PRACTICE EXAM 48: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 $3x + 7 = 5x - 9$ for x.

A. $x = 1$

B. $x = 8$

C. $x = -8$

D. $x = 2$

2. If $f(x) = 2x^2 - 5$, what is the value of $f(-4)$?

A. $f(-4) = -37$

B. $f(-4) = 11$

C. $f(-4) = 59$

D. $f(-4) = 27$

3. What is the slope of the line $3x + 4y = 24$?

A. $3/4$

B. 3

C. $-3/4$

D. $-4/3$

4. Which expression is the factored form of $x^2 + 2x - 15$?

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

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

C. $(x + 15)(x - 1)$

D. $(x + 5)(x + 3)$

5. A population of 8,000 decreases by 6% each year. Which function models the population after t years?

A. P(t) = 8000(1.06)^t

B. P(t) = 8000(0.06)^t

C. $P(t) = 8000(0.94)^t$

D. $P(t) = 8000 - 0.06t$

6. What are the solutions to the equation $x^2 - 10x + 21 = 0$?

A. $x = -3$ and $x = -7$

B. $x = 3$ and $x = 7$

C. $x = 3$ and $x = -7$

D. $x = 21$ and $x = 1$

7. What is the next term in the sequence 4, 10, 16, 22, …?

A. 28

B. 26

C. 32

D. 24

8. Solve the inequality $-5x + 3 > 18$.

A. $x > -3$

B. $x > 3$

C. $x < 3$

D. $x < -3$

9. What is the value of y in the solution to the system $x = 2y + 1$ and $3x + y = 17$?

A. $y = 5$

B. $y = 2$

C. $y = 3$

D. $y = 1$

10. The table below shows values of a function.

x: 0, 1, 2, 3

y: 1, 3, 9, 27

Which type of function is represented?

A. Linear, with a rate of change of 2

B. Quadratic, with constant second differences

C. Exponential, with a common ratio of 3

D. Exponential, with a common ratio of 2

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

A. $x^2 - 2x - 24$

B. $x^2 + 2x - 24$

C. $x^2 - 24$

D. $x^2 - 10x - 24$

12. Which statement best describes the transformation from $f(x) = x^2$ to $g(x) = (x - 1)^2 + 4$?

A. shifted left 1 unit and down 4 units

B. shifted left 1 unit and up 4 units

C. shifted right 1 unit and down 4 units

D. shifted right 1 unit and up 4 units

13. A line has a slope of 5 and passes through the point $(-1, 2)$. What is its equation in slope-intercept form?

A. $y = 5x + 2$

B. $y = 5x + 7$

C. $y = 5x - 3$

D. $y = 5x - 7$

14. What are the coordinates of the vertex of $f(x) = x^2 - 6x + 4$?

A. $(-3, -5)$

B. $(3, 5)$

C. (3, −5)

D. (6, 4)

15. Which of the following numbers is rational?

A. √81

B. √15

C. π

D. √2

16. A data set has the five-number summary: minimum 3, Q1 = 8, median 12, Q3 = 20, maximum 28. What is the interquartile range?

A. IQR = 25

B. IQR = 8

C. IQR = 4

D. IQR = 12

17. Which correlation coefficient indicates the strongest linear relationship?

A. r = 0.45

B. r = −0.60

C. r = −0.92

D. $r = 0.30$

18. A line of best fit predicts $\hat{y} = 4x + 2$, and a data point (3, 10) is observed. What is the residual for this point?

A. residual = 4

B. residual = −4

C. residual = 10

D. residual = 14

19. Which system of equations has exactly one solution?

A. $y = 2x + 1$ and $y = -x + 4$

B. $y = 3x + 2$ and $y = 3x - 5$

C. $y = x + 1$ and $2y = 2x + 2$

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

20. The function $f(x) = (3x - 12)(x + 2)$ has zeros at which values?

A. $x = 12$ and $x = -2$

B. $x = -4$ and $x = 2$

C. $x = 4$ and $x = -2$

D. $x = 12$ and $x = 2$

21. What is the average rate of change of $f(x) = x^2 + 2x$ over the interval $1 \leq x \leq 3$?

A. 12

B. 4

C. 3

D. 6

22. The function V(t) = 600(1.10)^t models the value of a collectible. By what percent does its value increase each year?

