PRACTICE EXAM 42: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. The formula for the perimeter of a rectangle is $P = 2l + 2w$. Which equation correctly solves the formula for w?

A. $w = P - 2l$

B. $w = 2P - l$

C. $w = (P - 2l)/2$

D. $w = P/2 - 2l$

2. If $f(x) = (1/2)x - 6$, what is the value of $f(8)$?

A. $f(8) = -2$

B. $f(8) = 2$

C. $f(8) = -10$

D. $f(8) = 10$

3. Solve the equation $4(x + 2) = 6x - 2$ for x.

A. $x = 1$

B. $x = 3$

C. $x = -5$

D. $x = 5$

4. Which expression is the completely factored form of $3x^2 + 12x + 9$?

A. $3(x + 9)(x + 1)$

B. $(3x + 3)(x + 3)$

C. $3(x + 1)(x + 3)$

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

5. A $2,000 investment grows at 4% annual interest compounded yearly. Which function gives its value after t years?

A. V(t) = 2000(0.04)^t

B. V(t) = 2000(1.04)^t

C. V(t) = 2000(4)^t

D. V(t) = 2000 + 0.04t

6. What are the roots of the equation $x^2 - 9x + 20 = 0$?

A. $x = -4$ and $x = -5$

B. $x = 2$ and $x = 10$

C. $x = -4$ and $x = 5$

D. $x = 4$ and $x = 5$

7. An arithmetic sequence has a first term of 3 and a common difference of 5. What is the 20th term?

A. $a_{20} = 98$

B. $a_{20} = 103$

C. $a_{20} = 100$

D. $a_{20} = 95$

8. A worker earns $18 per hour and wants to earn at least $540 this week. Which inequality represents the number of hours h the worker must work?

A. $h \leq 30$

B. $h \geq 30$

C. $h \geq 522$

D. $h \leq 540$

9. What is the value of x in the solution to the system $3x - 2y = 16$ and $y = x - 6$?

A. $x = 10$

B. $x = -2$

C. $x = 6$

D. $x = 4$

10. The table below shows values of a function.

x: 1, 2, 3, 4

y: 3, 0, −1, 0

Which type of function is represented?

