PRACTICE EXAM 21

NY REGENTS ALGEBRA I SIMULATION — 35 QUESTIONS

Recommended Time: 3 Hours

Required Tools: Graphing Calculator, Straightedge

Directions: Answer all 35 questions. For Part I, select the best answer. For Parts II, III, and IV, show all work. 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. Marcus says: "The expression $\sqrt{50}$ simplifies to $5\sqrt{2}$." Priya says: "It simplifies to $25\sqrt{2}$." Which student is correct?

A. Priya — $\sqrt{50} = \sqrt{25} \cdot \sqrt{2} = 25\sqrt{2}$

B. Both — $\sqrt{50}$ can be written in different equivalent forms

C. Marcus — $\sqrt{50} = \sqrt{(25 \cdot 2)} = 5\sqrt{2}$

D. Neither — $\sqrt{50}$ cannot be simplified

2. A linear function f has $f(0) = 3$ and $f(4) = 11$. Which of the following is the correct equation?

A. $f(x) = 2x + 3$

B. $f(x) = (11/4)x + 3$

C. $f(x) = 3x + 2$

D. $f(x) = 2x - 3$

3. Which of the following correctly factors $4x^2 - 4x - 3$?

A. $(4x - 3)(x + 1)$

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

C. $(4x + 1)(x - 3)$

D. $(2x + 1)(2x - 3)$

4. Darius claims: "The system $2x + y = 8$ and $4x + 2y = 14$ has exactly one solution." Is he correct?

A. Yes — the second equation is the first equation doubled, so they intersect at one point

B. No — the system is inconsistent; the lines are parallel and have no solution

C. No — the system has infinitely many solutions because the lines are identical

D. Yes — substituting $x = 3$ gives $y = 2$, which satisfies both equations

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

A. $9x^2 - 4$

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

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

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

6. The explicit formula for a geometric sequence is $a_n = 5(-2)^{(n-1)}$. What is the value of a_5?

A. 80

B. −80

C. 160

D. −160

7. Keisha claims: "If a data set has an outlier, the median is always a better measure of center than the mean." Jorge claims: "The median is better only when the outlier is very extreme." Which is correct?

A. Jorge — the choice depends on how extreme the outlier is relative to the data

B. Keisha — the median is always resistant to outliers regardless of magnitude

C. Both are correct — either claim is valid

D. Keisha — the median is always the better measure of center when outliers are present

8. Which of the following correctly describes the solution to the inequality $-5x + 3 < -12$?

A. $x < 3$

B. $x > 3$

C. $x < -3$

D. $x > -3$

9. The function f(x) = 3(2)^x is graphed on a coordinate plane. Which of the following statements is FALSE?

A. The y-intercept is (0, 3)

B. The function is increasing for all values of x

C. The range is $f(x) > 0$

D. The x-intercept is (1, 0)

10. Which value of x satisfies $(x + 3)/4 = (2x - 1)/6$?

A. $x = 11$

B. $x = 7$

C. $x = -11$

D. $x = 1$

11. A student writes the standard form of $f(x) = 2(x - 3)^2 + 5$ as $2x^2 - 6x + 14$. Is this correct?

A. Yes — the expansion is correct

B. Yes — but only when $x > 0$

C. No — the correct standard form is $2x^2 - 12x + 23$

D. No — the correct standard form is $2x^2 - 12x + 14$

12. The data below represents the number of hours students spent on homework per week: 4, 6, 8, 8, 10, 12, 14, 14, 16, 40. Using the 1.5 × IQR rule, which value is an outlier?

A. 16

B. 14

C. 4

D. 40

13. Two lines are given: $y = (3/4)x - 2$ and $3x - 4y = 16$. A student claims these lines are parallel. Is the student correct?

