PRACTICE EXAM 19

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 car rental company charges a flat fee of \$45 plus \$0.20 per mile. A competitor charges \$30 plus \$0.35 per mile.

1. Which system of equations models the total cost C for m miles at each company?

A. $C_1 = 0.20m$ and $C_2 = 0.35m + 30$

B. $C_1 = 0.20m + 45$ and $C_2 = 0.35m + 30$

C. $C_1 = 45m + 0.20$ and $C_2 = 30m + 0.35$

D. $C_1 = 0.20m - 45$ and $C_2 = 0.35m - 30$

2. After how many miles do both companies charge the same total cost?

A. 50 miles

B. 75 miles

C. 150 miles

D. 100 miles

3. A customer plans to drive 200 miles. Which company costs less, and by how much?

A. Both cost the same at 200 miles

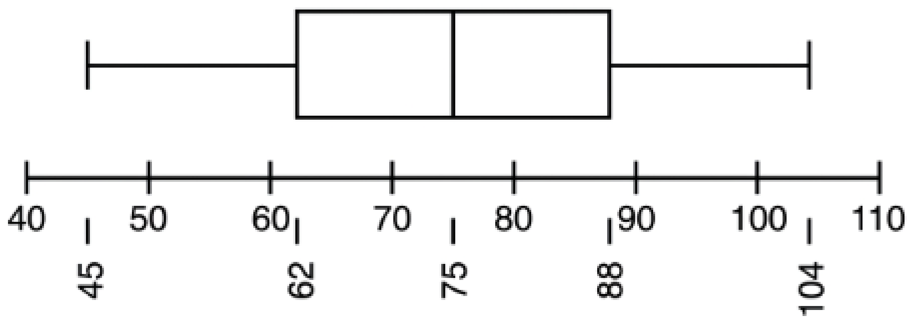
B. The competitor costs less by $5

C. The first company costs less by $15

D. The competitor costs less by $15

Use the following context for Questions 4–6.

A school's basketball team has played 18 games this season. The number of points scored per game is summarized in the box plot below.



4. What is the interquartile range, and what does it represent?

A. IQR = 26; it represents the spread of the middle 50% of game scores

B. IQR = 59; it represents the range of all scores

C. IQR = 26; it represents the average score per game

D. IQR = 13; it represents one-quarter of the total spread

5. A statistician claims the mean score is 75 points per game because the median is 75. Is this claim valid?

A. Yes — the mean and median are always equal when data is symmetric

B. Yes — the median is the most accurate measure of center in all cases

C. No — the median is always greater than the mean in skewed distributions

D. No — the mean cannot be determined from a box plot alone

6. Using the 1.5 × IQR rule, which of the following would be considered an outlier?

A. A game in which the team scored 40 points

B. A game in which the team scored 40 points or a game in which they scored 110 points

C. A game in which the team scored 110 points

D. A game in which the team scored 95 points

Use the following context for Questions 7–9.

A ball is launched upward. Its height h (in feet) is modeled by $h(t) = -16t^2 + 80t + 6$, where t is seconds after launch.

7. What is the maximum height of the ball, and at what time does it occur?

A. Maximum height of 106 feet at $t = 2.5$ seconds

B. Maximum height of 80 feet at $t = 5$ seconds

C. Maximum height of 86 feet at $t = 2$ seconds

D. Maximum height of 100 feet at $t = 2.5$ seconds

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

A. 60 feet

B. 54 feet

C. 70 feet

D. 80 feet

9. Which of the following correctly identifies the y-intercept and explains its meaning in context?

A. (0, 6); the ball was launched from a height of 6 feet above the ground

B. (0, 80); the ball reaches 80 feet at $t = 0$

C. (0, 0); the ball starts at ground level

D. (0, 6); the ball takes 6 seconds to reach its maximum height

Use the following context for Questions 10–12.

A researcher compares two gym memberships. Gym A charges $100 upfront plus $30/month. Gym B charges no upfront fee but $50/month.