A. Linear, with a constant rate of change

B. Exponential, with a constant ratio

C. Quadratic, with constant second differences

D. Absolute value, with a V-shaped graph

11. Which expression is equivalent to $3(2x - 4) - 2(x + 5)$?

A. $4x - 22$

B. $4x - 2$

C. $4x + 22$

D. $6x - 22$

12. Which statement best describes the transformation from $f(x) = x^2$ to $g(x) = (x + 3)^2$?

A. The graph of f(x) is shifted horizontally right 3 units

B. The graph of f(x) is shifted horizontally left 3 units

C. The graph of f(x) is shifted vertically up 3 units

D. The graph of f(x) is shifted vertically down 3 units

13. What is the x-intercept of the line $2x - 5y = 10$?

A. (0, 5)

B. (0, −2)

C. (−2, 0)

D. (5, 0)

14. The function $f(x) = 3x^2 - 12x + 7$ has a minimum value. What is that minimum value?

A. $f = -5$

B. $f = 2$

C. $f = 7$

D. $f = -1$

15. Which statement is true about the product $\sqrt{3} \cdot \sqrt{3}$?

A. It is irrational because both factors are irrational

B. It is irrational because it still contains a radical

C. It is rational because the product equals 3

D. It is undefined because $\sqrt{3}$ is not a real number

16. A data set of 5 numbers has a mean of 12. If a sixth number, 30, is added to the set, what is the new mean?

A. mean = 12

B. mean = 15

C. mean = 18

D. mean = 21

17. A data set has a correlation coefficient of $r = -0.15$. Which statement best describes the linear relationship?

A. a weak negative linear relationship

B. a strong negative linear relationship

C. a strong positive linear relationship

D. a perfect negative linear relationship

18. Which statement is true about the system $y = 4x - 7$ and $2y = 8x - 14$?

A. The system has exactly one solution at the origin

B. The system has no solution because the lines are parallel

C. The system has exactly one solution at (7, 0)

D. The system has infinitely many solutions

19. For what values of x does the function $f(x) = x(x - 8)$ equal zero?

A. $x = 8$ only

B. $x = -8$ and $x = 0$

C. $x = 0$ and $x = 8$

D. $x = 8$ and $x = 1$

20. What is the average rate of change of $f(x) = x^2 + 1$ over the interval $2 \leq x \leq 5$?

A. 21

B. 7

C. 9

D. 3

21. The function P(t) = 50000(0.97)^t models a town's population t years after a census. Which statement is correct?

A. The population starts at 50,000 and grows by 3% per year

B. The population starts at 97,000 and decreases each year

C. The population starts at 50,000 and decreases by 3% per year

D. The population starts at 50,000 and decreases by 97% per year

22. How many real solutions does the equation $x^2 - 4x + 7 = 0$ have?

A. no real solutions

B. exactly one real solution

C. exactly two real solutions

D. infinitely many real solutions

23. Function A is linear and increases by 8 at each step. Function B is exponential and multiplies by 2 at each step. Both functions begin at a value of 10. Which statement is true after several steps?

A. Function A will always be greater than Function B

B. Function B will eventually become and stay greater than Function A

C. Both functions increase by the same amount at each step

D. Function A is exponential and Function B is linear

24. If $f(x) = |2x - 5|$, what is the value of $f(1)$?

A. $f(1) = 7$

B. $f(1) = -3$

C. $f(1) = -7$

D. $f(1) = 3$

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.

$x + 2y = 11$

$3x - y = 5$

26. Write the equation of the line that is perpendicular to $y = (1/4)x + 2$ and passes through the point $(2, -1)$. Express your answer in slope-intercept form.

27. Solve the quadratic equation $x^2 - 3x - 40 = 0$ by factoring. Show all steps.

28. The table below shows values of a function.

x: 0, 1, 2, 3

y: 5, 8, 11, 14

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: $2x^3 - 8x^2 - 10x$.

30. An arithmetic sequence has a first term of -4 and a common difference of 6.

a. Write the explicit formula for the nth term.

b. Determine which term in the sequence is equal to 56.

31. Solve the inequality $3(x - 2) < 4x + 1$ and graph the solution set on a number line.

32. A line of best fit for a set of plant-growth data is given by $\hat{y} = 5x + 20$, where x is the number of weeks and $\hat{y}$ is the predicted height in centimeters. In week 4, the measured height was 35 cm.

Calculate the residual and explain what the sign of the residual tells you about the data point relative to the line.

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

Each question is worth 4 credits. Show all work.

33. Consider the quadratic function $f(x) = 2x^2 + 4x - 6$.

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 movie theater sells adult tickets for $12 and child tickets for $8. On one night, 200 tickets were sold for a total of $2,040.

a. Write a system of equations that models this situation, using a for the number of adult tickets and c for the number of child tickets.

b. Solve the system to determine how many adult tickets and how many child tickets were sold.

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 farmer has 60 meters of fencing to enclose a rectangular garden along a straight river. Fencing is needed on only three sides — the two sides perpendicular to the river and the one side parallel to it — because the river forms the fourth side. Let w represent the width of each of the two sides perpendicular to the river.

a. Write an expression for the length of the side parallel to the river in terms of w.

b. Write a function A(w) for the area of the garden in terms of w, and expand it into standard form.

c. Determine the width w that maximizes the enclosed area. Use the axis of symmetry and show your work.

d. Find the maximum area of the garden. Show your calculation.

e. Create a table of values for A(w) at w = 5, 10, 15, 20, and 25 meters. Use the table to confirm the width that produces the maximum area.

ANSWERS KEY AND EXPLANATIONS

1. C — $w = (P - 2l)/2$. Subtracting $2l$ from both sides of $P = 2l + 2w$ gives $2w = P - 2l$, and dividing by 2 isolates w. Each operation must be applied to the entire side, so the full quantity $P - 2l$ is divided by 2. Distributing the division only to part of the expression is the common error in Choice D.

