PRACTICE EXAM 24

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 school fundraiser sells two products: bookmarks at $2.50 each and pens at $1.25 each. The fundraiser sold a total of 240 items and collected $420.

1. Which system of equations correctly models this situation?

A. $b + p = 420$ and $2.50b + 1.25p = 240$

B. $2.50b + 1.25p = 420$ and $b - p = 240$

C. $b + p = 240$ and $2.50b + 1.25p = 420$

D. $b + p = 240$ and $1.25b + 2.50p = 420$

2. How many bookmarks were sold?

A. 96

B. 120

C. 144

D. 80

3. If the fundraiser had instead charged $3.00 for bookmarks and $1.50 for pens (keeping the same quantities sold), how much would have been collected?

A. $420

B. $480

C. $450

D. $504

Use the following context for Questions 4–6.

A ball is launched vertically. Its height above the ground (in feet) after t seconds is modeled by $h(t) = -16t^2 + 64t + 80$.

4. What is the maximum height reached by the ball?

A. 80 feet

B. 144 feet

C. 64 feet

D. 128 feet

5. At what time does the ball hit the ground?

A. t = 2 seconds

B. t = 4 seconds

C. t = 5 seconds

D. t = 6 seconds

6. What is the height of the ball at t = 1 second?

A. 128 feet

B. 80 feet

C. 64 feet

D. 96 feet

Use the following context for Questions 7–9.

A survey of 250 workers asked about commute method and job satisfaction. The results are shown in the two-way table below.

SatisfiedUnsatisfiedTotalCar9060150Public Transit6040100Total150100250

7. What percentage of car commuters are satisfied?

A. 36%

B. 40%

C. 54%

D. 60%

8. Of all satisfied workers, what percentage use public transit?

A. 24%

B. 36%

C. 60%

D. 40%

9. Is there evidence of an association between commute method and job satisfaction?

A. No — the satisfaction rates are identical for both groups

B. Yes — car commuters are satisfied at 60% vs. public transit commuters at 60%, but the group sizes differ

C. No — the overall satisfaction rate of 60% applies equally to both commute groups

D. Yes — car commuters are satisfied at a different rate than transit commuters

10. Which of the following correctly factors $6x^2 - 7x - 3$?

A. $(6x + 1)(x - 3)$

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

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

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

11. Which of the following correctly states the domain and range of $f(x) = -(x - 2)^2 + 6$?

A. Domain: all real numbers; Range: $f(x) \leq 6$

B. Domain: $x \geq 2$; Range: $f(x) \leq 6$

C. Domain: all real numbers; Range: $f(x) \geq 6$

D. Domain: all real numbers; Range: $f(x) \geq -6$

12. Which expression is equivalent to $(3x - 4)^3$? (Use only the first expansion step: cube of a binomial gives a degree-3 polynomial.)

A. $27x^3 - 64$

B. $9x^2 - 24x + 16$

C. $27x^3 - 108x^2 + 144x + 64$

D. $27x^3 - 108x^2 + 144x - 64$

13. The sum of two consecutive even integers is 90. Which equation correctly models this?

A. $n + (n + 1) = 90$

B. $n + (n + 2) = 90$

C. $2n + 1 = 90$

D. $n(n + 2) = 90$

14. Which of the following represents the solution to $-(2/3)x + 5 \leq -1$?

A. $x \leq -9$

B. $x \leq 9$

C. $x \geq 9$

D. $x \geq -9$

15. A student writes the equation of a parabola with zeros at $x = -5$ and $x = 3$ and a leading coefficient of -2 as $f(x) = -2(x + 5)(x - 3)$. Is this correct?

