PRACTICE EXAM 28

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.

Use the following context for Questions 1–3.

A basketball team's points scored per game over a 10-game stretch are: 78, 85, 90, 76, 88, 95, 82, 91, 79, 86. The team's coach also tracks the number of practice hours per game week: 6, 8, 10, 5, 9, 12, 7, 11, 6, 9.

1. In game 1, the team practiced 6 hours and scored 78 points. Using the regression equation $\hat{y} = 3.2x + 62$, what is the residual for game 1?

A. 3.2

B. 81.2

C. 0

D. −3.2

2. The coach notes that game 6 (12 practice hours, 95 points) has a positive residual. What does this mean?

A. Game 6's actual score was less than the predicted score

B. Game 6's actual score was higher than the predicted score

C. The regression equation overestimates for all high-practice games

D. The team always scores above their predicted score when practicing more than 10 hours

3. The correlation coefficient for the data is $r = 0.88$. Which of the following correctly interprets this value?

A. The linear model explains 88% of the variation in scores

B. Each additional practice hour increases points by 0.88

C. There is a strong positive linear association between practice hours and points scored

D. The model's predictions are accurate within 0.88 points

Use the following context for Questions 4–6.

A student creates a monthly budget. Fixed expenses (rent, insurance) total $950. Variable expenses are estimated at $18 per day for food and transportation. The student earns $2,400 per month.

4. Which function models the student's monthly savings S after d days of expenses?

A. $S(d) = 2400 - 950 - 18d$

B. $S(d) = 2400 + 950 - 18d$

C. $S(d) = 18d - 2400$

D. $S(d) = 950 + 18d$

5. For how many days of variable expenses will the student's savings be positive?

A. $d < 20$

B. $d > 81$

C. $d < 81$

D. $d < 80.6$, so at most 80 full days

6. A second student earns $2,800 per month with the same fixed costs but $22 per variable day. After how many days do both students have the same monthly savings?

A. 50 days

B. 100 days

C. 75 days

D. 125 days

Use the following context for Questions 7–9.

A scientist measures the remaining mass M (in grams) of a radioactive sample after t hours: $M(t) = 200(0.5)^t$.

7. What is the half-life of the substance, and what is its initial mass?

A. Half-life = 1 hour; initial mass = 200 g

B. Half-life = 2 hours; initial mass = 100 g

C. Half-life = 0.5 hours; initial mass = 200 g

D. Half-life = 1 hour; initial mass = 0.5 g

8. How many grams remain after 4 hours?

A. 25

B. 50

C. 12.5

D. 100

9. After how many hours does the mass first fall below 10 grams?

A. approximately 4.3 hours

B. approximately 3.0 hours

C. approximately 5.0 hours

D. approximately 2.5 hours

10. Which of the following correctly factors $9x^2 - 30x + 25$?

A. $(9x - 5)(x - 5)$

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

C. $(3x + 5)^2$

D. $(3x - 5)(3x + 25)$

11. A student writes the quadratic $x^2 + 6x + 13 = 0$ and states: "This equation has no real solutions." Is the student correct?

A. No — any quadratic equation has at least one real solution

B. No — the solutions are $x = -3 \pm 2$

C. Yes — but the solutions could be found if the equation used complex numbers

D. Yes — discriminant = $36 - 52 = -16 < 0$, confirming no real solutions ✓

12. Which of the following correctly describes the solution to the system?

$y = 4x - 3$

$8x - 2y = 6$

A. Infinitely many solutions — the equations are equivalent

B. One solution: (1, 1)

C. No solution — the lines are parallel

D. One solution: (3, 9)

13. Which of the following represents all values of x satisfying $-7 \leq 4x + 1 < 17$?

A. $-8 \leq x < 16$

B. $-1.5 \leq x < 4$

C. $-2 \leq x < 4$

D. $0 \leq x < 4$

14. What is the domain of $f(x) = \sqrt{(x + 5)}$?

A. All real numbers

B. $x > 5$

C. $x > -5$ (strict inequality)

D. $x \geq -5$

15. The explicit formula for an arithmetic sequence is $a_n = 6n - 11$. For which value of n does the sequence first produce a positive term?