2. A — f(8) = −2. Substituting 8 gives (1/2)(8) − 6 = 4 − 6 = −2. The coefficient 1/2 is multiplied by the input before the constant is subtracted. Following order of operations produces the correct value.
3. D — x = 5. Distributing gives 4x + 8 = 6x − 2, and collecting terms yields 10 = 2x, so x = 5. Variables are gathered on one side and constants on the other. Substituting back confirms both sides equal 18.
4. C — 3(x + 1)(x + 3). First factor out the GCF of 3 to get 3(x² + 4x + 3), then factor the trinomial into (x + 1)(x + 3). Complete factoring requires removing the greatest common factor before factoring the trinomial. Choice B leaves a common factor inside a binomial, so it is not fully factored.
5. B — V(t) = 2000(1.04)^t. A 4% annual increase means each year's value is 104% of the previous year, so the base is 1 + 0.04 = 1.04. The principal 2000 is multiplied repeatedly by this growth factor. A base greater than 1 models exponential growth rather than simple addition.
6. D — x = 4 and x = 5. Factoring x² − 9x + 20 gives (x − 4)(x − 5) = 0, so the roots are 4 and 5. The factor pair of +20 that sums to −9 is −4 and −5. Setting each factor to zero by the zero-product property yields the solutions.
7. A — a_{20} = 98. Using $a_n = a_1 + d(n - 1)$, the 20th term is 3 + 5(19) = 3 + 95 = 98. The common difference is multiplied by one less than the term number. The first term is added only once, at the start.
8. B — h ≥ 30. The earnings 18h must be at least 540, giving 18h ≥ 540, so h ≥ 30. The phrase "at least" translates to a greater-than-or-equal inequality. Dividing by the positive 18 preserves the inequality direction.
9. D — x = 4. Substituting y = x − 6 into 3x − 2y = 16 gives 3x − 2(x − 6) = 16, which simplifies to x + 12 = 16, so x = 4. Substitution replaces y entirely, leaving a single-variable equation. The corresponding y-value is −2, and both equations check.
10. C — Quadratic, with constant second differences. The first differences (−3, −1, +1) are not constant, but the second differences are a constant +2, which identifies a quadratic. A constant second difference is the defining signature of a quadratic function. The symmetric output values also reflect a parabola.
11. A — 4x − 22. Distributing gives 6x − 12 − 2x − 10, and combining like terms yields 4x − 22. The −2 must distribute to both terms of (x + 5), producing −2x and −10. Sign errors on the second distribution lead to the other choices.
12. B — shifted horizontally left 3 units. Adding inside the parentheses, (x + 3)², shifts the parabola in the negative x-direction. Horizontal shifts move opposite to the sign appearing with x, so +3 moves left. Shifts inside the function affect the input, producing horizontal movement.
13. D — (5, 0). The x-intercept occurs where y = 0, so 2x = 10 gives x = 5. An x-intercept always has a y-coordinate of zero. Substituting y = 0 isolates the value where the line crosses the x-axis.
14. A — f = −5. The vertex x-value is −b/(2a) = 12/6 = 2, and f(2) = 3(4) − 12(2) + 7 = 12 − 24 + 7 = −5. Because a > 0, the parabola opens upward and the vertex gives the minimum. The minimum value is the y-coordinate of the vertex.
15. C — rational because the product equals 3. Multiplying √3 by √3 returns the radicand, giving exactly 3, which is an integer and therefore rational. A square root multiplied by itself eliminates the radical. The product of two equal irrational square roots can be rational.

