Name_____ Class_____ Date_____

5-5 Practice

Form K

Theorems About Roots of Polynomial Equations

Use the Rational Root Theorem to list all possible rational roots for each equation. Then find any actual rational roots.

1. $x^3 - 5x^2 + 17x - 13$

To start, list the constant term's factors and the leading coefficient's factors.

constant term factors: $\pm 1, \pm 13$

leading coefficient factors: ± 1

2. $2x^3 - 5x^2 + x - 7$

3. $x^3 - 4x^2 - 15x + 18$

4. $x^3 - 8x^2 - 2$

5. $x^3 - x^2 + 6x - 6$

6. $4x^3 + 12x^2 + x + 3$

7. $x^3 - 3x^2 - 16x - 12$

8. $x^3 + 8x^2 - x - 8$

9. $x^3 - 3x^2 - 24x - 28$

Find all rational roots for $P(x) = 0$.

10. $P(x) = x^3 + 5x^2 + 2x - 8$

11. $P(x) = x^4 - 4x^3 - 13x^2 + 4x + 12$

12. $P(x) = x^3 + 14x^2 + 53x + 40$

13. $P(x) = x^3 + 3x^2 - 4x - 12$

14. $P(x) = x^3 + 5x^2 - 9x - 45$

15. $P(x) = x^3 + 9x^2 - x - 9$

16. $P(x) = x^3 - 7x^2 - x + 7$

17. $P(x) = x^3 - 7x^2 + 14x - 8$

Name_____ Class _____ Date_____

5-5 Practice (continued) *Form K*

Theorems About Roots of Polynomial Equations

A polynomial function $P(x)$ with rational coefficients has the given roots. Find two additional roots of $P(x) = 0$.

18. $1 + 4i$ and $\sqrt{3}$

19. $3 - \sqrt{2}$ and $1 + \sqrt{3}$

20. $-8i$ and $7 - i$

21. $6 - \sqrt{7}$ and $-3 + \sqrt{10}$

22. $\sqrt{2}$ and $-\sqrt{13}$

23. $1 - \sqrt{3}$ and $1 + \sqrt{2}$

Write a polynomial function with rational coefficients so that $P(x) = 0$ has the given roots.

24. $3i$

To start, use the Conjugate Root Theorem to identify a second root.

Since $3i$ is a root, $-3i$ is also a root.

25. -2 and -8

26. 4 and 1

27. $2i$ and $\sqrt{2}$

28. $3 + i$ and $1 - \sqrt{3}$

29. -4 and $5i$

30. $2i$ and i

What does Descartes' Rule of Signs say about the number of positive real roots and negative real roots for each polynomial function?

31. $P(x) = x^3 - x^2 - 8x + 12$

To start, count and identify the number of sign changes in $P(x)$.

There are 2 sign changes in $P(x)$. So there are 0 or 2 positive real roots.

32. $P(x) = 2x^3 + 2x^2 - 5x - 2$

33. $P(x) = x^4 - 3x^3 - x + 5$

Name_____ Class_____ Date_____

5-6 Practice

Form K

The Fundamental Theorem of Algebra

Without using a calculator, find all the roots of each equation.

1. $x^3 - 5x^2 + x - 5 = 0$

To start, identify the possible rational roots.

The possible rational roots are $\pm 1, \pm 5$

2. $x^5 + 3x^4 - 8x^3 - 24x^2 - 9x - 27 = 0$

3. $x^3 + 4x^2 + 9x + 36 = 0$

4. $x^3 + x^2 - 2x - 2 = 0$

5. $x^4 + 15x^2 - 16 = 0$

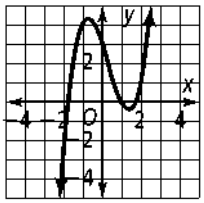
6. $x^4 - 8x^3 + 19x^2 - 32x + 60 = 0$

7. $x^3 + 5x^2 - 3x - 15 = 0$

Find all the zeros of each function.

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

To start, use a graphing calculator to find the possible rational roots.



9. $y = x^4 - 4x^3 + 7x^2 - 16x + 12$

10. $f(x) = x^3 + x^2 + 16x + 16$

11. $g(x) = x^3 - 4x^2 + 4x - 3$

12. $y = x^3 + 6x^2 - 5x - 30$

13. $f(x) = x^4 - 2x^3 + 2x^2 - 2x + 1$

14. $y = x^4 + 2x^3 - 5x^2 - 4x + 6$

5-6 Practice (continued) *Form K*

The Fundamental Theorem of Algebra

For each equation, state the number of complex roots, the possible number of positive real roots, and the possible rational roots.

15. $x^2 + 8x - 5 = 0$

16. $2x^3 - 18x + 4 = 0$

17. $x^4 + 8x^2 + 2 = 0$

18. $x^6 - 8x^4 + 2x^2 - 10 = 0$

19. $x^3 - 2x + 6 = 0$

20. $8x + x^2 - 12 = 0$

Find the number of complex roots for each equation.

21. $5x^6 + 3x^4 + x - 10 = 0$

22. $-4x^3 + 2x^2 - x + 5 = 0$

23. $2x^5 + 2x^3 - x^2 + 12x - 8 = 0$

24. $-x^3 + 7x^2 - 12x + 9 = 0$

25. $3x^8 + 4x^6 + 5x^2 - x + 15 = 0$

26. $12x^5 + 3x^4 + 2x^2 - 12 = 0$

27. $-5x^3 + 2x^3 + 2x - 32 = 0$

28. $x^{10} - 25 = 0$

29. Error Analysis Your friend says that the function $3x^4 - 2x^3 - x + 12 = 0$ has 3 complex roots. You say that the function has 4 complex roots. Who is correct? What mistake was made?

30. A section of a bridge can be modeled by the function $f(x) = x^4 - 5x^3 - 10x^2 + 20x + 24$. Support beams for this bridge will be placed at one of the zeros. What are the possible locations for the support beams?

31. How many complex roots does the equation $x^4 = 81$ have? What are they?