PRACTICE EXAM 49: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 $2(3x - 1) = 4(x + 3)$ for x.

A. $x = 5$

B. $x = -7$

C. $x = 7$

D. $x = 2$

2. If $f(x) = x^2 + 3x$, what is the value of $f(5)$?

A. $f(5) = 40$

B. $f(5) = 28$

C. $f(5) = 16$

D. $f(5) = 35$

3. What is the slope of the line that passes through the points $(-2, 6)$ and $(4, -3)$?

A. 3/2

B. 2/3

C. −2/3

D. −3/2

4. Which expression is the factored form of $x^2 - 4x - 12$?

A. $(x - 4)(x - 3)$

B. $(x - 6)(x + 2)$

C. $(x + 6)(x - 2)$

D. $(x - 12)(x + 1)$

5. An investment of $1,500 grows at 7% per year. Which function gives its value after t years?

A. V(t) = 1500(1.07)^t

B. V(t) = 1500(0.07)^t

C. $V(t) = 1500(0.93)^t$

D. $V(t) = 1500 + 0.07t$

6. What are the solutions to the equation $x^2 + 3x - 28 = 0$?

A. $x = 7$ and $x = -4$

B. $x = -7$ and $x = -4$

C. $x = 7$ and $x = 4$

D. $x = -7$ and $x = 4$

7. Which explicit formula represents the sequence −5, −1, 3, 7, …?

A. $a_n = -5 - 4(n - 1)$

B. $a_n = 4 - 5(n - 1)$

C. $a_n = -5 + 4(n - 1)$

D. $a_n = -5(4)^{(n - 1)}$

8. A student has $60 to spend. Notebooks cost $4 each and pens cost $2 each. If the student buys 5 pens, which inequality represents the number of notebooks n that can be bought?

A. $n \leq 15$

B. $n \leq 12.5$

C. $n \geq 12.5$

D. $n \leq 17.5$

9. What is the value of x in the solution to the system $3x + 2y = 12$ and $3x - y = 3$?

A. $x = 4$

B. $x = -2$

C. $x = 3$

D. $x = 2$

10. The table below shows values of a function.

x: 0, 1, 2, 3

y: 64, 32, 16, 8

Which type of function is represented?

A. Exponential, with a common ratio of 1/2

B. Linear, with a rate of change of −16

C. Quadratic, with constant second differences

D. Exponential, with a common ratio of 2

11. Which expression is equivalent to $(6x^2 - 2x + 9) - (4x^2 + 3x - 5)$?

A. $2x^2 + x + 4$

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

C. $2x^2 - 5x + 14$

D. $2x^2 + 5x + 14$

12. Which statement best describes the transformation from $f(x) = x^2$ to $g(x) = x^2 - 9$?

A. The graph of f(x) is shifted vertically up 9 units

B. The graph of f(x) is shifted vertically down 9 units

C. The graph of f(x) is shifted horizontally right 9 units

D. The graph of f(x) is shifted horizontally left 9 units

13. A line has an x-intercept of 4 and a y-intercept of −2. What is its equation in slope-intercept form?

A. $y = 2x - 2$

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

C. $y = (1/2)x + 4$

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

14. What is the minimum value of the function $f(x) = x^2 - 8x + 10$?

A. $f = -6$

B. $f = 4$

C. f = 10

D. f = −2

15. Which of the following products is an irrational number?

A. √4 × √9

B. 3 × (1/3)

C. 5 × √2

D. √16 × 2

16. A data set of 4 values has a mean of 20. If one value of 40 is removed, what is the mean of the remaining 3 values?

A. mean = 20

B. mean ≈ 13.33

C. mean = 15

D. mean = 40

17. A scatter plot shows points falling almost exactly along a line that rises from left to right. Which value is closest to the correlation coefficient?

A. r = −0.98

B. r = 0.20

C. $r = 0.00$

D. $r = 0.98$

18. A line of best fit predicts $\hat{y} = 6x - 4$, and a data point (5, 30) is observed. What is the residual, and what does it indicate?