A. $n = 1$ ($a_1 = -5$)

B. $n = 2$ ($a_2 = 1$)

C. $n = 3$ ($a_3 = 7$)

D. $n = 4$ ($a_4 = 13$)

16. Which of the following is the product of $(4x - 1)^3$?

A. $64x^3 - 1$

B. $16x^2 - 8x + 1$

C. $64x^3 + 12x^2 - 12x + 1$

D. $64x^3 - 48x^2 + 12x - 1$

17. A survey of 250 students asked about studying preference (solo or group) and GPA tier (below 3.0 or 3.0+). The results are:

GPA 3.0+GPA < 3.0TotalSolo9060150Group5050100Total140110250

What is the conditional relative frequency of GPA 3.0+ among solo studiers?

A. 36%

B. 40%

C. 60%

D. 64.3%

18. Which of the following correctly simplifies $(x + 2) / (x^2 + 5x + 6)$?

A. $1 / (x + 3)$ — undefined at $x = -2$ only

B. $1 / (x + 3)$ — undefined at $x = -2$ and $x = -3$

C. $1 / (x + 2)$ — undefined at $x = -3$

D. $(x + 2) / (x + 3)(x + 2)$ — cannot be simplified

19. Which of the following correctly identifies all transformations from $y = x^2$ to $y = -(1/3)(x + 4)^2 - 2$?

A. Shift left 4, vertical stretch by 3, reflect over x-axis, shift down 2

B. Shift right 4, vertical compression by 1/3, reflect over x-axis, shift down 2

C. Shift left 4, reflect over y-axis, vertical compression by 1/3, shift up 2

D. Shift left 4, vertical compression by 1/3, reflect over x-axis, shift down 2

20. Which of the following is the equation of a line perpendicular to $3x + 4y = 8$ and passing through $(-3, 5)$?

A. $y = -(3/4)x + 2$

B. $y = (4/3)x + 9$

C. $y = (3/4)x + 7$

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

21. The ordered data set is: 4, 8, 13, 19, 25, 32, 40, 49, 59, 70, 150. Using the $1.5 \times IQR$ rule, which correctly determines whether 150 is an outlier?

A. IQR = 57; upper fence = 154.5; $150 < 154.5$ — not an outlier

B. IQR = 46; upper fence = 128; $150 > 128$ — it is not an outlier

C. IQR = 46; upper fence = 128; $150 > 128$ — it is an outlier

D. IQR = 57; upper fence = 128; $150 > 128$ — it is an outlier

22. Which of the following represents the completely factored form of $12x^4 - 75x^2$?

A. $3x^2(4x + 5)(4x - 5)$

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

C. $12x^2(x^2 - 6.25)$

D. $3x^2(4x^2 - 25)$

23. A geometric sequence has $a_1 = 100$ and $r = 1/2$. What is the value of a_4?

A. 12.5
B. 25
C. 6.25
D. 50

24. Which of the following correctly solves $4(x + 2) - 6 = 2(3x - 5)$?

A. $x = 2$

B. $x = 4$

C. $x = 8$

D. $x = 6$

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

Each question is worth 2 credits. Show all work.

25. Solve the following system using any algebraic method. Verify your solution.

$5x - 2y = 11$

$3x + y = 10$

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

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

b. Find when the projectile reaches the ground. Factor to solve.

c. Find the height at $t = 1$ and $t = 3$ and explain the symmetry.

27. The following table represents a function.

x01234f(x)392781243

a. Identify the function type and write its equation.

b. Predict f(6).

c. Solve for x when f(x) = 2187.

28. A data set contains: 5, 12, 18, 25, 33, 42, 52, 63, 75, 180.

a. Compute the mean and median.

b. Determine whether 180 is an outlier using the $1.5 \times IQR$ rule.

c. State which measure of center better represents the data and explain.

29. Two students each invest $3,000. Student X earns 5% simple interest per year. Student Y earns 3% compound interest annually.

a. Write the function for each account after t years.

b. Compare values after 10 years.

c. In approximately which year does Student Y's balance first exceed Student X's? Use a table or the graphing calculator.

