

Quadratic Functions and Equations

OBJECTIVE 2.2

Master different methods to solve quadratic equations

How-To:

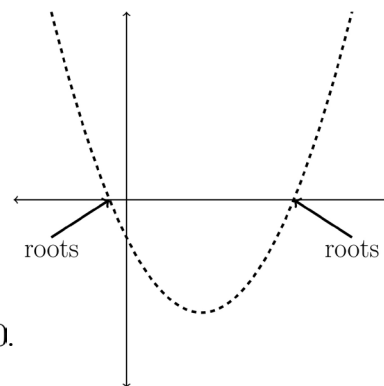
Factorize, use the quadratic formula or complete the square.

Remember, the quadratic formula is your trusty tool when others fail.

After using whichever method, you get two x 's.

These are the **roots/zeros** of the function.

We call them roots/zeros because that is when $y = 0$.



Factorization Method

1. Prepare the Equation: Ensure it's in the standard form $ax^2 + bx + c = 0$.

2. Identify Factors: Find two numbers that multiply to ac and sum to b .

3. Rewrite and Group: Decompose the middle term using the identified numbers, then factor by grouping.

4. Solve for x : Set each term equal to zero, for ex: $(x - 2) = 0$ so solving for x , $x = 2$.

5. Verify: Check the solutions in the original equation.

Example with $x^2 - 4x - 5 = 0$:

- **Prepare:** Already in standard form.
- **Identify Factors:** Numbers that multiply to -5 and sum to -4 are -5 and $+1$.
- **Rewrite and Group:** $x^2 - 5x + x - 5 = 0$ leads to $(x - 5)(x + 1) = 0$.
- **Solve for x :** $x = 5$ and $x = -1$.
- **Verify:** Substitute back to confirm $5^2 - 4(5) - 5 = 0$ and $(-1)^2 - 4(-1) - 5 = 0$.



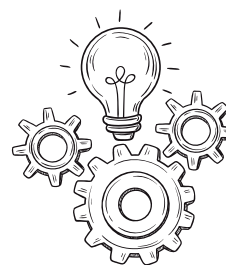
Completing the Square Method

1. Prepare the Equation: Ensure it's set to $ax^2 + bx = -c$.

2. Form a Perfect Square: Add $(\frac{b}{2})^2$ to both sides.

3. Solve for x : Convert into $(x - p)^2 = q$ and solve for x .

4. Verify: Substitute the solutions back into the original equation.



Example with $x^2 - 4x - 5 = 0$:

- **Prepare:** Move -5 to the other side: $x^2 - 4x = 5$.
- **Form a Perfect Square:** Add 4 to both sides to get $x^2 - 4x + 4 = 9$.
- **Solve for x :** $(x - 2)^2 = 9$ (from factoring prior equation leads to $x = 5$ and $x = -1$.)
- **Verify:** Check by plugging x back into the original equation.




Quadratic Functions and Equations

Quadratic Formula Method

- 1. Prepare the Equation:** Confirm standard form.
- 2. Apply the Formula:** Use the Quadratic formula.
- 3. Calculate:** Substitute a , b , and c into the formula and simplify.
- 4. Verify:** Check the solutions in the original equation.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Example with $x^2 - 4x - 5 = 0$:

- Prepare: Standard form verified.
- Apply the Formula: With $a = 1, b = -4, c = -5$, find x .
- Calculate: $x = \frac{4 \pm \sqrt{16 + 20}}{2}$ simplifies to $x = 5$ and $x = -1$
- Verify: Substitute x values to confirm correctness. 



**Make sure to simplify each part separately and keep track of your steps.
Be neat!!**

Practice Problems:

- Solve by factoring: $x^2 - 5x + 6 = 0$.

- Solve using the quadratic formula: $2x^2 - 3x - 2 = 0$.

- Solve by completing the square: $x^2 - 4x - 5 = 0$.

- Solve the equation $x^2 - 4x + 4 = 0$ using any method.

How to Choose a Method

Factoring: Best for equations with simple coefficients that are easy to factor.

Completing the Square: Ideal for finding the vertex form and with equations that are not straightforward to factor.

Quadratic Formula: Universal method that works for any quadratic equation, especially when other methods fail or coefficients are complex.

