PRACTICE EXAM 44: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 $(2/3)x - 5 = 7$ for x.

A. $x = 8$

B. $x = 18$

C. $x = 3$

D. $x = 12$

2. If $f(x) = 5x - 3$, for what value of x does $f(x) = 22$?

A. $x = 5$

B. $x = 19$

C. $x = 4$

D. $x = 25$

3. What is the slope of the line that passes through the points (−4, 1) and (2, 5)?

A. 3/2

B. −2/3

C. 6/4

D. 2/3

4. Which expression is the factored form of $2x^2 + 7x + 3$?

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

B. $(2x - 1)(x - 3)$

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

D. $(x + 7)(2x + 3)$

5. Which function represents exponential decay?

A. y = 200(0.65)^x

B. y = 200(1.65)^x

C. $y = 200(2)^x$

D. $y = 200 + 0.65x$

6. What are the solutions to the equation $2x^2 - 8x = 0$?

A. $x = 4$ only

B. $x = -4$ and $x = 0$

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

D. $x = 0$ and $x = 4$

7. The 3rd term of an arithmetic sequence is 10 and the 7th term is 26. What is the common difference?

A. $d = 16$

B. $d = 4$

C. $d = 8$

D. $d = 6$

8. A taxi charges $4 plus $2.50 per mile. Which inequality represents the number of miles m a rider can travel for at most $24?

A. $m \geq 8$

B. $m \leq 20$

C. $m \leq 8$

D. $m \leq 11.2$

9. What is the solution to the system $y = x + 1$ and $2x + y = 10$?

A. (3, 4)

B. (4, 3)

C. (3, −4)

D. (1, 9)

10. The table below shows values of a function.

x: 0, 1, 2, 3

y: 100, 80, 60, 40

Which type of function is represented?

A. Exponential, with a common ratio of 0.8

B. Linear, with a rate of change of −20

C. Quadratic, with constant second differences

D. Linear, with a rate of change of 20

11. Which expression is equivalent to $(x^2 + 3x - 5) + (2x^2 - x + 8)$?

A. $3x^2 + 4x + 3$

B. $2x^2 + 2x + 3$

C. $3x^2 + 2x + 3$

D. $3x^2 + 2x + 13$

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

A. shifted left 2 units and up 5 units

B. shifted right 2 units and up 5 units

C. shifted left 2 units and down 5 units

D. shifted right 2 units and down 5 units

13. Which equation represents a line parallel to $y = 3x - 2$ that passes through the point (0, 4)?

A. $y = 3x + 4$

B. $y = -(1/3)x + 4$

C. $y = 4x + 3$

D. $y = 3x - 2$

14. What is the axis of symmetry of the graph of $f(x) = x^2 + 8x + 3$?

A. $x = 4$

B. $x = -4$

C. $x = 8$

D. $x = -8$

15. Which operation produces an irrational number?

A. $9 \div 3$

B. $0.5 + 0.25$

C. $\sqrt{36} \times 2$

D. $5 + \sqrt{7}$

16. What is the range of the data set 8, 14, 22, 9, 30, 11?

A. range = 8

B. range = 30

C. range = 22

D. range = 16

17. A study finds a strong positive correlation between ice cream sales and the number of swimming pool visits. Which conclusion is most appropriate?

A. Buying ice cream causes people to visit swimming pools

B. A third factor, such as warm weather, likely affects both variables

C. Visiting swimming pools causes people to buy more ice cream

D. The correlation must be a calculation error since it makes no sense

18. What is the value of y in the solution to the system $x + 3y = 9$ and $2x + y = 8$?

A. $y = 2$

B. $y = 3$

C. $y = 1$

D. $y = 5$

19. What are the x-intercepts of the graph of $y = x^2 - 4x - 12$?

A. (4, 0) and (−12, 0)

B. (−6, 0) and (2, 0)

C. (6, 0) and (2, 0)

D. (6, 0) and (−2, 0)

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

A. 16

B. 4

C. 8

D. 9

21. A social media account has 5,000 followers and grows by 8% each month. Which expression gives the number of followers after 6 months?

