PRACTICE EXAM 50: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 $(3/4)x + 2 = 11$ for x.

A. $x = 12$

B. $x = 9$

C. $x = 6$

D. $x = 16$

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

A. $f(3) = 21$

B. $f(3) = -33$

C. $f(3) = 15$

D. $f(3) = -15$

3. What is the slope of the line that passes through the points $(3, -1)$ and $(7, 7)$?

A. 1/2

B. 2

C. −2

D. 4

4. Which expression is the factored form of $x^2 + x - 20$?

A. $(x - 5)(x + 4)$

B. $(x + 10)(x - 2)$

C. $(x + 5)(x - 4)$

D. $(x + 20)(x - 1)$

5. Which function represents a quantity decreasing by 12% each year?

A. y = A(1.12)^t

B. y = A(0.12)^t

C. $y = A(12)^t$

D. $y = A(0.88)^t$

6. What are the solutions to the equation $x^2 - x - 30 = 0$?

A. $x = 6$ and $x = -5$

B. $x = -6$ and $x = 5$

C. $x = 6$ and $x = 5$

D. $x = -6$ and $x = -5$

7. An arithmetic sequence has a first term of 8 and a common difference of −4. What is the 6th term?

A. $a_6 = -16$

B. $a_6 = -8$

C. $a_6 = -12$

D. $a_6 = 12$

8. Solve the inequality $7 - 3x \geq -2$.

A. $x \geq 3$

B. $x \leq 3$

C. $x \leq -3$

D. $x \geq -3$

9. What is the solution to the system $y = -x + 6$ and $y = 2x - 3$?

A. (3, 3)

B. (3, −3)

C. (−3, 3)

D. (6, 0)

10. The table below shows values of a function.

x: 0, 1, 2, 3

y: −2, 1, 6, 13

Which type of function is represented?

A. Linear, with a rate of change of 3

B. Exponential, with a constant ratio

C. Quadratic, with constant second differences

D. Linear, with a rate of change of −2

11. Which expression is equivalent to $(x - 7)^2$?

A. $x^2 - 49$

B. $x^2 + 49$

C. $x^2 - 14x - 49$

D. $x^2 - 14x + 49$

12. Which statement best describes the transformation from $f(x) = x^2$ to $g(x) = (x - 5)^2$?

A. The graph of f(x) is shifted horizontally right 5 units

B. The graph of f(x) is shifted horizontally left 5 units

C. The graph of f(x) is shifted vertically up 5 units

D. The graph of f(x) is shifted vertically down 5 units

13. A line has a slope of −1/2 and passes through the point (4, 1). What is its equation in slope-intercept form?

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

B. $y = -(1/2)x + 3$

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

D. $y = (1/2)x + 3$

14. What are the coordinates of the vertex of $f(x) = x^2 + 10x + 18$?

A. (5, −7)

B. (−5, 7)

C. $(-5, -7)$

D. $(-10, 18)$

15. Which statement about the number $\sqrt{45}$ is true?

A. It is rational because it simplifies to $3\sqrt{5}$

B. It is rational because 45 is divisible by 9

C. It is undefined because 45 is not a perfect square

D. It is irrational because 45 is not a perfect square

16. What is the mode of the data set 7, 12, 7, 15, 9, 7, 12?

A. mode = 7

B. mode = 12

C. mode = 9

D. mode = 15

17. A data set has a correlation coefficient of $r = 0.10$. Which statement best describes the linear relationship?

A. a strong positive linear relationship

B. a weak positive linear relationship

C. a strong negative linear relationship

D. a perfect positive linear relationship

18. A line of best fit predicts $\hat{y} = 2x + 5$, and a data point (10, 20) is observed. What is the residual for this point?

