Unit 4 Test Study Guide
(Solving Quadratic Equations)

Name: _____

Date: _____ Block: _____

Topic 1: Complex Numbers

Simplify each expresion below.	
1. $\sqrt{-324}$	**2.** $2\sqrt{-147}$
3. $(-4+7i)+(-3-8i)$	**4.** $(21+9i)-(13-2i)$
5. $(1+5i)(4-2i)$	**6.** $(7-i)^2$
7. $\dfrac{8}{-12i}$	**8.** $\dfrac{3-6i}{4-3i}$

Simplify, then name all sets to which the value belongs.	
9. i^{59}	**10.** $(9+5i)(9-5i)$
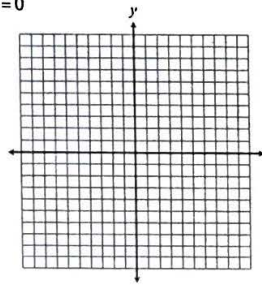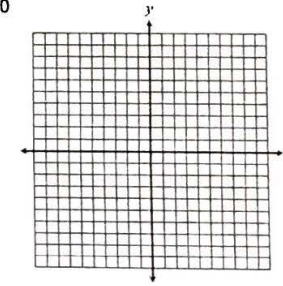
Use the complex numbers to write an example of each property.	
11. Associative Property of Multiplication	**12.** Distributive Property

13. Name the additive identity of $(-10+4i)$	**14.** Name the multiplicative inverse of $7i$
15. Name all sets that are closed under subtraction.	

Topic 2: Solving Quadratics by Graphing

16. $x^2+10x+24=0$	**17.** $-3x^2-6x=0$

Topic 3: Solving Quadratics by Factoring

18. $x^2-11x+18=0$	**19.** $2x^2-32x+128=0$
20. $8x^2+10x=0$	**21.** $7x^2-19x-6=0$

Complete the table below.

Standard Form	Vertex Form (Identify Vertex & Axis of Symmetry)	Factored Form (Identify the Roots)
22. $f(x) = x^2 + 16x + 63$		
23.	$f(x) = \left(x - \dfrac{1}{2}\right)^2 - \dfrac{25}{4}$	

Topic 4: Solving Quadratics by Square Roots

24. $16x^2 - 1 = 0$	**25.** $-3x^2 + 11 = 17$
26. $(x+5)^2 = 4$	**27.** $(x-8)^2 - 7 = 25$

Topic 5: Solving Quadratics by Completing the Square

28. $x^2 - 8x - 10 = 0$	**29.** $-4x^2 - 48x - 20 = 0$

Topic 6: Solving Quadratics by the Quadratic Formula

30. $-x^2 + 3x - 21 = 0$	**31.** $10x^2 + 8x - 1 = 0$

Topic 7: Discriminant/Choosing the Best Method

Find the discriminant of each equation, then determine the number and type of roots. Then solve using the most appropriate method. Use each method once only.

32. $-x^2 + 2x - 8 = 0$

- ☐ F
- ☐ SR
- ☐ CS
- ☐ QF

33. $-2x^2 + 8 = x^2 - 28$

- ☐ F
- ☐ SR
- ☐ CS
- ☐ QF

34. $-2x^2 - 5x - 4 = 0$

- ☐ F
- ☐ SR
- ☐ CS
- ☐ QF

35. $4x^2 + 32x - 36 = 0$

- ☐ F
- ☐ SR
- ☐ CS
- ☐ QF

Topic 8: Applications

36. The chicken coup at the petting farm is 10 by 14 feet. The farm would like to double the *current area* by adding the same amount, *x*, to the length and width. What are the dimensions of the new enclosure? Round to the nearest hundredth of a foot.

37. Natalie found a tennis ball outside a tennis court. She picked up the ball and threw it over the 12-foot fence into the court. The height of the ball, *h*, and time *t* seconds is given by the equation $h(t) = -16t^2 + 18t + 5$. Will she make it over the fence?

38. Jack was so frustrated with his slow laptop that he thew it out of his second story window. The height, *h*, of the laptop at time *t* seconds can be given by the equation $h(t) = -16t^2 + 28t + 17$. Assuming the laptop hits the ground below, find the domain of the function.

39. The table below shows the altitude, in feet, of an airplane at certain times during its flight from Baltimore to Orlando. Find the equation for the curve of best fit, then predict the altitude of the plane at 1:00 p.m.

time	11:00 a.m.	11:30 a.m.	11:45 a.m.	12:00 pm.	12:30 p.m.	12:45 p.m.
altitude	0	10,500	15,750	21,500	12,450	10,820

Unit 5 Test Study Guide
(Polynomial Functions)

Name: _____

Date: _____ Block: _____

Topic 1: Classifying Polynomials & Polynomial Operations

Classify each polynomial by degree and number of terms.

1. $-2x^2 - 9$	**2.** $x^5 - 6x^3 - x - 1$	**3.** $4x^3$

Simplify each expression. Final answers should be written in standard form.