A. $5000(0.08)^6$

B. $5000(1.08)^6$

C. $5000 + 0.08(6)$

D. $5000(8)^6$

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

A. no real solutions

B. exactly one real solution

C. two real rational solutions

D. two real irrational solutions

23. How many solutions does the equation $|x + 2| = 5$ have, and what are they?

A. one solution: $x = 3$

B. one solution: $x = 7$

C. two solutions: $x = 3$ and $x = -7$

D. two solutions: $x = 3$ and $x = 7$

24. Two linear functions model savings, where x is the number of weeks: $f(x) = 15x + 100$ and $g(x) = 25x + 40$. Which statement is true?

A. Function f saves more per week than function g

B. Functions f and g start with the same amount

C. Function g starts with a higher amount than function f

D. Function g saves more per week than function f

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.

$x + y = 7$

$2x - y = 5$

26. Write the equation of the line that is perpendicular to $y = (2/5)x - 1$ and passes through the point (4, 0). Express your answer in slope-intercept form.

27. Solve the quadratic equation $x^2 + 2x - 35 = 0$ by factoring. Show all steps.

28. The table below shows values of a function.

x: 1, 2, 3, 4

y: 6, 12, 24, 48

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: $4x^2 - 36$.

30. An arithmetic sequence has a first term of 50 and a common difference of −7.

a. Write the explicit formula for the nth term.

b. Find the value of the 8th term.

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

32. A line of best fit for study data is given by $\hat{y} = 1.2x + 5$, where x is the number of hours studied and $\hat{y}$ is the predicted quiz score. A student who studied 10 hours scored 20.

Calculate the residual and state whether the actual score 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 $f(x) = x^2 + 4x - 12$.

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 jar contains only nickels and dimes. There are 30 coins in the jar with a total value of $2.40.

a. Write a system of equations that models this situation, using n for the number of nickels and d for the number of dimes.

b. Solve the system to determine how many nickels and how many dimes are in the jar.

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 company's monthly profit P (in dollars) from selling x units of a product is modeled by the function $P(x) = -2x^2 + 80x - 350$.

a. Determine the number of units that produces the maximum monthly profit. Use the axis of symmetry and show your work.

b. Find the maximum monthly profit. Show your calculation.

c. Determine the number of units at which the profit equals $0 (the break-even points). Solve algebraically and show all work.

d. Create a table of values for P(x) at x = 5, 10, 20, 30, and 35 units. Show your calculations.

e. Over what interval of units does the company earn a positive profit? Justify your answer using your table or the break-even points.

PRACTICE EXAM 44 — ANSWER KEY AND EXPLANATIONS

1. B — $x = 18$. Adding 5 gives $(2/3)x = 12$, and multiplying by the reciprocal 3/2 gives $x = 18$. The fractional coefficient is undone by multiplying by its reciprocal. Substituting back gives $12 - 5 = 7$, confirming the solution.
2. A — $x = 5$. Setting $5x - 3 = 22$ gives $5x = 25$, so $x = 5$. Solving $f(x) = 22$ means finding the input that yields that output. Substituting back gives $5(5) - 3 = 22$, confirming the value.
3. D — slope = 2/3. Using $(5 - 1)/(2 - (-4)) = 4/6 = 2/3$. Slope is the ratio of vertical change to horizontal change between the two points. Reducing the fraction gives the correct form.
4. C — $(2x + 1)(x + 3)$. Expanding gives $2x^2 + 6x + x + 3 = 2x^2 + 7x + 3$, matching the original. The factors must produce both the correct product and the correct middle term. Trial of factor pairs confirms this arrangement.
5. A — $y = 200(0.65)^x$. A base between 0 and 1 produces exponential decay, and 0.65 is the only such base. Repeated multiplication by a factor less than 1 shrinks the value each step. A base above 1 would instead model growth.
6. D — $x = 0$ and $x = 4$. Factoring out the GCF gives $2x(x - 4) = 0$, so by the zero-product property $x = 0$ or $x = 4$. The common factor of x produces the zero at the origin. Both factors set to zero yield the solutions.

