

PRACTICE EXAM 45: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 $5x - 2(x + 4) = 10$ for x .

A. $x = 2$

B. $x = 18$

C. $x = 3$

D. $x = 6$

2. If $f(x) = x^2 + 1$, what is the value of $f(4) - f(2)$?

A. 10

B. 12

C. 20

D. 6

3. A line is given by the equation $y = -4x + 9$. Which statement is true?

A. The slope is -4 and the y -intercept is 9

B. The slope is 9 and the y -intercept is -4

C. The slope is 4 and the y -intercept is -9

D. The slope is -9 and the y -intercept is 4

4. Which expression is the factored form of $x^2 - 11x + 24$?

A. $(x - 4)(x - 6)$

B. $(x + 3)(x + 8)$

C. $(x - 3)(x - 8)$

D. $(x - 12)(x + 2)$

5. The function $f(x) = 3(2)^x$ is given. What is the value of $f(3)$?

A. $f(3) = 18$

B. $f(3) = 6$

C. $f(3) = 48$

D. $f(3) = 24$

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

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

B. $x = -3$ and $x = 2$

C. $x = 6$ and $x = -1$

D. $x = -6$ and $x = 1$

7. What is the 15th term of the arithmetic sequence 2, 5, 8, 11, ...?

A. $a_{15} = 47$

B. $a_{15} = 45$

C. $a_{15} = 44$

D. $a_{15} = 42$

8. Solve the inequality $4x + 9 < 2x - 5$.

A. $x < -7$

B. $x > -7$

C. $x < 7$

D. $x > 2$

9. A system of two linear equations has the same slope but different y-intercepts. How many solutions does the system have?

A. exactly one solution

B. no solution

C. infinitely many solutions

D. exactly two solutions

10. The table below shows values of a function.

x: 1, 2, 3, 4

y: 5, 8, 13, 20

Which type of function is represented?

A. Linear, with a constant rate of change

B. Exponential, with a constant ratio

C. Linear, with a rate of change of 3

D. Quadratic, with constant second differences

11. Which expression is equivalent to $(5x^2 - 3x + 7) - (2x^2 + x - 4)$?

A. $3x^2 - 4x + 11$

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

C. $3x^2 - 4x + 3$

D. $7x^2 - 2x + 11$

12. Which statement best describes the transformation from $f(x) = x^2$ to $g(x) = -x^2 + 3$?

A. reflection over the y-axis and shift up 3 units

B. reflection over the x-axis and shift down 3 units

C. reflection over the x-axis and shift up 3 units

D. reflection over the y-axis and shift down 3 units

13. A line has a slope of -2 and passes through the point $(3, 1)$. What is its equation in slope-intercept form?

A. $y = -2x + 1$

B. $y = -2x + 7$

C. $y = -2x - 5$

D. $y = 2x - 5$

14. What are the coordinates of the vertex of $f(x) = x^2 - 2x - 8$?

A. $(-1, -9)$

B. (1, 9)

C. (2, -8)

D. (1, -9)

15. Which of the following sums is a rational number?

A. $\sqrt{5} + \sqrt{5}$

B. $\pi + 1$

C. $\frac{1}{4} + 0.5$

D. $\sqrt{3} + 2$

16. What is the mean of the data set 12, 18, 15, 21, 24?

A. mean = 18

B. mean = 15

C. mean = 21

D. mean = 90

17. Two data sets have the same mean. Set P has values tightly clustered near the mean, while Set Q has values widely spread out. Which statement is true?

A. Set P has a greater standard deviation than Set Q

B. Both sets have a standard deviation of zero

C. The standard deviations of the two sets cannot be compared

D. Set Q has a greater standard deviation than Set P

18. What is the value of x in the solution to the system $y = 2x - 3$ and $4x - y = 9$?

A. $x = 6$

B. $x = 3$

C. $x = -3$

D. $x = 9$

19. The function $f(x) = (x - 7)(x + 1)$ has zeros at which values?

A. $x = -7$ and $x = 1$

B. $x = 7$ and $x = 1$

C. $x = 7$ and $x = -1$

D. $x = -7$ and $x = -1$

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

x : 0, 5

$g(x)$: 12, 2

What is the average rate of change of $g(x)$ from $x = 0$ to $x = 5$?