A. No — the zeros would be $x = 5$ and $x = -3$

B. Yes — the factored form correctly produces zeros at $x = -5$ and $x = 3$ ✓

C. No — the leading coefficient should be written inside the binomials

D. No — the standard form equivalent is $-2x^2 - 16x + 30$

16. Which of the following represents all values of x satisfying $|5 - 2x| < 7$?

A. $-1 < x < 6$

B. $x < -1$ or $x > 6$

C. $-6 < x < 1$

D. $x > 6$ only

17. An arithmetic sequence has $a_2 = 9$ and $a_6 = 29$. What is the explicit formula?

A. $a_n = 4n + 1$

B. $a_n = 5n + 4$

C. $a_n = 5n - 1$

D. $a_n = 4n - 1$

18. A student completes the square on $2x^2 - 12x + 7$ and writes $2(x - 3)^2 - 11$. Is this correct?

A. No — the correct result is $2(x - 3)^2 + 7$

B. No — the correct result is $2(x - 6)^2 - 11$

C. No — the correct result is $2(x - 3)^2 - 25$

D. Yes — $2(x^2 - 6x) + 7 = 2(x - 3)^2 - 18 + 7 = 2(x - 3)^2 - 11$ ✓

19. The function f(x) = 3^x and the constant function g(x) = 5 are graphed together. Between which consecutive integer x-values does f(x) first exceed g(x)?

A. Between x = 1 and x = 2

B. Between x = 0 and x = 1

C. At exactly x = 2

D. Between x = 2 and x = 3

20. The table shows values for function m(x):

xm(x)02162183544162

Which equation models m(x)?

A. m(x) = 4x + 2

B. $m(x) = 2x^3$

C. m(x) = 2(3)^x

D. m(x) = 3(2)^x

21. Which of the following correctly simplifies $\sqrt{(72x^6y^4)}$?

A. $6x^2y^2\sqrt{2}$

B. $6x^3y^2\sqrt{2}$

C. $8x^3y^2\sqrt{(x)}$

D. $36x^3y^2$

22. A line has slope $-5/2$ and passes through $(4, 3)$. Which of the following is the equation of a line parallel to this one through $(-2, 7)$?

A. $y = (2/5)x + 6$

B. $y = -(5/2)x + 8$

C. $y = -(5/2)x - (3/2)$

D. $y = (5/2)x + 7$

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

$3x - y = 8$

$-6x + 2y = 5$

A. One solution: $(3, 1)$

B. Infinitely many solutions — the equations are equivalent

C. One solution: $(1, -5)$

D. No solution — the lines are parallel with different y-intercepts

24. Which of the following correctly applies the distributive property to show $(a + b)(a^2 - ab + b^2) = a^3 + b^3$?

A. It equals $a^3 - a^2b + ab^2 + a^2b - ab^2 + b^3 = a^3 - b^3$

B. It equals $a^3 - a^2b + ab^2 + a^2b - ab^2 + b^3 = a^3 + b^3$

C. It equals $a^3 + 3a^2b + 3ab^2 + b^3$

D. It equals $a^3 - 3a^2b + 3ab^2 - b^3$

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

Each question is worth 2 credits. Show all work.

25. Solve the quadratic equation using any method: $x^2 + 3x - 28 = 0$. Show all work and verify both solutions.

26. A geometric sequence has $a_1 = -2$ and $r = 4$.

a. Write the explicit and recursive formulas.

b. Find a_6.

c. Determine whether the sequence has a term equal to −8192. Show your algebraic reasoning.

27. Two data sets are given:

Set A: 4, 8, 12, 16, 20, 24, 28, 32

Set B: 4, 8, 12, 16, 20, 24, 28, 100

a. Compute the mean and median for each set.

b. Explain why the medians are the same but the means differ.

c. Which measure of center better represents a typical value for Set B? Justify.

28. Solve the following system algebraically. Show all work.

$y = x^2 - 3x + 2$

$y = x - 1$

29. A student claims that f(x) = 4^x and g(x) = 2^(2x) are different functions. Prove or disprove algebraically.

30. Simplify the rational expression and state all domain restrictions.

$(3x^2 - 12x) / (x^2 - x - 12)$

31. The revenue of a small bakery is modeled by $R(x) = -3x^2 + 120x$, where x is the number of items sold per day.

a. Find the number of items that maximizes revenue.

b. Calculate the maximum revenue.

c. Find the revenue when 15 items are sold.

d. Find both values of x where revenue equals $900.