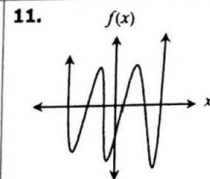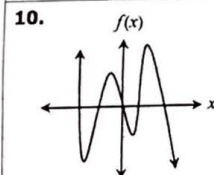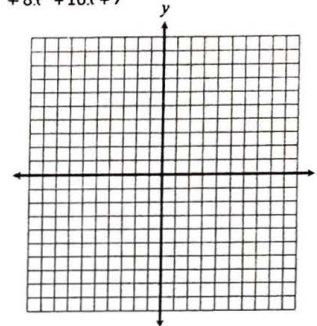|	
4. $(-4m^2n)^4 \cdot \frac{1}{6}m^{-10}n^{-4}$	**5.** $(8a^2 - 6 - 8a) + (1 - 6a - 7a^2)$
6. $(6x - 7x^2 + 7) - (5x^2 + 2x - 2x^3 - 1)$	**7.** $(y + 4)^3 - 2y(v - 1)$
8. $(3k - 6)(k^2 - k + 7)$	**9.** $\dfrac{-8c^6d^4 + 56c^4d^2 - 24c^2d}{8c^2d}$

Topic 2: Graphing Polynomial Functions

Determine the end behavior, whether the function is an even or odd degree, and the sign of the leading coefficient given each graph below.

10. $f(x)$	**11.** $f(x)$

Graph each function and identify its key characteristics.

12. $f(x) = x^3 + 8x^2 + 16x + 7$

Domain: _____

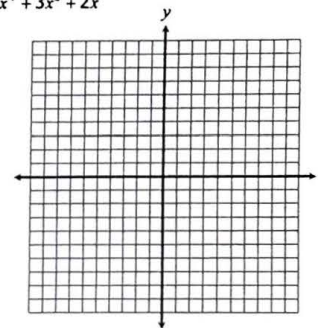Range: _____

Rel. Maximum(s): _____

Rel. Minimum(s): _____

End Behavior: As $x \to \infty$, $f(x) \to$ _____

As $x \to -\infty$, $f(x) \to$ _____

Inc. Intervals: _____

Dec. Intervals: _____

13. $f(x) = -x^4 + 3x^2 + 2x$

Domain: _____

Range: _____

Rel. Maximum(s): _____

Rel. Minimum(s): _____

End Behavior: As $x \to \infty$, $f(x) \to$ _____

As $x \to -\infty$, $f(x) \to$ _____

Inc. Intervals: _____

Dec. Intervals: _____

Identify the zeros (and their multiplicity) of each function below and the effect on the graph.

14. $f(x) = 3x^3(x - 1)^2(x - 8)$

Zero	Multiplicity	Effect

15. $f(x) = -x(5x + 3)^3(x - 2)^8$

Zero	Multiplicity	Effect

16. The graph of a polynomial function has zeros of 0 (multiplicity 2), 1 (multiplicity 2), and 5/2 (multiplicity 2). Write a function in standard form that could represent this function.

Topic 3: Factoring Polynomials

Differences of Squares $a^2 - b^2 =$	Sum of Cubes $a^3 + b^3 =$	Differences of Cubes $a^3 - b^3 =$

Factor each polynomial below completely.

17. $9x^3 + 21x^2$	**18.** $3n^4 - 147$
19. $64a^3 - 343b^3$	**20.** $648w + 1029w^4$
21. $32c^5d - 162cd^3$	**22.** $216pq - p^7q$
23. $2c^5 - 2c^3 - 60c$	**24.** $9y^4 - 7y^2 - 16$
25. $n^3 + 2n^2 - 36n - 72$	**26.** $8x^3 - 10x^2 + 28x - 35$

Topic 4: Solving Polynomial Equations

27. $2x^4 - 48x^2 = 0$	**28.** $25x^3 = 64x$
29. $108x^3 + 37 = 5$	**30.** $9x^5 - 72x^2 = 0$
31. $x^4 + 19x^2 - 20 = 0$	**32.** $x^5 = 18x^3 - 81x$

33. $3x^4 - 14x^2 = 5$

34. $2x^3 + 7x^2 - 16x - 56 = 0$

Topic 5: Dividing Polynomials

35. $(12x^2 - 20x + 3) \div (2x - 3)$

36. $(n^2 - 9n + 17) \div (n - 2)$

37. $(y^4 - 7y^3 - 2y + 18) \div (y - 7)$

Topic 6: Operations & Compositions of Functions

Given $f(x) = x^2 + 4x - 12$, $g(x) = 5x^2 - 2$, and $h(x) = x + 7$, find each function. Indicate any restrictions in the domain.

38. $(f - g)(x)$

39. $(h \cdot g)(x)$

40. $\left(\dfrac{h}{f}\right)(x)$

41. $(g \circ h)(x)$

Use the same functions above, evaluate each function.

42. $(g + h)(-4)$

43. $(h \circ f)(2)$

Topic 7: Regression

44. The population present in a bacteria culture over 5 days is given in the table below. Write a **cubic function** to represent the data.

Time (days)	0	1	2	3	4	5
Population	28	135	219	332	520	834

45. Use a **cubic function** to estimate the value of y when x is -8. How does the estimate change when a quartic function is used instead?

x	-4	0	4	8	12
y	975	128	-9	-160	-893

Unit 6 Test Study Guide
(Radical Functions)

Name: _____

Date: _____ Block: _____

Topic 1: Simplifying Radicals

Perfect Squares: _____

Perfect Cubes: _____

Perfect Fourths: _____

1. $-2\sqrt{294m^{16}n^7}$	2. $5\sqrt[3]{-80a^5}$	3. $-3\sqrt[4]{256p^{13}q^5}$

Topic 2: Operations with Radicals

Simplify.