A. residual = −4; the point lies below the line

B. residual = 0; the point lies on the line

C. residual = 4; the point lies above the line

D. residual = 30; the line fits the point poorly

19. Which system of equations has infinitely many solutions?

A. $y = 2x - 3$ and $2y = 4x - 6$

B. $y = 2x - 3$ and $y = 2x + 1$

C. $y = x$ and $y = 2x$

D. $y = 5x + 1$ and $y = -5x + 1$

20. What are the zeros of the function $f(x) = x^2 - 5x$?

A. $x = 5$ only

B. $x = 0$ and $x = 5$

C. $x = -5$ and $x = 0$

D. $x = 5$ and $x = 1$

21. The table below shows values of a function $f(x)$.

x: 2, 6

f(x): 10, 2

What is the average rate of change of $f(x)$ from $x = 2$ to $x = 6$?

A. −8

B. 2

C. −2

D. 4

22. A drug in the bloodstream is modeled by $D(t) = 250(0.80)^t$, where t is in hours. By what percent does the amount decrease each hour?

A. 20%

B. 80%

C. 0.80%

D. 8%

23. How many real solutions does the equation $x^2 + 6x + 4 = 0$ have?

A. no real solutions

B. two real solutions

C. exactly one real solution

D. it cannot be determined

24. Two savings accounts are modeled by $f(x) = 100x + 200$ and $g(x) = 100x + 350$, where x is the number of months. Which statement is true?

A. Account f saves more per month than Account g

B. Account g saves more per month than Account f

C. Both accounts start with the same amount

D. The accounts save at the same monthly rate, but g started with more

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.

$2x + y = 8$

$x - 2y = -1$

26. Write the equation of the line that passes through the points (0, −5) and (3, 4). Express your answer in slope-intercept form.

27. Solve the quadratic equation $2x^2 + 7x + 6 = 0$ by factoring. Show all steps.

28. The table below shows values of a function.

x: 0, 1, 2, 3

y: 1, 5, 9, 13

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: $2x^3 - 18x$.

30. A geometric sequence has $a_2 = 6$ and $a_3 = 18$. Find the common ratio, the first term, and write the explicit formula for the nth term.

31. Solve the inequality $5 - 2x \leq 11$ and graph the solution set on a number line.

32. A line of best fit for sales data is given by $\hat{y} = 3x + 12$, where x is the number of advertisements and $\hat{y}$ is the predicted number of units sold. In a week with 5 advertisements, the actual number of units sold was 30.

Calculate the residual and state whether the actual sales were 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 $f(x) = x^2 - 8x + 12$.

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 gym membership tracks the total amount paid over time. After 3 months the total paid is $145, and after 7 months the total paid is $285.

a. Determine the monthly cost (the slope). Show your work.

b. Write a linear function C(m) that gives the total cost after m months.

c. Identify the one-time joining fee and explain what it represents.

d. Use your function to determine the total cost after 12 months. Show your calculation.

PART IV — Extended Constructed Response (Question 35)

This question is worth 6 credits. Show all work.

35. A rare coin is purchased for $400. Its value increases by 25% each year, modeled by the function V(t) = 400(1.25)^t, where t is the number of years.

a. Determine the value of the coin after 1 year and after 2 years. Show your calculations.

b. Create a table of values for V(t) at t = 0, 1, 2, 3, and 4 years, rounding each value to the nearest dollar.

c. State whether the function represents growth or decay, and identify the rate.

d. Using your table, determine between which two years the value of the coin first exceeds $800. Justify your answer.

e. Find the average rate of change of the coin's value from t = 0 to t = 4, and explain what this value represents in the context of this problem.

PRACTICE EXAM 49 – ANSWER KEY AND EXPLANATIONS

1. C — x = 7. Distributing both sides gives 6x − 2 = 4x + 12, so 2x = 14 and x = 7. Each side is expanded before collecting variable and constant terms. Substituting back gives 40 on both sides, confirming the solution.
2. A — f(5) = 40. Substituting gives $5^2 + 3(5) = 25 + 15 = 40$. The squared term and the linear term are evaluated separately, then added. Order of operations produces the correct value.
3. D — slope = −3/2. Using (−3 − 6)/(4 − (−2)) = −9/6 = −3/2. The negative slope reflects that y decreases as x increases. Reducing the fraction gives the correct form.

