

Algebra 2 Mid-Year Test Study Guide - Dec. 2019

Name: _____

Date: _____ Block: _____

Topic 1: Radicals

Simplify each expression.

1. $\sqrt{243a^{25}}$

2. $3\sqrt{72} - 2\sqrt{8} + 2\sqrt{20}$

3. $\sqrt{2}(\sqrt{2} - 6\sqrt{10})$

4. $\frac{6}{\sqrt{12}}$

5. $\frac{\sqrt{2} - 2\sqrt{3}}{\sqrt{8}}$

6. $\frac{2 + \sqrt{3}}{5 - \sqrt{3}}$

Topic 2: Complex Numbers

***Recall:** $i =$ $i^2 =$ $i^3 =$ $i^4 =$ **Simplify each expression.**

7. $\sqrt{-81}$

8. $2\sqrt{-14} \cdot \sqrt{8}$

9. $18i^{49}$

10. $(i^3\sqrt{5})^2 \cdot 2i$

11. $(4 - 7i) - (5 + 2i)$

12. $(9 + 2i)(4 - i)$

13. $(6 - 2i)^2$

| | | |
|----------------------------|------------------------------|-------------------------------|
| 14. $\frac{15}{6i}$ | 15. $\frac{1-5i}{2i}$ | 16. $\frac{3-3i}{7-i}$ |
|----------------------------|------------------------------|-------------------------------|

Topic 3: Classifying Numbers & Identifying Properties

Simplify (if possible), then name all sets to which each value belongs.

| | | | |
|----------------------------------|-------------------------|-----------------------------------|---------------------------|
| 17. $\frac{\sqrt{64}}{5}$ | 18. $\sqrt{-36}$ | 19. $\sqrt{3} - \sqrt{3}$ | 20. $ 1 - 4^2 $ |
| 21. $2 + 5i$ | 22. $\sqrt{15}$ | 23. $-\sqrt{\frac{45}{5}}$ | 24. $-8i \cdot 5i$ |

Name the property that justifies each statement.

| | |
|---|--|
| 25. $\sqrt{5}(8 - \sqrt{3}) = 8\sqrt{5} - \sqrt{3} \cdot \sqrt{5}$ | 26. $2m^3 + (-2m^3) = 0$ |
| 27. $-9 \cdot (2 + 3i) = (2 + 3i) \cdot -9$ | 28. $\left(\frac{x}{5}\right) \cdot \left(\frac{5}{x}\right) = 1$ |

Topic 4: Factoring

Identify the special factoring patterns.

| | | |
|---|--------------------------------------|---|
| DIFFERENCE OF SQUARES $a^2 - b^2 =$ | SUM OF CUBES $a^3 + b^3 =$ | DIFFERENCE OF CUBES $a^3 - b^3 =$ |
|---|--------------------------------------|---|

Factor the expressions below completely.

| | |
|----------------------------|-----------------------|
| 29. $36x^2 - 64y^2$ | 30. $m^3 + 64$ |
|----------------------------|-----------------------|

| | |
|---------------------------------|-----------------------------------|
| 31. $81k^4 - 3k$ | 32. $2xy^5 + 250xy^2$ |
| 33. $p^3 - 10p^2 + 25p$ | 34. $x^4 - 11x^2 + 28$ |
| 35. $4x^3 + 18x^2 - 10x$ | 36. $9x^3 - 63x^2 - x + 7$ |

Topic 5: Absolute Value Equations & Inequalities

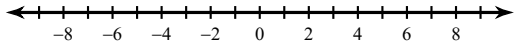
Solve each equation. Check all solutions.

37. $|4m + 5| = 9$

38. $-5|7 - x| + 6 = -14$

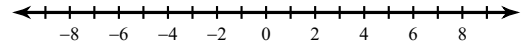
Solve each inequality and graph your solution. Write the solution in interval notation.

39. $|x - 2| \leq 3$



Interval Notation:

40. $-2|2x - 1| < -14$



Interval Notation:

Topic 6: Quadratic Equations

Discriminant Formula:

- If $d < 0$, there are **2 imaginary roots**.
- If $d = 0$, there is **1 rational root**
- If $d > 0$ and a **perfect square**, there are **2 rational roots**
- If $d > 0$ and **not a perfect square**, there are **2 irrational roots**.

Find the discriminant of each equation. Then, determine the number and type of roots.

41. $x^2 - 7x + 15 = 0$

42. $2x^2 - 72 = 0$

43. $-x^2 + 9x + 23 = 0$

Solve using the most appropriate method. Simplify all irrational and complex solutions.