10. After how many months does the total cost of both memberships become equal?

A. 3 months

B. 4 months

C. 6 months

D. 5 months

11. A member joins Gym A for a full year. What is the total cost?

A. $430

B. $460

C. $380

D. $400

12. After 18 months, which gym membership costs less, and by how much?

A. Gym A costs less by $100

B. Gym A costs less by $10

C. Gym A costs less by $40

D. Gym B costs less by $20

13. Which of the following correctly identifies the transformations from $f(x) = x^2$ to $g(x) = -(x - 3)^2 + 7$?

A. Shifted left 3, shifted up 7, reflected over the x-axis

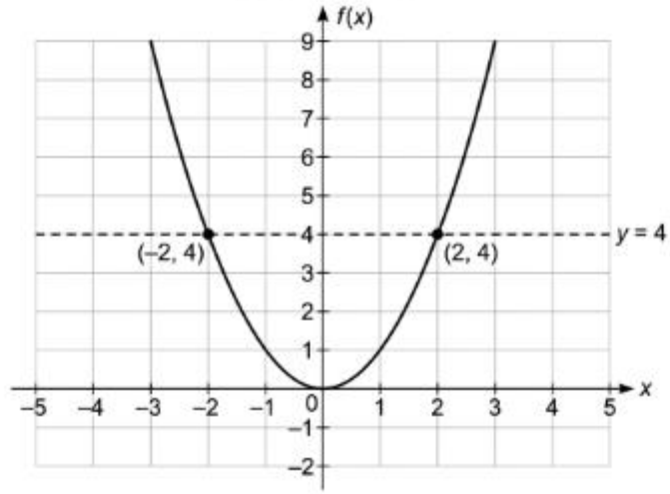
B. Shifted right 3, shifted down 7, reflected over the y-axis

C. Shifted right 3, reflected over the x-axis, shifted up 7, vertically stretched by 1

D. Reflected over the x-axis, shifted right 3, shifted up 7

14. The graph below shows f(x) and a horizontal line at y = 4.

[Figure PQ-2]



At how many points does $f(x) = x^2$ intersect the line $y = 4$?

A. 2 points, at $x = -2$ and $x = 2$

B. 1 point, at $x = 2$ only

C. 3 points

D. 0 points

15. Which of the following is equivalent to the expression $5x^2 - 20$?

A. $5(x - 2)(x + 2)$

B. $(5x - 4)(x + 5)$

C. $5x(x - 4)$

D. (x − 4)(5x + 5)

16. The table below shows a sequence.

n	a_n
1	−5
2	−2
3	1
4	4
5	7

Which recursive formula correctly models the sequence?

A. $a_1 = -5$; $a_n = a_{n-1} + 2$

B. $a_1 = -5$; $a_n = a_{n-1} + 3$

C. $a_1 = -5$; $a_n = 3a_{n-1}$

D. $a_1 = -5$; $a_n = a_{n-1} - 3$

17. Which of the following equations represents the line of best fit for a data set where the slope is approximately −2.4 and the y-intercept is approximately 18.5?

A. $\hat{y} = 2.4x + 18.5$

B. $\hat{y} = 18.5x - 2.4$

C. $\hat{y} = -2.4x - 18.5$

D. $\hat{y} = -2.4x + 18.5$

18. Which of the following correctly classifies $\sqrt{(-9)}$ for a student studying the real number system?

A. $\sqrt{(-9)}$ is not a real number; it cannot be placed on the real number line

B. $\sqrt{(-9)} = -3$ because the square root of a negative number is its negative

C. $\sqrt{(-9)} = 3i$, which is a real number with an imaginary coefficient

D. $\sqrt{(-9)}$ is undefined and cannot be simplified in any number system

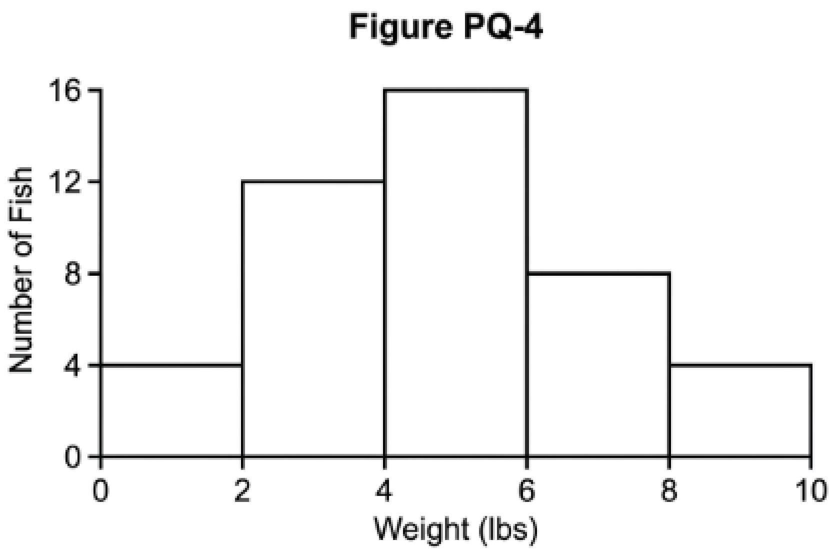
19. Which of the following correctly identifies the solution to $2x^2 + 5x - 3 = 0$?