A. 10%

B. 110%

C. 1.10%

D. 0.10%

23. The equation $3x^2 - 5x + 4 = 0$ has what type of solutions?

A. two real rational solutions

B. no real solutions

C. exactly one real solution

D. two real irrational solutions

24. Two car rental companies are modeled by $A(d) = 30d + 50$ and $B(d) = 45d$, where d is the number of days. Which statement is true?

A. Company A charges more per day than Company B

B. Both companies charge the same daily rate

C. Company B has a higher one-time fee than Company A

D. Company A charges less per day but has a one-time fee that Company B does not

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.

$x + y = 6$

$2x + 3y = 14$

26. Write the equation of the line that is parallel to $y = -3x + 2$ and passes through the point $(1, -4)$. Express your answer in slope-intercept form.

27. Solve the quadratic equation $x^2 - 9x + 14 = 0$ by factoring. Show all steps.

28. The table below shows values of a function.

x: 0, 1, 2, 3

y: −3, −1, 1, 3

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: $5x^2 - 80$.

30. A geometric sequence has a first term of 3 and a common ratio of 5.

a. Write the explicit formula for the nth term.

b. Find the value of the 4th term.

31. Solve the inequality $4x - 7 < 9$ and graph the solution set on a number line.

32. A line of best fit for attendance data is given by $\hat{y} = -0.5x + 30$, where x is the temperature in degrees and $\hat{y}$ is the predicted attendance. On a day when the temperature was 20 degrees, the actual attendance was 25.

Calculate the residual and state whether the actual attendance 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 $f(x) = x^2 + 2x - 24$.

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 candle burns at a constant rate. After 2 hours it is 18 cm tall, and after 5 hours it is 12 cm tall.

a. Determine the rate at which the candle burns (the slope). Show your work.

b. Write a linear function H(t) that gives the height of the candle after t hours.

c. Determine the original height of the candle.

d. Determine after how many hours the candle will be completely burned out. Show your work.

PART IV — Extended Constructed Response (Question 35)

This question is worth 6 credits. Show all work.

35. A concert hall has rows of seats arranged so that the number of seats increases by a fixed amount from one row to the next. The first row has 18 seats, and each row behind it has 4 more seats than the row in front of it.

a. Write an explicit formula for the number of seats in the nth row.

b. Determine how many seats are in the 10th row. Show your work.

c. Create a table showing the number of seats in rows 1 through 5.

d. The hall has 12 rows in total. Determine which row has exactly 62 seats, and justify your answer using your formula.

e. A row is considered a "large row" if it has at least 50 seats. Determine the first row that qualifies as a large row, and explain your reasoning.

PRACTICE EXAM 48 — ANSWER KEY AND EXPLANATIONS

1. B — $x = 8$. Collecting terms from $3x + 7 = 5x - 9$ gives $16 = 2x$, so $x = 8$. Variables are gathered on one side and constants on the other. Substituting back gives 31 on both sides, confirming the solution.
2. D — $f(-4) = 27$. Substituting gives $2(-4)^2 - 5 = 2(16) - 5 = 27$. The input is squared before multiplying by 2, and the negative disappears when squared. Order of operations produces the correct value.
3. C — slope $= -3/4$. Solving $3x + 4y = 24$ for y gives $4y = -3x + 24$, so $y = -(3/4)x + 6$ and the slope is $-3/4$. Isolating y converts standard form to slope-intercept form. The coefficient of x is the slope.
4. A — $(x + 5)(x - 3)$. The factor pair of -15 that sums to $+2$ is $+5$ and -3, giving $(x + 5)(x - 3)$. The larger-magnitude factor takes the positive sign to produce $+2x$. Expanding returns $x^2 + 2x - 15$.

