PRACTICE EXAM 43: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 proportion $x/5 = (x - 4)/3$ for x.

A. $x = 10$

B. $x = 4$

C. $x = -10$

D. $x = 2$

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

A. $h(-3) = 3$

B. $h(-3) = -15$

C. $h(-3) = -3$

D. $h(-3) = 15$

3. What is the slope of the line $6x + 3y = 12$?

A. 6

B. 2

C. −2

D. 4

4. Which expression is the completely factored form of $9x^2 - 25$?

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

B. $(3x - 5)^2$

C. $(9x - 5)(x + 5)$

D. $(3x + 25)(3x - 1)$

5. A bacteria culture starts with 80 cells and triples every day. Which function gives the number of cells after d days?

A. $N(d) = 80 + 3d$

B. $N(d) = 80(3)^{\wedge}d$

C. N(d) = 3(80)^d

D. N(d) = 80(0.3)^d

6. What are the solutions to the equation $(x - 3)^2 = 49$?

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

B. $x = 10$ only

C. $x = 52$ and $x = -46$

D. $x = 10$ and $x = -4$

7. A sequence is defined recursively by $a_1 = 5$ and $a_n = 2a_{n-1} + 1$. What is the value of a_3?

A. $a_3 = 11$

B. $a_3 = 21$

C. $a_3 = 23$

D. $a_3 = 47$

8. Which inequality represents the solution to $-3(x - 2) \geq 12$?

A. $x \leq -2$

B. $x \geq -2$

C. $x \leq 2$

D. $x \geq 2$

9. What is the value of x in the solution to the system $5x + 2y = 1$ and $3x - 2y = 7$?

A. $x = -1$

B. $x = 2$

C. $x = 3$

D. $x = 1$

10. The table below shows values of a function.

x: 0, 1, 2, 3

y: 2, 6, 18, 54

Which type of function is represented, and what is its key parameter?

A. Linear, with a rate of change of 4

B. Quadratic, with constant second differences

C. Exponential, with a common ratio of 3

D. Exponential, with a common ratio of 4

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

A. $9x^2 + 4$

B. $9x^2 - 4$

C. $6x^2 - 12x + 4$

D. $9x^2 - 12x + 4$

12. Which statement best describes the transformation from $f(x) = x^2$ to $g(x) = x^2 - 6$?

A. The graph of f(x) is shifted horizontally right 6 units

B. The graph of f(x) is shifted vertically down 6 units

C. The graph of f(x) is shifted vertically up 6 units

D. The graph of f(x) is shifted horizontally left 6 units

13. A gym membership costs $50 to join plus $30 per month. Which equation gives the total cost C after m months?

A. $C = 30m + 50$

B. $C = 50m + 30$

C. $C = 80m$

D. $C = 30m - 50$

14. The function $f(x) = (x - 4)^2 + 2$ is written in vertex form. What are the coordinates of the vertex?

A. $(-4, 2)$

B. $(4, -2)$

C. $(4, 2)$

D. $(2, 4)$

15. Which of the following numbers is rational?

A. $\sqrt{7}$

B. 0.625

C. π

D. $\sqrt{2}$

16. What is the median of the data set 14, 9, 21, 17, 9, 25, 12?

A. median = 12

B. median = 9

C. median = 15

D. median = 14

17. A survey of 100 students recorded whether they play a sport and whether they play an instrument.

	Plays sport	No sport	Total
Plays instrument:	20	15	35

No instrument:	40	25	65
Total:	60	40	100

What fraction of the students who play a sport also play an instrument?

A. 20/100

B. 20/35

C. 20/60

D. 35/100

18. A line of best fit is given by $\hat{y} = 0.5x + 4$. A data point at $x = 12$ has an actual value of 8. What is the residual, and what does it indicate?

A. residual = −2; the actual value is below the predicted value

B. residual = 2; the actual value is above the predicted value

C. residual = 10; the predicted value equals the actual value

D. residual = −10; the line perfectly fits the data point

19. Which system of equations has no solution?

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

B. $y = 3x + 4$ and $y = 3x - 1$

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

D. $2x + y = 6$ and $4x + 2y = 12$

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

x: 1, 2, 3, 4

f(x): 7, 4, 3, 19

What is the average rate of change of f(x) from x = 1 to x = 4?