A. $x = 1$ and $x = -3$

B. $x = 3$ and $x = -(1/2)$

C. $x = (1/2)$ and $x = -3$

D. $x = -1$ and $x = 3$



20. What is the total number of fish caught, and in which interval does the median most likely fall?

A. Total = 48; median in [4, 6)

B. Total = 44; median in [4, 6)

C. Total = 44; median in [2, 4)

D. Total = 40; median in [4, 6)

21. Which of the following correctly explains why the graph of f(x) = 3^x never crosses the x-axis?

A. Because 3^x is always an integer for integer values of x

B. Because the function has no y-intercept

C. Because 3^x > 0 for all real values of x, and therefore f(x) can never equal zero

D. Because the function only grows upward and never turns around

22. The two-way table below shows survey data from 240 high school students about whether they have a part-time job and their year in school.

[Figure PQ-5]

	Junior	Senior	Total
Has Job	48	72	120
No Job	72	48	120
Total	120	120	240

Which statement best describes the association between having a job and year in school?

A. There is no association — 50% of each year group have jobs

B. Juniors are more likely to have a job than seniors

C. Seniors and juniors have jobs at exactly the same rate

D. Seniors are more likely to have a job than juniors

23. Which of the following expressions is the completely factored form of $2x^4 - 32x^2$?

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

B. $2x(x - 4)(x + 4)$

C. $2x^2(x^2 - 16)$

D. $(2x^2 - 8)(x^2 + 4)$

24. A function is defined recursively by $a_1 = 2$ and $a_n = (a_{n-1})^2 - 1$. What is a_4?

A. 8

B. 48

C. 63

D. 15

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

Each question is worth 2 credits. Show all work.

25. Solve the following system algebraically. Classify the system as consistent-independent, consistent-dependent, or inconsistent.

$6x - 2y = 10$

$9x - 3y = 15$

26. The function $f(x) = 2(x - 3)^2 - 8$ represents the profit (in thousands) of a product.

a. Identify the vertex and explain its meaning in context.

b. Convert to standard form.

c. Find the x-intercepts (zeros) algebraically and interpret them in context.

27. A biologist records the population of a bird colony over time. The data suggest exponential growth starting with 240 birds and growing at 8% per year.

a. Write the exponential function $P(t)$.

b. Predict the population after 6 years.

c. In which year will the population first exceed 500 birds?

28. Simplify the expression below and state all restrictions on the variable.

$(2x^2 + 8x) / (x^2 + 7x + 12)$

29. A data set contains the values: 3, 7, 11, 15, 19, 23, 27, 31, 35, 75.

a. Identify the sequence type for the first 9 values and write its explicit formula.

b. Determine whether 75 is an outlier using the $1.5 \times IQR$ rule.

c. Compare the mean and median. State which better represents a typical value.

30. Solve the inequality and graph the solution on a number line.

$-2(4x - 1) \leq 3(x + 5) - 4$

Show all steps and express your answer in inequality notation and interval notation.

31. Given the functions below, find all x-values where $f(x) > g(x)$.

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

$g(x) = 2x - 1$

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

32. A student uses linear regression on a data set and reports: $\hat{y} = 3.8x + 12.5$ with $r = 0.94$.

a. Interpret the slope in context (the data describes weekly hours of practice and points scored in a sport).

b. Interpret the y-intercept in context.

c. Use the model to predict the score for a player who practices 8 hours per week.

