Name_____ Date_____

4.4 Extra Practice

In Exercises 1–14, factor the polynomial completely.

1. $20x^3 - 220x^2 + 600x$
2. $m^5 - 81m$
3. $27a^3 + 8b^3$
4. $5t^6 + 2t^5 - 5t^4 - 2t^3$
5. $y^4 - 13y^2 - 48$
6. $5p^3 + 5p - 5p^2 - 5$
7. $810k^4 - 160$
8. $a^5 + a^3 - a^2 - 1$
9. $2x^6 - 8x^5 - 42x^4$
10. $5z^3 + 5z^2 - 6z - 6$
11. $12x^2 - 22x - 20$
12. $3m^2 - 48m^6$
13. $4x^3 - 4x^2 + x$
14. $5m^4 - 70m^3 + 245m^2$

In Exercises 15–17, show that the binomial is a factor of the polynomial. Then factor the polynomial completely.

15. $f(x) = x^3 - 13x - 12; x + 1$

16. $f(x) = 6x^3 + 8x^2 - 34x - 12; x - 2$

17. $f(x) = 2x^4 - 12x^3 + 6x^2 + 20x; x - 5$

18. Factor each polynomial completely.

    a. $5a^2c - 3a^2d - 5b^2c + 3b^2d$

    b. $x^{2n} + 6x^n + 9$

19. What is the value of k such that $x - 6$ is a factor of $f(x) = 3x^3 - 17x^2 - kx + 18$? Justify your answer.

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4.5 Extra Practice

In Exercises 1–6, solve the equation.

1. $36r^3 - r = 0$
2. $20x^3 + 80x^2 = -60x$
3. $3m^2 = 75m^4$
4. $-13y^2 + 36 = -y^4$
5. $2x^3 - x^2 - 2x = -1$
6. $-20c^2 + 50c = 8c^3 - 125$

In Exercises 7–10, find the zeros of the function. Then sketch a graph of the function.

7. $f(x) = x^4 - x^3 - 12x^2$
8. $f(x) = -4x^3 + 12x^2 - 9x$
9. $f(x) = x^3 + 4x^2 - 6x - 24$
10. $f(x) = x^4 - 18x^2 + 81$

11. Find all the real solutions of $x^3 - 8x^2 - 21x + 108 = 0$.

12. Find all the real zeros of $f(x) = 3x^4 + 11x^3 - 40x^2 - 132x + 48$.

13. Write a polynomial function g of least degree that has rational coefficients, a leading coefficient of 1, and the zeros -5 and $4 + \sqrt{2}$.

14. All the possible rational solutions and actual rational solutions of the equation below are shown. Complete the equation.

    Possible: $\pm 1, \pm 2, \pm 3, \pm 6, \pm\frac{1}{2}, \pm\frac{3}{2}$

    Actual: $-3, \frac{1}{2}$

    $(x + \_\_\_\_)(x + \_\_\_\_)(x^2 + \_\_\_\_) = 0$

Name_____ Date_____

4.6 Extra Practice

In Exercises 1 and 2, identify the number of solutions of the polynomial equation. Then find all the solutions.

1. $2x^3 - 11x^2 - 2x + 2 = 0$

2. $x^4 + x^3 + 3x^2 + 9x = 54$

In Exercises 3–6, find all the zeros of the polynomial function.

3. $h(x) = x^4 - 3x^3 + 6x^2 + 2x - 60$

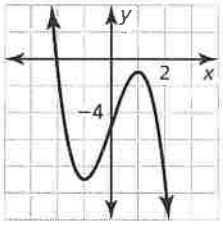
4. $f(x) = x^3 - 3x^2 - 15x + 125$

5. $g(x) = x^4 - 48x^2 - 49$

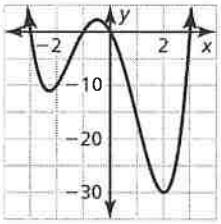
6. $h(x) = -5x^3 + 9x^2 - 18x - 4$

In Exercises 7 and 8, determine the number of imaginary zeros for the function with the given degree and graph. Explain your reasoning.

7. Degree: 3



8. Degree: 4



In Exercises 9–12, write a polynomial function *f* of least degree that has rational coefficients, a leading coefficient of 1, and the given zeros.

9. $-4, 1, 7$

10. $10, -\sqrt{5}$

11. $8, 3, -i$

12. $0, 2 - \sqrt{2}, 2 + 3i$

In Exercises 13 and 14, determine the possible numbers of positive real zeros, negative real zeros, and imaginary zeros for the function.

13. $g(x) = x^5 - 3x^4 - 7x^2 + 9$

14. $g(x) = x^6 + 2x^5 + x^4 - 3x^3 - 5x^2 + x - 8$

15. Three zeros of $f(x) = x^4 - x^3 - 4x^2 - 16x - 320$ are 5, $4i$, and $-4i$. Is the fourth zero *real* or *imaginary*? Explain your reasoning.