Each row and column must include numbers 1-6

			4		
5		1	3	6	
		4	5	3	1
1	5	3	2		
6		2	1	5	4
4	1	5	6	2	3

BRAIN BREAKS

Exponent Laws:

- $a^{\frac{m}{n}} = \sqrt[n]{a^m} = (\sqrt[n]{a})^m$
- **Example:** $4^{\frac{3}{2}} = (\sqrt{4})^3 = 2^3 = 8$
- **Try it!** Simplify $27^{\frac{2}{3}}$.

Graphing Functions

How-to Graph Any Function

1. Identify the Function Type:

- Linear, quadratic, radical, exponential, logarithmic, etc.

2. Find Key Features(if applicable):

- Vertex/intercepts
- Asymptotes
- Domain and range

3. Plot Key Points:

- Intercepts, vertex, and significant points ($x = 0, 1, 2 \dots$)
- Calculate corresponding y -values

4. Sketch the Graph:

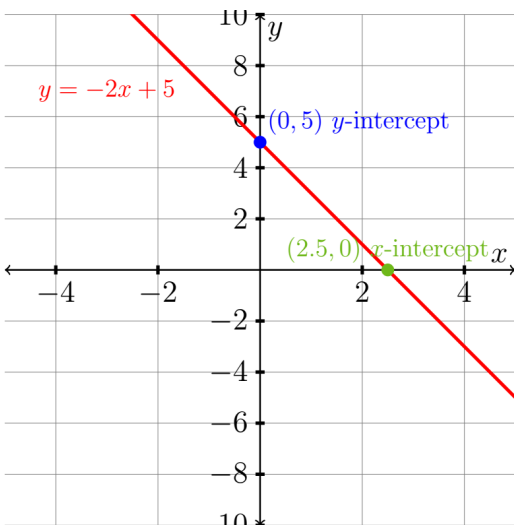
- Connect plotted points smoothly
- Reflect symmetry