A. -2

B. 2

C. -10

D. 10

21. The value of an investment is modeled by $V(t) = 4000(1.05)^t$. What is the annual percent increase?

A. 105%

B. 1.05%

C. 0.05%

D. 5%

22. What number must be added to $x^2 - 10x$ to make it a perfect-square trinomial?

A. 5

B. 100

C. 25

D. -25

23. How many solutions does the equation $|3x - 6| = 0$ have?

A. one solution

B. two solutions

C. no solution

D. infinitely many solutions

24. Three functions are defined as $f(x) = 100x$, $g(x) = x^2$, and $h(x) = 2^x$. For very large values of x , which function will produce the greatest value?

A. $f(x)$, the linear function

B. $h(x)$, the exponential function

C. $g(x)$, the quadratic function

D. all three functions grow at the same rate

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.

$$2x + y = 9$$

$$x - y = 3$$

26. Write the equation of the line that is parallel to $y = -(1/2)x + 6$ and passes through the point $(-2, 5)$. Express your answer in slope-intercept form.

27. Solve the quadratic equation $x^2 - 7x = 18$ by factoring. Show all steps.

28. The table below shows values of a function.

x : 0, 1, 2, 3

y: 7, 4, 1, -2

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: $3x^2 - 12x - 36$.

30. A geometric sequence has a first term of 2 and a common ratio of 4.

a. Write the explicit formula for the n th term.

b. Find the value of the 5th term.

31. Solve the inequality $2(x + 3) > x - 1$ and graph the solution set on a number line.

32. A line of best fit for attendance data is given by $\hat{y} = -1.5x + 40$, where x is the ticket price in dollars and \hat{y} is the predicted attendance. At a price of \$12, 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 $f(x) = x^2 - 2x - 15$.

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 pool contains 500 gallons of water and is being drained at a constant rate of 25 gallons per minute.

a. Write a linear function $W(t)$ that models the amount of water remaining after t minutes.

b. Determine how much water remains after 8 minutes. Show your calculation.

c. Determine how many minutes it will take for the pool to be completely empty. Show your work.

d. Interpret the slope and the y-intercept of the function in the context of this situation.

PART IV — Extended Constructed Response (Question 35)

This question is worth 6 credits. Show all work.

35. A biologist studies two populations of insects in a laboratory.

Population A starts at 200 insects and increases by 150 insects each week (linear growth).

Population B starts at 50 insects and doubles each week (exponential growth).

a. Write a function $A(w)$ for Population A and a function $B(w)$ for Population B, where w represents the number of weeks (starting at $w = 0$).

b. Create a table of values for both populations for weeks 0 through 5. Show your calculations.

c. During which week does Population B first exceed Population A? Justify your answer using your table.

d. After 5 weeks, how many more insects are in Population B than in Population A? Show your work.

e. Explain, in terms of the type of growth, why Population B overtakes Population A even though it begins with far fewer insects.