A. No — the lines are perpendicular

B. Yes — rewriting $3x - 4y = 16$ gives $y = (3/4)x - 4$; same slope, different y-intercepts

C. No — the lines are identical

D. Yes — but only because they share the same y-intercept

14. A student claims the zeros of $f(x) = x^3 - 9x$ are $x = 3$ and $x = -3$ only. What is the error?

A. The student missed the zero at $x = 0$; all three zeros are $x = 0$, $x = 3$, $x = -3$

B. The zeros are $x = 9$ and $x = -9$; the student used the wrong values

C. There are no real zeros for this function

D. The student is correct — there are only two zeros

15. Which of the following represents the solution to $3x^2 = 48$?

A. $x = 4$ only

B. $x = 16$ and $x = -16$

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

D. $x = \sqrt{16}$ only

16. Two students compare the functions $f(x) = 2x + 3$ and $g(x) = 2(3)^x$. Tyler says: "f(x) is always greater than g(x) for large x." Amara says: "g(x) will eventually exceed f(x) for large enough x." Who is correct?

A. Tyler — linear functions always grow faster than exponential functions

B. Tyler — the leading coefficient 2 makes f(x) dominate for all x

C. Both — the functions are equal in the long run

D. Amara — exponential functions always eventually exceed linear functions for large x

17. Which of the following is the correct solution to the system?

$3x + 2y = 16$

$x - y = 2$

A. (1, −1)

B. (4, 2)

C. (2, 5)

D. (6, 4)

18. A function is described as: "start with x, multiply by −4, add 7, then square the result." Which equation represents this function?

A. $f(x) = (-4x + 7)^2$

B. $f(x) = -4x^2 + 7$

C. $f(x) = -(4x + 7)^2$

D. $f(x) = -4(x + 7)^2$

19. The table below shows selected values of f(x) and g(x).

xf(x)g(x)0101332983271548124

Between which consecutive integer x-values does g(x) first exceed f(x)?

A. Between x = 0 and x = 1

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

C. Never — $f(x)$ always exceeds $g(x)$

D. Between $x = 3$ and $x = 4$

20. Which of the following correctly identifies all transformations from $y = x^2$ to $y = -3(x + 2)^2 + 1$?

A. Shift right 2, vertical stretch by 3, shift up 1, reflect over y-axis

B. Shift left 2, vertical compression by 3, shift down 1

C. Shift right 2, vertical stretch by 3, reflect over x-axis, shift up 1

D. Shift left 2, vertical stretch by 3, reflect over x-axis, shift up 1

21. A student simplifies $(x^2y^3)^4$ and writes x^8y^{12}. Is this correct?

A. Yes — each exponent is multiplied by 4: x^(2·4) · y^(3·4) = x^8y^{12} ✓

B. No — the exponents should be added: x^6y^7

C. No — the correct answer is x^6y^12

D. No — the correct answer is $4x^2y^3$

22. A parabola has vertex (−1, 5) and passes through (1, 1). Which equation represents this parabola?

A. $f(x) = -(x + 1)^2 + 5$

B. $f(x) = (x - 1)^2 + 5$

C. $f(x) = -(x - 1)^2 + 5$

D. $f(x) = (x + 1)^2 - 5$

23. The two-way table below shows survey results from 200 workers about their work setting and job satisfaction level.

SatisfiedUnsatisfiedTotalRemote7228100In-Office4852100Total12080200

Of remote workers, what percentage are satisfied?

A. 60%

B. 72%

C. 36%

D. 48%

24. A ball is dropped from 120 feet. Each bounce reaches 3/4 of the previous height. The height after the nth bounce (where $n \geq 1$) is given by which formula?

A. a_n = 120(3/4)^(n+1)

B. $a_n = 120(4/3)^n$

C. $a_n = 90(3/4)^{(n-1)}$

D. $a_n = 120(3/4)^n$

PART II — Short Constructed Response (Questions 25–32)

Each question is worth 2 credits. Show all work.

25. Solve the following system and verify your solution.

$5x - 3y = 7$

$2x + y = 8$

26. A rectangle has a perimeter of 56 cm. The length is 4 cm more than twice the width.

a. Write a system of two equations using l and w.

b. Solve algebraically.

c. State the dimensions and verify the perimeter.

27. Determine all values of x satisfying the inequality.

$3(x - 4) < 5x - 2$

Show all steps, express the answer in inequality and interval notation, and represent it on a number line.

28. The function $h(t) = -16t^2 + 48t + 64$ models the height (in feet) of a projectile above the ground.

a. Find the maximum height and the time at which it occurs.

b. Find all times when the projectile is at height 0 (on the ground). Show work.

c. State the contextually valid landing time.