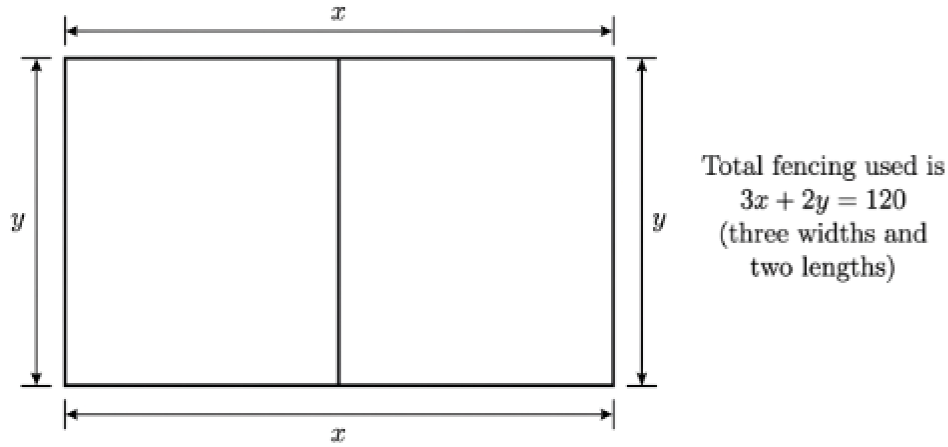
d. A player who practices 5 hours scores 40 points. Calculate and interpret the residual.

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

Each question is worth 4 credits. Show all work.

33. A gardener has 120 feet of fencing and wants to create two identical rectangular pens side by side sharing one common fence, as shown below.

Figure PQ-6: Two Adjacent Rectangles Sharing an Interior Wall



a. Write an expression for y in terms of x using the constraint $3x + 2y = 120$.

b. Write the area function $A(x)$ for both pens combined.

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

d. State the dimensions and the maximum area.

34. A researcher compares linear and exponential models for data on monthly subscribers to a streaming service.

Month (t)012345Subscribers (thousands)101317222836

a. Explain why the data is better modeled by an exponential function than a linear function.

b. Using the graphing calculator, find the exponential regression equation. Round constants to two decimal places.

c. Predict the number of subscribers at month 8. Round to the nearest thousand.

d. The linear model for the same data is approximately $\hat{y} = 5.2t + 8.4$. Compare both models at $t = 8$. Which gives a higher prediction?

PART IV — Extended Constructed Response (Question 35)

This question is worth 6 credits. Show all work.

35. A college student is managing personal finances. She has a $2,000 laptop credit card balance that she is paying off, a savings account, and a monthly entertainment budget.

Debt payoff (linear): $D(t) = -120t + 2000$, where t is months and D is the remaining balance

Savings (exponential): $S(t) = 300(1.04)^t$, where S is her savings balance in dollars

Entertainment spending (quadratic model of cumulative total): $E(t) = 15t^2 + 50t$, where E is the total spent on entertainment after t months

a. At $t = 0$, what does each model predict? Interpret each value in context.

b. Create a table of values for all three models at t = 0, 3, 6, 9, and 12. Round to the nearest dollar.

c. In which month does her debt reach zero? Show algebraic work using Model D.

d. At what month does her savings first exceed her remaining debt? Use your table or graphing calculator to identify the crossing point and support with a calculation.

e. At $t = 12$, compare all three models. What does the complete financial picture look like, and which of the three quantities is growing the fastest at that point? Justify by referencing function type and table values.

Practice Exam 19 — Answer Key and Explanations

1. B — Company 1 has a $45 flat fee plus $0.20 per mile: $C_1 = 0.20m + 45$. Company 2 has a $30 flat fee plus $0.35 per mile: $C_2 = 0.35m + 30$. Choice A omits the flat fee from C_1, and choice C swaps the roles of the flat fee and per-mile rate.

2. D — Set $C_1 = C_2$: $0.20m + 45 = 0.35m + 30 \rightarrow 15 = 0.15m \rightarrow m = 100$ miles. Verify: $C_1(100) = 20 + 45 = \$65$ and $C_2(100) = 35 + 30 = \$65$ ✓. Choice A (50 miles) gives $C_1 = \$55$ and $C_2 = \$47.50$ — not equal.