4. $-\sqrt{6}-3\sqrt{45}+2\sqrt{96}$	5. $\sqrt[3]{24}-2\sqrt[3]{112}+3\sqrt[3]{7}$	6. $\sqrt[3]{-12x^4y}\cdot\sqrt[3]{4x^2y^2}$
7. $\sqrt{18}(5-\sqrt{2})-11\sqrt{2}$	8. $(\sqrt{3}+\sqrt{6})(2\sqrt{3}-5\sqrt{6})$	9. $(\sqrt{5}-2)^2$
10. $\dfrac{\sqrt[4]{324}}{\sqrt[4]{4}}$	11. $\dfrac{\sqrt{112a^6b^{12}}}{\sqrt{7a^2b^3}}$	12. $\dfrac{\sqrt[3]{7}}{\sqrt[3]{56}}$

13. $\dfrac{5\sqrt{6}}{\sqrt{15}}$	14. $\sqrt{\dfrac{10m^3}{18m}}$	15. $\dfrac{\sqrt{5}-\sqrt{2}}{4\sqrt{2}}$
16. $\dfrac{2}{5+3\sqrt{2}}$	17. $\dfrac{2+\sqrt{7}}{5-\sqrt{7}}$	

Topic 3: Rational Exponents

Rewrite in radical form. Simplify if possible.

18. $16^{\frac{1}{4}}$	19. $a^{\frac{2}{3}}$	20. $(2y)^{\frac{5}{2}}$

Rewrite in exponential form.

21. $\sqrt[3]{17}$	22. $\sqrt[4]{(7x)^3}$	23. $\sqrt{12a^9}$

Simplify each expression. Give final answers in simplest radical form.

24. $x^{\frac{1}{8}}\cdot x^{\frac{5}{8}}$	25. $(81^8)^{-\frac{1}{4}}$	26. $\dfrac{k^{\frac{13}{3}}}{k}$
27. $\sqrt{m^9}\cdot\sqrt[4]{m}$	28. $\dfrac{2^3}{\sqrt{2^7}}$	29. $\dfrac{\sqrt{x^3}\cdot\sqrt[4]{x^3}}{x}$

Topic 4: Solving Radical Equations

Solve each equation. Check for extraneous solutions.

30. $\sqrt{5x-1}+4=11$

31. $1-2\sqrt{m+12}=5$

32. $(9a+45)^{\frac{1}{3}}=3$

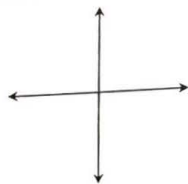**33.** $\sqrt{3n-27}=\sqrt{43-2n}$

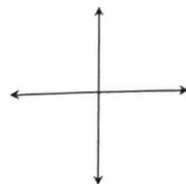**34.** $(18+7k)^{\frac{1}{2}}=k$

35. $\sqrt{6x+19}-4=x$

Topic 5: Graphing Radical Functions

Identify the parent function and sketch the shape of the graph.

SQUARE ROOT	CUBE ROOT

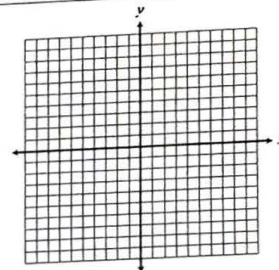**Describe the transformations on each function compared to its parent function.**

36. $f(x)=\frac{3}{4}\sqrt{x}+1$

37. $f(x)=2\sqrt[3]{x+5}-8$

38. The cubic parent function is reflected about the x-axis, then shifted so that its turning point is located at (-6, -2). Write an equation that represents this new function.

Graph each function and identify its key characteristics.

39. $f(x)=4\sqrt{x}-7$

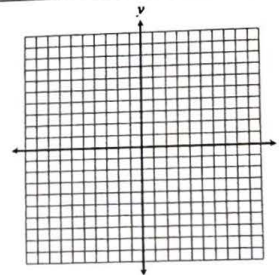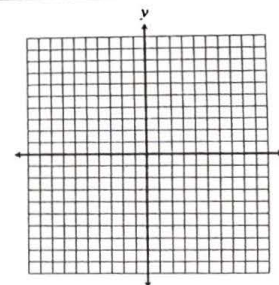D: _____ R: _____

Endpoint/Turning Point: _____

End Behavior:

As $x\rightarrow$ _____, $f(x)\rightarrow$ _____

As $x\rightarrow$ _____, $f(x)\rightarrow$ _____

Increasing Interval(s): _____

Decreasing Interval(s): _____

40. $f(x)=-\sqrt{x+6}+5$

D: _____ R: _____

Endpoint/Turning Point: _____

End Behavior:

As $x\rightarrow$ _____, $f(x)\rightarrow$ _____

As $x\rightarrow$ _____, $f(x)\rightarrow$ _____

Increasing Interval(s): _____

Decreasing Interval(s): _____

41. $f(x)=\sqrt[3]{x}-1$

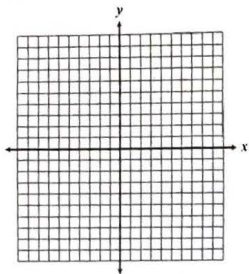D: _____ R: _____

Endpoint/Turning Point: _____

End Behavior:

As $x\rightarrow$ _____, $f(x)\rightarrow$ _____

As $x\rightarrow$ _____, $f(x)\rightarrow$ _____

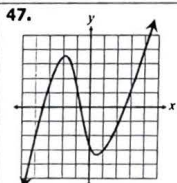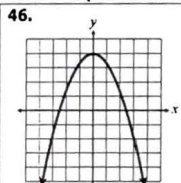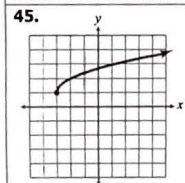Increasing Interval(s): _____

Decreasing Interval(s): _____

42. $f(x) = \frac{1}{2}\sqrt[3]{x+3} - 5$

D: _____   R: _____

Endpoint/Turning Point: _____

End Behavior:

As $x \to$ _____ . $f(x) \to$ _____

As $x \to$ _____ . $f(x) \to$ _____

Increasing Interval(s): _____

Decreasing Interval(s): _____

Topic 6: Inverse Functions

Find the inverse of each relation. Determine if it is a one-to-one function.
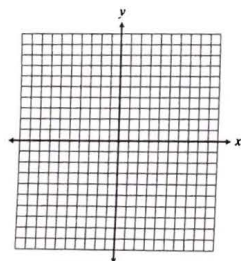
43. $R = \{(5, 1), (-2, -3), (5, 9), (2, 7)\}$

44. $R = \{(-2, 2), (-3, 3), (-4, 4), (-5, 5)\}$

Determine whether the relations below represent one-to-one functions.

45.

46.

47.

Find the inverse of each function below. Verify the inverse relationship on the graph.
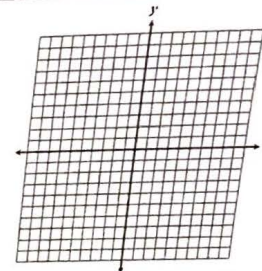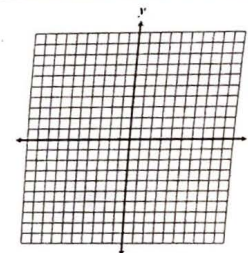
48. $f(x) = 4x$

49. $f(x) = x + 7$
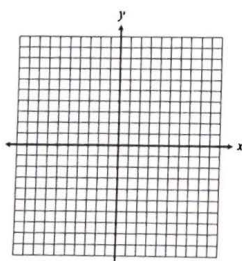
50. $f(x) = \frac{2}{5}x - 1$

51. $f(x) = \sqrt{x} + 3$

Determine whether the pair of functions are inverse functions.

52. $f(x) = 8x - 12$ and $g(x) = \frac{1}{8}x + \frac{3}{2}$

53. $f(x) = \frac{x-1}{9}$ and $g(x) = 9x + 9$

54. $f(x) = \frac{1}{2}x^3 - 2$ and $g(x) = \sqrt[3]{2x+4}$

Unit 7 Test Study Guide
(Exponential & Logarithmic Functions)

Name: _____

Date: _____ Block: _____

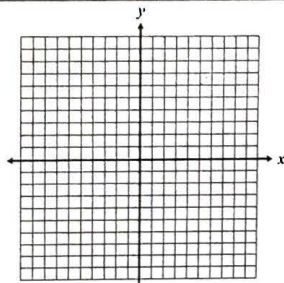## Topic 1: Graphing Exponential & Logarithmic Functions

Describe as an exponential growth or decay.

1. $f(x) = 5\left(\frac{2}{3}\right)^x$

2. $f(x) = \frac{1}{3}\left(\frac{6}{5}\right)^x$

Graph each function and identify its key characteristics.

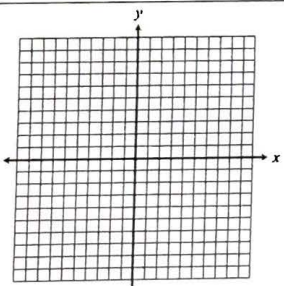**3.** $f(x) = 3^{x+1} - 6$

Domain: _____

Range: _____

End Behavior:

As $x \to \infty$, $f(x) \to$ _____

As $x \to -\infty$, $f(x) \to$ _____

y-intercept: _____

Asymptote: _____

4. $f(x) = \left(\frac{1}{2}\right)^{x-5} + 2$

Domain: _____

Range: _____

End Behavior:

As $x \to \infty$, $f(x) \to$ _____

As $x \to -\infty$, $f(x) \to$ _____

y-intercept: _____

Asymptote: _____

5. $f(x) = \log_2 x - 3$
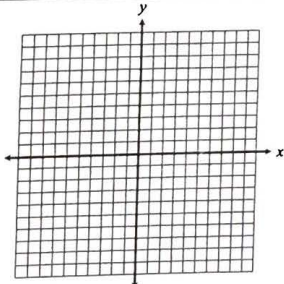
Domain: _____

Range: _____

End Behavior:

As $x \to$ _____, $f(x) \to \infty$

As $x \to$ _____, $f(x) \to -\infty$

x-intercept: _____

Asymptote: _____

6. $f(x) = \log_{\frac{1}{3}}(x+2) + 1$
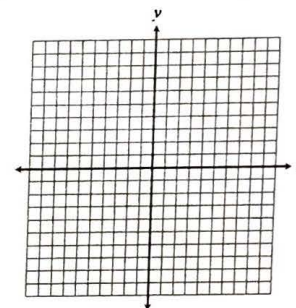
Domain: _____

Range: _____

End Behavior:

As $x \to$ _____, $f(x) \to \infty$

As $x \to$ _____, $f(x) \to -\infty$

x-intercept: _____

Asymptote: _____

Topic 2: Exponential vs. Logarithmic Form

Write in logarithmic form.

