MATH
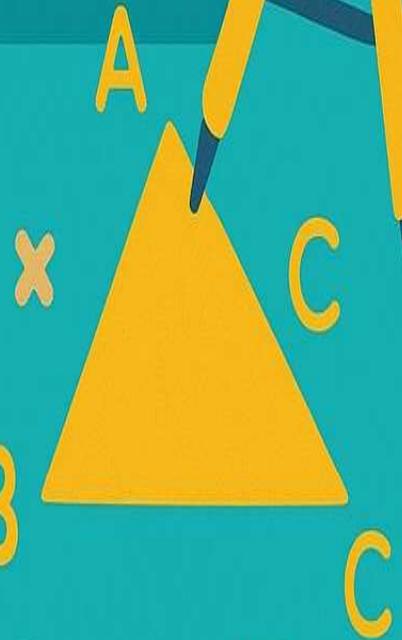
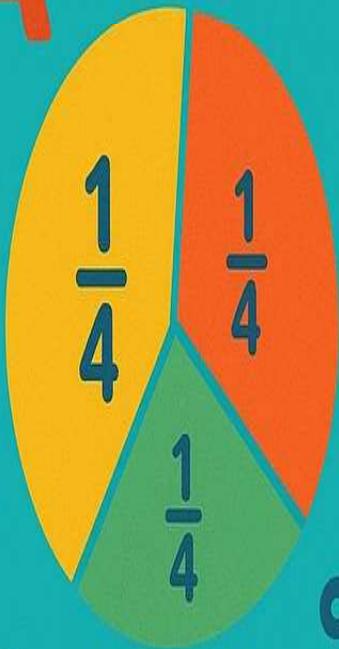## 6

Shaniya Jackson

Preface

Welcome to *6th Grade Math: A Journey of Discovery*! This book is more than just a collection of math lessons and problems; it's the culmination of an exciting and transformative summer experience I had at the "AI/ML Literacy and Training Models Using Web Browsers" camp. Over the course of the camp, I not only deepened my understanding of mathematics but also learned how to leverage artificial intelligence to create educational content. This project represents the knowledge and skills I gained during that time.

I owe my deepest gratitude to the incredible mentors who guided me throughout this journey. Dr. Hu, Garret Godwin, Ayodeji Williams, Tionna Freeman, and Stevie Scott offered their expertise, support, and encouragement, shaping both this book and my learning experience. Their insights and guidance were invaluable in making this dream a reality.

I would also like to extend my heartfelt thanks to my parents for their unwavering support and encouragement, as well as to Ms. Erica Jones for ensuring I could attend the camp by driving me there every day. Your belief in me has been the foundation of my success.

This book is designed to make 6th-grade math accessible, engaging, and fun. My hope is that it will inspire other students to not only embrace math but also explore the exciting possibilities of combining technology and education.

Thank you for joining me on this journey. Let's dive into the world of 6th-grade math together!

Sincerely,

Shaniya Jackson

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The book is also available online at
https://www.backupspirit.com/camp/2025/completion/ShaniyaJackson.html

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Whole Numbers & Negative Numbers: Concepts, Examples, and Tests

Master basic math skills: place value, operations, negatives, coordinates, and more!

Concepts Explained

1. Place Value

Each digit in a whole number has a value based on its position. For example, in 4,573:

- 4 is in the thousands place (4,000)
- 5 is in the hundreds place (500)
- 7 is in the tens place (70)
- 3 is in the ones place (3)

2. Adding & Subtracting Whole Numbers

Addition joins two or more numbers.
Subtraction finds the difference between two numbers.

3. Estimating Sums & Differences

Estimation makes calculations easier by rounding numbers. For example, 397 + 624 can be estimated as 400 + 600 = 1,000.

4. Multiplying Whole Numbers & Estimating Products

Multiplication is repeated addition. Estimation uses rounded numbers (e.g., 49 × 21 ≈ 50 × 20 = 1,000).

5. Dividing Whole Numbers & Estimating Quotients

Division splits a number into equal groups. Estimation helps check your answer (e.g., 198 ÷ 4 ≈ 200 ÷ 4 = 50).

6. Negative Numbers

Numbers less than zero (e.g., −5). Useful for temperatures, elevations, and finances.

7. Adding with Negative Numbers

When adding a negative, you move left on the number line. For example, 7 + (−3) = 4.

8. Absolute Value

The distance a number is from zero. Always positive. E.g., |−6| = 6.

9. Plotting Ordered Pairs

Ordered pairs (x, y) show positions on a coordinate plane. (3, 2) means 3 units right, 2 units up from the origin.

10. Distance

The straight-line length between two points. On a number line, it's the absolute difference. On a grid, use the Pythagorean theorem if needed.

