1

C. Both functions have the same y-intercept

D. Neither function has a y-intercept

PART II — Short Constructed Response (Questions 25–32)

Each question is worth 2 credits. Show all work.

25. Solve the following system algebraically and verify your solution.

$4x - y = 7$

$2x + y = 5$

26. Write the equation of the line that is perpendicular to $y = 4x - 3$ and passes through the point (8, 1). Express your answer in slope-intercept form.

27. Solve the quadratic equation $x^2 + 6x - 16 = 0$ by factoring. Show all steps.

28. The table below shows values of a function.

x: 1, 2, 3, 4

y: 4, 16, 64, 256

Determine whether the function is linear, quadratic, or exponential. Justify your answer using the table, then write a function rule.

29. Factor the following expression completely: $x^3 + 5x^2 - 14x$.

30. An arithmetic sequence has $a_5 = 23$ and $a_8 = 38$. Find the common difference, the first term, and write the explicit formula for the nth term.

31. Solve the compound inequality $1 < 3x - 5 \leq 10$ and graph the solution set on a number line.

32. A line of best fit for plant-growth data is given by $\hat{y} = 2x + 8$, where x is the number of weeks and $\hat{y}$ is the predicted height in centimeters. In week 6, the measured height was 18 cm.

Calculate the residual and state whether the measured height was above or below the line of best fit.

PART III — Medium Constructed Response (Questions 33–34)

Each question is worth 4 credits. Show all work.

33. Consider the quadratic function $f(x) = x^2 - 4x - 21$.

a. Find the vertex of the function using the axis of symmetry formula. Show your work.

b. Identify the zeros of f(x) algebraically.

c. Describe the key features of the graph: direction of opening, vertex, axis of symmetry, x-intercepts, and y-intercept. State the minimum value of the function.

34. A chemist needs to make 100 mL of a 35% acid solution by mixing a 20% acid solution with a 50% acid solution.

a. Write a system of equations that models this situation, using x for the milliliters of 20% solution and y for the milliliters of 50% solution.

b. Solve the system to determine how many milliliters of each solution are needed.

c. Verify that your solution satisfies both equations.

PART IV — Extended Constructed Response (Question 35)

This question is worth 6 credits. Show all work.

35. A rectangular community garden has a length that is 4 meters longer than its width. The total area of the garden is 96 square meters.

a. Let w represent the width of the garden. Write an expression for the length in terms of w, and write an equation that represents the area.

b. Write the area equation in standard form, set equal to zero.

c. Solve the equation by factoring to find the width of the garden. Show all work.

d. Explain why only one of the solutions is valid in the context of this problem.

e. State the length and width of the garden, and verify that the area is 96 square meters.

PRACTICE EXAM 47 — ANSWER KEY AND EXPLANATIONS

1. A — $x = 5$. Cross-multiplying gives $4(x - 1) = 2(x + 3)$, so $4x - 4 = 2x + 6$, leading to $2x = 10$ and $x = 5$. Cross-multiplication clears both denominators in the proportion. Substituting back gives $4/2 = 2$ and $8/4 = 2$, confirming equality.
2. C — $g(-3) = -5$. Substituting gives $4 - (-3)^2 = 4 - 9 = -5$. The input is squared first, producing 9, before subtracting from 4. The squaring removes the negative sign of the input.
3. B — slope = 2. Using $(6 - (-2))/(5 - 1) = 8/4 = 2$. Slope is the ratio of vertical change to horizontal change between the two points. The positive value reflects an upward direction.
4. D — $(x - 7)(x + 7)$. The expression is a difference of two squares, since $x^2 = (x)^2$ and $49 = 7^2$. The difference-of-squares pattern factors as $(x - 7)(x + 7)$. The middle terms cancel when expanded.
5. C — 25%. In $f(x) = 1200(1.25)^x$, the base 1.25 equals $1 + 0.25$, indicating a 25% growth rate. The growth rate is the amount the base exceeds 1. A base greater than 1 represents exponential growth.

