HW 2-1 5-1

Name _____ Class _____ Date _____

# Practice

Form G

## Polynomial Functions

* 2 pages.

**Write each polynomial in standard form. Then classify it by degree and by number of terms.**

1. $4x + x + 2$ — $5x+2$ linear binomial
2. $-3 + 3x - 3x$ — $-3$ constant monomial
3. $6x^4 - 1$ — $6x^4-1$ quartic binomial
4. $1 + 2s + 5s^4$ — $5s^4+2s+1$ quartic trinomial
5. $5m^2 - 3m^2$ — $2m^2$ quadratic monomial
6. $x^2 + 3x - 4x^3$ — $-4x^3+x^2+3x$ cubic +
7. $-1 + 2x^2$
8. $5m^2 - 3m^3$
9. $5x - 7x^2$
10. $2 + 3x^3 - 2$
11. $6 - 2x^3 - 4 + x^3$
12. $6x - 7x$
13. $a^3(a^2 + a + 1)$
14. $x(x + 5) - 5(x + 5)$
15. $p(p - 5) + 6$
16. $(3c^2)^2$
17. $-(3 - b)$
18. $6(2x - 1)$
19. $\frac{2}{3} + s^2$
20. $\frac{2x^4 + 4x - 5}{4}$
21. $\frac{3 - z^5}{3}$

**Determine the end behavior of the graph of each polynomial function.**

22. $y = 3x^4 + 6x^3 - x^2 + 12$
23. $y = 50 - 3x^3 + 5x^2$
24. $y = -x + x^2 + 2$
25. $y = 4x^2 + 9 - 5x^4 - x^3$
26. $y = 12x^4 - x + 3x^7 - 1$
27. $y = 2x^5 + x^2 - 4$
28. $y = 5 + 2x + 7x^2 - 5x^3$
29. $y = 20 - 5x^6 + 3x - 11x^3$
30. $y = 6x + 25 + 4x^4 - x^2$

**Describe the shape of the graph of each cubic function by determining the end behavior and number of turning points.**

31. $y = x^3 + 4x$
32. $y = -2x^3 + 3x - 1$
33. $y = 5x^3 + 6x^2$

**Determine the degree of the polynomial function with the given data.**

34.

| x | y |
|---|---|
| −2 | −16 |
| −1 | 1 |
| 0 | 4 |
| 1 | 5 |
| 2 | 16 |

35.

| x | y |
|---|---|
| −2 | 52 |
| −1 | 6 |
| 0 | 2 |
| 1 | 4 |
| 2 | 48 |

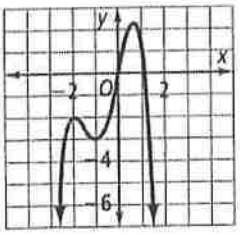
HW 2-1 5-1

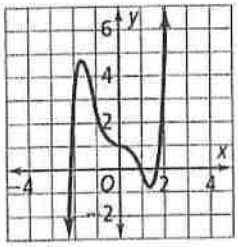
Name _____ Class _____ Date _____

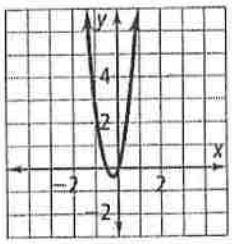
## Practice (continued) Form G

Polynomial Functions

**Determine the sign of the leading coefficient and the degree of the polynomial function for each graph.**

36. 


37. 


38. 


39. **Error Analysis** A student claims the function $y = 3x^4 - x^3 + 7$ is a fourth-degree polynomial with end behavior of down and down. Describe the error the student made. What is wrong with this statement?