Fractions, Ratios, and More: Math Guide

Chapter 1: Numbers & Values

- **Whole Number:** A whole number is a number without fractions or decimals. Examples: 0, 1, 2, 3, 10, 100.
- **Place Value:** Place value is the value of a digit based on its position in a number. For example, in 345, the 3 is in the hundreds place, so it's worth 300.
- **Absolute Value:** The absolute value of a number is its distance from zero on a number line, always positive. For example, $|-5| = 5$.
- **Distance:** In math, distance means how far apart two points or numbers are. For numbers, it's the absolute value of their difference. For example, the distance between 2 and −3 is $|2 - (-3)| = |5| = 5$.

Chapter 2: Fractions & Mixed Numbers

- **Changing Improper Fractions to Mixed Numbers:**
  Divide the numerator by the denominator. The quotient is the whole number, the remainder is the new numerator.

  > Example:
  > $\frac{9}{4} = 2\frac{1}{4}$ because $9 \div 4 = 2$ remainder 1.

- **Changing Mixed Numbers to Improper Fractions:**
  Multiply the whole number by the denominator and add the numerator. Put that over the original denominator.

  > Example:

$$3\frac{2}{5} = \frac{3\times5+2}{5} = \frac{17}{5}$$

Chapter 3: Adding & Subtracting Fractions

- **Adding Fractions with Like Denominators:** Add the numerators; keep the denominator.

$$\frac{2}{7} + \frac{3}{7} = \frac{5}{7}$$

- **Subtracting Fractions with Like Denominators:** Subtract the numerators; keep the denominator.

$$\frac{5}{8} - \frac{1}{8} = \frac{4}{8} = \frac{1}{2}$$

- **Adding or Subtracting Fractions with Unlike Denominators:** Find a common denominator, convert, then add or subtract.

$$\frac{1}{4} + \frac{1}{6} = \frac{3}{12} + \frac{2}{12} = \frac{5}{12}$$

- **Adding Mixed Numbers with Unlike Denominators:** Convert to improper fractions, find common denominator, add, and simplify.
- **Subtracting Mixed Numbers with Unlike Denominators:** Convert to improper fractions, find common denominator, subtract, and simplify.
- **Estimating Sums and Differences of Fractions and Mixed Numbers:** Round fractions to 0, ½, or 1; round mixed numbers to nearest whole. Then add or subtract to estimate.

Chapter 4: Multiplying & Dividing Fractions

- **Multiplying Fractions and Whole Numbers:** Multiply the whole number by the numerator; keep the denominator.

$$3 \times \frac{2}{5} = \frac{6}{5} = 1\frac{1}{5}$$

- **Multiplying Fractions: Reciprocals:** The reciprocal of a fraction is obtained by swapping numerator and denominator. Multiplying a number by its reciprocal gives 1.

Reciprocal of $\frac{3}{4}$ is $\frac{4}{3}$. $\frac{3}{4} \times \frac{4}{3} = 1$

- **Multiplying Fractions and Mixed Numbers: Reducing:** Convert mixed numbers to improper fractions, multiply, then simplify.
- **Dividing Fractions by Whole Numbers:** Multiply by the reciprocal of the whole number.

$$\frac{5}{6} \div 2 = \frac{5}{6} \times \frac{1}{2} = \frac{5}{12}$$

- **Dividing Whole Numbers by Fractions:** Multiply the whole number by the reciprocal of the fraction.

$$3 \div \frac{2}{5} = 3 \times \frac{5}{2} = \frac{15}{2}$$

- **Dividing Fractions by Fractions:** Multiply by the reciprocal of the divisor.

$$\frac{3}{4} \div \frac{1}{2} = \frac{3}{4} \times \frac{2}{1} = \frac{6}{4} = \frac{3}{2}$$

- **Dividing Mixed Numbers:** Convert to improper fractions, then follow the steps above.

Chapter 5: Ratios & Proportions

- **Ratios:** A ratio compares two quantities. Written as a:b, a to b, or a/b.
- **Proportions and Cross-Multiplying:** A proportion is two equal ratios. To solve: cross-multiply and solve for the unknown.

$$\text{If } \frac{2}{3} = \frac{x}{6}, \text{ then } 2 \times 6 = 3 \times x \implies x = 4$$

- **Ratio Tables:** A table that shows equivalent ratios.

2:3, 4:6, 6:9, ...

- **Rates:** A rate is a ratio comparing two quantities with different units (e.g. miles per hour).
- **Problem-Solving with Proportions:** Use proportions to solve real-world problems (e.g. recipes, maps, scaling).

Chapter 6: Examples

Q1: Change $\frac{11}{3}$ to a mixed number.
A: $11 \div 3 = 3$ remainder 2, so $\frac{11}{3} = 3\frac{2}{3}$

Q2: Add $\frac{1}{4} + \frac{1}{6}$.
A: Find common denominator: 12.
$\frac{1}{4} = \frac{3}{12}$, $\frac{1}{6} = \frac{2}{12}$.
$\frac{3}{12} + \frac{2}{12} = \frac{5}{12}$

Q3: Multiply $2\frac{1}{2} \times \frac{3}{5}$.
A: Convert $2\frac{1}{2} = \frac{5}{2}$.
$\frac{5}{2} \times \frac{3}{5} = \frac{15}{10} = \frac{3}{2}$

Q4: If 4 pencils cost \$2, how much do 10 pencils cost?
A: Set up proportion: $\frac{4}{2} = \frac{10}{x}$. Cross-multiplied: $4x = 20 \implies x = 5$.
10 pencils cost \$5.