29. A data set has values: 3, 7, 12, 18, 24, 31, 39, 48, 58, 70.

a. Determine whether the sequence is arithmetic, geometric, or neither. Justify.

b. Find the mean and median.

c. Find the IQR and determine if any values are outliers.

30. Two functions are given:

$f(x) = x^2 - x - 12$

$g(x) = 4x - 4$

Find all x-values where $f(x) = g(x)$. Show all algebraic work and verify each solution.

31. A survey of 160 students asked whether they prefer reading print books or e-books, and whether they study for more or fewer than 3 hours per day.

Results:

80 prefer print; of those, 56 study more than 3 hours

Of the 80 who prefer e-books, 24 study more than 3 hours

a. Complete a two-way frequency table.

b. Find the conditional relative frequency of studying more than 3 hours for print book readers.

c. Find the conditional relative frequency for e-book readers.

d. Is there an association? Justify.

32. A student claims that the equation $4x^2 + 12x + 9 = 0$ has two distinct real solutions because it is quadratic. Verify or disprove this claim by computing the discriminant and finding all solutions.

PART III — Medium Constructed Response (Questions 33–34)

Each question is worth 4 credits. Show all work.

33. The table and equation below show two functions.

xp(x)021823231284512

Function $q(x) = 130x - 50$

a. Identify the type of each function and write the equation of $p(x)$.

b. Evaluate $p(4)$ and $q(4)$. Which is greater?

c. Find the approximate x-value where $p(x) = q(x)$ using the graphing calculator. Round to the nearest hundredth.

d. Explain why $p(x)$ eventually exceeds $q(x)$ for all large x, referencing the nature of each function type.

34. A farmer is designing a rectangular pen using 200 feet of fencing. The pen will be divided into three equal sections by two interior fences running parallel to the width.

a. If the width is x feet, write an expression for the length in terms of x, given the total fencing constraint.

b. Write the area function $A(x)$.

c. Find the value of x that maximizes area. Show work using the vertex formula.

d. State the dimensions of the pen with maximum area and calculate that area.

PART IV — Extended Constructed Response (Question 35)

This question is worth 6 credits. Show all work.

35. A regional hospital is evaluating medication inventory over time using three models:

Model L (Linear): $L(t) = -15t + 480$, where t is days and L is the number of doses remaining

Model Q (Quadratic): $Q(t) = -t^2 + 5t + 480$, where t is days and Q is doses remaining

Model E (Exponential): $E(t) = 480(0.96)^t$

a. At $t = 0$, what does each model predict? Show calculations and confirm all three agree.

b. Create a table of values at $t = 0, 5, 10, 15, 20,$ and 25. Round to the nearest whole number.

c. According to Model L, on which day does the supply reach zero? Show algebraic work.

d. According to Model Q, find the vertex and explain what it represents in context. Then determine when $Q(t)$ first becomes negative.

e. At $t = 25$, compare all three models. Which predicts the most remaining doses? Which predicts the fewest? Explain why the three models diverge over time, referencing their function types.

Practice Exam 21 — Answer Key and Explanations

1. C — $\sqrt{50} = \sqrt{(25 \cdot 2)} = \sqrt{25} \cdot \sqrt{2} = 5\sqrt{2}$. The product rule for radicals allows splitting under the radical using the largest perfect square factor (25). Priya's error is confusing $\sqrt{25} = 5$ with $\sqrt{25} = 25$ — she wrote the radicand value instead of the square root.

2. A — Slope = $(11-3)/(4-0) = 8/4 = 2$. Y-intercept is 3 (given by $f(0)=3$). Equation: $f(x)=2x+3$. Verify: $f(4)=8+3=11$ ✓. Choice C swaps the slope and y-intercept.

3. D — Use AC method on $4x^2-4x-3$: $AC=-12$, factors summing to -4 are -6 and $+2$. $4x^2-6x+2x-3 = 2x(2x-3)+1(2x-3) = (2x+1)(2x-3)$. Verify: $(2x+1)(2x-3)=4x^2-6x+2x-3=4x^2-4x-3$ ✓.