A. 12

B. −3

C. 3

D. 4

21. A medication has 200 mg in the bloodstream, and the amount is halved every 4 hours. How much remains after 12 hours?

A. 100 mg

B. 50 mg

C. 25 mg

D. 12.5 mg

22. How many x-intercepts does the graph of $f(x) = x^2 - 6x + 9$ have?

A. zero x-intercepts

B. exactly one x-intercept

C. exactly two x-intercepts

D. three x-intercepts

23. A function is defined as $f(x) = \sqrt{(x - 5)}$. What is the domain of this function?

A. all real numbers

B. $x \leq 5$

C. $x > 0$

D. $x \geq 5$

24. Function f is defined by $f(x) = 4x + 1$. Function g is shown in the table below.

x: 0, 1, 2, 3

g(x): 2, 5, 8, 11

Which function has the greater rate of change?

A. Function f has the greater rate of change

B. Function g has the greater rate of change

C. Both functions have the same rate of change

D. Neither function has a constant rate of change

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.

$3x + 4y = 10$

$x - 2y = 0$

26. Write the equation of the line that passes through the points $(-1, 4)$ and $(3, -4)$. Express your answer in slope-intercept form.

27. Solve the quadratic equation $3x^2 - 10x + 8 = 0$ by factoring. Show all steps.

28. The table below shows values of a function.

x: 0, 1, 2, 3

y: 1, 4, 9, 16

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: $x^3 - 4x^2 - 21x$.

30. A geometric sequence has $a_2 = 12$ and $a_5 = 96$. Find the common ratio, the first term, and write the explicit formula for the nth term.

31. Solve the compound inequality $-7 < 2x + 1 \leq 9$ and graph the solution set on a number line.

32. A line of best fit for ticket-sales data is given by $\hat{y} = -2.5x + 60$, where x is the ticket price in dollars and $\hat{y}$ is the predicted number of tickets sold. At a price of $10, the actual number of tickets sold was 40.

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 $f(x) = x^2 - 6x + 5$.

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 car is purchased for $30,000 and loses 12% of its value each year.

a. Write a function V(t) that models the value of the car after t years.

b. Find the value of the car after 3 years, rounded to the nearest dollar. Show your calculation.

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

d. Explain whether the value of the car will ever reach exactly $0, and justify your answer.

PART IV — Extended Constructed Response (Question 35)

This question is worth 6 credits. Show all work.

35. Two gyms offer different membership plans.

FitZone charges a one-time enrollment fee of $120 plus $25 per month.

PowerHouse charges no enrollment fee but $45 per month.

a. Write a linear function F(m) for the total cost at FitZone and a function P(m) for the total cost at PowerHouse, where m represents the number of months.

b. Create a table of the total costs for both gyms at months 2, 4, 6, and 8. Show your calculations.

c. Set the two functions equal and solve algebraically to find the month at which the total costs are equal. Show all work.

d. A person plans to keep a membership for 12 months. Determine which gym is less expensive over that period and by how much. Show your calculation.

e. Explain, in terms of the slopes and starting values of the two functions, why FitZone becomes the better choice for longer memberships.