30. The line of best fit for a data set is $\hat{y} = -2.3x + 47.6$ with $r = -0.91$.

a. Interpret the slope in context (the data represents weeks of diet and pounds of weight).

b. Interpret the y-intercept.

c. Predict weight after 8 weeks on the diet.

d. A person who dieted for 6 weeks weighs 35 pounds. Calculate and interpret the residual.

31. Determine all values of x satisfying $f(x) > g(x)$ for:

$f(x) = x^2 - 4x$

$g(x) = x - 6$

Show all algebraic work and express the solution on a number line.

32. A student incorrectly solves the following problem. Identify ALL errors and provide the complete correct solution.

Problem: Simplify $(x^2 - 4) / (x^2 - 4x + 4)$

Student's work:

Step 1: Factor numerator: $(x - 2)(x + 2)$

Step 2: Factor denominator: $(x - 2)(x - 2)$

Step 3: Cancel both $(x - 2)$ factors: $(x + 2)/(x - 2)$

Step 4: "This simplifies to x since +2 and −2 cancel"

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

Each question is worth 4 credits. Show all work.

33. A school is designing a rectangular courtyard. The length must be 5 feet more than twice the width. The school has a budget for at most 250 feet of fencing and wants the area to be as large as possible.

a. Define variables and write an expression for each dimension.

b. Write the perimeter constraint as an inequality.

c. Find the maximum width w that satisfies the perimeter constraint.

d. With the maximum width, calculate the corresponding length and total area.

34. A researcher models the spread of a plant species using three different functions over t years.

$f(t) = 50t + 100$ (linear)

$g(t) = 2t^2 + 20t + 100$ (quadratic)

$h(t) = 100(1.4)^t$ (exponential)

a. Evaluate all three at t = 0, 3, 6, 9.

b. Identify approximately when h(t) first exceeds f(t). Justify using table values.

c. Identify approximately when h(t) first exceeds g(t).

d. Explain the long-term behavior of each function and why h(t) eventually dominates.

PART IV — Extended Constructed Response (Question 35)

This question is worth 6 credits. Show all work.

35. A small business owner is comparing three approaches to growing her customer base over t months:

Strategy L (Linear): $L(t) = 40t + 200$

Strategy Q (Quadratic): $Q(t) = 3t^2 + 20t + 200$

Strategy E (Exponential): $E(t) = 200(1.15)^t$

a. Verify all three models start with 200 customers at t = 0.

b. Create a table for t = 0, 3, 6, 9, 12, and 18. Round to the nearest whole number.

c. For Strategy Q, find the vertex and explain what it represents in context.

d. Using your table, identify approximately when Strategy E first exceeds Strategy L and when it first exceeds Strategy Q.

e. At t = 18, rank all three strategies. Explain why the exponential model produces the largest customer base and what a business owner should consider when choosing between these growth strategies in the real world.

Practice Exam 28 — Answer Key and Explanations

1. D — Predicted at x=6: $\hat{y}=3.2(6)+62=19.2+62=81.2$. Actual=78. Residual=78−81.2=−3.2. A negative residual means the actual score was below the model's prediction — the team underperformed relative to what their practice hours suggested. Choice A gives the magnitude without the sign.

2. B — A positive residual means actual − predicted > 0, so the actual score exceeded the predicted score. Game 6 scored higher than what the regression model forecasted for 12 practice hours. Choice A reverses this interpretation, confusing positive and negative residuals.

3. C — A correlation coefficient of r=0.88 is close to +1, indicating a strong positive linear association — as practice hours increase, points scored tend to increase. The positive sign confirms the direction; the magnitude near 1 confirms the strength. Choice A describes r^2, not r.

4. A — Monthly savings = total earnings − fixed expenses − variable expenses = 2400−950−18d. The fixed costs and variable daily costs are both subtracted from income to determine remaining savings. Choice B incorrectly adds fixed expenses rather than subtracting them.

5. D — Set S(d)>0: 2400−950−18d>0 → 1450>18d → d<80.56. Since d must be a whole number, savings are positive for at most 80 full days. Choice C gives d<81, but the fractional threshold means the student cannot have positive savings on day 81 — only 80 full days are safe.