7. $8^2 = 64$	**8.** $2^{x-4} = 32$	**9.** $10^{2x} = 54$	**10.** $e^6 = x - 2$

Write in exponential form.

11. $\log_3 27 = 3$	**12.** $\log_x 7 = \frac{1}{2}$	**13.** $\log_4 90 = x$	**14.** $\ln x = 38$

Topic 3: Evaluating Logarithms

Evaluate each logarithm. Use the Change of Base Formula when necessary: $\log_b a =$

15. $\log_9 81$	**16.** $\log_{81} 3$	**17.** $\log_5 \frac{1}{25}$	**18.** $\log_6 1$
19. $\log 63$	**20.** $\log_7 95$	**21.** $\log_2 78$	**22.** $\ln 42$

Topic 4: Properties of Logarithms

Product Rule	Quotient Rule	Power Rule
$\log_b(m \cdot n) =$	$\log_b\left(\dfrac{m}{n}\right) =$	$\log_b m^n =$

Condense each expression into a single logarithm.

23. $3 \cdot \log 2 + \log(x-4)$	**24.** $\dfrac{1}{2} \cdot \log_5 324 - \log_5 2$	**25.** $3 \cdot \ln 6 - \dfrac{3}{2} \cdot \ln 4$

Expand each expression.

26. $\log_3(x^2 y^5)^3$	**27.** $\ln\left(\dfrac{2}{a^3}\right)^4$	**28.** $\log_4 \sqrt{p^3 q^{10}}$

Topic 5: Solving Logarithmic Equations

29. $\log_4(5x+7) = \log_4(2x+31)$	**30.** $\ln(p^2 - p) = \ln(6p + 18)$
31. $\dfrac{1}{2} \cdot \log_8 36 + \log_8(3k+7) = \log_8 132$	**32.** $2 \cdot \log(y+5) = \log 20 - \log 5$

33. $\log_2(9m+2) = 7$	**34.** $5 \cdot \ln(2a-1) = 15$

Topic 6: Solving Exponential Equations

35. $64^{x+7} = 4^{5x-3}$	**36.** $9^{w-8} = \left(\dfrac{1}{27}\right)^{2w}$
37. $8^{n-5} = 48$	**38.** $2 \cdot 3^{4y} - 11 = 61$
39. $e^{a-1} = 65$	**40.** $-3 \cdot e^{2m-5} - 7 = -34$

Topic 7: Applications

Exponential Growth	Exponential Decay	Compound Interest
a = initial amount r = growth rate t = time	a = initial amount r = decay rate t = time (in years)	P = initial amount r = rate n = # of times compounded/year t = time (in years)

41. Sophie invested $5,000 into an account that will increase in value by 2.3% each year. Write a function to model this situation, then find the value of the investment after 15 years.

42. A baseball card that was valued at $200 in 1980 has increased in value by 7% each year. Write a function to model this situation, then find the value of the card in 2016.

43. Miles invested $2,400 into a retirement account that earns 1.8% interest compounded bimonthly. Write a function to model this situation, then find the balance of the account after 25 years.

44. Sarah took out a $30,000 loan at a 4% interest rate to put a new pool in her backyard. If the interest is compounded quarterly, write a function to model this situation. How much will interest will she have paid after 12 years?

Topic 8: Regression

45. The table below shows the value of a stock over the course of five years. Using an **exponential model**, write an equation for the curve of best fit, then estimate the value of the stock in 2025.

Year	Value ($)
1998	400
1999	438
2000	480
2001	525
2002	575

46. The table below shows the wind speed along with the corresponding wind chill factor. Using a **logarithmic model**, write an equation for the curve of best fit, then find the approximate wind speed that corresponds to a wind chill factor of -18 °F.

Wind Speed (mi/hr)	Wind Chill Factor (°F)
3	1
5	-3
14	-8
20	-11
27	-14

47. The table below shows the number of seniors at Greenville High School that are also taking college credit classes during certain years. Which model would best fit this data: linear, quadratic, or cubic? Use the model to write a best-fit equation, then estimate the number of seniors taking college classes in 2020.

Year	Students
2004	18
2006	24
2008	39
2012	48
2015	64

48. The table below shows the number of used textbooks sold each year on an online bookstore. Which model would best fit this data: cubic, quartic, or exponential? Use the model to write a best-fit equation, then estimate the number of books sold in 2014.