40. The table at the right shows data representing a polynomial function.
    a. What is the degree of the polynomial function?
    b. What are the second differences of the $y$-values?
    c. What are the differences when they are constant?

| $x$ | $y$ |
|---|---|
| −3 | −999 |
| −2 | −140 |
| −1 | −7 |
| 0 | 0 |
| 1 | 1 |
| 2 | 116 |
| 3 | 945 |

**Classify each polynomial by degree and by number of terms. Simplify first if necessary.**

41. $4x^5 - 5x^2 + 3 - 2x^2$

42. $b(b - 3)^2$

43. $(7x^2 + 9x - 5) + (9x^2 - 9x)$

44. $(x + 2)^3$

45. $(4s^4 - s^2 - 3) - (3s - s^2 - 5)$

46. 13

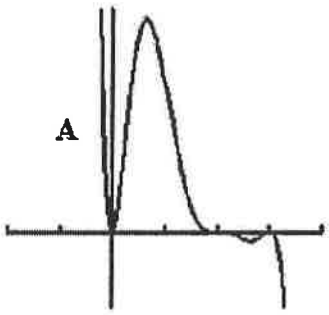
47. **Open-Ended** Write a third-degree polynomial function. Make a table of values and a graph.

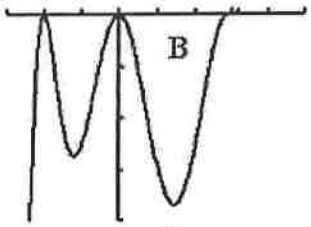
48. **Writing** Explain why finding the degree of a polynomial is easier when the polynomial is written in standard form.

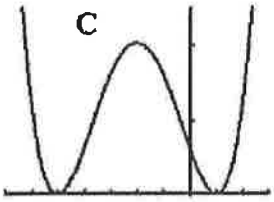
HW 2-2 → 2 pages

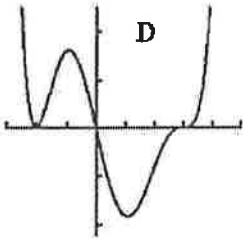
Using the given equation in the table, fill in the rest for each example. Lastly, match each polynomial to its correct graph shown below. The first one is done for you. **Some of them don't have matches!**

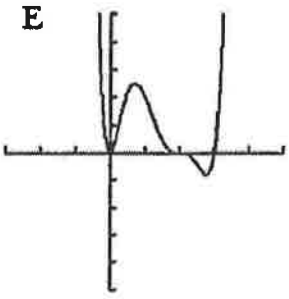
| Equation | Graph | Degree | (Root, multiplicity) |
|---|---|---|---|
| $y = x(x+2)^2(x-3)^3$ | D | 6 | x = 0, m = 1 \| x = -2, m = 2 \| x = 3, m = |
| $y = x^2(x+2)^2(x-3)^3$ | | | |
| $y = (x+5)^2(x-1)$ | | | |
| $y = (x+5)^2(x-1)^2$ | | | |
| $y = -(x-1)^3(x+1)\ \ (x+2)$ | | | |
| $\boldsymbol{y = (x-1)^3(x+1)\ \ (x-2)}$ | | | |
| $y = (x-4)^2(x+3)^2$ | | | |
| $y = -(x-4)^2(x+3)^2$ | | | |
| $y = x^2(x-2)^3(x-3)$ | | | |
| $y = -x^2(x-2)^3(x-3)^2$ | | | |