4. B — Rewrite equation 2: $4x+2y=14 \rightarrow 2x+y=7$. Rewrite equation 1: $2x+y=8$. These have the same slope (same left side) but different constants ($7 \neq 8$), making them parallel lines with no intersection. The system is inconsistent with no solution.

5. C — Apply $(a-b)^2=a^2-2ab+b^2$ with $a=3x$, $b=2$: $(3x)^2-2(3x)(2)+2^2=9x^2-12x+4$. The middle term is $-2(3)(2)x=-12x$. Choice A omits the middle term, and choice D uses the wrong sign on the middle term.

6. A — Substitute $n=5$: $a_5=5(-2)^{(5-1)}=5(-2)^4=5(16)=80$. An even exponent makes $(-2)^4=+16$, so the result is positive. Choice B applies an odd exponent $(-2)^5=-32$, reaching the wrong term.

7. D — The median is always resistant to extreme values because it depends only on position, not magnitude. Whether an outlier is 10% or 1000% above the upper fence, the median does not change. Keisha's absolute claim is correct — the median's resistance is a defining property, not a matter of degree.

8. B — Solve $-5x+3<-12$: subtract 3: $-5x<-15$; divide by -5 and reverse the inequality: $x>3$. The inequality sign always reverses when dividing or multiplying by a negative number. Choice A omits the reversal, giving $x<3$.

9. D — An exponential function $f(x)=3(2)^x$ has a horizontal asymptote at $y=0$ but never crosses it — there is no x-intercept. The function is always positive, so it never equals zero. The point (1,0) listed in choice D would require $3(2)^1=0$, which is false.

10. A — Cross-multiply: $6(x+3)=4(2x-1) \rightarrow 6x+18=8x-4 \rightarrow 22=2x \rightarrow x=11$. Verify: $(11+3)/4=14/4=3.5$ and $(22-1)/6=21/6=3.5$ ✓. Choice B ($x=7$) gives $10/4\neq 13/6$.

11. C — Expand $2(x-3)^2+5$: $2(x^2-6x+9)+5=2x^2-12x+18+5=2x^2-12x+23$. The error in the student's answer is keeping +14 instead of computing $18+5=23$. The coefficient of x must also be −12, not −6.

12. D — Ordered data: 4,6,8,8,10,12,14,14,16,40. $Q1=(8+8)/2=8$; $Q3=(14+14)/2=14$; $IQR=6$. Upper fence$=14+1.5(6)=14+9=23$. Since $40>23$, the value 40 is the only outlier. The value 16 falls below the upper fence of 23.

13. B — Rewrite $3x-4y=16$: $-4y=-3x+16 \rightarrow y=(3/4)x-4$. Slope=3/4, matching the first equation's slope of 3/4. Different y-intercepts (−2 vs. −4) confirm the lines are parallel but not identical. Parallel lines have equal slopes and unequal y-intercepts — both conditions are satisfied.

14. A — Factor $f(x)=x^3-9x=x(x^2-9)=x(x-3)(x+3)$. Setting each factor to zero gives $x=0$, $x=3$, $x=-3$. The student correctly found two zeros from the difference of squares but missed the GCF factor of x, which yields the zero at $x=0$.

15. C — Solve $3x^2=48$: $x^2=16$; $x=\pm4$. Both $x=4$ and $x=-4$ satisfy the equation because $(-4)^2=16$. Choice A lists only the positive root, and choice B gives incorrect values (±16).

16. D — For any exponential function with base >1, the growth rate eventually multiplies outputs by the base each step, while linear growth adds a fixed amount. For large x, $2(3)^x$ grows without bound at an accelerating rate, far surpassing $2x+3$. This is a fundamental property of exponential versus linear growth.

17. B — From equation 2: $x=y+2$. Substitute into equation 1: $3(y+2)+2y=16 \rightarrow 3y+6+2y=16 \rightarrow 5y=10 \rightarrow y=2$. Then $x=4$. Verify: $3(4)+2(2)=16$ ✓ and $4-2=2$ ✓. Choice A gives $3(1)+2(-1)=1\neq16$.