32. A sequence is defined by $a_1 = -4$ and $d = 6$.

a. Write the explicit formula.

b. Find the 30th term.

c. Find the sum of the first 30 terms.

d. Find the first term that exceeds 200.

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

Each question is worth 4 credits. Show all work.

33. The following incomplete student work attempts to solve the system below. Identify all errors and provide the complete correct solution.

System:

$5x + 2y = 14$

$3x - y = 4$

Student's work:

Multiply equation 2 by 2: $6x - 2y = 8$

Add equations: $11x = 22 \rightarrow x = 2$

Substitute $x = 2$ into equation 1: $10 + 2y = 14 \rightarrow 2y = 4 \rightarrow y = 2$

Student's answer: (2, 2)

34. The data below represent the number of hours of sunlight per day and the high temperature (°F) for 10 days:

Hours678991011121314Temp48525762657073788388

a. Enter the data into the graphing calculator and find the equation of the line of best fit and the correlation coefficient. Round to two decimal places.

b. Interpret the slope and y-intercept in context.

c. Predict the high temperature on a day with 15 hours of sunlight.

d. Calculate the residual for the data point (10, 70) and interpret its sign.

PART IV — Extended Constructed Response (Question 35)

This question is worth 6 credits. Show all work.

35. A climate scientist is studying sea ice coverage in the Arctic Ocean. Three models are proposed for the remaining sea ice area (in millions of square kilometers) over years t since 2000:

Model 1 (Linear): $L(t) = -0.6t + 12$

Model 2 (Quadratic): $Q(t) = 0.02t^2 - 0.8t + 12$

Model 3 (Exponential): $E(t) = 12(0.96)^t$

a. All three models agree at t = 0. Verify this and state the initial sea ice area each predicts.

b. Create a table of values for all three models at t = 0, 5, 10, 15, 20, and 25. Round to one decimal place.

c. According to Model 1, in what year does the sea ice coverage reach zero? Show algebraic work.

d. Model 2 has a vertex (minimum). Find it and explain what it represents in context. Then determine when Q(t) begins increasing again.

e. At t = 25, compare all three models. Which predicts the most sea ice remaining? Which predicts the least? Explain how each function's mathematical behavior drives the long-term prediction.

Practice Exam 24 — Answer Key and Explanations

1. C — Let b = bookmarks and p = pens. Total items: b+p=240. Total revenue: 2.50b+1.25p=420. Choice A swaps the right-hand sides of the two equations, and choice D reverses the prices of the two items.

2. A — From b+p=240: p=240−b. Substitute into revenue equation: 2.50b+1.25(240−b)=420 → 2.50b+300−1.25b=420 → 1.25b=120 → b=96. Verify: p=144; 2.50(96)+1.25(144)=240+180=420 ✓.

3. D — Using the quantities found (b=96, p=144): new revenue = 3.00(96)+1.50(144)=288+216=$504. The price-per-item increase of 20% on both items produces a proportional revenue increase. Choice B ($480) would result from 3.00(96)+1.25(144), incorrectly keeping the original pen price.

4. B — Axis of symmetry: $t=-64/[2(-16)]=2$ seconds. Maximum height: $h(2)=-16(4)+64(2)+80=-64+128+80=144$ feet. The vertex of a downward-opening parabola is the maximum — above the launch height of 80 feet. Choice A gives only the launch height, ignoring the upward flight.

5. C — Set $h(t)=0$: $-16t^2+64t+80=0 \rightarrow t^2-4t-5=0 \rightarrow (t-5)(t+1)=0 \rightarrow t=5$ or $t=-1$. The contextually valid solution is $t=5$ seconds (positive time). Verify: $-16(25)+64(5)+80=-400+320+80=0$ ✓.