Year	Books Sold (thousands)
2008	1
2009	6.2
2010	9.7
2011	12.1
2012	13.3

Unit 8 Test Study Guide
(Rational Functions)

Name: _____

Date: _____ Block: _____

Topic 1: Simplifying Rational Expressions

1. $\dfrac{12x^2 - 30x}{20x^3 - 50x^2}$	**2.** $\dfrac{4a^2 - 36}{24 - 8a}$	**3.** $\dfrac{n^2 - 13n + 40}{3n^2 - 14n - 5}$

Topic 2: Operations with Rational Expressions

4. $\dfrac{6p^2 - 13p + 5}{2p^2 + 17p - 9} \cdot \dfrac{p^2 + 16p + 63}{4p + 28}$	**5.** $\dfrac{50 - 2w^2}{3w^2 + 9w - 30} \cdot \dfrac{w^2 + 5w - 14}{6w - 30}$
6. $\dfrac{5y + 5}{2} \div \dfrac{25y - 20}{40y^2 - 32y}$	**7.** $\dfrac{2c^2 + 4c - 6}{4c^2 - 7c + 3} \div \dfrac{16c^2 + 48c}{16c^2 - 9}$
8. $\dfrac{6x}{x^2 - 16} - \dfrac{x - 20}{x^2 - 16}$	**9.** $\dfrac{16}{3} - \dfrac{4k + 56}{3k + 15}$

10. $\dfrac{m^2 - 7m - 18}{m^2 - 10m + 9} \div \dfrac{6}{m - 1}$	**11.** $\dfrac{r}{2r + 1} + \dfrac{12r - 6}{4r^2 - 1}$
12. $\dfrac{a + 4}{8a} + \dfrac{5}{24}$	**13.** $\dfrac{2}{h + 2} + \dfrac{5}{h + 5}$
14. $\dfrac{3x - 1}{x - 1} - \dfrac{x - 1}{x - 3} + \dfrac{x + 1}{x^2 - 4x + 3}$	

Topic 3: Complex Fractions

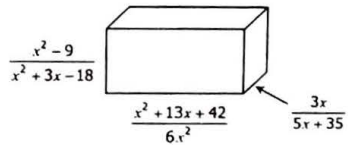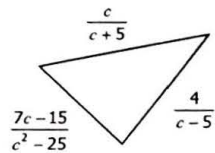|	
15. $\dfrac{\dfrac{12m^3}{m^2 + 14m + 45}}{\dfrac{3m^3 - 6m^2}{m^2 + 7m - 18}}$	**16.** $\dfrac{\dfrac{8k + 12}{9}}{\dfrac{k}{3} + \dfrac{1}{2}}$
17. $\dfrac{\dfrac{b}{2} - \dfrac{32}{b}}{1 + \dfrac{8}{b}}$	**18.** $\dfrac{\dfrac{x}{x + 1} + \dfrac{4}{x}}{\dfrac{4x + 7}{3x + 3} - \dfrac{1}{3}}$

Topic 4: Applications

19. If the **area** of the rectangle below is $\dfrac{n-3}{n}+\dfrac{7}{2}$, find w, its **width**.

$$\begin{array}{c}\boxed{} \\[2pt] \dfrac{3}{4n}-\dfrac{1}{2n^2}\end{array}$$

(rectangle with width w on the right side, and base label $\dfrac{3}{4n}-\dfrac{1}{2n^2}$)
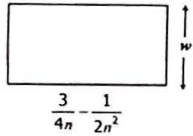
20. Find the **volume** of the rectangular prism below.

$\dfrac{x^2-9}{x^2+3x-18}$

$\dfrac{x^2+13x+42}{6x^2}$ $\dfrac{3x}{5x+35}$

21. Find the **perimeter** of the triangle below.

$\dfrac{c}{c+5}$

$\dfrac{7c-15}{c^2-25}$ $\dfrac{4}{c-5}$

Topic 5: Solving Rational Equations

22. $\dfrac{a-8}{a}=\dfrac{3}{a+5}$

23. $\dfrac{3}{2n}+\dfrac{1}{n^2}=\dfrac{n-2}{2n^2}$

24. $\dfrac{p^2+p+8}{p^2-7p+6}+\dfrac{2}{p-1}=\dfrac{2}{3}$

25. $\dfrac{1}{3}-\dfrac{1}{4v+3}=\dfrac{v^2-3v-18}{12v+9}$

Topic 6: Graphing Rational Functions

26. $f(x)=\dfrac{1}{x+4}-7$
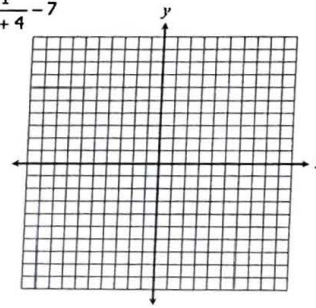
Domain: _____ VA: _____