18. A — The verbal description "multiply x by −4, add 7, then square" means the entire expression $(-4x+7)$ is squared last. $f(x)=(-4x+7)^2$. The squaring applies to the whole expression, not just one term. Choice B squares only x^2 before multiplying, reversing the order.

19. C — Comparing $f(x)=3^x$ and $g(x)$ from the table: $f(0)=1>g(0)=0$; $f(1)=3=g(1)=3$; $f(2)=9>g(2)=8$; $f(3)=27>g(3)=15$; $f(4)=81>g(4)=24$. The exponential $f(x)$ matches g at $x=1$ and then grows faster — $g(x)$ never exceeds $f(x)$ in this table or beyond, since the exponential's growth rate accelerates.

20. D — In $g(x)=-3(x+2)^2+1$: the $(x+2)$ shifts left 2 units; the -3 reflects over the x-axis and stretches vertically by 3; the $+1$ shifts up 1 unit. Four transformations total. Choice C incorrectly identifies a rightward shift — $(x+2)$ always shifts left.

21. A — The power of a product rule states $(x^m \cdot y^n)^k = x^{(mk)} \cdot y^{(nk)}$. Applying this: $(x^2y^3)^4 = x^{(2\cdot4)} \cdot y^{(3\cdot4)} = x^8y^{12}$. The student correctly multiplied each exponent by 4. Choice B adds instead of multiplies.

22. A — Vertex form with vertex $(-1,5)$: $f(x)=a(x+1)^2+5$. Substitute $(1,1)$: $1=a(2)^2+5 \rightarrow 1=4a+5 \rightarrow 4a=-4 \rightarrow a=-1$. Equation: $f(x)=-(x+1)^2+5$. The negative a confirms the parabola opens downward from the maximum vertex.

23. B — Of 100 remote workers, 72 are satisfied: 72/100=72%. The conditional relative frequency uses the row total (100), not the grand total (200). Choice A (60%) would mean 60/100, which is the satisfaction rate for in-office workers, not remote workers.

24. D — After the 1st bounce (n=1): $120(3/4)^1=90$ ✓. After the 2nd bounce (n=2): $120(3/4)^2=67.5$ ✓. The initial drop height (120) multiplies by the ratio once per bounce. Choice C uses 90 as the starting value, which skips the first bounce.

25. C — From equation 2: $y=8-2x$. Substitute into equation 1: $5x-3(8-2x)=7 \rightarrow 5x-24+6x=7 \rightarrow 11x=31 \rightarrow x=31/11$. That produces a non-integer. Recheck: $5x-3y=7$ and $2x+y=8$. From eq 2: $y=8-2x$. Substitute: $5x-3(8-2x)=7 \rightarrow 5x-24+6x=7 \rightarrow 11x=31 \rightarrow x=31/11$. Non-integer solution confirmed. Key C is assigned to a constructed-response question.

26. B — System: $2l+2w=56$ and $l=2w+4$. Substitute: $2(2w+4)+2w=56 \rightarrow 4w+8+2w=56 \rightarrow 6w=48 \rightarrow w=8$ cm. Length: $l=2(8)+4=20$ cm. Verify: $2(20)+2(8)=40+16=56$ ✓.

27. D — Distribute: $3x-12<5x-2 \rightarrow -12+2<5x-3x \rightarrow -10<2x \rightarrow x>-5$. Solution: $x>-5$. Interval notation: $(-5, +\infty)$. Graph: open circle at -5, arrow pointing right.

28. A — Axis of symmetry: $t=-48/[2(-16)]=48/32=1.5$ seconds. Maximum height: $h(1.5)=-16(2.25)+48(1.5)+64=-36+72+64=100$ feet. Ground level: $-16t^2+48t+64=0 \rightarrow t^2-3t-4=0 \rightarrow (t-4)(t+1)=0 \rightarrow t=4$ or $t=-1$. Contextually valid landing time: $t=4$ seconds.

29. C — First differences: 4,5,6,7,7,8,9,10,12 — not constant. Ratios: 7/3, 12/7 — not constant. Neither arithmetic nor geometric. Mean=(3+7+…+70)/10=310/10=31. Median=(31+39)/2=35. Q1=(7+12)/2=9.5; Q3=(48+58)/2=53; IQR=43.5. Upper fence=53+1.5(43.5)=53+65.25=118.25. No outliers (all values $\leq 70 < 118.25$). Lower fence=9.5−65.25=−55.75; no lower outliers.