44. $2x^2 - 18 = 78$

45. $x^2 - 16x + 73 = 0$

46. $9x^2 - 18x = 11$

47. $2x^2 - 10x - 26 = x - 5$

48. The roots of a quadratic equation are -7 and 1. Write an equation that could represent this function. Give your answer in standard form and factored form.

Topic 7: Polynomial Equations

Solve each equation. Simplify all irrational and complex solutions.

49. $x^3 - 27 = 0$

50. $2x^3 - 5x^2 + 18x - 45 = 0$

51. A polynomial function is defined by the equation below. Identify the zeros, their multiplicity, and the effect on the graph

$$f(x) = -2x(3x + 2)^7(x - 1)^2$$

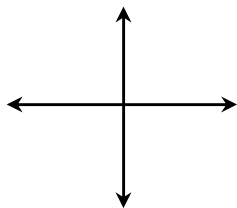
| Zero | Multiplicity | Effect |
|------|--------------|--------|
| | | |
| | | |
| | | |

52. The zeros of a polynomial equation are -4 (multiplicity 2) and 3 (multiplicity 1). Write an equation in standard form that could represent the function.

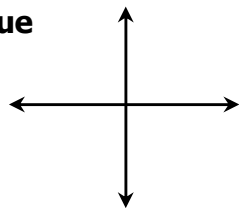
Topic 8: Parent Functions, Transformations, and Graphing

Identify each parent function, then sketch the graph.

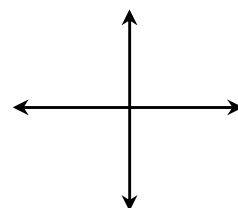
Linear



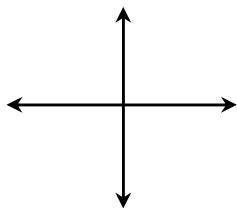
Absolute Value



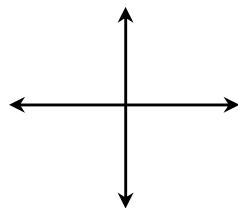
Quadratic



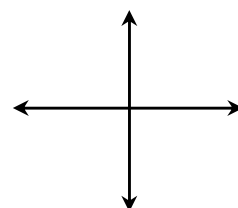
Cubic



Square Root

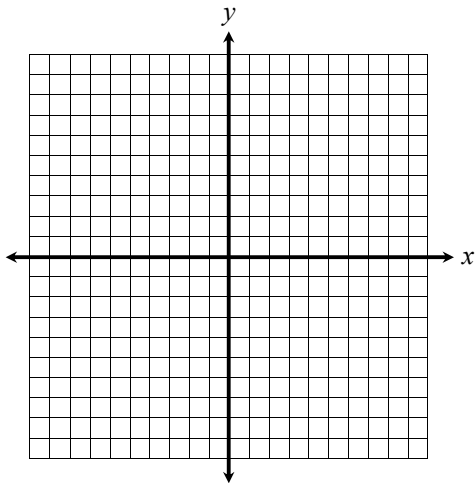


Cube Root



Graph each function and identify its key characteristics.

53. $f(x) = (x - 5)^2 - 3$



Domain: _____

Range: _____

Vertex: _____

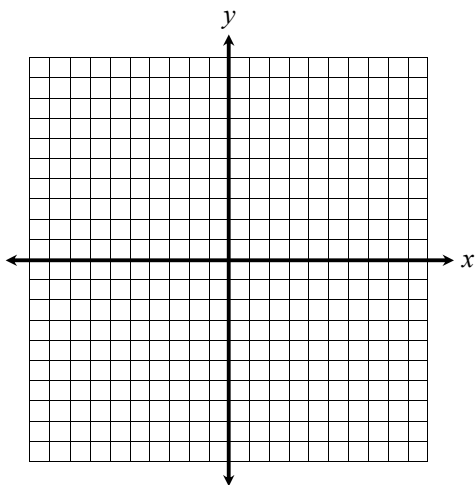
End Behavior: As $x \rightarrow \infty$, $f(x) \rightarrow$ _____

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

Inc. Intervals: _____

Dec. Intervals: _____

54. $f(x) = -2|x + 3| - 1$



Domain: _____

Range: _____

Vertex: _____

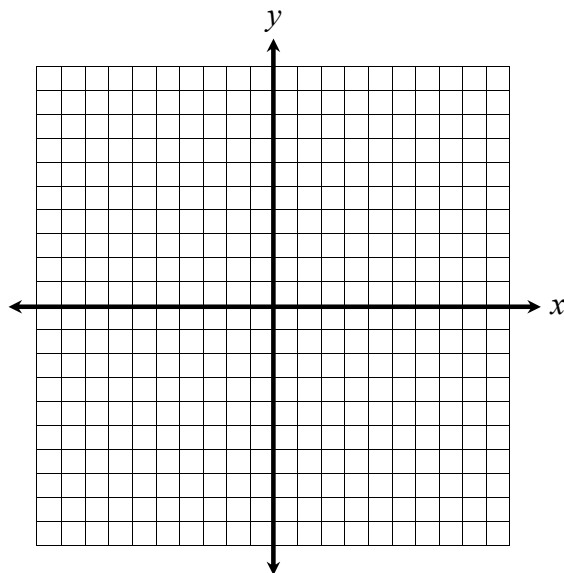
End Behavior: As $x \rightarrow \infty$, $f(x) \rightarrow$ _____