ANSWERS KEY AND EXPLANATIONS

1. D — $x = 6$. Distributing the -2 gives $5x - 2x - 8 = 10$, so $3x - 8 = 10$ and $3x = 18$, yielding $x = 6$. The negative must distribute to both terms inside the parentheses. Substituting back gives $30 - 20 = 10$, confirming the result.
2. B — 12. Evaluating each term, $f(4) = 16 + 1 = 17$ and $f(2) = 4 + 1 = 5$, so the difference is $17 - 5 = 12$. Each input is squared before the constant is added. The two function values are computed separately and then subtracted.
3. A — slope -4 and y -intercept 9 . In slope-intercept form $y = mx + b$, the coefficient of x is the slope and the constant is the y -intercept. Here $m = -4$ and $b = 9$. Reading the equation directly identifies both features.
4. C — $(x - 3)(x - 8)$. The factor pair of $+24$ that sums to -11 is -3 and -8 , giving $(x - 3)(x - 8)$. Both factors are negative because the product is positive and the sum is negative. Expanding returns $x^2 - 11x + 24$.
5. D — $f(3) = 24$. Substituting gives $3(2)^3 = 3(8) = 24$. The exponent applies only to the base 2 before multiplying by the coefficient 3 . Order of operations requires evaluating the power first.
6. B — $x = -3$ and $x = 2$. Factoring $x^2 + x - 6$ gives $(x + 3)(x - 2) = 0$, so the solutions are -3 and 2 . The factor pair of -6 that sums to $+1$ is $+3$ and -2 . Setting each factor to zero produces the roots.
7. C — $a_{15} = 44$. Using $a_n = a_1 + d(n - 1)$, the 15th term is $2 + 3(14) = 2 + 42 = 44$. The common difference of 3 is multiplied by one less than the term number. The first term is added only once.
8. A — $x < -7$. Subtracting $2x$ and 9 from both sides gives $2x < -14$, so $x < -7$. Dividing by the positive 2 preserves the inequality direction. Collecting variable terms on one side isolates the solution.
9. B — no solution. Lines with equal slopes but different y -intercepts are parallel and never intersect. A system of parallel lines has no point in common. Equal slopes with unequal intercepts is the defining condition for no solution.
10. D — 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. A — $3x^2 - 4x + 11$. Distributing the subtraction gives $5x^2 - 3x + 7 - 2x^2 - x + 4$, and combining like terms yields $3x^2 - 4x + 11$. Every term in the second polynomial changes sign. The constant becomes $7 + 4 = 11$ after the negative distributes.
12. C — reflection over the x -axis and shift up 3 units. The negative sign on x^2 reflects the parabola across the x -axis, and adding 3 raises it vertically. Reflection comes from the sign change applied to the output, while the $+3$ produces a vertical shift. Both transformations act on the function's output values.

13. B — $y = -2x + 7$. Using point-slope, $y - 1 = -2(x - 3)$, which expands to $y = -2x + 6 + 1 = -2x + 7$. The given point and slope are substituted directly. The resulting y-intercept is 7.
14. D — $(1, -9)$. The vertex x-value is $-b/(2a) = 2/2 = 1$, and $f(1) = 1 - 2 - 8 = -9$, giving vertex $(1, -9)$. The axis of symmetry locates the x-coordinate. Evaluating the function there gives the y-coordinate.
15. C — $1/4 + 0.5$. This sum equals 0.75, which is the rational number $3/4$. A sum of two rational numbers is always rational. The other options each include an irrational term, producing irrational results.
16. A — mean = 18. The values total $12 + 18 + 15 + 21 + 24 = 90$, and dividing by 5 gives 18. The mean is the sum of all values divided by their count. Each value contributes equally to the average.
17. D — Set Q has a greater standard deviation than Set P. Standard deviation measures how far values spread from the mean, so the widely scattered Set Q has the larger value. Tightly clustered data, as in Set P, produces a smaller standard deviation. Spread, not center, determines standard deviation here.
18. B — $x = 3$. Substituting $y = 2x - 3$ into $4x - y = 9$ gives $4x - (2x - 3) = 9$, so $2x + 3 = 9$ and $x = 3$. Substitution replaces y entirely, leaving one variable. The corresponding y-value is 3, and both equations check.
19. C — $x = 7$ and $x = -1$. By the zero-product property, $x - 7 = 0$ gives $x = 7$ and $x + 1 = 0$ gives $x = -1$. The zeros are the x-values that make each factor zero. The sign inside each factor reverses to give the root.
20. A — -2 . The average rate of change is $[g(5) - g(0)]/(5 - 0) = (2 - 12)/5 = -10/5 = -2$. The negative result reflects that the function decreases over the interval. It equals the slope of the segment joining the two points.
21. D — 5%. In $V(t) = 4000(1.05)^t$, the base 1.05 equals $1 + 0.05$, indicating a 5% annual increase. The growth rate is the amount the base exceeds 1. A base greater than 1 represents exponential growth.
22. C — 25. To complete the square for $x^2 - 10x$, add $(b/2)^2 = (-10/2)^2 = 25$, producing $(x - 5)^2$. Half the linear coefficient, squared, completes the perfect-square trinomial. The result factors as a binomial squared.
23. A — one solution. Since absolute value equals zero only when its contents equal zero, $3x - 6 = 0$ gives the single solution $x = 2$. A nonzero absolute-value equation yields two solutions, but zero yields exactly one. The distance from zero is zero only at one point.
24. B — $h(x)$, the exponential function. Exponential growth eventually outpaces both linear and quadratic growth for large inputs. Although $f(x) = 100x$ and $g(x) = x^2$ may lead at small values, 2^x grows by repeated doubling and overtakes them. Exponential functions dominate polynomial functions in the long run.
25. $x = 4, y = 1$. Adding the two equations eliminates y: $(2x + y) + (x - y) = 9 + 3$, giving $3x = 12$ and $x = 4$; then $4 - y = 3$, so $y = 1$. Verification: $2(4) + 1 = 9$ and $4 - 1 = 3$, so both equations hold. The solution is $(4, 1)$.
26. $y = -(1/2)x + 4$. A parallel line shares the slope $-1/2$. Using point-slope with $(-2, 5)$: $y - 5 = -(1/2)(x + 2)$, which expands to $y = -(1/2)x - 1 + 5 = -(1/2)x + 4$.
27. $x = 9$ and $x = -2$. Rewriting gives $x^2 - 7x - 18 = 0$, which factors as $(x - 9)(x + 2) = 0$. Setting each factor to zero, $x - 9 = 0$ yields $x = 9$ and $x + 2 = 0$ yields $x = -2$.