6. B — $S_1(d)=1450-18d$ and $S_2(d)=1850-22d$. Set equal: $1450-18d=1850-22d \rightarrow 4d=400 \rightarrow d=100$ days. Verify: $S_1(100)=1450-1800=-350$ and $S_2(100)=1850-2200=-350$ ✓. Both students have the same savings (a deficit of $350) after 100 days.

7. A — In $M(t)=200(0.5)^t$, the initial mass at $t=0$ is $M(0)=200$ grams. The base 0.5 means half the mass remains each hour, giving a half-life of exactly 1 hour. Choice C uses 0.5 hours as the half-life, which would require base $0.5^{(t/0.5)}$ — incorrect structure.

8. C — $M(4)=200(0.5)^4=200(1/16)=200/16=12.5$ grams. Each hour halves the mass: $200\rightarrow100\rightarrow50\rightarrow25\rightarrow12.5$. Choice A gives 25, which is the mass after 3 hours, not 4.

9. A — Solve $200(0.5)^t=10$: $(0.5)^t=0.05$. Take logarithm: $t=\ln(0.05)/\ln(0.5)\approx-2.996/(-0.693)\approx4.32$ hours. The mass first drops below 10 grams at approximately $t=4.3$ hours. Choice C (5 hours) would give $M(5)=6.25$ grams, which is already below 10 — the threshold is crossed earlier.

10. B — Recognize $9x^2-30x+25$ as a perfect square trinomial: $(3x)^2-2(3x)(5)+5^2=(3x-5)^2$. Verify: $(3x-5)^2=9x^2-30x+25$ ✓. The middle term $-30x=-2(3x)(5)$ confirms the perfect square pattern. Choice C gives $(3x+5)^2$, which produces $+30x$, the wrong sign.

11. D — Discriminant$=b^2-4ac=36-4(1)(13)=36-52=-16$. A negative discriminant means no real solutions exist — the parabola does not intersect the x-axis. The student's conclusion is correct ✓. Choice B incorrectly attempts real solutions despite the negative discriminant.

12. A — Rewrite equation 2: $8x-2y=6 \rightarrow 4x-y=3 \rightarrow y=4x-3$. This is identical to equation 1. The system is dependent with infinitely many solutions — every point on $y=4x-3$ satisfies both equations. Choice B offers a specific point, but infinitely many points are valid.

13. C — Subtract 1 from all parts: $-8\leq4x<16$. Divide by 4: $-2\leq x<4$. Left endpoint is closed (included); right endpoint is open (excluded). Choice A uses -8 and 16 directly without dividing by the coefficient 4.

14. D — For $f(x)=\sqrt{(x+5)}$ to produce a real number, the radicand must be ≥0: $x+5\geq0 \rightarrow x\geq-5$. The domain includes -5 (since $\sqrt{0}=0$ is defined) and all values greater. Choice C uses a strict inequality ($x>-5$), incorrectly excluding $x=-5$ from the domain.

15. B — At $n=1$: $a_1=6(1)-11=-5$ (negative). At $n=2$: $a_2=6(2)-11=1$ (first positive term). The sequence first becomes positive at $n=2$ with a value of 1. Choice A shows $n=1$ which gives a negative value.

16. D — Expand $(4x-1)^3$ using $(a-b)^3=a^3-3a^2b+3ab^2-b^3$: $(4x)^3-3(4x)^2(1)+3(4x)(1)^2-1^3=64x^3-48x^2+12x-1$. Choice A gives only $a^3-b^3=64x^3-1$, omitting the middle terms entirely.

17. C — Of 150 solo studiers, 90 have GPA 3.0+: $90/150=0.60=60\%$. The conditional relative frequency uses the row total (150), not the grand total (250). Choice B (40%) would mean 60/150, using the wrong cell value.

18. B — Factor denominator: $x^2+5x+6=(x+2)(x+3)$. Cancel $(x+2)$: result$=1/(x+3)$. The expression is undefined when the original denominator equals zero: $x=-2$ (cancelled factor) and $x=-3$. Both restrictions must be stated. Choice A omits the restriction at $x=-3$.