5. Label Key Points and Features:

- Intercepts, vertex, asymptotes

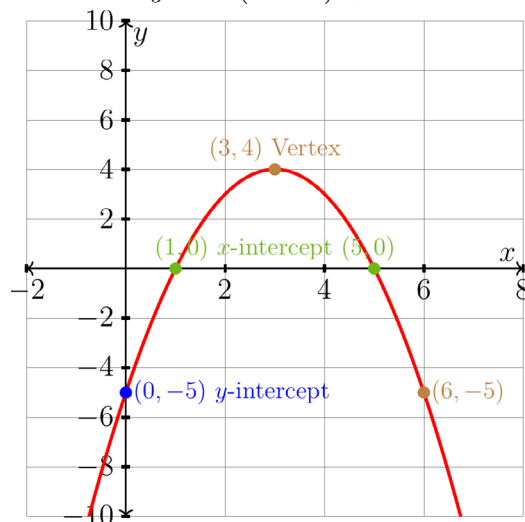
Linear Function

$$y = -2x + 5$$



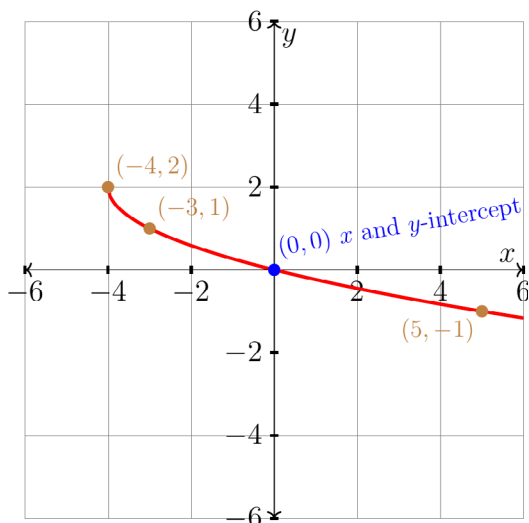
Quadratic Function

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



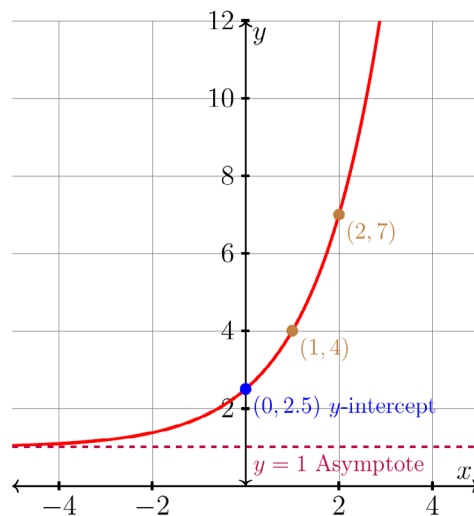
Radical Function

$$y = -\sqrt{x + 4} + 2$$



Exponential Functions

$$y = 3 \cdot 2^{x-1} + 1$$



Understanding Credit and Debt

OBJECTIVE 4.1

Learn how credit and credit scores work

How Credit Works and the Importance of Credit Scores:

Credit: Credit is the ability to borrow money or access goods and services with the understanding that you'll pay later.

When used responsibly, credit can help build your financial profile. Credit checks are performed by lenders, landlords

(for apartments), car dealerships, and employers to evaluate your financial reliability.



Credit Score (FICO score): A credit score is a number that represents your creditworthiness. Scores typically range from 300 to 850, with higher scores indicating better creditworthiness. Lenders use credit scores to decide whether to approve you for loans or credit cards and to determine interest rates.

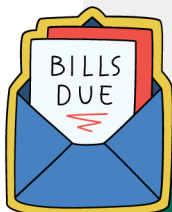
Credit Score Ranges	300-579	580-669	670-739	740-799	800-855
Rating	Poor	Fair	Good	Very good	Exceptional

If you're building or rebuilding credit, a **secured credit card** is a smart option. These require a refundable deposit and are available through banks, credit unions, or stores like Walmart or Target.

Building and Maintaining Good Credit

Pay Bills on Time

Late payments can negatively impact your credit score, so always pay bills by their due dates. Use **AutoPay** when possible.



Keep Credit Utilization Low

Aim to use less than **30%** of your available credit. For example, if you have a \$1,000 credit limit, try to keep your balance below \$300.

Limit New Credit Applications

Applying for multiple credit accounts at once can lower your score. Only apply for credit when **necessary**.



Vocabulary

- **Creditworthiness:** A measure of how likely you are to repay borrowed money, often based on credit score and credit history.
- **Credit Utilization:** The percentage of your available credit that you're using; a lower utilization rate benefits your credit score.
- **Annual Percentage Rate (APR):** The yearly interest rate charged on a loan or credit card balance. **Ex)** A \$1,000 loan with an APR of 12%. This means she will pay 12% interest per year on the remaining balance.
- **Repayment Plan:** The schedule for paying back the loan, typically including monthly payments that cover both principal and interest.

Understanding Credit and Debt

Good Debt vs. Bad Debt

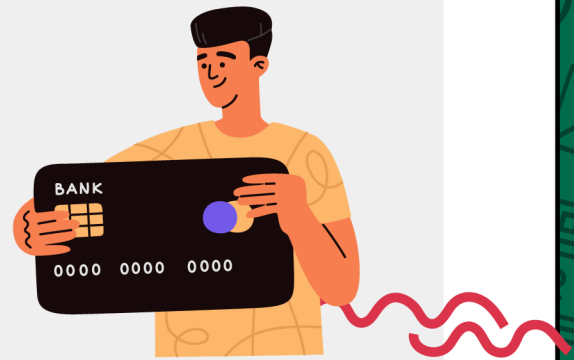
Bad Debt: Debt that generally has high interest rates and doesn't contribute to long-term wealth, like credit card debt or payday loans.

Good Debt: Debt that can help build wealth or increase income potential over time, like student loans (for education) or a mortgage (for homeownership).

Building Good Credit with a Credit Card

Imagine you've just opened your first credit card with a \$500 limit. Your goal is to use this credit responsibly to build a good credit history.

You decide to use the credit card only for essential purchases, like groceries, and limit spending to \$100 a month to keep your credit utilization low (under 30%).



Paying on Time

Each month, you pay off the full balance by the due date to avoid interest charges and maintain a positive payment history, which helps build your credit score.