A. residual = 5

B. residual = 20

C. residual = 25

D. residual = −5

19. Which system of equations has no solution?

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

B. $y = x - 4$ and $y = 3x + 2$

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

D. $3x + y = 5$ and $6x + 2y = 10$

20. The function $f(x) = (x + 9)(2x - 8)$ has zeros at which values?

A. $x = -9$ and $x = 4$

B. $x = 9$ and $x = -4$

C. $x = -9$ and $x = 8$

D. $x = 9$ and $x = 4$

21. What is the average rate of change of $f(x) = x^2 - 3x$ over the interval $2 \leq x \leq 5$?

A. 12

B. 4

C. 3

D. 6

22. The function P(t) = 2000(1.045)^t models a population. What is the annual growth rate?

A. 1.045%

B. 104.5%

C. 45%

D. 4.5%

23. The equation $x^2 + 10x + 25 = 0$ has how many distinct real solutions?

A. zero distinct real solutions

B. two distinct real solutions

C. exactly one distinct real solution

D. three distinct real solutions

24. Two trees' heights are modeled by Tree A: h(x) = 2x + 30 and Tree B: h(x) = 5x + 12, where x is the number of years and h is the height in inches. Which statement is true?

A. Tree A grows faster than Tree B each year

B. Tree A is taller at the start, but Tree B grows faster each year

C. Both trees grow at the same rate each year

D. Tree B is taller at the start than Tree A

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.

$3x + 2y = 4$

$x + 2y = 8$

26. Write the equation of the line that is perpendicular to $y = (2/3)x + 5$ and passes through the point $(6, -2)$. Express your answer in slope-intercept form.

27. Solve the quadratic equation $3x^2 - 11x - 4 = 0$ by factoring. Show all steps.

28. The table below shows values of a function.

x: 0, 1, 2, 3

y: 5, 10, 20, 40

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: $4x^3 - 16x$.

30. An arithmetic sequence has $a_2 = 11$ and $a_6 = 31$. Find the common difference, the first term, and write the explicit formula for the nth term.

31. Solve the compound inequality $-4 \leq 2x - 6 < 8$ and graph the solution set on a number line.

32. A line of best fit for revenue data is given by $\hat{y} = 4x - 10$, where x is the number of units sold and $\hat{y}$ is the predicted revenue in dollars. When 8 units were sold, the actual revenue was $20.

Calculate the residual and state whether the actual revenue 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 $f(x) = x^2 - 10x + 16$.

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. At a school fair, hot dogs cost $3 each and drinks cost $2 each. A family spent $29 and bought 12 items in total.

a. Write a system of equations that models this situation, using h for the number of hot dogs and d for the number of drinks.

b. Solve the system to determine how many hot dogs and how many drinks the family bought.

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. The cross-section of a parabolic archway is modeled by the function $h(x) = -0.5x^2 + 4x$, where x is the horizontal distance in feet from the left base of the arch and h(x) is the height in feet.

a. Determine the height of the arch at x = 0 and explain what this point represents.

b. Find the horizontal distance at which the arch reaches its maximum height, and determine that maximum height. Use the axis of symmetry and show your work.

c. Determine the total width of the arch at its base, where the height is 0. Solve algebraically and show all work.

d. Determine the height of the arch at a horizontal distance of 2 feet. Show your calculation.

e. A truck that is 6 feet tall needs to pass under the arch. Use your results to explain whether the truck can pass through the center of the arch.

PRACTICE EXAM 50 – ANSWER KEY AND EXPLANATIONS

1. A — x = 12. Subtracting 2 gives (3/4)x = 9, and multiplying by the reciprocal 4/3 gives x = 12. The fractional coefficient is undone by multiplying by its reciprocal. Substituting back gives 9 + 2 = 11, confirming the solution.
2. D — f(3) = −15. Substituting gives $-2(3)^2 + 3 = -18 + 3 = -15$. The squaring is done first, then multiplied by −2, before adding the linear term. The negative coefficient makes the squared term negative.
3. B — slope = 2. Using (7 − (−1))/(7 − 3) = 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. C — (x + 5)(x − 4). The factor pair of −20 that sums to +1 is +5 and −4, giving (x + 5)(x − 4). The larger-magnitude factor is positive to produce the +1x middle term. Expanding returns $x^2 + x - 20$.
5. D — y = A(0.88)^t. A 12% decrease leaves 88% of the quantity each year, so the base is 1 − 0.12 = 0.88. A base between 0 and 1 models exponential decay. The decay factor is applied repeatedly to the starting amount A.
6. A — x = 6 and x = −5. Factoring $x^2 - x - 30$ gives (x − 6)(x + 5) = 0, so the solutions are 6 and −5. The factor pair of −30 that sums to −1 is −6 and +5. Setting each factor to zero produces the roots.
7. C — $a_6 = -12$. Using $a_n = a_1 + d(n - 1)$, the 6th term is 8 + (−4)(5) = 8 − 20 = −12. The common difference of −4 is multiplied by one less than the term number. The decreasing sequence produces a negative term.
8. B — x ≤ 3. Subtracting 7 gives −3x ≥ −9, and dividing by −3 reverses the inequality to x ≤ 3. Dividing by a negative number flips the inequality symbol. Omitting that reversal produces the incorrect Choice A.