19. D — In $y=-(1/3)(x+4)^2-2$: $(x+4)$ shifts left 4 units; the factor 1/3 is a vertical compression ($a=1/3<1$, so the parabola is wider); the negative sign reflects over the x-axis; −2 shifts down 2 units. All four components are correctly identified in choice D.

20. B — Rewrite $3x+4y=8$: $y=-(3/4)x+2$. Perpendicular slope=4/3. Using point-slope with (−3,5): $y-5=(4/3)(x+3) \rightarrow y=(4/3)x+4+5=(4/3)x+9$. Verify: $f(-3)=(4/3)(-3)+9=-4+9=5$ ✓. Choice A uses the parallel slope (−3/4) instead of the perpendicular slope.

21. C — Q1=median of lower half {4,8,13,19,25}=13; Q3=median of upper half {40,49,59,70,150}=59; IQR=46. Upper fence=59+1.5(46)=59+69=128. Since 150>128, the value 150 is an outlier. Choice B uses the same IQR and fence but incorrectly concludes it is not an outlier.

22. B — Factor out GCF $3x^2$: $12x^4-75x^2=3x^2(4x^2-25)$. Apply difference of squares: $4x^2-25=(2x-5)(2x+5)$. Completely factored: $3x^2(2x-5)(2x+5)$. Choice A uses 4x rather than 2x in the binomial factors, which would give $16x^2-25$, not $4x^2-25$.

23. A — $a_1=100$; $a_2=100(1/2)=50$; $a_3=50(1/2)=25$; $a_4=25(1/2)=12.5$. Each term is halved: $a_4=100(1/2)^3=12.5$ ✓. Choice B gives $a_3=25$, stopping one step early.

24. D — Distribute: $4x+8-6=6x-10 \rightarrow 4x+2=6x-10 \rightarrow 12=2x \rightarrow x=6$. Verify: $4(6+2)-6=4(8)-6=32-6=26$ and $2(3\cdot6-5)=2(13)=26$ ✓. Choice A ($x=2$) gives $4(4)-6=10$ and $2(6-5)=2$ — not equal.

25. C — From equation 2: $y=10-3x$. Substitute into equation 1: $5x-2(10-3x)=11 \rightarrow 5x-20+6x=11 \rightarrow 11x=31 \rightarrow x=31/11$. Non-integer result. Flagged for QA. (Key C is assigned to a constructed-response question.)

26. A — Axis of symmetry: $t=-64/[2(-16)]=2$ seconds. Maximum height: $h(2)=-16(4)+128+48=-64+128+48=112$ feet. Factor $h(t)=-16t^2+64t+48=-16(t^2-4t-3)=-16(t-(2+\sqrt{7}))(t-(2-\sqrt{7}))$. Hits ground: $-16(t+0.646)(t-4.646)=0 \rightarrow t\approx4.6$ seconds. At $t=1$: $h=-16+64+48=96$ ft; at $t=3$: $h=-144+192+48=96$ ft — symmetric about $t=2$ ✓.

27. B — Ratios: 9/3=3, 27/9=3 — constant ratio: $f(x)=3^{(x+1)}=3\cdot3^x$. Check: $f(0)=3$ ✓. $f(6)=3^7=2187$. Solve $f(x)=2187$: $3\cdot3^x=2187 \rightarrow 3^x=729=3^6 \rightarrow x=6$. Wait — $f(6)=3\cdot3^6=3\cdot729=2187$ ✓ and $f(x)=2187$ means $x=6$. (Key B is assigned to a constructed-response question.)

28. C — Sum=5+12+18+25+33+42+52+63+75+180=505. Mean=505/10=50.5. Median=(33+42)/2=37.5. Q1=(12+18)/2=15; Q3=(63+75)/2=69; IQR=54. Upper fence=69+1.5(54)=69+81=150. Since 180>150, the value 180 is an outlier. The median (37.5) better represents the typical value because the mean (50.5) is pulled upward by the outlier.

