

Lesson 7.1 • Polynomial Degree and Finite Differences

Name _____ Period _____ Date _____

1. Identify the degree of each polynomial.

a. $3x^4 - 2x^3 + 3x^2 - x + 7$

b. $x^5 - 1$

c. $0.2x - 1.5x^2 + 3.2x^3$

d. $250 - 16x^2 + 20x$

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

f. $5x^2 - 6x^5 + 2x^6 - 3x^4 + 8$

2. Determine which of the expressions are polynomials. For each polynomial, state its degree and write it in general form. If it is not a polynomial, explain why not.

a. $1 + x^2 - x^3$

b. $0.2x^3 + 0.5x^4 + 0.6x^2$

c. $x - \frac{1}{x^2}$

d. 25

e. $-\frac{2}{3}x^2 + \frac{3}{5}x^3 + \frac{5}{12} + \frac{5}{8}x$

f. $\sqrt{x} + 3x^2 + 5$

3. For the data set below, find each set of common differences until the common differences are constant. State the degree of polynomial that models the data.

x	-3	-2	-1	0	1	2	3
y	22	22	14	4	-2	2	22

4. The figures below show why the numbers in the sequence 1, 3, 6, 10, ... are called *triangular numbers*.



- a. Complete the table.

<i>n</i>	1	2	3	4	5	6	7
<i>n</i>th triangular number	1	3	6	10			

- b. Calculate the finite differences for the completed table.
- c. What is the degree of the polynomial function that you would use to model this data set?
- d. Write a polynomial function t that gives the n th triangular number as a function of n . (*Hint*: Create and solve a system of equations to find the coefficients.)

Lesson 7.2 • Equivalent Quadratic Forms

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1. Identify each quadratic function as being in general form, vertex form, factored form, or none of these forms. Give all answers that apply.

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

b. $y = (x - 2.5)^2 + 7.5$

c. $y = -0.5(x + 3)^2$

d. $y = 2(x - 8)(x + 6)$

e. $y = -1.5x(x - 2)$

f. $y = x^2 - 7$

2. Convert each quadratic function to general form.

a. $y = 2x(x - 5)$

b. $y = (x - 3)^2$

c. $y = 1.5(x + 2)^2 - 3$

d. $y = 2(x - 5)(x + 7)$

e. $y = -5(x + 3)(x - 2) - 30$

f. $y = 3(x - 1.5)^2 - 10$

g. $y = -\frac{1}{2}(x - 6)^2$

h. $y = \frac{2}{3} - \left(x - \frac{1}{2}\right)^2$

i. $y = -2.5(x - 4)(x + 6)$

3. Find the vertex of the graph of each quadratic function.

a. $y = -x^2$

b. $y = x^2 + 5$

c. $y = (x - 4)^2$

d. $y = (x + 3)^2 - 5$

e. $y = -(x - 1)^2 + 6$

f. $y = 10 - (x + 6)^2$

g. $y = 6.5 + 0.5(x + 4)^2$

h. $y = -2\left(x - \frac{2}{3}\right)^2 + \frac{1}{4}$

i. $y = \frac{1}{2}\left(x + \frac{5}{6}\right)^2 - \frac{7}{12}$

4. Find the zeros of each quadratic function.

a. $y = (x + 5)(x - 3)$

b. $y = -2(x - 1)(x + 6)$

c. $y = 0.5x(x - 5)$

d. $y = (x - 7.5)^2$

e. $y = -0.2(x + 3.6)(x - 4.8)$

f. $y = 6\left(x + \frac{2}{3}\right)\left(x - \frac{1}{2}\right)$

5. Consider this table of values generated by a quadratic function.

x	-3	-2.5	-2	-1.5	-1	-0.5	0
y	-0.5	-3	-4.5	-5	-4.5	-3	-0.5

- What is the line of symmetry for the graph of the quadratic function?
- Identify the vertex of the graph of this quadratic function, and determine whether it is a maximum or a minimum.
- Use the table of values to write the quadratic function in vertex form.