Range: _____ HA: _____

27. $f(x)=\dfrac{-2}{x}+3$

Domain: _____ VA: _____

Range: _____ HA: _____

28. $f(x)=\dfrac{x+5}{x+2}$

x-int: _____

VA: _____

HA: _____

Hole: _____

Domain: _____

Range: _____

29. $f(x) = \dfrac{x^2 + 6x}{2x + 12}$

x-int: _____

VA: _____

HA: _____

Hole: _____

Domain: _____

Range: _____

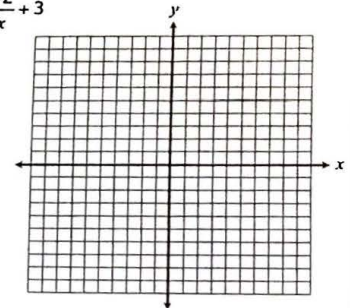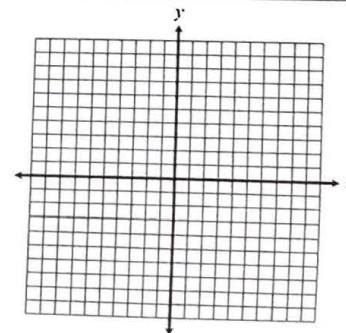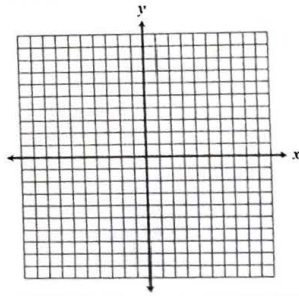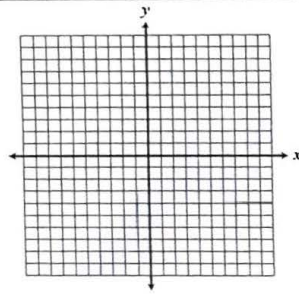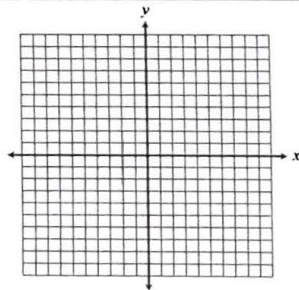**30.** $f(x) = \dfrac{x^2 - 11x + 24}{x^2 - 9}$

x-int: _____

VA: _____

HA: _____

Hole: _____

Domain: _____

Range: _____

31. $f(x) = \dfrac{3x + 3}{2x^2 + 9x + 7}$

x-int: _____

VA: _____

HA: _____

Hole: _____

Domain: _____

Range: _____

32. The reciprocal parent function is translated 8 units left and 3 units up. Write an equation to represent this function. Then, identify the asymptotes.

33. A rational function has an x-intercept at (-1, 0) and vertical asymptotes at $x = 7$ and $x = -5$. Write an equation that could represent this function, then identity the horizontal asymptote.

Topic 7: Variation

DIRECT VARIATION	JOINT VARIATION	INVERSE VARIATION

Translate into an equation to represent the relationship.

34. "s varies jointly with t cubed and v"	**35.** "m varies inversely with n squared and directly with p"

Determine if the equation represents a direct, joint, or inverse variation. Identify the constant.

36. $3y = x^2z$	**37.** $\dfrac{1}{2}d = r$	**38.** $\dfrac{8}{x} = \dfrac{y}{6}$

Use the variation type to find the missing value.

39. w varies directly as r cubed and inversely as s. If $w = 24$ when $r = 4$ and $s = 8$, find r when $w = 81$ and $s = 27$.	**40.** If b varies jointly with a and c and $b = 112$ when $a = 12$ and $c = 7$, find a when $b = 72$ and $c = 2$.

41. The wind force F on a sail varies jointly as the area A of the sail and the square of the wind speed w. The force on a sale with area an area of 500 ft² is 64.8 pounds when the wind speed is 18 mph. What would be the force for a sail with an area of 250 ft² with a wind speed of 35 mph.

42. The volume, V, of a gas varies directly as the temperature, t, and inversely as the pressure, P. At a temperature of 200° and a pressure of 500 mmHG, the volume of the gas is 240 cm³. Find the volume of the gas at a temperature of 275° and a pressure of 400 mmHG.

Unit 9 Test Study Guide
(Sequences & Series)

Name: _____

Date: _____ Block: _____

Topic 1: Sequences, Explicit & Recursive Formulas

1. What is a sequence? _____
_____

2. Describe the difference between recursive and explicit formulas: _____
_____
_____

Given the formula, write the first six terms of each sequence.

3. $a_1 = -1$; $a_n = 2a_{n-1} - 5$ (for $n \geq 2$)	**4.** $a_1 = 1$, $a_2 = 2$; $a_n = (a_{n-1})^2 - a_{n-2}$ (for $n \geq 3$)
5. $a_n = 3n - 8$	**6.** $a_n = \frac{1}{4} \cdot (-2)^{n-1}$
7. $a_n = \frac{n+4}{n+2}$	**8.** $a_n = n^3 - n^2$

Topic 2: Expanding & Evaluating Series

9. What is a series? _____

Write each sequence as a series, then find S_6.

10. $a_1 = 2$, $a_2 = 3$; $a_n = a_{n-1} \cdot a_{n-2}$ (for $n \geq 3$)	**11.** $a_n = n^2 + 2n$

Expand and evaluate each series.

12. $\displaystyle\sum_{k=1}^{16} (k-5)^2$

13. $\displaystyle\sum_{k=3}^{14} m^3 - 4m$

Topic 3: Arithmetic vs. Geometric Sequences

	Definition
ARITHMETIC	
GEOMETRIC	

For each sequence: a) Determine if the sequence is arithmetic, geometric, or neither and b) Determine the common difference (d) or common ratio (r).