7. B — $d = 4$. The terms a_3 and a_7 are 4 common differences apart, so $4d = 26 - 10 = 16$ and $d = 4$. The change in term value divided by the change in position gives the common difference. Each step adds 4.
8. C — $m \le 8$. The total cost $4 + 2.50m$ must not exceed 24, giving $4 + 2.50m \le 24$, so $2.50m \le 20$ and $m \le 8$. The flat fee is added once, and the per-mile rate scales with m. Solving the inequality keeps the fare within budget.
9. A — (3, 4). Substituting $y = x + 1$ into $2x + y = 10$ gives $2x + x + 1 = 10$, so $3x = 9$ and $x = 3$, making $y = 4$. Substitution replaces y entirely, leaving one variable. Both equations are satisfied by (3, 4).
10. B — Linear, with a rate of change of −20. The y-values decrease by a constant 20 each step (100, 80, 60, 40), which defines a constant rate of change. A constant first difference indicates a linear function. The negative sign reflects the decreasing values.
11. C — $3x^2 + 2x + 3$. Combining like terms gives $(x^2 + 2x^2) + (3x - x) + (-5 + 8) = 3x^2 + 2x + 3$. Each pair of like terms is added separately. The constants combine to +3.
12. D — shifted right 2 units and down 5 units. The −2 inside the parentheses shifts the parabola right, and the −5 outside shifts it down. Inside changes move the graph horizontally opposite to the sign, and outside changes move it vertically. Both transformations act together.
13. A — $y = 3x + 4$. A parallel line shares the slope 3, and passing through (0, 4) gives a y-intercept of 4. The equation is therefore $y = 3x + 4$. Parallel lines have equal slopes.
14. B — $x = -4$. The axis of symmetry is $x = -b/(2a) = -8/2 = -4$. This vertical line passes through the vertex of the parabola. It is found directly from the coefficients a and b.
15. D — $5 + \sqrt{7}$. Since $\sqrt{7}$ is irrational, adding the rational number 5 produces an irrational sum. A rational number added to an irrational number is always irrational. The other operations simplify to rational values such as 3, 0.75, and 12.
16. C — range = 22. The range is the maximum minus the minimum, $30 - 8 = 22$. The range measures the total spread of the data. Identifying the largest and smallest values gives the difference.
17. B — A third factor, such as warm weather, likely affects both variables. A strong correlation does not establish causation; a lurking variable can drive both behaviors. Warm weather increases both ice cream sales and pool visits. Correlation alone cannot prove one causes the other.
18. A — $y = 2$. Solving $x + 3y = 9$ for x gives $x = 9 - 3y$; substituting into $2x + y = 8$ yields $2(9 - 3y) + y = 8$, so $18 - 5y = 8$ and $y = 2$. Substitution reduces the system to one variable. The corresponding x-value is 3, and both equations check.
19. D — (6, 0) and (−2, 0). Factoring $x^2 - 4x - 12 = (x - 6)(x + 2)$ gives x-intercepts at $x = 6$ and $x = -2$. The x-intercepts occur where $y = 0$. Each factor set to zero gives one intercept.
20. C — 8. The average rate of change is $[f(3) - f(1)]/(3 - 1) = (18 - 2)/2 = 16/2 = 8$. Only the endpoint values of the interval are used. The result equals the slope of the segment joining those points.
21. B — $5000(1.08)^6$. An 8% monthly increase means multiplying by 1.08 each month, and 6 months gives the exponent 6. The starting count 5,000 is the coefficient. A base of 1.08 represents the monthly growth factor.