6. A — $x = -3$ and $x = -4$. Factoring $x^2 + 7x + 12$ gives $(x + 3)(x + 4) = 0$, so the solutions are −3 and −4. The factor pair of +12 that sums to +7 is +3 and +4. Setting each factor to zero gives the negative roots.
7. D — $a_{10} = 32$. Substituting $n = 10$ gives $5 + 3(10 - 1) = 5 + 27 = 32$. The common difference of 3 is multiplied by one less than the term number. The first term 5 is added only once.
8. B — $x \leq 8$. Distributing gives $2x - 6 \leq 10$, so $2x \leq 16$ and $x \leq 8$. Dividing by the positive 2 preserves the inequality direction. The boundary value is included because the symbol allows equality.
9. C — (2, 6). Substituting $y = 3x$ into $x + y = 8$ gives $x + 3x = 8$, so $4x = 8$ and $x = 2$, making $y = 6$. Substitution replaces y entirely, leaving one variable. Both equations are satisfied by (2, 6).
10. A — Linear, with a rate of change of 3. The y-values increase by a constant 3 each step (−1, 2, 5, 8), which defines a constant rate of change. A constant first difference indicates a linear function. The starting value of −1 does not change the slope.
11. B — $2x^2 + 4x - 5$. Combining like terms gives $(4x^2 - 2x^2) + (x + 3x) + (-6 + 1) = 2x^2 + 4x - 5$. Each pair of like terms is added separately. The constants combine to −5.
12. D — shifted vertically up 7 units. Adding 7 outside the squared term raises every output by 7, moving the parabola upward. Constants added to the whole function produce vertical shifts. The positive sign moves the graph up.
13. C — $y = -2x$. The given slope is 1/2, so the perpendicular slope is the negative reciprocal, −2; passing through the origin gives a y-intercept of 0. The equation is therefore $y = -2x$. Perpendicular slopes are negative reciprocals of each other.
14. A — (−2, −3). The vertex x-value is $-b/(2a) = -4/2 = -2$, and $f(-2) = 4 - 8 + 1 = -3$, giving vertex (−2, −3). The axis of symmetry locates the x-coordinate. Evaluating the function there gives the y-coordinate.
15. D — rational because it is equal to the integer 8. Since 64 is a perfect square, $\sqrt{64} = 8$, an integer and therefore rational. Perfect-square roots simplify to whole numbers. Only non-perfect-square roots are irrational.
16. B — The mean is greater than the median because of the outlier. The value 50 pulls the mean up to 14.4, while the median remains 6. Outliers strongly affect the mean but not the median. This gap is the signature of a high outlier in a small data set.
17. C — $r = 0.05$. Randomly scattered points with no consistent trend produce a correlation coefficient near zero. A value of 0.05 reflects essentially no linear association. Values near ±1 would indicate strong relationships, which is not the case here.
18. D — $y = 4x - 1$ and $y = 4x + 6$. These lines share the slope 4 but have different y-intercepts, so they are parallel and never intersect. Parallel lines produce a system with no solution. Equal slopes with unequal intercepts is the defining condition.
19. A — (3, 0) and (−2, 0). Factoring $x^2 - x - 6$ gives $(x - 3)(x + 2) = 0$, so the x-intercepts are at $x = 3$ and $x = -2$. The x-intercepts occur where $y = 0$. Each factor set to zero gives one intercept.
20. B — 3. A linear function has a constant rate of change equal to its slope, which is 3. The average rate of change over any interval of a line is always the slope. Unlike nonlinear functions, the value does not depend on the interval chosen.
21. C — \$520.20. Substituting $t = 2$ gives $500(1.02)^2 = 500(1.0404) = 520.20$. The base is squared before multiplying by the principal. The result rounds exactly to \$520.20.