6. A — $h(1)=-16(1)+64(1)+80=-16+64+80=128$ feet. Substituting $t=1$ evaluates each term: -16, $+64$, $+80$ sum to 128. The ball is still ascending at $t=1$ (before the maximum at $t=2$). Choice B gives only the launch height, omitting the dynamic terms.

7. D — Of 150 car commuters, 90 are satisfied: $90/150=0.60=60\%$. The conditional relative frequency uses the row total (150), not the grand total (250). Choice A (36%) divides 90 by 250, using the wrong denominator.

8. D — Of 150 satisfied workers total, 60 use public transit: $60/150=0.40=40\%$. The denominator here is the column total (150 satisfied workers), not the grand total of 250. Choice A (24%) incorrectly divides 60 by 250.

9. B — Car commuters: $90/150=60\%$ satisfied. Public transit commuters: $60/100=60\%$ satisfied. The conditional satisfaction rates are identical for both groups, indicating no association between commute method and job satisfaction. Choice D incorrectly claims an association exists without supporting it with conditional frequency data.

10. C — Use the AC method on $6x^2-7x-3$: $AC=-18$. Factors of -18 summing to -7: -9 and $+2$. Rewrite: $6x^2-9x+2x-3=3x(2x-3)+1(2x-3)=(3x+1)(2x-3)$. Verify: $(3x+1)(2x-3)=6x^2-9x+2x-3=6x^2-7x-3$ ✓.

11. A — The parabola $f(x)=-(x-2)^2+6$ opens downward ($a=-1<0$), so the vertex (2,6) is a maximum — all outputs are at or below 6. The domain of any polynomial is all real numbers. The range is $f(x)\leq 6$. Choice C gives range $f(x)\geq 6$, which would apply to an upward-opening parabola.

12. D — Expand $(3x-4)^3$ using $(a-b)^3=a^3-3a^2b+3ab^2-b^3$ with $a=3x$, $b=4$: $27x^3-3(9x^2)(4)+3(3x)(16)-64=27x^3-108x^2+144x-64$. Choice A omits all middle terms, using only a^3-b^3 which is not the cube formula.

13. B — Consecutive even integers differ by 2, so they are n and $n+2$. Their sum: $n+(n+2)=90$. Choice A uses consecutive integers (differing by 1), not consecutive even integers. Choice D is a product equation, not a sum.

14. C — Solve $-(2/3)x+5\leq -1$: subtract 5: $-(2/3)x\leq -6$; multiply by $-3/2$ and reverse the inequality: $x\geq 9$. The inequality reverses when multiplying by a negative value ($-3/2$). Verify: at $x=9$: $-6+5=-1\leq -1$ ✓; at $x=10$: $-20/3+5\approx -1.67\leq -1$ ✓.

15. B — Setting each factor to zero: $x+5=0 \rightarrow x=-5$ and $x-3=0 \rightarrow x=3$. The factored form $-2(x+5)(x-3)$ correctly places the zeros and includes the required leading coefficient. Choice D would require expanding $-2(x+5)(x-3)=-2(x^2+2x-15)=-2x^2-4x+30$, not $-2x^2-16x+30$ as claimed.

16. A — Solve $|5-2x|<7$: $-7<5-2x<7$. Subtract 5: $-12<-2x<2$. Divide by -2 and reverse both inequalities: $-1<x<6$. This is a bounded "and" solution. Choice B gives the solution to $|5-2x|>7$ (the complementary case).

17. C — From $a_2=9$ and $a_6=29$: $d=(29-9)/(6-2)=20/4=5$. $a_1=a_2-d=9-5=4$. Explicit: $a_n=4+(n-1)(5)=5n-1$. Verify: $a_2=10-1=9$ ✓; $a_6=30-1=29$ ✓. Choice A gives $4n+1$, which gives $a_2=9$ but $a_6=25\neq29$.

18. D — Factor out 2: $2(x^2-6x)+7$. Complete the square: $2(x^2-6x+9)-18+7=2(x-3)^2-11$. Adding 9 inside requires subtracting $2\cdot9=18$ outside (because of the factor of 2). Verify: $2(0-6(0))+7=7$ and $2(0-3)^2-11=18-11=7$ ✓.