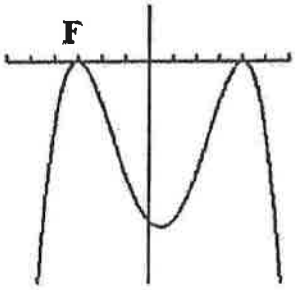


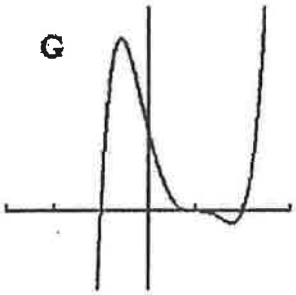



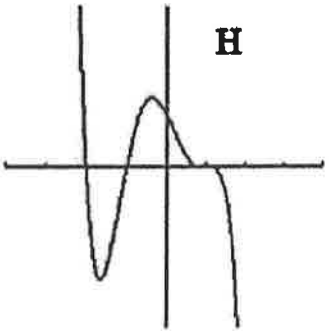



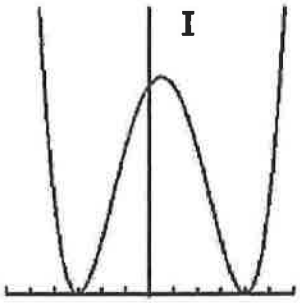



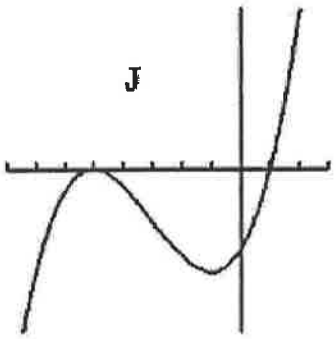






HW 2-2 Cont

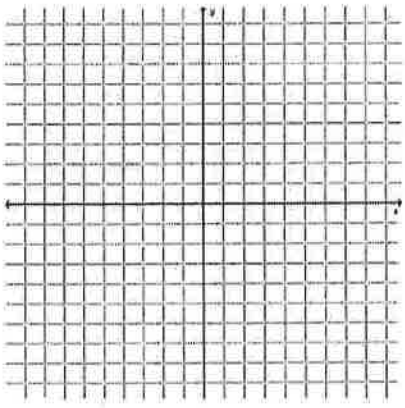
Describe the zeros, multiplicity, and end behavior of the graph of each function.

1. $y = -x(x+2)^2(x-3)$

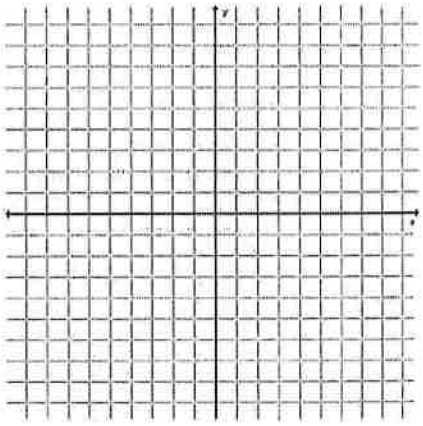
2. $y = x^2(x-1)(x+3)$

Sketch the graph of the polynomial based on the end behavior, zeros, and multiplicity.

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



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



H. Math 3 HW 2-3 Name_____

Do all work on notebook paper!!

## I. Factor the polynomial completely

| | | |
|---|---|---|
| 1. $14x^2 - 21x$ | 2. $c^3 + 9c^2 + 18c$ | 3. $3y^5 - 48y^3$ |
| 4. $m^3 - 6m^2 - 72m$ | 5. $x^3 + 8$ | 6. $y^3 - 64$ |
| 7. $27m^3 + 1$ | 8. $192w^3 - 3$ | 9. $y^3 - 7y^2 + 4y - 28$ |
| 10. $x^4 - 25$ | 11. $32x^5 - 2x$ | 12. $x^4 + 7x^2 + 6$ |

## II. Solve to find all roots.

| | | |
|---|---|---|
| 13. $y^3 - 5y^2 = 0$ | 14. $m^3 + 3m^2 - m - 3 = 0$ | 15. $x^4 - 5x^2 + 4 = 0$ |
| 16. $x^4 - 9x^2 + 14 = 0$ | 17. $x^4 = 81x^2$ | 18. $x^3 - 27 = 0$ |
| 19. $x^3 - 64 = 0$ | 20. $4x^2 - 9 = 0$ | 21. $x^2 + 4 = 0$ |

Name _____ Class _____ Date _____

# 5-3 Practice

Form G

## Solving Polynomial Equations

HW 2-4

**Find the real or imaginary solutions of each equation by factoring.**

1. $8x^3 - 27 = 0$
2. $x^3 + 64 = 0$
3. $2x^3 + 54 = 0$
4. $2x^3 - 250 = 0$
5. $4x^3 - 32 = 0$
6. $27x^3 + 1 = 0$
7. $64x^3 - 1 = 0$
8. $x^3 - 27 = 0$
9. $x^4 - 5x^2 + 4 = 0$
10. $x^4 - 12x^2 + 11 = 0$
11. $x^4 - 10x^2 + 16 = 0$
12. $x^4 - 8x^2 + 16 = 0$
13. $x^4 - 9x^2 + 14 = 0$
14. $x^4 + 13x^2 + 36 = 0$
15. $x^4 - 10x^2 + 9 = 0$
16. $x^4 + 3x^2 - 4 = 0$

Show All work on notebook paper!