Monitoring Credit Score

After six months, you check your credit score and notice it has improved. By paying on time and keeping your utilization low, you're building a strong credit profile, which will help if you apply for a larger loan in the future, like a car loan or student loan.

This example shows how small, consistent steps can establish and maintain good credit.

Practice Problems:

1. If you miss a credit card payment by 30 days, how might this affect your credit score and your ability to borrow money in the future?

2. What is one effective way to build good credit?
 A. Applying for multiple credit cards at once B. Keeping your credit card balance high
 C. Paying your credit card bills on time D. Ignoring your credit report
3. Imagine you have a \$500 credit card limit. If you spend \$200 on groceries and pay the full balance on time, how will this impact your credit score? Highlight the role of payment history and utilization rate.

4. If you have a credit card with a \$1,000 balance and an APR of 18%, how much interest will you owe in 2 years if you make no payments? Why is it important to pay off credit card balances quickly?

Interactive Activity #3

Interest Rate Comparison

Objective: Analyze and compare interest rates for Home Loans, Personal Loans and Credit Card from different financial institutions.

Date: _____

1. Home Loans Comparison


Step 1: Go to a financial comparison website like Bankrate.com or [SmartAsset.com](https://www.smartasset.com).

<https://www.nerdwallet.com/h/category/loans> and <https://wallethub.com/mortgage-rates>

Step 2: Navigate to the section for **mortgages** or **home loans**.

Step 3: Filter results by Loan type and desired terms (e.g., 30-year, 15-year).

Step 4: Collect data on the following:

 **TIP:** Choose a **fixed interest** rate when possible – it keeps your payments predictable.

Lender Name	City/State	Price	Interest Rate (%)	APR (%)	Loan Type (Fixed/Adjustable)	Term (Years)

Analyze which home loan suits you the best: _____

2. Auto Loans Comparison

Step 1: Visit a site like <https://www.bankrate.com/loans/auto-loans/> or

<https://www.nerdwallet.com/best/loans/auto-loans> select the personal loans section.

Step 2: Use filters to choose loan amounts and repayment terms.

Step 3: Gather data on:

Lender Name	Car Make/Model	Price	Interest Rate (%)	APR (%)	Loan Type (Fixed/Adjustable)	Term (Years)

Analyze which personal loan suits you the best: _____

Primitive Types

OBJECTIVE 2.1

Understand and Work with Basic Data Types in Java (int, double, boolean, char)

In Java, **primitive types** are the simplest data types for storing basic values. These types help Java determine what kind of data it's handling and how much memory to allocate.

Here's a quick guide to four essential primitive types in Java:

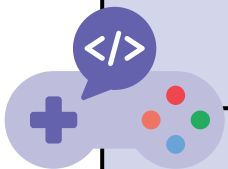


Integers

In Java, **integer data types** are used to store whole numbers, both positive and negative, without any fractional part. Choosing the appropriate integer type allows for efficient memory usage while meeting the needs of your program.

In Java, every statement ends with a semicolon (;). Think of it like a period at the end of a sentence—it tells the computer that the instruction is complete.

Integer	Examples	Definition	Memory
byte	<pre>byte a = 127; byte number = -50;</pre>	Used to store small integers ranging from -128 to 127.	Takes 1 byte of memory.
short	<pre>short c = -32000; short size = 1500;</pre>	Stores integer values from -32,768 to 32,767.	Takes 2 bytes of memory.
int	<pre>int e = 100000; int Height = -50000;</pre>	The default integer type, storing values from -2,147,483,648 to 2,147,483,647.	Takes 4 bytes of memory.
long	<pre>long g = 10000000000L; long h = -2.9000000000L;</pre>	Stores very large integer values from -9 quintillion to +9 quintillion. Must end with an L.	Takes 8 bytes of memory.



Where Are Primitive Types Used?

Video Games: Game engines use int and float for physics and character movement.

Banking & Finance: long and double are used to store big monetary values accurately.

Cryptography: Secure encryption algorithms rely on bitwise operations using byte arrays.

Primitive Types

Floating Point

Floating-point data types: **float** and **double**, are used to store decimal numbers. They are ideal for calculations requiring precision, such as scientific computations or financial operations. These types are essential when working with values that require accuracy beyond whole numbers.