19. A — f(x)=3^x and g(x)=5. At x=1: f(1)=3<5 (g greater). At x=2: f(2)=9>5 (f greater). The crossing happens between x=1 and x=2 because f(1)<g(1) and f(2)>g(2). Beyond this point, the exponential permanently exceeds the constant.

20. C — Check ratios: 6/2=3, 18/6=3, 54/18=3 — constant ratio of 3 confirms exponential with initial value 2: m(x)=2(3)^x. Verify: m(0)=2 ✓; m(1)=6 ✓; m(2)=18 ✓. Choice D uses m(x)=3(2)^x, giving $m(0)=3\neq2$.

21. B — $\sqrt{(72x^6y^4)}=\sqrt{(36\cdot2\cdot x^6\cdot y^4)}=6\sqrt{2}\cdot x^3\cdot y^2=6x^3y^2\sqrt{2}$. Each variable exponent is halved since they are perfect squares ($x^6 \rightarrow x^3$, $y^4 \rightarrow y^2$). Choice A has x^2 instead of x^3, resulting from incorrectly halving 6 to get 2 instead of 3.

22. C — Parallel lines share the same slope ($-5/2$). Using point-slope with $(-2,7)$: $y-7=-(5/2)(x+2)=-(5/2)x-5 \rightarrow y=-(5/2)x+2$.

23. D — Rewrite equation 1: $y=3x-8$. Rewrite equation 2: $2y=6x+5 \rightarrow y=3x+5/2$. Both lines have slope 3 but y-intercepts -8 and $5/2$ — they are parallel and never intersect. Choice B is wrong because the equations are NOT equivalent (they produce different y-intercepts).

24. B — Distribute $(a+b)(a^2-ab+b^2)$: $a(a^2-ab+b^2)+b(a^2-ab+b^2)=a^3-a^2b+ab^2+a^2b-ab^2+b^3$. The middle terms $-a^2b+a^2b=0$ and $ab^2-ab^2=0$ both cancel, leaving a^3+b^3. This is the sum of cubes identity. Choice A gives a^3-b^3, which uses the difference of cubes identity instead.

25. A — Factor: $x^2+3x-28=(x+7)(x-4)=0 \rightarrow x=-7$ and $x=4$. Verify $x=-7$: $49-21-28=0$ ✓. Verify $x=4$: $16+12-28=0$ ✓. Factoring requires finding two numbers with product -28 and sum $+3$: $+7$ and -4.

26. C — Explicit: $a_n=-2(4)^{(n-1)}$. Recursive: $a_1=-2$; $a_n=4a_{n-1}$. $a_6=-2(4)^5=-2(1024)=-2048$. For $a_n=-8192$: $-2(4)^{(n-1)}=-8192 \rightarrow (4)^{(n-1)}=4096=4^6 \rightarrow n-1=6 \rightarrow n=7$. Yes, −8192 is the 7th term.

27. D — Set A: mean=(4+8+…+32)/8=128/8=16; median=(16+20)/2=18. Set B: mean=(4+8+12+16+20+24+28+100)/8=212/8=26.5; median=(16+20)/2=18. The medians are the same

because the middle two values are unchanged; the outlier (100) only affects the mean by pulling it upward. The median (18) better represents a typical value for Set B because the mean (26.5) is inflated by the extreme value 100.

28. B — Substitute $y=x-1$ into equation 1: $x-1=x^2-3x+2 \rightarrow x^2-4x+3=0 \rightarrow (x-3)(x-1)=0 \rightarrow x=3$ or $x=1$. Solutions: (3,2) and (1,0). Verify (3,2): $y=3-1=2$ ✓ and $9-9+2=2$ ✓. Verify (1,0): $y=1-1=0$ ✓ and $1-3+2=0$ ✓.

29. A — $g(x)=2^{(2x)}=(2^2)^x=4^x=f(x)$. Using the power of a power rule, $2^{(2x)}=(2^2)^x=4^x$. Since both expressions equal 4^x for all values of x, the two functions are identical. The student's claim is false.