9. A — (3, 3). Setting $-x + 6 = 2x - 3$ gives $9 = 3x$, so $x = 3$, and substituting yields $y = 3$. The solution is the point that satisfies both equations. Both equations give $y = 3$ at $x = 3$, confirming (3, 3).
10. C — Quadratic, with constant second differences. The first differences (3, 5, 7) are not constant, but the second differences are a constant 2, identifying a quadratic. A constant second difference is the signature of a quadratic function. The non-constant first differences rule out a linear rule.
11. D — $x^2 - 14x + 49$. Squaring the binomial gives $(x)^2 - 2(x)(7) + 7^2 = x^2 - 14x + 49$. 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. A — shifted horizontally right 5 units. Subtracting 5 inside the parentheses, $(x - 5)^2$, shifts the parabola in the positive x-direction. Horizontal shifts move opposite to the sign appearing with x, so −5 moves right. Changes inside the function affect the input, producing horizontal movement.
13. B — $y = -(1/2)x + 3$. Using point-slope, $y - 1 = -(1/2)(x - 4)$, which expands to $y = -(1/2)x + 2 + 1 = -(1/2)x + 3$. The given point and slope are substituted directly. The resulting y-intercept is 3.
14. C — (−5, −7). The vertex x-value is $-b/(2a) = -10/2 = -5$, and $f(-5) = 25 - 50 + 18 = -7$, giving vertex (−5, −7). The axis of symmetry locates the x-coordinate. Evaluating the function there gives the y-coordinate.
15. D — irrational because 45 is not a perfect square. The square root of a non-perfect-square integer is a non-terminating, non-repeating decimal and therefore irrational. Although $\sqrt{45}$ simplifies to $3\sqrt{5}$, that form still contains an irrational radical. Only perfect-square roots are rational.
16. A — mode = 7. The value 7 appears three times, more often than any other value in the set. The mode is the value that occurs most frequently. Counting occurrences identifies 7 as the most common.
17. B — a weak positive linear relationship. A correlation of 0.10 is close to zero, indicating little linear association, and the positive sign gives a slight upward direction. Values near zero reflect weak relationships regardless of sign. Only values near ±1 indicate strong association.
18. D — residual = −5. The predicted value is $2(10) + 5 = 25$, and the residual is $20 - 25 = -5$. A negative residual means the observed point lies below the line of best fit. Residuals measure the vertical gap between data and prediction.
19. C — $y = -4x + 1$ 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.
20. A — $x = -9$ and $x = 4$. By the zero-product property, $x + 9 = 0$ gives $x = -9$ and $2x - 8 = 0$ gives $x = 4$. Each factor must be solved fully, so $2x - 8 = 0$ is divided by 2. Both factors set to zero yield the zeros.
21. B — 4. The average rate of change is $[f(5) - f(2)]/(5 - 2) = (10 - (-2))/3 = 12/3 = 4$. Only the endpoint values of the interval are used. The result equals the slope of the segment joining those points.
22. D — 4.5%. In $P(t) = 2000(1.045)^t$, the base 1.045 equals 1 + 0.045, indicating a 4.5% annual increase. The growth rate is the amount the base exceeds 1. A base greater than 1 represents exponential growth.