# 2, 4, 8, 10, 12, 14

**Find the real solutions of each equation by graphing.**

17. $2x^4 = 9x^2 - 4$
18. $x^2 - 16x = -1$
19. $6x^3 + 10x^2 + 5x = 0$
20. $36x^3 + 6x^2 = 9x$
21. $15x^4 = 11x^3 + 14x^2$
22. $x^4 = 81x^2$

**For Exercises 23 and 24, write an equation to model each situation. Then solve each equation by graphing.**

23. The volume $V$ of a container is 84 $ft^3$. The width, the length, and the height are $x$, $x + 1$, and $x - 4$ respectively. What are the container's dimensions?

24. The product of three consecutives integers $n - 1$, $n$, and $n + 1$ is $-336$. What are the integers?

Name _____ Class _____ Date _____

# 5-4 Practice

Form G

## Dividing Polynomials

HW 2-5

Show work on Notebook paper!

**Divide using long division. Check your answers.**

1. $(x^2 - 13x - 48) \div (x + 3)$
2. $(2x^2 + x - 7) \div (x - 5)$
3. $(x^3 + 5x^2 - 3x - 1) \div (x - 1)$
4. $(3x^3 - x^2 - 7x + 6) \div (x + 2)$
5. $(x^2 - 3x + 1) \div (x - 4)$
6. $(x^3 - 4x^2 + 3x + 2) \div (x + 2)$

**Determine whether each binomial is a factor of $x^3 + 3x^2 - 10x - 24$.**

7. $x + 4$
8. $x - 3$
9. $x + 6$
10. $x + 2$

**Divide using synthetic division.**

11. $(x^3 - 8x^2 + 17x - 10) \div (x - 5)$
12. $(x^3 + 5x^2 - x - 9) \div (x + 2)$
13. $(-2x^3 + 15x^2 - 22x - 15) \div (x - 3)$
14. $(x^3 + 7x^2 + 15x + 9) \div (x + 1)$
15. $(x^3 + 2x^2 + 5x + 12) \div (x + 3)$
16. $(x^3 - 5x^2 - 7x + 25) \div (x - 5)$
17. $(x^4 - x^3 + x^2 - x + 1) \div (x - 1)$
18. $(2x^4 + 7x^3 - 11x^2 + 21x + 5) \div (x + 5)$
19. $(x^4 - 5x^3 + 5x^2 + 7x - 12) \div (x - 4)$
20. $(2x^4 + 23x^3 + 60x^2 - 125x - 500) \div (x + 4)$

**Use synthetic division and the given factor to completely factor each polynomial function.**

21. $y = x^3 + 3x^2 - 13x - 15; (x + 5)$
22. $y = x^3 - 3x^2 - 10x + 24; (x - 2)$
23. $y = x^3 + x^2 - 10x + 8; (x - 1)$
24. $y = x^3 + 4x^2 - 9x - 36; (x + 3)$
25. The expression $V(x) = x^3 - 13x + 12$ represents the volume of a rectangular safe in cubic feet. The length of the safe is $x + 4$. What linear expressions with integer coefficients could represent the other dimensions of the safe? Assume that the height is greater than the width.

**Use synthetic division and the Remainder Theorem to find $P(a)$.**

26. $P(x) = 3x^3 - 4x^2 - 5x + 1; a = 2$
27. $P(x) = x^3 + 7x^2 + 12x - 3; a = -5$
28. $P(x) = x^3 + 6x^2 + 10x + 3; a = -3$
29. $P(x) = 2x^4 - 9x^3 + 7x^2 - 5x + 11; a = 4$

HW 2-6

Show ALL work on Notebook Paper!

**Divide using long division**

1) $2x^3 - 3x^2 - 4x + 5 \div x + 1$

2) $8x^2 - 26x - 9 \div 2x - 7$

3) $9x^3 + 18x^2 - 4x - 10 \div x + 2$

4) $x^6 - 4x^3 - 42 \div x - 1$

5) $(2x^4 - 5x^3 + 2x^2 + 5x - 10) \div (x - 2)$

6) $(x^3 - 4x^2 + 9) \div (x - 3)$

7) $(x^4 - 2x^3 - 70x + 20) \div (x - 5)$

8) $(4x^4 + 5x^3 + 2x^2 - 1) \div (x + 1)$

**Use the Remainder Theorem**

1) Is $(x - 1)$ a factor of $x^3 + 2x^2 - 2x - 1$?