Chapter 7: Pre-Test (40 Questions)

1. What is the absolute value of -12?
   ○ 12
   ○ -12
   ○ 0
   ○ 1

2. What is the place value of 5 in 5,432?
   ○ Thousands
   ○ Hundreds
   ○ Tens
   ○ Ones

3. What is a whole number?
   ○ A number with no fraction or decimal
   ○ A decimal
   ○ A fraction

○ A negative number

4. What is the distance between 7 and -2?

○ 9

○ 5

○ 7

○ 2

5. What digit is in the tens place in 2,345?

○ 4

○ 5

○ 3

○ 2

6. |15| = ?

○ 15

○ -15

○ 0

○ 1

7. Which is NOT a whole number?

○ 2.5

○ 0

○ 12

○ 53

8. The place value of 8 in 582 is:

○ Tens

○ Ones

○ Hundreds

○ Thousands

9. Change 7/3 to a mixed number.

○ 2 1/3

○ 2 2/3

○ 3 1/3

○ 3 2/3

10. Convert 4 1/2 to an improper fraction.

○ 9/2

○ 8/2

○ 10/2

○ 5/2

11. Which is an improper fraction?

○ 7/4

○ 1/2

○ 3/8

○ 5/9

12. Which is a mixed number?

○ 2 1/5

○ 7/3

○ 6/9

○ 1/4

13. 3 2/5 = ?

○ 17/5

○ 15/2

○ 8/5

○ 10/3

14. 5/2 = ?

○ 2 1/2

○ 2 2/5

○ 2 1/5

○ 3 1/2

15. 1/5 + 2/5 = ?

○ 3/5

○ 3/10

○ 1/10

○ 1/15

16. 7/8 - 3/8 = ?

○ 1/2

○ 4/8

○ 5/8

○ 3/5

17. 1/2 + 1/3 = ?

○ 5/6

○ 2/5

○ 2/3

○ 1/6

18. Estimate: 3/4 + 1/8 ≈ ?

○ 1

○ 1/2

○ 2

○ 3/4

19. 2 1/4 + 1 3/4 = ?

○ 4

○ 3

○ 3 1/2

○ 3 3/4

20. Subtract: 5 2/3 − 2 1/3

○ 3 1/3

○ 4

○ 2

○ 2 1/3

21. Estimate: 2 2/3 − 1 1/3 ≈ ?

○ 1

○ 2

○ 3

○ 0

22. 3 × 2/7 = ?

○ 6/7

○ 5/7

○ 3/14

○ 2/3

23. Reciprocal of 3/5 =

○ 5/3

○ 3/5

○ 2/5

○ 1/3

24. 2/3 × 3/4 = ?

- ○ 1/2
- ○ 6/7
- ○ 2/7
- ○ 5/6

25. 5/6 ÷ 2 =
- ○ 5/12
- ○ 5/3
- ○ 6/5
- ○ 1/2

26. 3 ÷ 2/5 = ?
- ○ 7 1/2
- ○ 6/5
- ○ 15/2
- ○ 5/6

27. 1/2 ÷ 1/4 = ?
- ○ 2
- ○ 1/2
- ○ 1/4
- ○ 4

28. 3 1/2 × 2/3 = ?
- ○ 7/3
- ○ 2/7
- ○ 3/4
- ○ 1/3

29. Ratio of 6 to 9 is:
- ○ 2:3
- ○ 3:2
- ○ 3:1
- ○ 1:3

30. If 2/x = 6/12, x = ?
- ○ 4
- ○ 12
- ○ 6
- ○ 2

31. What is a rate?
- ○ A ratio with different units
- ○ A whole number
- ○ A mixed number
- ○ A fraction

32. Ratio table: 1:2, 2:4, 3:6. What is next?
- ○ 4:8
- ○ 4:6
- ○ 4:10
- ○ 5:10

33. If 3 pencils cost $1.50, price for 6 pencils?
- ○ $3.00
- ○ $2.00
- ○ $4.00
- ○ $3.50

34. Which is a proportion?
- ○ 2/3 = 4/6
- ○ 2/3 = 3/4
- ○ 5/7 = 2/3
- ○ 1/2 = 3/4

35. Solve: x/5 = 6/15
- ○ 2
- ○ 3
- ○ 6
- ○ 5

36. Estimate: 5 1/2 + 2 1/2 ≈ ?
- ○ 8
- ○ 7
- ○ 6
- ○ 9

37. Which is the greatest?
- ○ 7/8
- ○ 5/6
- ○ 3/4
- ○ 2/3

38. Simplify: 8/12

○ 2/3

○ 4/6

○ 1/2

○ 2/5

39. Simplify: 15/45

○ 1/3

○ 1/2

○ 3/4

○ 1/5

40. Which is a mixed number?

○ 4 1/2

○ 9/7

○ 3/8

○ 1/9

Check Answers

Chapter 8: Step-by-Step Solutions for Pre-Test Errors

Take the Pre-Test above. Step-by-step instructions for any missed questions will appear here.