ANSWERS KEY AND EXPLANATIONS

1. A — $x = 10$. Cross-multiplying $x/5 = (x - 4)/3$ gives $3x = 5(x - 4)$, so $3x = 5x - 20$, leading to $-2x = -20$ and $x = 10$. Cross-multiplication clears the fractions in a proportion. Substituting back gives $10/5 = 2$ and $6/3 = 2$, confirming equality.
2. D — $h(-3) = 15$. Substituting gives $(-3)^2 - 2(-3) = 9 + 6 = 15$. The squared term is positive, and subtracting a negative adds 6. Careful sign handling on both terms produces the correct value.
3. C — slope = -2. Solving $6x + 3y = 12$ for y gives $3y = -6x + 12$, so $y = -2x + 4$ and the slope is -2. Isolating y converts standard form into slope-intercept form. The coefficient of x is the slope.
4. A — $(3x - 5)(3x + 5)$. The expression is a difference of two squares, since $9x^2 = (3x)^2$ and $25 = 5^2$. The difference-of-squares pattern factors as $(3x - 5)(3x + 5)$. The middle terms cancel when expanded, returning $9x^2 - 25$.
5. B — N(d) = 80(3)^d. Tripling each day means multiplying by a constant factor of 3, so the base is 3 and the starting value is 80. Repeated multiplication defines exponential growth. The initial count is the coefficient applied at $d = 0$.
6. D — $x = 10$ and $x = -4$. Taking the square root of both sides of $(x - 3)^2 = 49$ gives $x - 3 = \pm 7$, so $x = 10$ or $x = -4$. The square-root method yields two solutions because both +7 and -7 square to 49. Including both signs is essential.
7. C — $a_3 = 23$. Using the rule, $a_2 = 2(5) + 1 = 11$ and $a_3 = 2(11) + 1 = 23$. A recursive formula builds each term from the previous one. Each step doubles the prior term and adds 1.
8. A — $x \leq -2$. Distributing gives $-3x + 6 \geq 12$, so $-3x \geq 6$, and dividing by -3 reverses the inequality to $x \leq -2$. Dividing by a negative number flips the inequality symbol. Omitting that reversal produces the incorrect Choice B.
9. D — $x = 1$. Adding the two equations eliminates y: $(5x + 2y) + (3x - 2y) = 1 + 7$, giving $8x = 8$ and $x = 1$. Elimination works because the y-terms are opposites. Their sum cancels, leaving a single-variable equation.
10. C — Exponential, with a common ratio of 3. Each output is multiplied by 3 (2, 6, 18, 54), giving a constant ratio rather than a constant difference. A constant multiplier between consecutive terms defines an exponential function. The ratio $6/2 = 3$ confirms the base.
11. D — $9x^2 - 12x + 4$. Squaring the binomial gives $(3x)^2 - 2(3x)(2) + 2^2 = 9x^2 - 12x + 4$. The middle term comes from twice the product of the two terms. Omitting the middle term is the common error in the other choices.

12. B — shifted vertically down 6 units. Subtracting 6 from the entire function lowers every output by 6, moving the parabola down. Constants added or subtracted outside the squared term produce vertical shifts. The negative sign moves the graph downward.
13. A — $C = 30m + 50$. The \$50 join fee is a one-time constant, and the \$30 monthly charge is multiplied by the number of months m. This gives $C = 30m + 50$, with 50 as the y-intercept and 30 as the rate. The variable cost depends on time, while the fee is fixed.
14. C — (4, 2). In vertex form $f(x) = a(x - h)^2 + k$, the vertex is (h, k), so $h = 4$ and $k = 2$. The value subtracted inside the parentheses gives the positive x-coordinate. The constant added outside gives the y-coordinate.
15. B — 0.625. This is a terminating decimal equal to the fraction 5/8, which makes it rational. Any number expressible as a ratio of integers is rational. The other options are non-terminating, non-repeating values and therefore irrational.
16. D — median = 14. Ordering the values gives 9, 9, 12, 14, 17, 21, 25, and the middle value of seven numbers is the fourth, which is 14. The median is the center value of an ordered data set. Sorting first is required before locating the middle.
17. C — 20/60. Among the 60 students who play a sport, 20 also play an instrument, giving the conditional fraction 20/60. The denominator must be the subgroup of sport players, not the full sample. Conditional questions restrict the total to the stated group.
18. A — residual = −2; the actual value is below the predicted value. The predicted value is $0.5(12) + 4 = 10$, and the residual is $8 - 10 = -2$. A negative residual means the observed point lies below the line of best fit. Residuals measure the vertical gap between data and prediction.
19. B — $y = 3x + 4$ and $y = 3x - 1$. These lines share the slope 3 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.
20. D — 4. The average rate of change is $[f(4) - f(1)]/(4 - 1) = (19 - 7)/3 = 12/3 = 4$. Only the endpoints of the interval are used, not the intermediate values. The result is the slope of the segment joining those endpoints.
21. C — 25 mg. Twelve hours contains three 4-hour half-lives, so the amount halves three times: $200 \rightarrow 100 \rightarrow 50 \rightarrow 25$. Each half-life multiplies the remaining amount by one-half. After three halvings the medication is reduced to 25 mg.
22. B — exactly one x-intercept. The discriminant is $(-6)^2 - 4(1)(9) = 36 - 36 = 0$, indicating one repeated root. A zero discriminant means the parabola touches the x-axis at its vertex. The expression factors as $(x - 3)^2$, confirming a single x-intercept at $x = 3$.
23. D — $x \geq 5$. The radicand must be nonnegative, so $x - 5 \geq 0$, giving $x \geq 5$. Square roots of negative numbers are not real, which restricts the domain. Only inputs of 5 or greater keep the expression defined.
24. A — Function f has the greater rate of change. Function f has a slope of 4, while function g increases by 3 per step (2, 5, 8, 11). Comparing the constant rates shows 4 is greater than 3. The steeper slope indicates the faster rate of change.
25. $x = 2$, $y = 1$. From $x - 2y = 0$, $x = 2y$; substituting into $3x + 4y = 10$ gives $3(2y) + 4y = 10$, so $10y = 10$ and $y = 1$, making $x = 2$. Verification: $3(2) + 4(1) = 10$ and $2 - 2(1) = 0$, so both equations hold. The solution is (2, 1).
26. $y = -2x + 2$. The slope is $(-4 - 4)/(3 - (-1)) = -8/4 = -2$; using point-slope with (−1, 4): $y - 4 = -2(x + 1)$, which expands to $y = -2x - 2 + 4 = -2x + 2$.