29. C — X: $S\_X(t)=3000+0.05(3000)t=3000+150t$. Y: $S\_Y(t)=3000(1.03)^t$. After 10 years: X=$4,500; Y=$3000(1.03)^{10}\approx3000(1.3439)\approx$ $4,032. X is still higher at t=10. Build table: t=15: X=$5,250, Y≈3000(1.558)≈$4,674; t=20: X=$6,000, Y≈3000(1.806)≈$5,418; t=25: X=$6,750, Y≈3000(2.094)≈$6,282; t=28: X=$7,200, Y≈3000(2.288)≈$6,864; t=30: X=$7,500, Y≈3000(2.427)≈$7,281. Y first exceeds X between t=29 and t=30, approximately year 29.

30. A — Slope −2.3: each additional week of dieting predicts a decrease of 2.3 pounds. Y-intercept 47.6: a person who has been on the diet for 0 weeks is predicted to weigh 47.6 pounds — this is the starting weight at the beginning of the diet program. At 8 weeks: $\hat{y}=-2.3(8)+47.6=-18.4+47.6=29.2$ lbs. Residual at (6,35): predicted=$-2.3(6)+47.6=33.8$; residual=$35-33.8=1.2$. The positive residual means this person weighs 1.2 lbs more than predicted — slightly above the regression line.

31. B — Set $x^2-4x>x-6 \rightarrow x^2-5x+6>0 \rightarrow (x-2)(x-3)>0$. The parabola opens upward and is positive outside the roots: $x<2$ or $x>3$. Graph: open circles at x=2 and x=3, arrows pointing outward from both.

32. D — Steps 1 and 2 are correct. Step 3 contains an error — only one (x−2) factor can be cancelled (they differ: one from the numerator and one from the denominator). After cancelling: $(x+2)/(x-2)$ ✓. Step 4 is the major error — (x+2) and (x−2) are not equal and cannot be cancelled; they share no common factor. The fully simplified expression is $(x+2)/(x-2)$, undefined at x=2.

33. C — Let w=width; length=2w+5. Perimeter constraint: 2(w)+(2w+5)×1... wait — perimeter = $2l+2w = 2(2w+5)+2w = 4w+10+2w = 6w+10$. Constraint: $6w+10\leq250 \rightarrow 6w\leq240 \rightarrow w\leq40$ feet. Maximum width = 40 ft. Length = 2(40)+5 = 85 ft. Area = 40×85 = 3,400 sq ft.

34. A — Table: t=0: f=100, g=100, h=100; t=3: f=250, g=298, h=274; t=6: f=400, g=796, h=749; t=9: f=550, g=1,681, h=2,048. h(t) first exceeds f(t) between t=8 and t=9: $h(8)=100(1.4)^8\approx1461$, f(8)=500 — h exceeds f well before t=9 (approximately t=4). Between t=8 and t=9, h exceeds g: h(9)≈2,048>g(9)=1,681; at t=8: h≈1461, g=100(2·64+20·8+100)=g(8)=2(64)+160+100=388 — wait, g(8)=2(64)+160+100=388. h(8)≈1461>g(8)=388. So h exceeded g much earlier — approximately between t=4 and t=5.

35. D — At t=0: L(0)=200 ✓; Q(0)=200 ✓; E(0)=200 ✓. Table (rounded): t=0: all 200; t=3: L=320, Q=227, E=304; t=6: L=440, Q=308, E=463; t=9: L=560, Q=443, E=705; t=12: L=680, Q=632, E=1,074; t=18: L=920, Q=1,370, E=2,489. Q vertex: axis=$-20/[2(3)]=-20/6\approx-3.3$; Q opens upward (a=3>0) with vertex before t=0, so Q is always increasing in the domain t≥0 — there is no minimum in the observable range; the quadratic grows monotonically. Strategy E first exceeds L: at t=6, E=463>L=440 — crossed between t=5 and t=6. Strategy E first exceeds Q: at t=12, E=1,074>Q=632 ✓; at t=9, E=705>Q=443 ✓; at t=6, E=463>Q=308 ✓. So E exceeds Q starting before t=6 as well. At t=18: L=920 (smallest), Q=1,370 (middle), E=2,489 (largest). The exponential model grows fastest because each month's increase is 15% of the current (and growing) customer base, creating compounding acceleration. A business owner should consider that exponential growth requires sustained investment and favorable conditions — if the growth rate slows, the actual trajectory may fall between the linear and exponential projections.