Chapter 9: Post-Test (40 Questions)

1. What is the absolute value of -12?

○ 12

○ -12

○ 0

○ 1

2. What is the place value of 5 in 5,432?

○ Thousands

○ Hundreds

○ Tens

○ Ones

3. What is a whole number?

○ A number with no fraction or decimal

○ A decimal

○ A fraction

○ A negative number

4. What is the distance between 7 and -2?

○ 9

○ 5

○ 7

○ 2

5. What digit is in the tens place in 2,345?

○ 4

○ 5

○ 3

○ 2

6. |15| = ?

○ 15

○ -15

○ 0

○ 1

7. Which is NOT a whole number?

○ 2.5

○ 0

○ 12

○ 53

8. The place value of 8 in 582 is:

○ Tens

○ Ones

○ Hundreds

○ Thousands

9. Change 7/3 to a mixed number.

- ⃝ 2 1/3
- ⃝ 2 2/3
- ⃝ 3 1/3
- ⃝ 3 2/3

10. Convert 4 1/2 to an improper fraction.
- ⃝ 9/2
- ⃝ 8/2
- ⃝ 10/2
- ⃝ 5/2

11. Which is an improper fraction?
- ⃝ 7/4
- ⃝ 1/2
- ⃝ 3/8
- ⃝ 5/9

12. Which is a mixed number?
- ⃝ 2 1/5
- ⃝ 7/3
- ⃝ 6/9
- ⃝ 1/4

13. 3 2/5 = ?
- ⃝ 17/5
- ⃝ 15/2
- ⃝ 8/5
- ⃝ 10/3

14. 5/2 = ?
- ⃝ 2 1/2
- ⃝ 2 2/5
- ⃝ 2 1/5
- ⃝ 3 1/2

15. 1/5 + 2/5 = ?
- ⃝ 3/5
- ⃝ 3/10
- ⃝ 1/10
- ⃝ 1/15

16. 7/8 - 3/8 = ?
- ○ 1/2
- ○ 4/8
- ○ 5/8
- ○ 3/5

17. 1/2 + 1/3 = ?
- ○ 5/6
- ○ 2/5
- ○ 2/3
- ○ 1/6

18. Estimate: 3/4 + 1/8 ≈ ?
- ○ 1
- ○ 1/2
- ○ 2
- ○ 3/4

19. 2 1/4 + 1 3/4 = ?
- ○ 4
- ○ 3
- ○ 3 1/2
- ○ 3 3/4

20. Subtract: 5 2/3 − 2 1/3
- ○ 3 1/3
- ○ 4
- ○ 2
- ○ 2 1/3

21. Estimate: 2 2/3 − 1 1/3 ≈ ?
- ○ 1
- ○ 2
- ○ 3
- ○ 0

22. 3 × 2/7 = ?
- ○ 6/7
- ○ 5/7
- ○ 3/14
- ○ 2/3

23. Reciprocal of 3/5 =

○ 5/3

○ 3/5

○ 2/5

○ 1/3

24. 2/3 × 3/4 = ?

○ 1/2

○ 6/7

○ 2/7

○ 5/6

25. 5/6 ÷ 2 =

○ 5/12

○ 5/3

○ 6/5

○ 1/2

26. 3 ÷ 2/5 = ?

○ 7 1/2

○ 6/5

○ 15/2

○ 5/6

27. 1/2 ÷ 1/4 = ?

○ 2

○ 1/2

○ 1/4

○ 4

28. 3 1/2 × 2/3 = ?

○ 7/3

○ 2/7

○ 3/4

○ 1/3

29. Ratio of 6 to 9 is:

○ 2:3

○ 3:2

○ 3:1

○ 1:3

30. If 2/x = 6/12, x = ?

○ 4

○ 12

○ 6

○ 2

31. What is a rate?

○ A ratio with different units

○ A whole number

○ A mixed number

○ A fraction

32. Ratio table: 1:2, 2:4, 3:6. What is next?

○ 4:8

○ 4:6

○ 4:10

○ 5:10

33. If 3 pencils cost $1.50, price for 6 pencils?

○ $3.00

○ $2.00

○ $4.00

○ $3.50

34. Which is a proportion?

○ 2/3 = 4/6

○ 2/3 = 3/4

○ 5/7 = 2/3

○ 1/2 = 3/4

35. Solve: x/5 = 6/15

○ 2

○ 3

○ 6

○ 5

36. Estimate: 5 1/2 + 2 1/2 ≈ ?

○ 8

○ 7

○ 6

○ 9

37. Which is the greatest?

○ 7/8
○ 5/6
○ 3/4
○ 2/3

38. Simplify: 8/12

○ 2/3
○ 4/6
○ 1/2
○ 2/5

39. Simplify: 15/45

○ 1/3
○ 1/2
○ 3/4
○ 1/5

40. Which is a mixed number?

○ 4 1/2
○ 9/7
○ 3/8
○ 1/9

Check Answers

Decimals, Fractions, and Percents: A Complete Guide

Master decimal operations, fractions, and percents with explanations, examples, and practice tests.