4. B — $(x - 6)(x + 2)$. The factor pair of −12 that sums to −4 is −6 and +2, giving $(x - 6)(x + 2)$. The larger-magnitude factor is negative to produce the −4x middle term. Expanding returns $x^2 - 4x - 12$.
5. A — $V(t) = 1500(1.07)^t$. A 7% annual increase means each year's value is 107% of the previous year, so the base is 1 + 0.07 = 1.07. The principal 1,500 is multiplied repeatedly by this growth factor. A base above 1 models exponential growth.
6. D — x = −7 and x = 4. Factoring $x^2 + 3x - 28$ gives $(x + 7)(x - 4) = 0$, so the solutions are −7 and 4. The factor pair of −28 that sums to +3 is +7 and −4. Setting each factor to zero produces the roots.
7. C — $a_n = -5 + 4(n - 1)$. The first term is −5 and the common difference is +4, since each term increases by 4. The explicit form $a_1 + d(n - 1)$ gives $-5 + 4(n - 1)$. A positive common difference reflects the increasing sequence.
8. B — $n \leq 12.5$. The total cost $4n + 2(5)$ must not exceed 60, giving $4n + 10 \leq 60$, so $4n \leq 50$ and $n \leq 12.5$. The five pens contribute a fixed $10, while notebook cost scales with n. Solving the inequality keeps spending within budget.
9. D — x = 2. Subtracting the second equation from the first eliminates x: $(3x + 2y) - (3x - y) = 12 - 3$, giving $3y = 9$ and $y = 3$; then $3x - 3 = 3$, so $x = 2$. Elimination works because both equations share the term 3x. The matching coefficient allows direct subtraction.
10. A — Exponential, with a common ratio of 1/2. Each output is multiplied by 1/2 (64, 32, 16, 8), giving a constant ratio rather than a constant difference. A constant multiplier between consecutive terms defines exponential decay. The ratio 32/64 = 1/2 confirms the base.
11. C — $2x^2 - 5x + 14$. Distributing the subtraction gives $6x^2 - 2x + 9 - 4x^2 - 3x + 5$, and combining like terms yields $2x^2 - 5x + 14$. Every term in the second polynomial changes sign. The constant becomes 9 + 5 = 14 after the negative distributes.
12. B — shifted vertically down 9 units. Subtracting 9 from the entire function lowers every output by 9, moving the parabola down. Constants subtracted outside the squared term produce vertical shifts. The negative sign moves the graph downward.
13. D — $y = (1/2)x - 2$. The line passes through (4, 0) and (0, −2), giving slope $(0 - (-2))/(4 - 0) = 1/2$ and y-intercept −2. The equation is therefore $y = (1/2)x - 2$. The intercepts provide both the slope and the constant.
14. A — f = −6. The vertex x-value is $-b/(2a) = 8/2 = 4$, and $f(4) = 16 - 32 + 10 = -6$. 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 — $5 \times \sqrt{2}$. Multiplying the rational number 5 by the irrational $\sqrt{2}$ produces an irrational product. A nonzero rational times an irrational number is always irrational. The other products simplify to rational values such as 6, 1, and 8.
16. B — mean ≈ 13.33. The four values total 4 × 20 = 80, and removing 40 leaves 40, which divided by 3 is about 13.33. The mean is the sum of the remaining values divided by their count. Removing a value above the mean lowers the average.
17. D — r = 0.98. Points falling almost exactly along a line that rises from left to right indicate a strong positive relationship. A value of 0.98 reflects both high strength and positive direction. A correlation near +1 corresponds to tightly clustered, upward-trending data.
18. C — residual = 4; the point lies above the line. The predicted value is 6(5) − 4 = 26, and the residual is 30 − 26 = 4. A positive residual means the observed point lies above the line of best fit. Residuals measure the vertical gap between data and prediction.