Lesson 7.3 • Completing the Square

Name _____ Period _____ Date _____

1. Factor each quadratic expression.

a. $x^2 + 10x + 25$

b. $x^2 - 22x + 121$

c. $x^2 - x + \frac{1}{4}$

d. $4x^2 - 20x + 25$

e. $0.04x^2 + 1.8x + 20.25$

f. $9x^2 - 24xy + 16y^2$

2. What value is required to complete the square?

a. $x^2 + 6x + \underline{\hspace{2cm}}$

b. $x^2 - 18x + \underline{\hspace{2cm}}$

c. $x^2 - 5x + \underline{\hspace{2cm}}$

d. $x^2 + 11x + \underline{\hspace{2cm}}$

e. $x^2 - 0.8x + \underline{\hspace{2cm}}$

f. $x^2 + 4.3x + \underline{\hspace{2cm}}$

3. Convert each quadratic function to vertex form.

a. $y = x^2 - 8x + 14$

b. $y = x^2 + 14x + 50$

c. $y = x^2 + 5x + 8$

d. $y = x^2 - 11x + 28$

e. $y = 5x^2 - 10x - 3$

f. $y = 2x^2 + 5x$

4. Find the vertex of the graph of each quadratic function, and state whether the vertex is a maximum or a minimum.

a. $y = x^2 - 6x + 11$

b. $y = (x - 2)(x + 6)$

c. $y = -3x^2 + 12x + 17$

d. $y = -3.5x^2 - 7x$

e. $y = x^2 + 9x - 10$

f. $y = -0.5x^2 + 2.5x + 8$

5. Rewrite each expression in the form $ax^2 + bx + c$, and then identify the coefficients a , b , and c .

a. $5 + x + 4x^2$

b. $2x - 5x^2$

c. $-6 + 3x^2 + 6x + 8$

d. $-2x(x - 8)$

e. $25 - x^2$

f. $(2x - 3)(x + 5)$

6. A ball is thrown up and off the roof of a 75 m tall building with an initial velocity of 14.7 m/s.

- Let t represent the time in seconds and h represent the height of the ball in meters. Write an equation that models the height of the ball.
- At what time does the ball reach maximum height? What is the ball's maximum height?
- At what time or times is the ball 30 m above the ground?
- At what time does the ball hit the ground?

Lesson 7.4 • The Quadratic Formula

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1. Solve.

a. $(x - 5)^2 = 49$

b. $(x + 12)^2 = 169$

c. $(x + 1.3)^2 = 20.25$

d. $(x - 2.8)^2 = 39.69$

e. $\left(x - \frac{2}{3}\right)^2 = \frac{25}{81}$

f. $\left(x + \frac{5}{6}\right)^2 = \frac{49}{144}$

2. Evaluate each expression. Round your answers to the nearest thousandth.

a. $\frac{-6 + \sqrt{6^2 - 4(1)(-5)}}{2(1)}$

b. $\frac{4 - \sqrt{(-4)^2 - 4(2)(1)}}{2(2)}$

c. $\frac{5 + \sqrt{(-5)^2 - 4(4)(-3)}}{2(4)}$

d. $\frac{-10 - \sqrt{10^2 - 4(2)(5)}}{2(2)}$

3. Solve by any method. Give your answers in exact form.

a. $x^2 + 3x - 10 = 0$

b. $x^2 + 12x + 35 = 0$

c. $2x^2 - 5x = 12$

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

e. $12x^2 - 11x - 5 = 0$

f. $25x^2 - 49 = 0$

g. $2x^2 - 4x - 7 = 0$

h. $4x^2 + 7x - 1 = 0$

i. $6x^2 + 19x = 7$

j. $x^2 = 5.8x$

k. $x^2 - 48 = 0$

l. $x^2 - 9.6x + 23.04 = 0$

4. Write each equation in factored form, $y = a(x - r_1)(x - r_2)$, where r_1 and r_2 are the roots of the equation.

a. $y = x^2 - 7x + 12$

b. $y = x^2 + 5x - 24$

c. $y = x^2 - 7x - 8$

d. $y = 2x^2 - 8x + 6$

e. $y = 4x^2 + 2x - 2$

f. $y = 5x^2 + 19x + 12$

5. Write a quadratic function in general form that satisfies the given conditions.

a. $a = 1$; x -intercepts of graph are 6 and 9.

b. $a = -1$; x -intercepts of graph are -4 and -2 .

c. $a = 2$; x -intercepts of graph are -7 and 5 .

d. x -intercepts of graph are 8 and -3 ; y -intercept is -12 .

e. x -intercepts of graph are 0 and 13; graph contains point $(2, 22)$.

f. x -intercept of graph is 4.8; y -intercept is -5.76 .