Key Concepts Explained

- **Decimal Place Value and Rounding:**
  Each digit in a decimal has a place value (tenths, hundredths, thousandths, etc.). Rounding means making a decimal simpler but keeping its value close.

- **Changing Fractions to Decimals:**
  Divide the numerator by the denominator. Example: `3/4 = 0.75`.

- **Changing Decimals to Fractions:**
  Write the decimal as a fraction with 10, 100, 1000, etc., as the denominator and simplify.

- **Comparing and Ordering Decimals:**
  Line up decimals by the decimal point; compare from left to right.

- **Adding & Subtracting Decimals:**
  Align decimal points before operating.

- **Estimating Decimal Sums and Differences:**
  Round decimals before adding or subtracting to get an estimate.

- **Multiplying Decimals:**
  Multiply as whole numbers, then count total decimal places in factors and place the decimal point in the product.

- **Estimating Decimal Products:**
  Round the numbers before multiplying.

- **Dividing Decimals:**
  If dividing by a decimal, make the divisor a whole number by multiplying both by 10, 100, etc.

- **Understanding Percents:**

  Percent means "per hundred." 45% = 45 out of 100.
- **Percents, Fractions, and Decimals:**

  Convert between them by dividing or multiplying by 100.

Worked Examples

- **Rounding Decimals:** Round 3.786 to the nearest hundredth:

  Look at the thousandths (6). Since 6 >= 5, round up: `3.79`
- **Fraction to Decimal:**

  `5/8 = 0.625` (5 ÷ 8)
- **Decimal to Fraction:**

  `0.2 = 2/10 = 1/5`
- **Comparing Decimals:**

  Which is greater: 0.57 or 0.507?

  0.57 > 0.507
- **Adding Decimals:**

  `4.3 + 2.15 = 6.45`
- **Subtracting Decimals:**

  `7.25 - 1.9 = 5.35`
- **Estimating Decimal Sums:**

  2.68 + 5.14 ≈ 3 + 5 = 8
- **Multiplying Decimals:**

  `0.6 × 0.4 = 0.24`
- **Dividing Decimals by Whole Numbers:**

  `4.8 ÷ 3 = 1.6`
- **Dividing Whole Numbers by Decimals:**

  `6 ÷ 0.2 = 30`
- **Percent to Decimal:**

  25% = 0.25 (divide by 100)
- **Decimal to Percent:**

  0.85 = 85% (multiply by 100)

- **Multiplying Percents and Fractions:**
  25% of 32 = 0.25 × 32 = 8

Pre-Test (40 Questions)

Q1. What is the place value of 7 in 3.475?

○ Hundredths

○ Tenths

○ Thousandths

○ Ones

Q2. Round 5.639 to the nearest tenth.

○ 5.6

○ 5.64

○ 5.63

○ 5.7

Q3. Write 2/5 as a decimal.

○ 0.25

○ 0.4

○ 0.5

○ 0.2

Q4. Write 0.8 as a fraction in simplest form.

○ 4/5

○ 2/5

○ 8/10

○ 8/100

Q5. Compare: 0.45 ___ 0.405

○ >

○ =

○ <

○ Cannot compare

Q6. Order from least to greatest: 0.7, 0.67, 0.76

○ 0.7, 0.67, 0.76

○ 0.67, 0.7, 0.76

○ 0.67, 0.76, 0.7

○ 0.76, 0.7, 0.67

Q7. 3.5 + 2.48 = ?

○ 5.98

○ 5.88

○ 5.98

○ 5.94

Q8. 6.2 - 4.55 = ?

○ 2.55

○ 1.65

○ 1.75

○ 2.65

Q9. Estimate: 4.78 + 1.25 ≈

○ 5

○ 6

○ 7

○ 8

Q10. Estimate: 8.67 - 3.12 ≈

○ 6

○ 7

○ 5

○ 8

Q11. 0.3 × 0.6 = ?

○ 0.09

○ 0.18

○ 0.24

○ 0.12

Q12. Estimate: 3.7 × 1.9 ≈

○ 6

○ 8

○ 9

○ 7

Q13. Multiply: $3.25 × 4

○ $13.00

○ $12.00

○ $14.00

○ $11.00

Q14. Divide: 7.2 ÷ 3

○ 2.2

○ 2.4

○ 2.5

○ 2.3

Q15. Divide: 9 ÷ 0.3

○ 30

○ 3

○ 27

○ 90

Q16. Divide: 0.56 ÷ 0.7

○ 0.8

○ 0.7

○ 0.56

○ 0.9

Q17. Estimate: 5.94 ÷ 2 ≈

○ 2

○ 3

○ 4

○ 1

Q18. What percent is 0.56?