30. C — Factor numerator: $3x^2-12x=3x(x-4)$. Factor denominator: $x^2-x-12=(x-4)(x+3)$. Cancel $(x-4)$: result $=3x/(x+3)$. Undefined when $x=4$ (cancelled) and $x=-3$. Both restrictions must be stated.

31. D — Axis of symmetry: $x=-120/[2(-3)]=20$ items. Maximum revenue: $R(20)=-3(400)+120(20)=-1200+2400=\$1{,}200$. At $x=15$: $R(15)=-3(225)+1800=-675+1800=\$1{,}125$. For $R(x)=900$: $-3x^2+120x=900 \rightarrow x^2-40x+300=0 \rightarrow (x-10)(x-30)=0 \rightarrow x=10$ and $x=30$.

32. B — Explicit: $a_n=-4+(n-1)(6)=6n-10$. $a_{30}=6(30)-10=170$. $S_{30}=30/2\cdot(-4+170)=15\cdot166=2{,}490$. First term exceeding 200: $6n-10>200 \rightarrow 6n>210 \rightarrow n>35 \rightarrow$ first is $n=36$: $a_{36}=6(36)-10=206$.

33. A — The student's work is actually correct: multiply eq 2 by 2 gives $6x-2y=8$; add to eq 1 ($5x+2y=14$) gives $11x=22 \rightarrow x=2$; substitute into eq 1: $10+2y=14 \rightarrow y=2$. Verify in original equations: $5(2)+2(2)=14$ ✓ and $3(2)-2=4$ ✓. The student's solution (2,2) is correct — there are no errors in the work.

34. D — LinReg on the data produces approximately $\hat{y}\approx3.70x+25.30$ with $r\approx0.999$. Slope: each additional hour of sunlight predicts a temperature increase of about 3.70°F. Y-intercept: theoretically, with 0 hours of sunlight the temperature would be about 25.3°F — useful as a mathematical anchor but not necessarily realistic for extreme conditions. At 15 hours: $\hat{y}=3.70(15)+25.30=55.50+25.30\approx80.8$°F. Residual at (10,70): predicted $=3.70(10)+25.30=62.30$; residual $=70-62.30=7.70$. The positive residual means the actual temperature was about 7.7°F warmer than the model predicted for 10 hours of sunlight.

35. C — At $t=0$: $L(0)=12$ ✓; $Q(0)=12$ ✓; $E(0)=12$ ✓. All three agree at 12 million km². Table (rounded): $t=0$: all 12.0; $t=5$: L=9.0, Q=10.5, E=9.8; $t=10$: L=6.0, Q=10.0, E=7.9; $t=15$: L=3.0, Q=10.5, E=6.4; $t=20$: L=0.0, Q=12.0, E=5.2; $t=25$: L=−3.0 (unrealistic—0), Q=14.5, E=4.2. Model 1 reaches zero: $-0.6t+12=0 \rightarrow t=20$ years → year 2020. Model 2 vertex: axis $=0.8/[2(0.02)]=20$; $Q(20)=0.02(400)-0.8(20)+12=8-16+12=4.0$ — minimum 4.0 million km² at $t=20$ (year 2020). Before $t=20$, Q is decreasing; after $t=20$, Q begins increasing — which is physically unrealistic but mathematically the parabola turns upward. At $t=25$: L predicts 0 (coverage exhausted), Q predicts $0.02(625)-0.8(25)+12=12.5-20+12=4.5$, E predicts $12(0.96)^{25}\approx12(0.360)\approx4.3$. Model 2 predicts the most coverage (4.5); Model 1 predicts the least (zero, already depleted). Linear models decrease at a constant rate until they hit zero and become physically meaningless; quadratic models curve back upward; exponential decay models slow as coverage shrinks, maintaining nonzero values indefinitely — which is why E and Q both show coverage remaining at $t=25$ while L has already reached zero.