23. C — exactly one distinct real solution. The discriminant is $10^2 - 4(1)(25) = 100 - 100 = 0$, indicating one repeated root. The expression factors as $(x + 5)^2$, giving a single solution $x = -5$. A zero discriminant means the parabola touches the x-axis at one point.
24. B — Tree A is taller at the start, but Tree B grows faster each year. Tree A has a larger y-intercept (30 versus 12), so it begins taller, while Tree B's slope of 5 exceeds Tree A's slope of 2. The constant is the starting height, and the coefficient of x is the yearly growth rate. Comparing both terms confirms the statement.
25. $x = -2$, $y = 5$. Subtracting the second equation from the first eliminates y: $(3x + 2y) - (x + 2y) = 4 - 8$, giving $2x = -4$ and $x = -2$; then $-2 + 2y = 8$, so $y = 5$. Verification: $3(-2) + 2(5) = 4$ and $-2 + 2(5) = 8$, so both equations hold. The solution is $(-2, 5)$.
26. $y = -(3/2)x + 7$. The given slope is 2/3, so the perpendicular slope is the negative reciprocal, $-3/2$. Using point-slope with $(6, -2)$: $y + 2 = -(3/2)(x - 6)$, which expands to $y = -(3/2)x + 9 - 2 = -(3/2)x + 7$.
27. $x = -1/3$ and $x = 4$. Factoring $3x^2 - 11x - 4$ gives $(3x + 1)(x - 4) = 0$. Setting each factor to zero, $3x + 1 = 0$ yields $x = -1/3$ and $x - 4 = 0$ yields $x = 4$.
28. Exponential. Each output is multiplied by a constant 2 (5 → 10 → 20 → 40), giving a common ratio rather than a constant difference. With an initial value of 5 and a base of 2, the function rule is y = 5(2)^x.
29. $4x(x - 2)(x + 2)$. Factor out the GCF of 4x to get $4x(x^2 - 4)$, then factor the difference of two squares: $x^2 - 4 = (x - 2)(x + 2)$. The fully factored form is $4x(x - 2)(x + 2)$.
30. $d = 5$, $a_1 = 6$, $a_n = 6 + 5(n - 1)$. Since $a_6 - a_2 = 4d = 31 - 11 = 20$, the common difference is $d = 5$. From $a_2 = a_1 + d = a_1 + 5 = 11$, the first term is $a_1 = 6$, giving the explicit formula $a_n = 6 + 5(n - 1)$.
31. $1 \leq x < 7$. Adding 6 to all parts gives $2 \leq 2x < 14$, and dividing by 2 yields $1 \leq x < 7$. On a number line, this is shown with a closed circle at 1, an open circle at 7, and shading between them.
32. Residual = −2, below the line. The predicted revenue is $\hat{y} = 4(8) - 10 = 22$, and the residual is $20 - 22 = -2$. Because the residual is negative, the actual revenue was below the value predicted by the line of best fit.
33. a. The axis of symmetry is $x = -b/(2a) = 10/2 = 5$, and $f(5) = 25 - 50 + 16 = -9$, giving vertex $(5, -9)$. b. Factoring $x^2 - 10x + 16 = (x - 2)(x - 8)$ gives zeros $x = 2$ and $x = 8$. c. The parabola opens upward ($a > 0$); the vertex is $(5, -9)$; the axis of symmetry is $x = 5$; the x-intercepts are $(2, 0)$ and $(8, 0)$; the y-intercept is $(0, 16)$; and the minimum value is −9.
34. a. $h + d = 12$ and $3h + 2d = 29$. b. Solving the first for d gives $d = 12 - h$; substituting yields $3h + 2(12 - h) = 29$, so $h + 24 = 29$, giving $h = 5$ hot dogs and $d = 7$ drinks. c. Verification: $5 + 7 = 12$ and $3(5) + 2(7) = 15 + 14 = 29$, so both equations are satisfied.
35. a. $h(0) = 0$; this is the left base of the arch, where it meets the ground. b. The axis of symmetry is $x = -4/(2 \cdot -0.5) = 4$ feet, and $h(4) = -0.5(16) + 4(4) = -8 + 16 = 8$ feet, the maximum height. c. Setting $-0.5x^2 + 4x = 0$ gives $x(-0.5x + 4) = 0$, so $x = 0$ or $x = 8$; the arch spans from 0 to 8, a total base width of 8 feet. d. $h(2) = -0.5(2)^2 + 4(2) = -2 + 8 = 6$ feet. e. At the center ($x = 4$), the arch reaches its maximum height of 8 feet, which is greater than the truck's height of 6 feet, so the truck can pass through the center with 2 feet of clearance.