○ 56%

○ 5.6%

○ 0.56%

○ 560%

Q19. Convert 75% to a decimal.

○ 0.075

○ 0.75

○ 7.5

○ 0.0075

Q20. Write 1/8 as a percent.

○ 8%

○ 12.5%

○ 18%

○ 25%

Q21. Find 20% of 90.

○ 18

○ 27

○ 20

○ 9

Q22. Convert 0.03 to a percent.

○ 3%

○ 0.3%

○ 30%

○ 300%

Q23. Write 0.125 as a fraction.

○ 1/8

○ 1/2

○ 1/4

○ 1/10

Q24. Round 2.844 to the nearest hundredth.

○ 2.84

○ 2.85

○ 2.80

○ 2.88

Q25. Compare: 0.065 ___ 0.056

○ >

○ =

○ <

○ Cannot compare

Q26. Add: 5.07 + 3.8

○ 8.87

○ 8.97

○ 8.77

○ 8.07

Q27. Subtract: 9.6 - 2.45

○ 7.25

○ 6.15

○ 7.15

○ 6.25

Q28. Estimate: 7.98 + 1.05 ≈

○ 8

○ 10

○ 9

○ 7

Q29. Multiply: 0.75 × 0.2

○ 0.15

○ 0.25

○ 0.10

○ 0.20

Q30. Estimate: 6.1 × 0.6 ≈

○ 4

○ 3

○ 5

○ 6

Q31. Divide: 8.1 ÷ 9

○ 0.9

○ 1.9

○ 1.1

○ 0.81

Q32. Divide: 5 ÷ 0.5

○ 10

○ 1

○ 2.5

○ 0.1

Q33. Divide: 0.42 ÷ 0.6

○ 0.7

○ 0.6

○ 0.42

○ 0.9

Q34. Estimate: 3.99 ÷ 2 ≈

○ 1

○ 2

○ 3

○ 4

Q35. What percent is 0.2?

○ 2%

○ 20%

○ 0.2%

○ 200%

Q36. Convert 12% to a decimal.

○ 0.12

○ 1.2

○ 0.012

○ 12

Q37. Write 0.75 as a percent.

○ 75%

○ 0.75%

○ 7.5%

○ 750%

Q38. Find 15% of 60.

○ 9

○ 6

○ 15

○ 12

Q39. Convert 0.04 to a fraction.

○ 1/25

○ 1/20

○ 1/40

○ 1/50

Q40. Round 7.456 to the nearest tenth.

○ 7.4

○ 7.5

○ 7.45

○ 7.46

Submit Pre-Test

Questions and Answers

Post-Test (40 Questions)

Q1. What is the place value of 9 in 4.093?

○ Tenths

○ Hundredths

○ Thousandths

○ Ones

Q2. Round 6.782 to the nearest hundredth.

○ 6.78

○ 6.80

○ 6.79

○ 6.70

Q3. Write 3/8 as a decimal.

○ 0.38

○ 0.375

○ 0.25

○ 0.3

Q4. Write 0.6 as a fraction in simplest form.

○ 6/100

○ 3/5

○ 6/10

○ 2/3

Q5. Compare: 0.72 ___ 0.702

○ >

○ <

○ =

○ Cannot compare

Q6. Order from least to greatest: 0.63, 0.36, 0.6

○ 0.36, 0.6, 0.63

○ 0.6, 0.36, 0.63

○ 0.63, 0.6, 0.36

○ 0.63, 0.36, 0.6

Q7. 2.7 + 3.56 = ?

○ 6.16

○ 6.26

○ 5.26

○ 5.16

Q8. 7.9 - 5.17 = ?

○ 2.63

○ 2.83

○ 2.73

○ 2.53

Q9. Estimate: 5.93 + 2.12 ≈

○ 8

○ 7

○ 6

○ 9

Q10. Estimate: 9.48 - 1.53 ≈

○ 9

○ 7

○ 8

○ 6

Q11. 0.7 × 0.5 = ?

○ 0.35

○ 0.25

○ 0.45

○ 0.15

Q12. Estimate: 4.2 × 2.7 ≈

○ 6

○ 10

○ 8

○ 12

Q13. Multiply: $4.75 × 3

○ $12.25

○ $13.25

○ $14.25

○ $15.25

Q14. Divide: 8.4 ÷ 2

○ 4.2

○ 4.6

○ 4.8

○ 4.4

Q15. Divide: 7 ÷ 0.7

○ 10

○ 1

○ 7

○ 0.1

Q16. Divide: 0.81 ÷ 0.9

○ 0.9

○ 1.1

○ 0.81

○ 0.91

Q17. Estimate: 6.44 ÷ 2 ≈

○ 2

○ 3

○ 4

○ 5

Q18. What percent is 0.72?

○ 7.2%

○ 72%

○ 0.72%

○ 720%

Q19. Convert 60% to a decimal.

○ 0.6

○ 6

○ 0.06

○ 60

Q20. Write 1/5 as a percent.