2) Is $(x + 2)$ a factor of $4x^2 + 13x + 10$?

3) What is the remainder when $3x^3 + 10x^2 + x - 6$ is divided by $x + 3$

4) Is $(x - 2)$ a factor of $4x^2 + 13x + 10$?

5) What is the remainder when $3x^3 + 10x^2 + x - 6$ is divided by $x - 1$?

**Find the zeros using the given information**

1) Find all the zeros of $f(x) = x^3 - 4x^2 + x + 6$ given that $x + 1$ is a factor.

2) Solve for all the solutions of $2x^3 - 5x^2 + x + 2 = 0$ given that 2 is a solution.

3) Find all the zeros of $g(x) = 2x^3 + 3x^2 + 8x + 12$ if $-\frac{3}{2}$ is a root.

HW 2-7

**Use the Remainder Theorem to find out if the divisor is a factor. If not, what is the remainder?**

1) $(2x^2 - 3x + 1) \div (x - 2)$

2) $(x^4 - 5) \div (x - 1)$

3) $x^3 - x^2 + 2x - 1 \div (x + 3)$

4) $x^5 - 2x^4 + 3x^2 - 20x + 3 \div (x + 1)$

**Use the Rational Zeros Theorem to a) write a list of all potential zeros, b) use the Remainder Theorem to determine which ones, if any, are zeros, and c) find remaining zeros.**

5) $y = x^3 - 9x^2 + 28x - 30$

6) $y = x^4 + x^3 + 2x^2 + 4x - 8$

**Use your calculator to find a zero of the given polynomial. Then, find the remaining roots.**

7) $y = 2x^3 - 3x^2 - 14x + 15$

8) $y = -3x^3 + 20x^2 - 36x + 16$

11) $y = 3x^3 - x^2 - 5x + 3$

12) $y = x^3 - 6x^2 + 4x + 16$

(HW 2-8)

# Finding Zeros Practice

**Now it's time to practice. Fill in the table. Follow the example provided.**
Graph each polynomial function on your calculator. You may need to change your window to get a "good" picture. Sketch the graph. Write the degree of the function and find the number of real zeros (number of $x$-intercepts). Using synthetic division and your real zeros, find all the zeros of the function. Remember once you have a quadratic expression and you can factor or use the quadratic formula to solve.

| Function | Degree | # Of Zeros | Graph | # Of Real Zeros | List of All Zeros |
|---|---|---|---|---|---|
| **1.** $f(x)=x^3-3x^2+x-3$ | | | | | |
| **3.** $f(x)=x^3-4x^2-7x+10$ | | | | | |
| **4.** $g(x)=x^4-x^3+2x^2-4x-8$ | | | | | |
| **5.** $f(x)=x^3+3x^2-4x-6$ | | | | | |

HW 2-8 cont

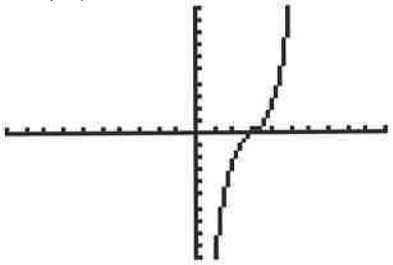
| Function | Degree | # Of Zeros | Graph | # Of Real Zeros | List of All Zeros |
|---|---|---|---|---|---|
| **6.** $h(x)=x^4+2x^3-5x^2-4x+6$ | | | | | |
| **7.** $g(x)=x^3+6x^2-6x-36$ | | | | | |
| **9.** $f(x)=x^3+8$ | | | | | |
| **10.** $f(x)=x^4-x^3+9x^2-9x$ | | | | | |

w Unit 2 Review ⇒ 2 pages

Show ALL work on notebook paper!