16. B — mean = 15. The original five values total $5 \times 12 = 60$, and adding 30 makes 90, which divided by 6 equals 15. The mean is the total sum divided by the number of values. Adding a value above the current mean raises the average.
17. A — a weak negative linear relationship. A correlation of -0.15 is close to zero, indicating little linear association, and the negative sign gives a slight downward direction. Values near zero reflect weak relationships regardless of sign. Only values near ±1 indicate strong association.
18. D — infinitely many solutions. Dividing $2y = 8x - 14$ by 2 produces $y = 4x - 7$, identical to the first equation, so the two equations represent the same line. Coincident lines share every point, giving infinitely many solutions. Equations that are scalar multiples of each other are dependent.
19. C — $x = 0$ and $x = 8$. By the zero-product property, $x = 0$ or $x - 8 = 0$, giving $x = 0$ and $x = 8$. A product equals zero only when at least one factor is zero. Both factors must be set equal to zero to capture all solutions.
20. B — 7. The average rate of change is $[f(5) - f(2)]/(5 - 2) = (26 - 5)/3 = 21/3 = 7$. This represents the slope of the line connecting the two endpoints of the interval. It measures the mean change in output per unit input.
21. C — starts at 50,000 and decreases by 3% per year. The coefficient 50000 is the initial population, and the base 0.97 equals $1 - 0.03$, indicating a 3% annual decline. A base between 0 and 1 always signals exponential decay. The percent decrease is the difference between 1 and the base.
22. A — no real solutions. The discriminant $b^2 - 4ac = (-4)^2 - 4(1)(7) = 16 - 28 = -12$, which is negative. A negative discriminant means the parabola does not cross the x-axis, so there are no real roots. The sign of the discriminant determines the number of real solutions.
23. B — Function B will eventually become and stay greater than Function A. Exponential growth multiplies by a constant factor, while linear growth adds a constant amount, so the exponential function ultimately overtakes the linear one. Although the linear function may lead early, repeated doubling outpaces fixed addition. Exponential growth dominates linear growth in the long run.
24. D — $f(1) = 3$. Substituting gives $|2(1) - 5| = |-3| = 3$, since absolute value returns the nonnegative distance from zero. The expression inside is evaluated first, then its absolute value is taken. Absolute value can never produce a negative result.
25. $x = 3$, $y = 4$. Solving $3x - y = 5$ for y gives $y = 3x - 5$; substituting into $x + 2y = 11$ yields $x + 2(3x - 5) = 11$, so $7x - 10 = 11$ and $x = 3$, making $y = 4$. Verification: $3 + 2(4) = 11$ and $3(3) - 4 = 5$, so both equations hold. The solution is (3, 4).
26. $y = -4x + 7$. The given slope is 1/4, so the perpendicular slope is the negative reciprocal, -4. Using point-slope with $(2, -1)$: $y + 1 = -4(x - 2)$, which expands to $y = -4x + 8 - 1 = -4x + 7$.
27. $x = 8$ and $x = -5$. Factoring $x^2 - 3x - 40$ gives $(x - 8)(x + 5) = 0$. Setting each factor to zero, $x - 8 = 0$ yields $x = 8$ and $x + 5 = 0$ yields $x = -5$.
28. Linear. The first differences are a constant +3 ($5 \rightarrow 8 \rightarrow 11 \rightarrow 14$), which indicates a constant rate of change rather than a constant ratio or second difference. With a y-intercept of 5 and slope 3, the function rule is $y = 3x + 5$.
29. $2x(x - 5)(x + 1)$. Factor out the GCF of $2x$ to get $2x(x^2 - 4x - 5)$, then factor the trinomial into $(x - 5)(x + 1)$. The fully factored form is $2x(x - 5)(x + 1)$.

30. a. $a_n = -4 + 6(n - 1)$. b. Setting $-4 + 6(n - 1) = 56$ gives $6(n - 1) = 60$, so $n - 1 = 10$ and $n = 11$. The 11th term equals 56.
31. $x > -7$. Distributing gives $3x - 6 < 4x + 1$; subtracting $3x$ and 1 from both sides yields $-7 < x$, or $x > -7$. On a number line, this is shown with an open circle at -7 and shading extending to the right.
32. Residual = -5, below the line. The predicted height is $\hat{y} = 5(4) + 20 = 40$, and the residual is $35 - 40 = -5$. Because the residual is negative, the actual measured height lies below the value predicted by the line of best fit.
33. a. The axis of symmetry is $x = -b/(2a) = -4/4 = -1$, and $f(-1) = 2(1) + 4(-1) - 6 = -8$, giving vertex $(-1, -8)$. b. Factoring $2x^2 + 4x - 6 = 2(x^2 + 2x - 3) = 2(x + 3)(x - 1)$ gives zeros $x = -3$ and $x = 1$. c. The parabola opens upward ($a > 0$); the vertex is $(-1, -8)$; the axis of symmetry is $x = -1$; the x-intercepts are $(-3, 0)$ and $(1, 0)$; the y-intercept is $(0, -6)$; and the minimum value is -8.
34. a. $a + c = 200$ and $12a + 8c = 2040$. b. Solving the first for c gives $c = 200 - a$; substituting yields $12a + 8(200 - a) = 2040$, so $4a + 1600 = 2040$, giving $a = 110$ adult tickets and $c = 90$ child tickets. c. Verification: $110 + 90 = 200$ and $12(110) + 8(90) = 1320 + 720 = 2040$, so both equations are satisfied.
35. a. The side parallel to the river has length $60 - 2w$. b. Area is $A(w) = w(60 - 2w) = 60w - 2w^2$. c. The axis of symmetry is $w = -b/(2a) = -60/(2 \cdot -2) = 15$ meters. d. $A(15) = 60(15) - 2(15)^2 = 900 - 450 = 450$ square meters. e. $A(5) = 250$, $A(10) = 400$, $A(15) = 450$, $A(20) = 400$, $A(25) = 250$; the table is symmetric about $w = 15$, confirming the maximum area of 450 square meters occurs at a width of 15 meters.