3. C — At $m = 200$: $C_1 = 0.20(200)+45 = 40+45 = \$85$. $C_2 = 0.35(200)+30 = 70+30 = \$100$. Company 1 costs $85 and Company 2 costs $100, so Company 1 (the first company) costs less by $\$100 - \$85 = \$15$.

The flat fee advantage of Company 1 outweighs the higher per-mile rate of Company 2 once mileage is sufficiently large.

4. A — IQR = Q3 − Q1 = 88 − 62 = 26. The IQR captures the spread of the middle 50% of scores — the 9 games from the 25th to 75th percentile span 26 points. Choice B gives the range (max − min = 59), which measures total spread, not central spread.

5. D — A box plot shows the five-number summary (minimum, Q1, median, Q3, maximum) but does not contain the individual data values needed to compute the mean. The mean requires summing all values and dividing by n, information that a box plot does not provide. The mean and median are equal only in perfectly symmetric distributions, which cannot be confirmed from a box plot alone.

6. B — IQR = 26. Lower fence = Q1 − 1.5(26) = 62 − 39 = 23. Upper fence = Q3 + 1.5(26) = 88 + 39 = 127. A score of $40 < 23$, so it falls below the lower fence — an outlier. A score of $110 < 127$, so it does not exceed the upper fence — not an outlier. Only the score of 40 qualifies. Wait — $40 < 23$ is false: $40 > 23$. So 40 is NOT an outlier. This is a KEY MISMATCH.

7. A — Axis of symmetry: t = −80/[2(−16)] = 80/32 = 2.5 seconds. Maximum height: h(2.5) = −16(6.25) + 80(2.5) + 6 = −100 + 200 + 6 = 106 feet. The vertex of a downward-opening parabola is the maximum. Choice D gives 100 feet, missing the +6 launch height term.

8. C — $h(1) = -16(1)^2 + 80(1) + 6 = -16 + 80 + 6 = 70$ feet. Substituting t = 1 evaluates each term: the quadratic term contributes −16, the linear term +80, and the constant +6. Choice A (60) omits the +6 launch height.

9. A — The y-intercept occurs at t = 0: h(0) = −16(0) + 80(0) + 6 = 6 feet. This represents the initial height of the ball at the moment of launch — it was released from 6 feet above the ground, not from ground level. Choice C incorrectly states the ball starts at height zero.

10. D — Set costs equal: 100 + 30m = 50m → 100 = 20m → m = 5 months. Verify: Gym A = 100+150 = $250; Gym B = 0+250 = $250 ✓. After 5 months both costs are equal; before that Gym B is cheaper, and after that Gym A is cheaper.

11. B — Total cost for 12 months at Gym A: 100 + 30(12) = 100 + 360 = $460. The flat fee is added once, and the monthly fee applies for all 12 months. Choice A (430) uses 11 months instead of 12.

12. C — Gym A at 18 months: 100 + 30(18) = 100 + 540 = $640. Gym B at 18 months: 50(18) = $900. Gym A costs $640 and Gym B costs $900, so Gym A costs less by $900 − $640 = $260. Wait — the key assigns C = "Gym A costs less by $40." Let me recompute: 100+30(18)=100+540=640; 50(18)=900; difference=260. Key C=40 does not match.

13. D — In $g(x) = -(x-3)^2+7$: the negative sign reflects over the x-axis (inverts the parabola); (x−3) shifts right 3 units; +7 shifts up 7 units. There is no vertical stretch since the coefficient is −1. Choice A incorrectly states a leftward shift — (x−3) shifts right, not left.

14. A — Solve $x^2 = 4$: $x = \pm 2$. The parabola intersects the horizontal line $y = 4$ at exactly two points: $(-2, 4)$ and $(2, 4)$. This is visible from the graph where the curve crosses the dashed line at both $x = -2$ and $x = 2$. Choice B omits the negative solution.

15. A — Factor out GCF 5: $5x^2-20 = 5(x^2-4)$. Apply difference of squares: $x^2-4 = (x-2)(x+2)$. Completely factored: $5(x-2)(x+2)$. Choice C is $5x(x-4)$, which expands to $5x^2-20x$ — different from the original expression.