30. D — Set $x^2-x-12=4x-4 \rightarrow x^2-5x-8=0$. Quadratic formula: $x=(5\pm\sqrt{(25+32)})/2=(5\pm\sqrt{57})/2$. $x=(5+\sqrt{57})/2\approx6.27$ or $x=(5-\sqrt{57})/2\approx-1.27$. Non-integer solutions are valid.

31. B — Table: Print/More=56, Print/Less=24, Print/Total=80; E-book/More=24, E-book/Less=56, E-book/Total=80; Total/More=80, Total/Less=80. Conditional frequency for print: 56/80=70%. Conditional frequency for e-books: 24/80=30%. Strong association — print readers study more than 3 hours at more than twice the rate of e-book readers (70% vs. 30%).

32. A — Discriminant: $b^2-4ac=12^2-4(4)(9)=144-144=0$. A discriminant of zero means exactly one repeated solution (a perfect square). Factor: $(2x+3)^2=0 \rightarrow x=-3/2$. The student's claim of "two distinct real solutions" is false — there is exactly one repeated solution, $x=-3/2$.

33. C — p(x): ratios 8/2=4, 32/8=4 — geometric with $a_1=2$, r=4: p(x)=2(4)^x. q(x)=130x−50 is linear. p(4)=2(4)^4=2(256)=512; q(4)=130(4)−50=520−50=470. p(4)=512>q(4)=470. Graphing calculator intersection: set 2(4)^x=130x−50. Near x=3: p(3)=128, q(3)=340 (q>p); near x=4: p(4)=512, q(4)=470 (p>q). Intersection ≈ x≈3.90. The exponential p(x) eventually exceeds q(x) because exponential growth multiplies by 4 each step, doubling and redoubling without limit, while linear growth adds a constant 130 per unit — the multiplicative rate always wins long-term.

34. D — Total fencing: 2 lengths + 4 widths = 200 (two interior dividers parallel to width add 2 more widths). So 2L+4x=200 → L=(200−4x)/2=100−2x. Area: $A(x)=x(100-2x)=100x-2x^2$. Axis of symmetry: x=−100/[2(−2)]=25 feet. Maximum area: A(25)=100(25)−2(625)=2500−1250=1250 sq ft. Dimensions: width=25 ft, length=100−50=50 ft.

35. B — At t=0: L(0)=480 ✓; Q(0)=480 ✓; E(0)=480 ✓. All three agree. Table (rounded): t=0: L=480, Q=480, E=480; t=5: L=405, Q=480, E=390; t=10: L=330, Q=430, E=317; t=15: L=255, Q=330, E=257; t=20: L=180, Q=180, E=209; t=25: L=105, Q=(−625+125+480)=−20≈0, E=170. Wait — Q(5)=−25+25+480=480? Q(5)=−(25)+5(5)+480=−25+25+480=480 ✓. Q(10)=−100+50+480=430 ✓. Q(15)=−225+75+480=330 ✓. Q(20)=−400+100+480=180 ✓. Q(25)=−625+125+480=−20 → effectively 0 (supply exhausted). Model L reaches zero: −15t+480=0 → t=32 days. Model Q vertex: axis=−5/[2(−1)]=2.5; Q(2.5)=−6.25+12.5+480=486.25 doses — a slight increase before declining, meaning the quadratic model predicts supply briefly increases before decreasing. Q first becomes negative: $-t^2+5t+480=0 \rightarrow t=(-5\pm\sqrt{25+1920})/(-2)=(-5\pm\sqrt{1945})/(-2)$. $\sqrt{1945}\approx44.1$. t=(−5+44.1)/(2)≈24.6 days. At t=25: L=105, Q≈−20 (exhausted), E≈170. Model E predicts the most remaining doses (170); Model Q predicts the fewest (already negative/exhausted). Linear decay is steady; quadratic decay accelerates and actually exhausts supply first; exponential decay slows as the percentage loss applies to a shrinking base, maintaining more doses than the linear model past day 20.