○ 5%

○ 20%

○ 10%

○ 25%

Q21. Find 10% of 140.

○ 14

○ 10

○ 1.4

○ 140

Q22. Convert 0.09 to a percent.

○ 0.9%

○ 9%

○ 90%

○ 0.09%

Q23. Write 0.375 as a fraction.

○ 3/8

○ 1/4

○ 1/8

○ 3/4

Q24. Round 8.941 to the nearest hundredth.

○ 8.94

○ 8.95

○ 8.90

○ 8.99

Q25. Compare: 0.409 ___ 0.49

○ <

○ >

○ =

○ Cannot compare

Q26. Add: 6.13 + 2.9

○ 8.93

○ 9.03

○ 9.13

○ 8.83

Q27. Subtract: 8.8 - 3.45

○ 5.25

○ 5.35

○ 5.15

○ 4.45

Q28. Estimate: 6.92 + 1.07 ≈

○ 7

○ 8

○ 9

○ 10

Q29. Multiply: 0.8 × 0.25

○ 0.2

○ 0.25

○ 0.15

○ 0.3

Q30. Estimate: 5.3 × 0.4 ≈

○ 2

○ 3

○ 4

○ 5

Q31. Divide: 9.6 ÷ 8

○ 1.2

○ 1.1

○ 1.3

○ 1.4

Q32. Divide: 6 ÷ 0.6

○ 10

○ 1

○ 6

○ 0.1

Q33. Divide: 0.36 ÷ 0.6

○ 0.6

○ 0.36

○ 0.7

○ 0.9

Q34. Estimate: 4.92 ÷ 2 ≈

○ 2

○ 3

○ 4

○ 5

Q35. What percent is 0.03?

○ 0.3%

○ 3%

○ 30%

○ 0.03%

Q36. Convert 18% to a decimal.

○ 0.18

○ 1.8

○ 0.018

○ 18

Q37. Write 0.6 as a percent.

○ 6%

○ 60%

○ 0.6%

○ 600%

Q38. Find 30% of 50.

○ 15

○ 30

○ 20

○ 25

Q39. Convert 0.12 to a fraction.

○ 3/25

○ 12/100

○ 1/8

○ 1/12

Q40. Round 5.789 to the nearest tenth.

○ 5.7

○ 5.8

○ 5.79

○ 5.9

Submit Post-Test

Basic Algebra Concepts

A Guided Study of Foundational Topics

1. Exponents & Scientific Notation

Exponents

An exponent shows how many times a number (the base) is multiplied by itself. For example, $2^3 = 2 \times 2 \times 2 = 8$.

- **Base:** The number being multiplied (e.g., 2)
- **Exponent:** How many times to multiply (e.g., 3)

Scientific Notation

Scientific notation expresses very large or very small numbers as a product of a number between 1 and 10 and a power of 10.

Example: $4,500,000 = 4.5 \times 10^6$

2. Properties & Operations

Order of Operations

The order in which mathematical operations must be performed: **PEMDAS**:

- Parentheses
- Exponents
- Multiplication & Division (left to right)
- Addition & Subtraction (left to right)

Commutative & Associative Properties

- **Commutative Property**: Order doesn't matter (addition/multiplication): $a + b = b + a$, $ab = ba$
- **Associative Property**: Grouping doesn't matter (addition/multiplication): $(a + b) + c = a + (b + c)$

Distributive & Identity Properties

- **Distributive Property:** $a(b + c) = ab + ac$
- **Identity Property:** For addition: $a + 0 = a$, for multiplication: $a \times 1 = a$

Zero Property & Equality Properties

- **Zero Property of Multiplication:** $a \times 0 = 0$
- **Equality Properties:** If $a = b$, then $a + c = b + c$, $a - c = b - c$, etc.

3. Factors & Multiples

- **Factors**: Numbers you can multiply together to get another number. (e.g., factors of 12: 1, 2, 3, 4, 6, 12)
- **Multiples**: The result of multiplying a number by an integer. (e.g., multiples of 3: 3, 6, 9, 12,...)

4. Variable Expressions & Equations

Understanding Variable Expressions

A variable expression involves numbers, variables (like x), and operations (like +, -, ×, ÷).
Examples:
$2x + 5, 7 - y, ab$

Solving Equations by Addition & Subtraction

To keep equations balanced, do the same operation on both sides.
Example: $x + 7 = 12$
Subtract 7 from both sides: $x = 5$

Solving Equations by Multiplication & Division

Example: $3x = 12$
Divide both sides by 3: $x = 4$

5. Inequalities & Substitution

Inequalities

- **<** : Less than
- **>** : Greater than
- **≤** : Less than or equal to
- **≥** : Greater than or equal to
- **≠** : Not equal to

Example: $x + 3 > 7 \rightarrow x > 4$

Solving Equations & Inequalities by Substitution

Substitute a value for the variable and check if the equation or inequality is true.
Example: In $2x = 8$, substitute $x = 4$ to see if $2 \times 4 = 8$.