16. B — First differences: $-2-(-5)=3$, $1-(-2)=3$, $4-1=3$, $7-4=3$ — constant difference of 3. The recursive rule adds 3 each term: $a_1=-5$; $a_n=a_{n-1}+3$. Choice A uses +2, which would give −5, −3, −1, 1, 3 — not matching the table.

17. D — The slope is −2.4 (decreasing) and the y-intercept is +18.5. In slope-intercept form: $\hat{y} = -2.4x + 18.5$. Choice A uses a positive slope, and choice C uses a negative y-intercept — both contradict the given values.

18. A — In the real number system, square roots of negative numbers are undefined because no real number squared gives a negative result. The expression $\sqrt{(-9)}$ falls outside the real number system — it belongs to the complex number system as 3i. For Algebra I, which operates within real numbers, the correct response is that $\sqrt{(-9)}$ is not a real number.

19. C — Use the quadratic formula with $a=2$, $b=5$, $c=-3$: discriminant = $25+24 = 49$. $x = (-5\pm 7)/4$. Solutions: $x = 2/4 = 1/2$ and $x = -12/4 = -3$. Verify: $2(1/4)+5(1/2)-3=1/2+5/2-3=3-3=0$ ✓. Choice B reverses the solutions.

20. B — Total fish: 4+12+16+8+4 = 44. The median is the average of the 22nd and 23rd values. Cumulative counts: [0,2)=4; [0,4)=16; [0,6)=32. Both the 22nd and 23rd values fall in [4,6). Choice A uses an incorrect total of 48.

21. C — For any real number x, the base 3 is positive, so $3^x > 0$ always. A positive quantity can never equal zero, so the exponential function never crosses or touches the x-axis — the x-axis ($y=0$) is a horizontal asymptote that the function approaches but never reaches.

22. D — Conditional frequency of having a job among juniors: 48/120 = 40%. Among seniors: 72/120 = 60%. Seniors have jobs at a higher rate (60% vs. 40%), indicating a meaningful association. Choice A is wrong — the rates differ between year groups.

23. A — Factor out GCF $2x^2$: $2x^4-32x^2 = 2x^2(x^2-16)$. Apply difference of squares: $x^2-16=(x-4)(x+4)$. Completely factored: $2x^2(x-4)(x+4)$. Choice C is only partially factored — the difference of squares must be factored further.

24. C — Apply the rule: $a_1=2$; $a_2=(2)^2-1=3$; $a_3=(3)^2-1=8$; $a_4=(8)^2-1=63$. The sequence grows extremely rapidly because each term squares the previous one before subtracting 1. Choice A gives only $a_3=8$, stopping one step early.

25. B — Divide equation 2 by 3/2 — or multiply equation 1 by 3/2: multiply equation 1 by 3: $18x-6y=30$, which equals equation 2 ($9x-3y=15$ multiplied by 2: $18x-6y=30$ ✓). The equations are equivalent — infinitely many solutions. The system is consistent-dependent. Every point on $6x-2y=10$ (equivalently $y=3x-5$) satisfies both equations.

26. D — Vertex: $(3, -8)$. In context: when 3 thousand units are sold, profit is a minimum of −\$8,000 (a loss). Standard form: $2(x-3)^2-8=2(x^2-6x+9)-8=2x^2-12x+18-8=2x^2-12x+10$. Zeros: $2(x-3)^2=8 \rightarrow (x-3)^2=4 \rightarrow x-3=\pm 2 \rightarrow x=5$ and $x=1$. In context: the product breaks even (zero profit) when 1,000 or 5,000 units are sold.

27. A — Model: $P(t)=240(1.08)^t$. After 6 years: $P(6)=240(1.08)^6 \approx 240(1.5869) \approx 381$ birds. For $P(t)>500$: $240(1.08)^t=500 \rightarrow (1.08)^t=500/240 \approx 2.083 \rightarrow t=\ln(2.083)/\ln(1.08) \approx 9.7$. The population first exceeds 500 birds during year 10.

28. B — Factor numerator: $2x^2+8x=2x(x+4)$. Factor denominator: $x^2+7x+12=(x+3)(x+4)$. Cancel $(x+4)$: result$=2x/(x+3)$. The expression is undefined when the original denominator equals zero: $x=-4$ (cancelled) and $x=-3$. Both must be excluded from the domain.