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

Inc. Intervals: _____

Dec. Intervals: _____

55. $f(x) = x^3 - 9x^2 + 24x - 16$



Domain: _____

Range: _____

Rel. Maximum(s): _____

Rel. Minimum(s): _____

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

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

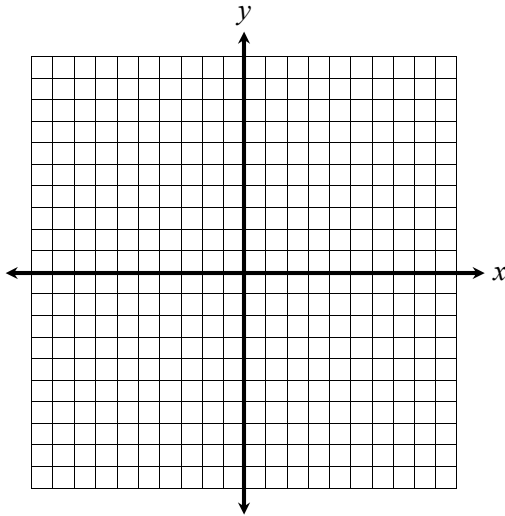
Inc. Intervals: _____

Dec. Intervals: _____

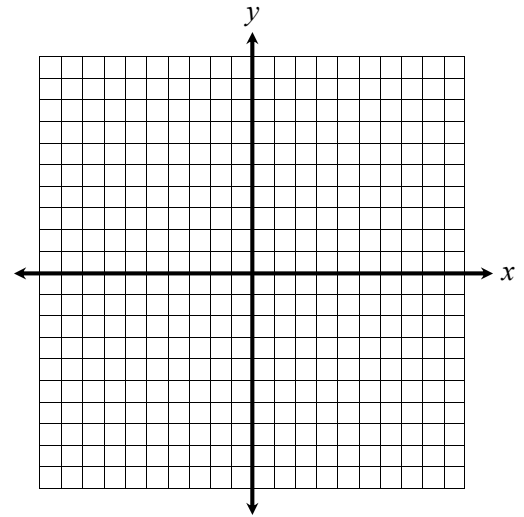
Topic 9: Graphing Absolute Value Inequalities

Graph each inequality.

56. $f(x) < |x - 4| - 1$



57. $f(x) \geq -\frac{1}{2}|x| + 5$



Topic 10: Applications & Regression

58. This past Saturday, Jack worked for 3 hours mowing the lawn and doing chores in the house. Mowing the lawn burns 352 calories per hour and doing chores burns 136 calories per hour. If he burned a total of 570 calories, how long did it take him to mow the lawn?

59. The pilot in a helicopter tossed a life float down to a swimmer in the water. The height, h , of the float after time t seconds is represented by the equation $h(t) = -16t^2 - 3t + 55$. Find the time it takes the float to reach the swimmer.

60. The table below shows the number of teachers, t , and the number of students, s , at 6 high schools in the city. Write a **linear** equation to model the data, then predict the number of teachers for a school with 1,500 students.

| | | | | | | |
|-----|-------|-------|-----|-------|-------|-----|
| t | 115 | 140 | 76 | 168 | 110 | 92 |
| s | 1,122 | 1,390 | 788 | 1,564 | 1,081 | 924 |

61. The table below shows the population, p , of a city during certain years, t . Write a **cubic** equation to model the data, then predict the population of the city in 2020.

| | | | | | | |
|-----|-------|-------|-------|-------|--------|--------|
| t | 1993 | 1996 | 2000 | 2005 | 2009 | 2014 |
| s | 2,850 | 3,257 | 4,234 | 6,475 | 10,158 | 27,385 |

Topic 11: Functions

Use $f(x) = x^2 + 5x - 14$, $g(x) = x + 1$, and $h(x) = 15 - 2x^2$ to answer questions 62 – 63.

62. Find $[f(7)] - 2$

63. If $g(x) = -23$, find x .

For each equation: (1) identify the function family, and (2) describe the transformations.

71. $f(x) = \frac{1}{3}(x + 7)^2 - 2$