Lesson 7.5 • Complex Numbers

Name _____ Period _____ Date _____

1. Add, subtract, or multiply.

a. $(4 - 5i) + (6 + 2i)$

c. $4(2 - 5i)$

e. $(-2.4 - 5.6i) + (5.9 + 1.8i)$

g. $(3 - 2i)(3 + 2i)$

b. $(-5 + 6i) - (1 - i)$

d. $\left(\frac{3}{5} - \frac{1}{10}i\right) - \left(\frac{7}{10} - \frac{4}{5}i\right)$

f. $-4i(-6 + i)$

h. $(2.5 + 1.5i)(3.4 - 0.6i)$

2. Find the conjugate of each complex number.

a. $3 - 2i$

b. $5 - 4i$

c. -2

d. $7i$

e. $\frac{1}{3} + \frac{5}{6}i$

f. $-3.25 + 4.82i$

3. Rewrite each quotient in the form $a + bi$.

a. $\frac{2}{3 + i}$

b. $\frac{1 + i}{1 - i}$

c. $\frac{3 + 2i}{4 - i}$

d. $\frac{3i}{2 + i}$

e. $\frac{3 + 5i}{6i}$

f. $\frac{4 + 5i}{2 - 3i}$

4. Solve each equation. Label each solution as real, imaginary, and/or complex.

a. $x^2 - 2x + 5 = 0$

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

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

d. $x^2 + 7 = 0$

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

f. $x(x - 5) = 1$

g. $x^2 + x + 1 = 0$

h. $4x^2 + 9 = 0$

i. $(x + 7)(x - 3) = 5 - 2x$

5. Write a quadratic function in general form that has the given zeros and leading coefficient of 1.

a. $x = -4, x = 7$

b. $x = 11i, x = -11i$

c. $x = -2 + 3i, x = -2 - 3i$

Lesson 7.6 • Factoring Polynomials

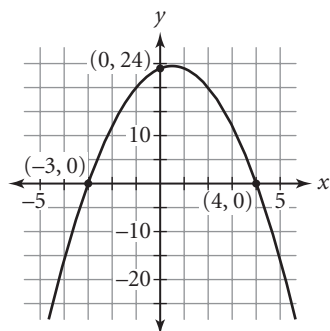
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1. Without graphing, find the x -intercepts and the y -intercept for the graph of each equation.

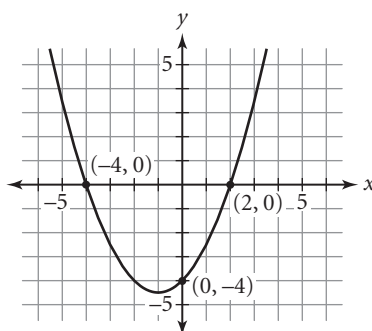
a. $y = (x + 6)(x - 5)$ b. $y = -(x - 8)^2$ c. $y = 2(x + 1)(x - 1)$
 d. $y = 3(x + 4)(x + 2)$ e. $y = -(x + 2)(x - 1)(x - 6)$ f. $y = 0.75x(x - 2)(x + 6)$

2. Write the factored form of the quadratic function. Don't forget the vertical scale factor.

a.



b.



3. Convert each polynomial function to general form.

a. $y = (x + 5)(x - 3)$ b. $y = -2(x - 2.5)(x + 2.5)$ c. $y = x(x - 1)(x + 5)$
 d. $y = -0.5(x + 3)^2$ e. $y = -x(x + 12)(x - 12)$ f. $y = 0.8(x + 4)(x - 6)$

4. Write each polynomial as a product of factors.

a. $2x^2 + 4x - 30$ b. $x^2 - 14x + 49$ c. $x^3 - 3x^2 + 2x$
 d. $2x^2 + 3x - 5$ e. $x^2 - 169$ f. $x^2 + 169$
 g. $x^2 - 15$ h. $x^2 + 15$ i. $x^4 - 10x^2 + 9$
 j. $12x^2 - 5x - 3$ k. $x^3 + 5x^2 - 17x - 21$ l. $3x^3 + 3x^2 - 30x + 24$