22. A — no real solutions. The discriminant is $3^2 - 4(2)(5) = 9 - 40 = -31$, 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. C — two solutions: $x = 3$ and $x = -7$. Since $|x + 2| = 5$ means $x + 2 = 5$ or $x + 2 = -5$, the solutions are $x = 3$ and $x = -7$. A nonzero absolute-value equation produces two cases. Both the positive and negative possibilities must be solved.
24. D — Function g saves more per week than function f. Function g has a slope of 25, greater than function f's slope of 15. The coefficient of x represents the weekly savings rate. Comparing the slopes shows g accumulates faster per week.
25. $x = 4$, $y = 3$. Adding the two equations eliminates y: $(x + y) + (2x - y) = 7 + 5$, giving $3x = 12$ and $x = 4$; then $4 + y = 7$, so $y = 3$. Verification: $4 + 3 = 7$ and $2(4) - 3 = 5$, so both equations hold. The solution is (4, 3).
26. $y = -(5/2)x + 10$. The given slope is 2/5, so the perpendicular slope is the negative reciprocal, $-5/2$. Using point-slope with (4, 0): $y - 0 = -(5/2)(x - 4)$, which expands to $y = -(5/2)x + 10$.
27. $x = -7$ and $x = 5$. Factoring $x^2 + 2x - 35$ gives $(x + 7)(x - 5) = 0$. Setting each factor to zero, $x + 7 = 0$ yields $x = -7$ and $x - 5 = 0$ yields $x = 5$.
28. Exponential. Each output is multiplied by a constant 2 ($6 \rightarrow 12 \rightarrow 24 \rightarrow 48$), giving a common ratio rather than a constant difference. With the values equal to 3 times a power of 2, the function rule is $y = 3(2)^x$.
29. $4(x - 3)(x + 3)$. Factor out the GCF of 4 to get $4(x^2 - 9)$, then factor the difference of two squares: $x^2 - 9 = (x - 3)(x + 3)$. The fully factored form is $4(x - 3)(x + 3)$.
30. a. $a_n = 50 - 7(n - 1)$. b. The 8th term is $a_8 = 50 - 7(8 - 1) = 50 - 49 = 1$.
31. $-9 \leq x < 9$. Subtracting 1 from all parts gives $-3 \leq (1/3)x < 3$, and multiplying by 3 yields $-9 \leq x < 9$. On a number line, this is shown with a closed circle at -9, an open circle at 9, and shading between them.
32. Residual = 3, above the line. The predicted score is $\hat{y} = 1.2(10) + 5 = 17$, and the residual is $20 - 17 = 3$. Because the residual is positive, the actual score was above the value predicted by the line of best fit.
33. a. The axis of symmetry is $x = -b/(2a) = -4/2 = -2$, and $f(-2) = 4 - 8 - 12 = -16$, giving vertex $(-2, -16)$. b. Factoring $x^2 + 4x - 12 = (x + 6)(x - 2)$ gives zeros $x = -6$ and $x = 2$. c. The parabola opens upward ($a > 0$); the vertex is $(-2, -16)$; the axis of symmetry is $x = -2$; the x-intercepts are $(-6, 0)$ and $(2, 0)$; the y-intercept is $(0, -12)$; and the minimum value is -16.
34. a. $n + d = 30$ and $0.05n + 0.10d = 2.40$. b. Solving the first for n gives $n = 30 - d$; substituting yields $0.05(30 - d) + 0.10d = 2.40$, so $1.5 + 0.05d = 2.40$, giving $d = 18$ dimes and $n = 12$ nickels. c. Verification: $12 + 18 = 30$ and $0.05(12) + 0.10(18) = 0.60 + 1.80 = 2.40$, so both equations are satisfied.
35. a. The axis of symmetry is $x = -b/(2a) = -80/(2 \cdot -2) = 20$ units, the number that maximizes profit. b. $P(20) = -2(20)^2 + 80(20) - 350 = -800 + 1600 - 350 = 450$, so the maximum monthly profit is \$450. c. Setting $-2x^2 + 80x - 350 = 0$ and dividing by -2 gives $x^2 - 40x + 175 = 0$, which factors as $(x - 5)(x - 35) = 0$, so the break-even points are 5 units and 35 units. d. $P(5) = 0$, $P(10) = 250$, $P(20) = 450$, $P(30) = 250$, $P(35) = 0$. e. The company earns a positive profit for $5 < x < 35$ units, the interval between the two break-even points where the parabola lies above the x-axis.