5. C — P(t) = 8000(0.94)^t. A 6% annual decrease leaves 94% of the population each year, so the base is 1 − 0.06 = 0.94. The starting value 8,000 is multiplied repeatedly by this decay factor. A base between 0 and 1 models exponential decay.
6. B — x = 3 and x = 7. Factoring $x^2 - 10x + 21$ gives $(x - 3)(x - 7) = 0$, so the solutions are 3 and 7. The factor pair of +21 that sums to −10 is −3 and −7. Setting each factor to zero produces the roots.
7. A — 28. The common difference is 6 (4 → 10 → 16 → 22), so the next term is 22 + 6 = 28. Each term is found by adding the constant difference to the previous term. The consistent gap of 6 confirms the arithmetic pattern.
8. D — $x < -3$. Subtracting 3 gives $-5x > 15$, and dividing by −5 reverses the inequality to $x < -3$. Dividing by a negative number flips the inequality symbol. Omitting that reversal produces the incorrect Choice A.
9. B — y = 2. Substituting x = 2y + 1 into 3x + y = 17 gives 3(2y + 1) + y = 17, so 7y + 3 = 17 and y = 2. Substitution replaces x entirely, leaving one variable. The corresponding x-value is 5, and both equations check.
10. C — Exponential, with a common ratio of 3. Each output is multiplied by 3 (1, 3, 9, 27), giving a constant ratio rather than a constant difference. A constant multiplier between consecutive terms defines exponential behavior. The ratio 3/1 = 3 confirms the base.
11. A — $x^2 - 2x - 24$. Multiplying gives $x^2 - 6x + 4x - 24$, and combining the middle terms produces $x^2 - 2x - 24$. The outer and inner products combine to −2x. Both binomials must be fully distributed.
12. D — shifted right 1 unit and up 4 units. The −1 inside the parentheses shifts the parabola right, and the +4 outside shifts it up. Inside changes move the graph horizontally opposite to the sign, and outside changes move it vertically. Both transformations act together.
13. B — y = 5x + 7. Using point-slope, y − 2 = 5(x + 1), which expands to y = 5x + 5 + 2 = 5x + 7. The given point and slope are substituted directly. The resulting y-intercept is 7.
14. C — (3, −5). The vertex x-value is −b/(2a) = 6/2 = 3, and f(3) = 9 − 18 + 4 = −5, giving vertex (3, −5). The axis of symmetry locates the x-coordinate. Evaluating the function there gives the y-coordinate.
15. A — √81. Since 81 is a perfect square, √81 = 9, an integer and therefore rational. Perfect-square roots simplify to whole numbers. The other options are non-perfect-square roots or π, which are irrational.
16. D — IQR = 12. The interquartile range is Q3 − Q1 = 20 − 8 = 12. The IQR measures the spread of the middle 50% of the data, between the first and third quartiles. It is unaffected by the minimum and maximum.
17. C — r = −0.92. The strength of a linear relationship depends on how close the magnitude of r is to 1, regardless of sign. With an absolute value of 0.92, this is the strongest among the choices. The negative sign indicates direction, not weakness.
18. B — residual = −4. The predicted value is 4(3) + 2 = 14, and the residual is 10 − 14 = −4. A negative residual means the observed point lies below the line of best fit. Residuals measure the vertical gap between data and prediction.
19. A — y = 2x + 1 and y = −x + 4. These lines have different slopes (2 and −1), so they intersect at exactly one point. Lines with unequal slopes cross once, giving a single solution. Equal slopes would instead give no solution or infinitely many.