5. Sketch a graph for each situation if possible.

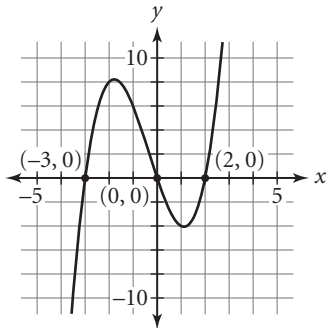
- a. A quadratic function with two real zeros, whose graph has the line $x = 2$ as its axis of symmetry
 b. A quadratic function with no real zeros, whose graph has a negative y -intercept
 c. A cubic function with three real zeros, whose graph has a positive y -intercept
 d. A cubic function with two real zeros, whose graph has a negative y -intercept

Lesson 7.7 • Higher-Degree Polynomials

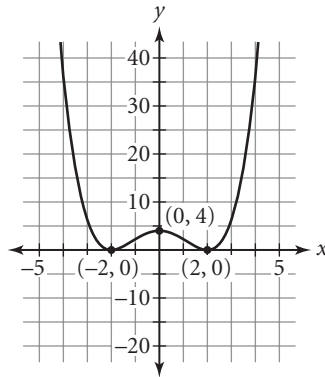
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1. Refer to these two graphs of polynomial functions.

i.



ii.



- Identify the zeros of each function.
 - Find the y -intercept of each graph.
 - Identify the lowest possible degree of each function.
 - Write the factored form for each polynomial function. Check your work by graphing on your calculator.
2. Write a polynomial function with the given features.
- A quadratic function whose graph has only one x -intercept, -4 , and whose y -intercept is -8
 - A cubic function with leading coefficient -1 whose graph has x -intercepts 0 and 5 , where $x = 5$ is a double root
 - A quadratic function whose graph has vertex $(3, -8)$, which is a minimum, and two x -intercepts, one of which is 5
 - A fourth-degree polynomial function with two double roots, 0 and 2 , and whose graph contains the point $(1, -1)$
3. Write the lowest-degree polynomial function that has the given set of zeros and whose graph has the given y -intercept. Write each polynomial function in factored form. Give the degree of each function.
- Zeros: $x = -3, x = 5$; y -intercept: -30
 - Zeros: $x = -2$ (triple root); y -intercept: -8
 - Zeros: $x = -2, x = 1, x = 3$; y -intercept: 3
 - Zeros: $x = \pm 2i, x = -2$ (double root), $x = 5$; y -intercept: 80

Lesson 7.8 • More About Finding Solutions

Name _____ Period _____ Date _____

1. Divide.

a. $x - 2 \overline{) 3x^3 - 8x^2 - 11x + 30}$

b. $x - 4 \overline{) x^4 - 13x^2 - 48}$

c. $\frac{32x^5 - 1}{2x - 1}$

2. Varsha started out dividing two polynomials by synthetic division this way:

$$\begin{array}{r|rrrrr} -3 & -3 & -5 & 0 & -35 & 7 \end{array}$$

- Identify the dividend and divisor.
 - Write the numbers that will appear in the second line of the synthetic division.
 - Write the numbers that will appear in the last line of the synthetic division.
 - Write the quotient and remainder for this division.
3. In each division problem, use the polynomial that defines P as the dividend and the quotient that defines D as the divisor. Write the result of the division in the form $P(x) = D(x) \cdot Q(x) + R$, where the polynomial that defines Q is the quotient and R is an integer remainder. (It is not necessary to write the remainder if $R = 0$.)
- $P(x) = x^2 + 8x - 9$; $D(x) = x + 9$
 - $P(x) = 2x^2 - 9x + 2$; $D(x) = x - 5$
 - $P(x) = 2x^3 - 5x^2 + 8x - 5$; $D(x) = x - 1$
 - $P(x) = 6x^3 - 5x^2 + 16x - 8$; $D(x) = 3x - 1$
4. Make a list of the possible rational roots of each equation.
- $x^3 + x^2 - 10x + 8 = 0$
 - $2x^3 - 3x^2 - 17x + 30 = 0$
5. Find all the zeros of each polynomial function. Then write the function in factored form.
- $y = x^3 - 6x^2 + 5x + 12$
 - $y = x^3 - 5x^2 + 9x - 45$
 - $y = 6x^3 + 17x^2 + 6x - 8$
 - $y = x^4 - 21x^2 - 100$