28. Linear. The first differences are a constant -3 ($7 \rightarrow 4 \rightarrow 1 \rightarrow -2$), indicating a constant rate of change. With a y-intercept of 7 and slope -3 , the function rule is $y = -3x + 7$.
29. $3(x - 6)(x + 2)$. Factor out the GCF of 3 to get $3(x^2 - 4x - 12)$, then factor the trinomial into $(x - 6)(x + 2)$. The fully factored form is $3(x - 6)(x + 2)$.
30. a. $a_n = 2(4)^{(n - 1)}$. b. The 5th term is $a_5 = 2(4)^4 = 2(256) = 512$.
31. $x > -7$. Distributing gives $2x + 6 > x - 1$; subtracting x and 6 from both sides yields $x > -7$. On a number line, this is shown with an open circle at -7 and shading extending to the right.
32. Residual = 3, above the line. The predicted attendance is $\hat{y} = -1.5(12) + 40 = 22$, and the residual is $25 - 22 = 3$. 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 $f(1) = 1 - 2 - 15 = -16$, giving vertex $(1, -16)$. b. Factoring $x^2 - 2x - 15 = (x - 5)(x + 3)$ gives zeros $x = 5$ and $x = -3$. c. The parabola opens upward ($a > 0$); the vertex is $(1, -16)$; the axis of symmetry is $x = 1$; the x-intercepts are $(5, 0)$ and $(-3, 0)$; the y-intercept is $(0, -15)$; and the minimum value is -16 .
34. a. $W(t) = 500 - 25t$. b. $W(8) = 500 - 25(8) = 500 - 200 = 300$ gallons. c. Setting $500 - 25t = 0$ gives $25t = 500$, so $t = 20$ minutes. d. The slope of -25 represents the draining rate of 25 gallons per minute, and the y-intercept of 500 represents the initial amount of water in the pool.
35. a. $A(w) = 200 + 150w$ and $B(w) = 50(2)^w$. b. At $w = 0$: $A = 200$, $B = 50$; at $w = 1$: $A = 350$, $B = 100$; at $w = 2$: $A = 500$, $B = 200$; at $w = 3$: $A = 650$, $B = 400$; at $w = 4$: $A = 800$, $B = 800$; at $w = 5$: $A = 950$, $B = 1600$. c. Population B first exceeds Population A in week 5, since the two populations are equal at 800 in week 4 and B (1600) surpasses A (950) in week 5. d. After 5 weeks, $B - A = 1600 - 950 = 650$ more insects. e. Population B grows exponentially by repeated doubling, while Population A grows linearly by adding a fixed amount; exponential growth eventually outpaces linear growth regardless of the smaller starting value.