20. C — $x = 4$ and $x = -2$. By the zero-product property, $3x - 12 = 0$ gives $x = 4$ and $x + 2 = 0$ gives $x = -2$. Each factor must be solved fully, so $3x - 12 = 0$ is divided by 3. Both factors set to zero yield the zeros.
21. D — 6. The average rate of change is $[f(3) - f(1)]/(3 - 1) = (15 - 3)/2 = 12/2 = 6$. Only the endpoint values of the interval are used. The result equals the slope of the segment joining those points.
22. A — 10%. In $V(t) = 600(1.10)^t$, the base 1.10 equals $1 + 0.10$, indicating a 10% annual increase. The growth rate is the amount the base exceeds 1. A base greater than 1 represents exponential growth.
23. B — no real solutions. The discriminant is $(-5)^2 - 4(3)(4) = 25 - 48 = -23$, 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.
24. D — Company A charges less per day but has a one-time fee that Company B does not. Company A's daily rate of \$30 is lower than Company B's \$45, but A adds a fixed \$50 fee while B has none. The coefficient of d is the daily rate, and the constant is the one-time fee. Comparing both terms confirms the statement.
25. $x = 4$, $y = 2$. Solving $x + y = 6$ for x gives $x = 6 - y$; substituting into $2x + 3y = 14$ yields $2(6 - y) + 3y = 14$, so $12 + y = 14$ and $y = 2$, making $x = 4$. Verification: $4 + 2 = 6$ and $2(4) + 3(2) = 14$, so both equations hold. The solution is (4, 2).
26. $y = -3x - 1$. A parallel line shares the slope -3. Using point-slope with $(1, -4)$: $y + 4 = -3(x - 1)$, which expands to $y = -3x + 3 - 4 = -3x - 1$.
27. $x = 2$ and $x = 7$. Factoring $x^2 - 9x + 14$ gives $(x - 2)(x - 7) = 0$. Setting each factor to zero, $x - 2 = 0$ yields $x = 2$ and $x - 7 = 0$ yields $x = 7$.
28. Linear. The first differences are a constant 2 ($-3 \rightarrow -1 \rightarrow 1 \rightarrow 3$), indicating a constant rate of change. With a y-intercept of -3 and slope 2, the function rule is $y = 2x - 3$.
29. $5(x - 4)(x + 4)$. Factor out the GCF of 5 to get $5(x^2 - 16)$, then factor the difference of two squares: $x^2 - 16 = (x - 4)(x + 4)$. The fully factored form is $5(x - 4)(x + 4)$.
30. a. $a_n = 3(5)^{(n - 1)}$. b. The 4th term is $a_4 = 3(5)^3 = 3(125) = 375$.
31. $x < 4$. Adding 7 gives $4x < 16$, and dividing by 4 yields $x < 4$. On a number line, this is shown with an open circle at 4 and shading extending to the left.
32. Residual = 5, above the line. The predicted attendance is $\hat{y} = -0.5(20) + 30 = 20$, and the residual is $25 - 20 = 5$. Because the residual is positive, the actual attendance was above the value predicted by the line of best fit.
33. a. The axis of symmetry is $x = -b/(2a) = -2/2 = -1$, and $f(-1) = 1 - 2 - 24 = -25$, giving vertex $(-1, -25)$. b. Factoring $x^2 + 2x - 24 = (x + 6)(x - 4)$ gives zeros $x = -6$ and $x = 4$. c. The parabola opens upward ($a > 0$); the vertex is $(-1, -25)$; the axis of symmetry is $x = -1$; the x-intercepts are $(-6, 0)$ and $(4, 0)$; the y-intercept is $(0, -24)$; and the minimum value is -25.
34. a. The burn rate is $(12 - 18)/(5 - 2) = -6/3 = -2$ cm per hour. b. Using $H(t) = -2t + b$ with $18 = -2(2) + b$ gives $b = 22$, so $H(t) = -2t + 22$. c. The original height is the value at $t = 0$, which is 22 cm. d. Setting $-2t + 22 = 0$ gives $2t = 22$, so $t = 11$ hours until the candle is completely burned out.
35. a. $a_n = 18 + 4(n - 1)$. b. $a_{10} = 18 + 4(9) = 18 + 36 = 54$ seats. c. Row 1: 18, Row 2: 22, Row 3: 26, Row 4: 30, Row 5: 34. d. Setting $18 + 4(n - 1) = 62$ gives $4(n - 1) = 44$, so $n - 1 = 11$ and $n = 12$; the 12th row has 62 seats. e. Setting $18 + 4(n - 1) \geq 50$ gives $4(n - 1) \geq 32$,

so $n - 1 \geq 8$ and $n \geq 9$; the first large row is row 9, which has $a_9 = 18 + 4(8) = 50$ seats, the first to reach at least 50.