27. $x = 4/3$ and $x = 2$. Factoring $3x^2 - 10x + 8$ gives $(3x - 4)(x - 2) = 0$. Setting each factor to zero, $3x - 4 = 0$ yields $x = 4/3$ and $x - 2 = 0$ yields $x = 2$.
28. Quadratic. The first differences are 3, 5, 7 (not constant), but the second differences are a constant 2, which identifies a quadratic function. The values are the perfect squares of $(x + 1)$, so the rule is $y = (x + 1)^2 = x^2 + 2x + 1$.
29. $x(x - 7)(x + 3)$. Factor out the GCF of x to get $x(x^2 - 4x - 21)$, then factor the trinomial into $(x - 7)(x + 3)$. The fully factored form is $x(x - 7)(x + 3)$.
30. $r = 2$, $a_1 = 6$, $a_n = 6(2)^{(n - 1)}$. Since $a_5/a_2 = r^3 = 96/12 = 8$, the common ratio is $r = 2$. From $a_2 = a_1 r = 12$, the first term is $a_1 = 6$, giving the explicit formula $a_n = 6(2)^{(n - 1)}$.
31. $-4 < x \leq 4$. Subtracting 1 from all parts gives $-8 < 2x \leq 8$, and dividing by 2 yields $-4 < x \leq 4$. On a number line, this is shown with an open circle at -4, a closed circle at 4, and shading between them.
32. Residual = 5, above the line. The predicted value is $\hat{y} = -2.5(10) + 60 = 35$, and the residual is $40 - 35 = 5$. 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 $x = -b/(2a) = 6/2 = 3$, and $f(3) = 9 - 18 + 5 = -4$, giving vertex $(3, -4)$. b. Factoring $x^2 - 6x + 5 = (x - 1)(x - 5)$ gives zeros $x = 1$ and $x = 5$. c. The parabola opens upward ($a > 0$); the vertex is $(3, -4)$; the axis of symmetry is $x = 3$; the x-intercepts are $(1, 0)$ and $(5, 0)$; the y-intercept is $(0, 5)$; and the minimum value is -4.
34. a. $V(t) = 30000(0.88)^{t}$, since retaining 88% of the value each year corresponds to a base of 0.88. b. $V(3) = 30000(0.88)^3 = 30000(0.681472) \approx \$20{,}444$. c. This is exponential decay, with a rate of 12% lost per year. d. The value will never reach exactly \$0; an exponential decay function approaches zero as a horizontal asymptote but never equals it.
35. a. $F(m) = 25m + 120$ and $P(m) = 45m$. b. At $m = 2$: $F = 170$, $P = 90$; at $m = 4$: $F = 220$, $P = 180$; at $m = 6$: $F = 270$, $P = 270$; at $m = 8$: $F = 320$, $P = 360$. c. Setting $25m + 120 = 45m$ gives $120 = 20m$, so $m = 6$ months, where both cost \$270. d. At 12 months, $F(12) = 25(12) + 120 = 420$ and $P(12) = 45(12) = 540$, so FitZone is cheaper by $\$540 - \$420 = \$120$. e. FitZone has the smaller slope (25 versus 45) but a larger starting value (120 versus 0); over longer memberships the lower monthly rate outweighs the one-time fee, so the line with the smaller slope produces the lower total cost after the break-even point.