1. **Simplify:** $\left(2x^3-6x+4\right)-\left(3x^4-2x^3+4x^2+1\right)+\left(x^3-9x^2+8\right)$
2. **Simplify:** $(2x-1)(x+3)^2$
3. **Factor:** $3x^3+12x^2-3x-12$
4. **Solve:** $16x^3+54=0$
5. **Solve:** $x^4-9x^2+20=0$
6. **Divide using long division:** $\left(5x^4+14x^3+9x^2+38x+1\right)\div\left(x^2+3x\right)$
7. **Divide using synthetic division:** $\left(2x^4-3x^2+4\right)\div(x-1)$
8. **Write the polynomial function given the following zeros: 0,-2 , 3/5**
9. **List the number of zeros, the number of real zeros, and then list all zeros:**

$f(x)=x^3-9x^2+28x-30$

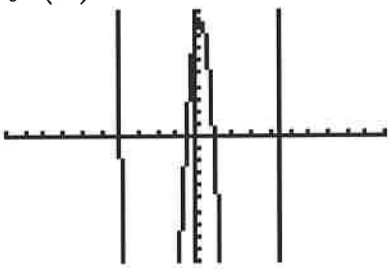


| X | Y1 |
|---|---|
| 0 | -30 |
| 1 | -10 |
| 2 | -2 |
| 3 | 0 |
| 4 | 2 |
| 5 | 10 |
| 6 | 30 |

X=3

10. **List the number of zeros, the number of real zeros, and then list all zeros:**

$f(x)=x^4-x^3-18x^2+10x+8$



| X | Y1 |
|---|---|
| -5 | 258 |
| -4 | 0 |
| -3 | -76 |
| -2 | -60 |
| -1 | -18 |
| 0 | 8 |
| 1 | 0 |

X=1

11. A shipping company wants to make an open box from a sheet of cardboard 12 in by 15 in. Write a function for the volume of the box. Find the max volume of the box and the length of the side cut-outs for max volume.
12. A rectangular patio is 12 feet by 14 feet. The homeowner wants to increase the area by 30 sq ft. Find the equation that could be used to find what value of "x" could be added to each dimension to get the new area.
13. Write polynomial function in factored form with roots at x=-4 with multiplicity of 2, x=2 with multiplicity 3 and x=0 with multiplicity 1.

w

14. In $f(x) = -x^3(x-2)(x+1)^2$, a. Describe the end behavior, b. the roots and multiplicity

15. Solve: $\frac{2}{3}|x-1| - 1 > 5$

16. Use the remainder theorem to find the remainder when $\frac{1}{3}x^2 + 4x^3 - 2x + \frac{2}{3}$ is divided by $x-2$.

17. Is x-1 a factor of the polynomial $x^3 + x^2 - 2 = 0$ ? If so, solve to find all the roots.

18. Find the discriminant of $3x^2 - 2x = 5$ and completely describe the roots.

19. Classify each polynomial by degree and by number of terms. Simplify first if necessary.

A. $2x(x-3) - x(x+7)$

B. $(-8x^3 - 2x + 5) - (-x^3 - 6)$

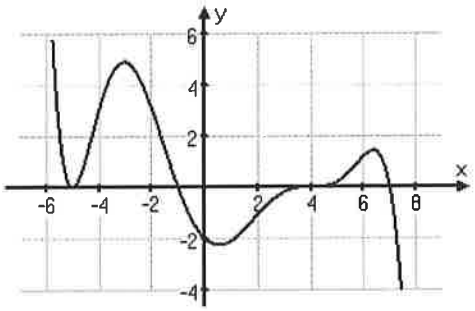
20. For the function $f(x) = -x^2(x-2)$ A. describe the end behavior

B. determine x intercepts

21. Write a polynomial function in factored form with roots at x =-3 with multiplicity 4, x = -2 with multiplicity 3 and x = 0 with multiplicity 1.

22. Is x+2 a factor of the polynomial $2x^4 + 6x^3 + 5x - 6$? If so what are the other factors? If not, why?

23/.Write the polynomial of the given graph $f(x)$, including the correct multiplicities and leading coefficient.




**Be sure to study placemat for this unit, quizzes, notes and homework!**