22. D — exactly one distinct real solution. The discriminant is $(-8)^2 - 4(1)(16) = 64 - 64 = 0$, indicating one repeated root. The expression factors as $(x - 4)^2$, giving a single solution $x = 4$. A zero discriminant means the parabola touches the x-axis at one point.
23. B — 11. Evaluating each absolute value, $|-6| = 6$ and $|3 - 8| = |-5| = 5$, so the sum is $6 + 5 = 11$. Absolute value returns the nonnegative distance from zero. The expression inside each bar is simplified before taking its absolute value.
24. A — Function f, with a y-intercept of 5. The y-intercept is the output at $x = 0$, which is 5 for f and 1 for g (since $g(0) = 1$). Comparing the two, 5 is greater than 1. The y-intercept is read directly from the table at $x = 0$.
25. $x = 2$, $y = 1$. Adding the two equations eliminates y: $(4x - y) + (2x + y) = 7 + 5$, giving $6x = 12$ and $x = 2$; then $2(2) + y = 5$, so $y = 1$. Verification: $4(2) - 1 = 7$ and $2(2) + 1 = 5$, so both equations hold. The solution is (2, 1).
26. $y = -(1/4)x + 3$. The given slope is 4, so the perpendicular slope is the negative reciprocal, $-1/4$. Using point-slope with (8, 1): $y - 1 = -(1/4)(x - 8)$, which expands to $y = -(1/4)x + 2 + 1 = -(1/4)x + 3$.
27. $x = -8$ and $x = 2$. Factoring $x^2 + 6x - 16$ gives $(x + 8)(x - 2) = 0$. Setting each factor to zero, $x + 8 = 0$ yields $x = -8$ and $x - 2 = 0$ yields $x = 2$.
28. Exponential. Each output is multiplied by a constant 4 ($4 \rightarrow 16 \rightarrow 64 \rightarrow 256$), giving a common ratio rather than a constant difference. The function rule is $y = 4^x$, with a base of 4.
29. $x(x + 7)(x - 2)$. Factor out the GCF of x to get $x(x^2 + 5x - 14)$, then factor the trinomial into $(x + 7)(x - 2)$. The fully factored form is $x(x + 7)(x - 2)$.
30. $d = 5$, $a_1 = 3$, $a_n = 3 + 5(n - 1)$. Since $a_8 - a_5 = 3d = 38 - 23 = 15$, the common difference is $d = 5$. From $a_5 = a_1 + 4d = a_1 + 20 = 23$, the first term is $a_1 = 3$, giving the explicit formula $a_n = 3 + 5(n - 1)$.
31. $2 < x \leq 5$. Adding 5 to all parts gives $6 < 3x \leq 15$, and dividing by 3 yields $2 < x \leq 5$. On a number line, this is shown with an open circle at 2, a closed circle at 5, and shading between them.
32. Residual = −2, below the line. The predicted height is $\hat{y} = 2(6) + 8 = 20$, and the residual is $18 - 20 = -2$. Because the residual is negative, the measured height was below the value predicted by the line of best fit.
33. a. The axis of symmetry is $x = -b/(2a) = 4/2 = 2$, and $f(2) = 4 - 8 - 21 = -25$, giving vertex (2, −25). b. Factoring $x^2 - 4x - 21 = (x - 7)(x + 3)$ gives zeros $x = 7$ and $x = -3$. c. The parabola opens upward ($a > 0$); the vertex is (2, −25); the axis of symmetry is $x = 2$; the x-intercepts are (7, 0) and (−3, 0); the y-intercept is (0, −21); and the minimum value is −25.
34. a. $x + y = 100$ and $0.20x + 0.50y = 35$. b. Solving the first for y gives $y = 100 - x$; substituting yields $0.20x + 0.50(100 - x) = 35$, so $0.20x + 50 - 0.50x = 35$, giving $-0.30x = -15$ and $x = 50$, with $y = 50$. So 50 mL of each solution are needed. c. Verification: $50 + 50 = 100$ and $0.20(50) + 0.50(50) = 10 + 25 = 35$, so both equations are satisfied.
35. a. The length is $w + 4$, and the area equation is $w(w + 4) = 96$. b. Expanding and setting equal to zero gives $w^2 + 4w - 96 = 0$. c. Factoring gives $(w + 12)(w - 8) = 0$, so $w = -12$ or $w = 8$. d. A width cannot be negative, so $w = -12$ is rejected and only $w = 8$ is valid in this context. e. The width is 8 meters and the length is $8 + 4 = 12$ meters; the area is $8 \times 12 = 96$ square meters, which verifies the solution.