14. $\{3, 12, 48, 192, 768, \ldots\}$	**15.** $\{16, 106, 1006, 10006, 100006, \ldots\}$
16. $\{2, -5, -12, -19, -26, \ldots\}$	**17.** $\left\{45, -15, 5, -\frac{5}{3}, \frac{5}{9}, \ldots\right\}$
18. $\{6, 8, 11, 15, 20, \ldots\}$	**19.** $\{-11, -8, -5, -2, 1, \ldots\}$
20. $\left\{-1125, -450, -180, -36, -\frac{36}{5}, \ldots\right\}$	**21.** $\{0, 1, 1, 2, 3, 5, \ldots\}$

Topic 4: Writing Arithmetic & Geometric Sequence Formulas

Arithmetic Sequence Formula:	Geometric Sequence Formula:

Write a formula for each arithmetic sequence, then find the indicated term.

22. $\{-13, -7, -1, 5, \ldots\}$; a_{42}	**23.** $\{34, 24, 14, 4, \ldots\}$; a_{30}
24. $\left\{-\frac{3}{8}, -\frac{1}{8}, \frac{1}{8}, \frac{3}{8}, \frac{5}{8}, \ldots\right\}$; a_{21}	**25.** $\left\{4, \frac{5}{2}, 1, -\frac{1}{2}, -2, \ldots\right\}$; a_{25}

Write a formula for the arithmetic sequence and find the indicated value.

26. $a_{31} = -108$; $d = -3$; Find a_1	**27.** $a_{14} = 15$; $d = 9$; Find a_4
28. $a_1 = -2$ and $a_{10} = 43$; Find d	**29.** $a_1 = 10$ and $a_{21} = 2$; Find a_{14}

Write a formula for each geometric sequence, then find the indicated term.

30. $\{8, -16, 32, -64, \ldots\}; a_{18}$	**31.** $\{6561, 2187, 729, 243, \ldots\}; a_{11}$
32. $\left\{18, 24, 32, \dfrac{128}{3}, \ldots\right\}; a_6$	**33.** $\left\{-\dfrac{2}{5}, -2, -10, -50, \ldots\right\}; a_8$

Write a formula for the geometric sequence and find the indicated value.

34. $a_5 = -10$ and $r = -\dfrac{1}{2}$; Find a_1	**35.** $a_1 = 2$ and $a_5 = 4802$; Find r
36. $a_3 = -18$ and $a_6 = 486$; Find a_1	**37.** $a_2 = 1500$ and $a_4 = 960$; Find a_6

Topic 5: Arithmetic & Geometric Series

Sum of an Arithmetic Series	Sum of a Geometric Series	Sum of a Convergent Infinite Geometric Series

Find the indicated sum for each series.

38. $\{6 + 1 + (-4) + (-9) + \ldots\}; S_{22}$	**39.** $\{2 + 12 + 72 + 432 + \ldots\}; S_{15}$
40. $\left\{800 - 200 + 50 - \dfrac{25}{2} + \ldots\right\}; S_8$	**41.** $\{(-29) + (-27) + (-25) + (-23) + \ldots\}; S_{36}$
42. $\displaystyle\sum_{y=1}^{9} -2 \cdot (-3)^{y-1}$	**43.** $\displaystyle\sum_{n=1}^{24} (4n - 7)$
44. $\displaystyle\sum_{k=3}^{10} 64 \cdot \left(\dfrac{1}{2}\right)^{k-1}$	**45.** $\displaystyle\sum_{m=6}^{39} (2m - 38)$

Determine if the series is convergent or divergent. Find the sum, if possible.

46. $\left\{-\dfrac{3}{2} + \dfrac{3}{4} - \dfrac{3}{8} + \dfrac{3}{16} + \ldots\right\}$	**47.** $\left\{24 + 6 + \dfrac{3}{2} + \dfrac{3}{8} + \ldots\right\}$

48. $\{4+16+64+256+...\}$	**49.** $\{500-300+180-108+...\}$
50. $\displaystyle\sum_{k=1}^{\infty} 9\cdot\left(\frac{4}{5}\right)^{k-1}$	**51.** $\displaystyle\sum_{r=1}^{\infty} 10\cdot\left(-\frac{4}{3}\right)^{r-1}$
52. $\displaystyle\sum_{n=4}^{\infty} -54\cdot\left(\frac{1}{3}\right)^{n-1}$	**53.** $\displaystyle\sum_{i=5}^{\infty} -\frac{9}{2}\cdot\left(-\frac{1}{2}\right)^{i-1}$

Topic 6: Applications

54. Bricks are stacked in a pile with 42 bricks on the bottom row and 9 bricks on the top row. Each row has three fewer bricks than the row below it. Write a formula to represent the number of bricks on each row, then determine the number of bricks on the 7th row.

55. A company is offering a job with a salary of $48,000 for the first year, then a raise of 2% each year after that. Write a formula to represent the salary after each year of employment, then determine the salary after 30 years.

56. The table shows the number of seats in the first three rows of the concert hall. This pattern continues for a total of 12 rows. Determine if there are enough seats for a group of 500 people to attend a concert.

Row	Seats
1	30
2	32
3	34