Floating Point	Examples	Definition	Memory
Float	<pre>float pi = 3.14f; float radius = 5.5f;</pre>	Used to store all real numbers with a precision of 6-7 significant decimal digits.	Takes 4 bytes of memory and stores decimal numbers with less precision than double.
Double	<pre>double pi = 3.14159265; double radius = 5.5;</pre>	Used to store all real numbers with a precision of 15-16 significant decimal digits. More accurate than floats.	Takes 8 bytes of memory with higher precision.

Non-Numeric

Java also includes **non-numeric** primitive data types like **char** and **boolean**, which represent characters and logical values. These data types add versatility to Java and enable textual and logical operations.

Non Numeric	Examples	Definition	Memory
Boolean	<pre>boolean isJavaFun = true; boolean hasLicense = false;</pre>	Used to store logical variables with a value of either true or false. Useful for decision making.	Usually takes about 1 byte of memory.
Char	<pre>char grade = 'A'; char symbol = '#';</pre>	Used to store single characters. Enables support for various languages and symbols.	Takes 2 bytes of memory, allowing representation of characters, including letters, numbers, and symbols from various languages.

Primitive Types

Practice Problems:

1. Select the most appropriate (least memory used) data type for the following scenarios:

- a. Store the population of a small town (~10,000 people).
 A. byte B. short C. int D. long
- b. Store the number of apples in a basket (less than 100).
 A. byte B. short C. int D. long
- c. Store the first letter of someone's middle name.
 A. char B. short C. int D. boolean
- d. Store whether a basket is full or not.
 A. char B. short C. int D. boolean

2. Match the values to the correct data type:

[byte, short, int, long, float, double, boolean, char]

- a. The value of π (3.14159). _____
- b. Distance from Earth to the Sun in meters ($\approx 149,600,000,000$) _____
- c. The population of the United States ($\approx 330,000,000$) _____
- d. Is the device powered on? _____
- e. 123456789.123456 _____
- f. The mass of the Earth ($5.972e24$ kilograms) _____
- g. A small currency value, such as 0.99. _____
- h. A temperature reading between -50 and 50. _____

3. Write a statement with the correct data type for the following scenarios:

- a. Represent the age of a senior citizen who is 65.

- b. Represent the weight of a package that is 4.5425252 grams.

- c. Represent the temperature that is 28.7 Fahrenheit.

- d. Represent a person's middle initial when filling out a form.

- e. Represent the population of a large country with population of 2 billion.

- f. Represent the number of hours in a day.

4. Find and fix the errors in the following declarations:

- a. `int population = 10L;` _____
- b. `int radius = 7.5;` _____
- c. `boolean isTrue = "true";` _____
- d. `long distance = 5000000;` _____



Interactive Activity #2

Basic Calculator

Objective: Write a simple program that performs calculations using variables.

Create a Simple Calculator

- Write a Java program that performs basic arithmetic operations (addition, subtraction, multiplication and division) on two numbers entered by the user.

Create Two Numbers

- Declare and initialize two double variables with example values.
- These values will be used to perform arithmetic operations.

Perform Calculations

- Declare variables to store results for addition, subtraction, multiplication, and division.
- Apply a one-line formula from to calculate the distance between two numbers using the absolute value function.

Display the Results

- Print the results for all four operations using System.out.println().

```
1 public class BasicCalculator {
2     public static void main(String[] args) {
3
4         // Declare and initialize two numbers
5         double num1 = _____; // Example value 1
6         _____ = _____; // Example value 2
7
8         // Perform arithmetic operations
9         double sum = _____;
10        double difference = _____;
11        double _____ = _____;
12        double quotient = _____ / _____;
13        _____;
14
15        // Display results
16        System.out.println("Numbers: " + num1 + " and " + num2);
17        System.out.println("Addition: " + _____); // Print the sum
18        System.out.println("Subtraction: " + _____); // Print the
19        difference
20        _____("Multiplication: " + _____); // Print the product
21
22        _____ // Print the quotient
23        _____
24    }
25 }
```

Output



Code Checker

Check your code throughout the book using this online program.
If your code runs and outputs correct you're correct!