19. A — $y = 2x - 3$ and $2y = 4x - 6$. Dividing the second equation by 2 produces $y = 2x - 3$, identical to the first, so the two represent the same line. Coincident lines share every point, giving infinitely many solutions. Equations that are scalar multiples of each other are dependent.
20. B — $x = 0$ and $x = 5$. Factoring gives $x(x - 5) = 0$, so by the zero-product property $x = 0$ or $x = 5$. Each factor set to zero yields one zero. The common factor of x produces the zero at the origin.
21. C — −2. The average rate of change is $[f(6) - f(2)]/(6 - 2) = (2 - 10)/4 = -8/4 = -2$. The negative result reflects that the function decreases over the interval. It equals the slope of the segment joining the two points.
22. A — 20%. In $D(t) = 250(0.80)^t$, the base 0.80 equals $1 - 0.20$, indicating a 20% decrease each hour. A base between 0 and 1 signals exponential decay. The percent decrease is the difference between 1 and the base.
23. B — two real solutions. The discriminant is $6^2 - 4(1)(4) = 36 - 16 = 20$, which is positive. A positive discriminant means the parabola crosses the x-axis at two distinct points. The sign of the discriminant determines the number of real solutions.
24. D — The accounts save at the same monthly rate, but g started with more. Both functions have a slope of 100, so they save at the same rate, while g has a larger y-intercept (350 versus 200). The coefficient of x is the monthly rate, and the constant is the starting amount. Comparing both terms confirms the statement.
25. $x = 3$, $y = 2$. Solving $2x + y = 8$ for y gives $y = 8 - 2x$; substituting into $x - 2y = -1$ yields $x - 2(8 - 2x) = -1$, so $5x - 16 = -1$ and $x = 3$, making $y = 2$. Verification: $2(3) + 2 = 8$ and $3 - 2(2) = -1$, so both equations hold. The solution is (3, 2).
26. $y = 3x - 5$. The slope is $(4 - (-5))/(3 - 0) = 9/3 = 3$, and the point (0, −5) gives a y-intercept of −5. The equation is therefore $y = 3x - 5$.
27. $x = -3/2$ and $x = -2$. Factoring $2x^2 + 7x + 6$ gives $(2x + 3)(x + 2) = 0$. Setting each factor to zero, $2x + 3 = 0$ yields $x = -3/2$ and $x + 2 = 0$ yields $x = -2$.
28. Linear. The first differences are a constant 4 ($1 \rightarrow 5 \rightarrow 9 \rightarrow 13$), indicating a constant rate of change. With a y-intercept of 1 and slope 4, the function rule is $y = 4x + 1$.
29. $2x(x - 3)(x + 3)$. Factor out the GCF of 2x to get $2x(x^2 - 9)$, then factor the difference of two squares: $x^2 - 9 = (x - 3)(x + 3)$. The fully factored form is $2x(x - 3)(x + 3)$.
30. $r = 3$, $a_1 = 2$, $a_n = 2(3)^{(n - 1)}$. The common ratio is $a_3/a_2 = 18/6 = 3$. Since $a_2 = a_1 r = 3a_1 = 6$, the first term is $a_1 = 2$, giving the explicit formula $a_n = 2(3)^{(n - 1)}$.
31. $x \geq -3$. Subtracting 5 gives $-2x \leq 6$, and dividing by −2 reverses the inequality to $x \geq -3$. On a number line, this is shown with a closed circle at −3 and shading extending to the right.
32. Residual = 3, above the line. The predicted sales are $\hat{y} = 3(5) + 12 = 27$, and the residual is $30 - 27 = 3$. Because the residual is positive, the actual sales were above the value predicted by the line of best fit.
33. a. The axis of symmetry is $x = -b/(2a) = 8/2 = 4$, and $f(4) = 16 - 32 + 12 = -4$, giving vertex (4, −4). b. Factoring $x^2 - 8x + 12 = (x - 2)(x - 6)$ gives zeros $x = 2$ and $x = 6$. c. The parabola opens upward ($a > 0$); the vertex is (4, −4); the axis of symmetry is $x = 4$; the x-intercepts are (2, 0) and (6, 0); the y-intercept is (0, 12); and the minimum value is −4.
34. a. The monthly cost is $(285 - 145)/(7 - 3) = 140/4 = 35$ dollars per month. b. Using $C(m) = 35m + b$ with $145 = 35(3) + b$ gives $b = 40$, so $C(m) = 35m + 40$. c. The joining fee is

$40, the one-time charge applied before any monthly payments. d. $C(12) = 35(12) + 40 = 420 + 40 = 460$, so the total cost after 12 months is $460.

35. a. $V(1) = 400(1.25) = 500$ dollars and $V(2) = 400(1.25)^2 = 400(1.5625) = 625$ dollars. b. $V(0) = 400$, $V(1) = 500$, $V(2) = 625$, $V(3) \approx 781$, $V(4) \approx 977$. c. The function represents exponential growth, with a rate of 25% per year. d. The value first exceeds $800 between year 3 and year 4, since $V(3) \approx 781$ is below 800 and $V(4) \approx 977$ is above 800. e. The average rate of change from $t = 0$ to $t = 4$ is $(977 - 400)/(4 - 0) = 577/4 \approx \$144.25$ per year, which represents the average yearly increase in the coin's value over the four-year period.