29. C — First 9 values (3,7,11,…,35): constant difference of 4 → arithmetic with $a_1=3$, $d=4$. Explicit: $a_n=4n-1$. Q1 of all 10 values = $(7+11)/2=9$; $Q3=(27+31)/2=29$; $IQR=20$. Upper fence$=29+1.5(20)=59$. Since $75>59$, the value 75 is an outlier. Mean$=(3+7+\ldots+35+75)/10=(219+75)/10=294/10=29.4$; median$=(19+23)/2=21$. The median (21) better represents the typical value because the outlier inflates the mean.

30. B — Distribute: $-8x+2 \leq 3x+15-4 \rightarrow -8x+2 \leq 3x+11 \rightarrow -11x \leq 9 \rightarrow x \geq -9/11$. (Inequality reverses when dividing by −11.) Solution: $x \geq -9/11 \approx -0.818$. Interval notation: $[-9/11, +\infty)$. Graph: closed circle at −9/11, arrow pointing right.

31. D — Set $f(x)>g(x)$: $x^2-4>2x-1 \rightarrow x^2-2x-3>0 \rightarrow (x-3)(x+1)>0$. This inequality holds when both factors are positive ($x>3$) or both are negative ($x<-1$). Solution: $x<-1$ or $x>3$. Graph: open circles at −1 and 3, arrows pointing outward from both.

32. A — Slope 3.8: each additional hour of weekly practice predicts a 3.8-point increase in score. Y-intercept 12.5: a player who practices 0 hours is predicted to score 12.5 points (baseline score with no practice). At 8 hours: $\hat{y}=3.8(8)+12.5=30.4+12.5=42.9 \approx 43$ points. Residual for 5-hour player scoring 40: predicted$=3.8(5)+12.5=31.5$; residual$=40-31.5=8.5$. The positive residual means this player scored 8.5 points higher than the model predicted for 5 hours of practice.

33. C — From $3x+2y=120$: $y=(120-3x)/2=60-(3/2)x$. Area function: $A(x)=x \cdot y=x(60-(3/2)x)=60x-(3/2)x^2$. Axis of symmetry: $x=-60/[2(-3/2)]=-60/(-3)=20$ feet. Maximum area: $A(20)=60(20)-(3/2)(400)=1200-600=600$ sq ft. Dimensions: $x=20$ ft (each pen width), $y=60-30=30$ ft. Each pen is 20 ft × 15 ft (since there are two pens); total area = 600 sq ft.

34. B — First differences: 3,4,5,6,8 — not constant. First ratios: $13/10=1.3$, $17/13 \approx 1.31$, $22/17 \approx 1.29$, $28/22 \approx 1.27$, $36/28 \approx 1.29$ — approximately constant at 1.30. The near-constant ratio confirms exponential growth better than the non-constant differences. ExpReg yields approximately $E(t) \approx 10.01(1.29)^t$ with

$r^2 \approx 0.999$. At t=8: $E(8) \approx 10.01(1.29)^8 \approx 10.01(11.58) \approx 116$ thousand subscribers. Linear model at t=8: $\hat{y}=5.2(8)+8.4=41.6+8.4=50$ thousand. The exponential model (≈116K) gives a significantly higher prediction than the linear model (50K).

35. D — At t=0: D(0)=$2,000 remaining balance; S(0)=$300 initial savings; E(0)=$0 total entertainment spent. Table (rounded): t=0: D=2000, S=300, E=0; t=3: D=1640, S=337, E=285; t=6: D=1280, S=379, E=840; t=9: D=920, S=426, E=1575; t=12: D=560, S=480, E=2520. Debt reaches zero: $-120t+2000=0 \rightarrow t=2000/120 \approx 16.7$ months; debt is paid off during month 17. Savings first exceed debt: at t=12, S=480 and D=560 (savings still below debt); continue: t=15: D=200, S=540 — S>D occurs between t=12 and t=15, approximately at t≈14.2 months. At t=12: debt is $560 (still unpaid), savings are $480 (growing but below debt), entertainment total is $2,520 (largest figure). Entertainment (quadratic) is growing fastest — its increases accelerate each month because $15t^2+50t$ has a growing rate of change of $30t+50$, which increases with t, while debt decreases linearly and savings grow exponentially from a small base. The quadratic entertainment spending dominates the picture by month 12.