6. In-Depth Concepts

- **Greatest Common Factor (GCF):** The largest factor that two numbers share.
- **Least Common Multiple (LCM):** The smallest multiple that two numbers share.
- **Inverse Operations:** Operations that undo each other (addition/subtraction, multiplication/division).
- **Properties of Equality:** Allow you to balance and solve equations.
- **Evaluating Expressions:** Replacing variables with numbers and performing operations.

7. Examples

- Exponents: $5^2 = 25$
- Scientific Notation: $0.0009 = 9 \times 10^{-4}$
- Order of Operations: $2 + 3 \times 4 = 2 + 12 = 14$
- Commutative: $4 + 7 = 7 + 4$
- Associative: $(2 + 3) + 4 = 2 + (3 + 4)$
- Distributive: $3(a + 2) = 3a + 6$
- Zero Property: $9 \times 0 = 0$
- Factor: Factors of 15: 1, 3, 5, 15
- Multiple: Multiples of 6: 6, 12, 18, 24,...
- Variable Expression: If $x = 2$, then $3x + 4 = 10$
- Solving Equation: $x - 5 = 13 \implies x = 18$
- Inequality: $y + 2 < 10 \implies y < 8$
- Substitution: $2y = 10$, if $y = 5$, $2 \times 5 = 10$

8. Pre-Test (40 Questions, Multiple Choice)

1. What is 3^3?

  A) 6

  B) 9

  C) 27

  D) 12

2. Write 250,000 in scientific notation.

  A) 2.5×10^4

  B) 2.5×10^5

  C) 25×10^4

  D) 0.25×10^6

3. What is the value of $(2 + 4) \times 3$?

  A) 18

  B) 14

C) 12

D) 20

4. What does the commutative property state?

A) Changing the grouping doesn't change the result

B) Changing the order doesn't change the result

C) Multiplying by zero gives zero

D) Adding zero gives the same number

5. Is $a(b + c) = ab + ac$ an example of the distributive property?

A) Yes

B) No

C) Only when $a = 1$

D) Only for addition

6. What is the identity element for addition?

A) 1

B) 0

C) -1

D) Any number

7. What is 7×0?

A) 0

B) 7

C) 1

D) Undefined

8. If $a = 7$, what is $a + 5$?

A) 10

B) 12

C) 2

D) 35

9. Name two factors of 18.

A) 2 and 9

B) 3 and 5

C) 6 and 11

D) 1 and 19

10. What is the third multiple of 5?

A) 5

B) 10

C) 15

D) 20

11. What is the solution to $x + 8 = 12$?

   A) 20

   B) 4

   C) 2

   D) 6

12. Solve: $4x = 24$

   A) $x = 6$

   B) $x = 4$

   C) $x = 12$

   D) $x = 8$

13. What does $x < 10$ mean?

   A) x is greater than 10

   B) x is equal to 10

   C) x is less than 10

   D) x is not equal to 10

14. If $y = 3$, what is $2y + 1$?

   A) 5

   B) 6

   C) 7

   D) 8

15. What is the least common multiple of 4 and 6?

   A) 12

   B) 24

   C) 18

   D) 6

16. What is the greatest common factor of 15 and 25?

   A) 5

   B) 10

   C) 15

   D) 25

17. What is 10^0?

   A) 1

   B) 0

   C) 10

   D) 100

18. Write 3.2×10^4 in standard form.

    A) 32,000

    B) 3,200

    C) 320

    D) 320,000

19. Is $(a + b) + c = a + (b + c)$ always true?

    A) Yes

    B) No

    C) Only for addition

    D) Only for multiplication

20. What is the solution to $x - 3 = 7$?

    A) 4

    B) 10

    C) 7

    D) 2

21. Give an example of a variable expression.

    A) $5 + 4$

    B) $x + 3$

    C) $7 - 2$

    D) 12×2

22. If $x = 6$, is $x + 2 = 8$ true?

    A) Yes

    B) No

    C) Only if $x = 7$

    D) Only if $x = 8$

23. What is $5 \times (2 + 3)$?

    A) 15

    B) 10

    C) 25

    D) 20

24. What is the solution to $9y = 81$?

    A) 9

    B) 8

    C) 10

    D) 81

25. What is the fourth multiple of 3?

    A) 9
    B) 12
    C) 15
    D) 6

26. What is the solution to $x/4 = 5$?

    A) 9
    B) 20
    C) 1
    D) 4

27. What is the value of 2^4?

    A) 8
    B) 16
    C) 12
    D) 24

28. Write 0.004 in scientific notation.

    A) 4×10^{-3}
    B) 4×10^{-2}
    C) 4×10^{-4}
    D) 4×10^{3}

29. If $m = 2$, what is $3m$?

    A) 6
    B) 5
    C) 7
    D) 3

30. Solve: $y + 9 = 15$

    A) 4
    B) 6
    C) 5
    D) 7

31. What is the identity element for multiplication?

    A) 0
    B) 1
    C) -1
    D) 10

32. What is 8×1?

    A) 8

    B) 1

    C) 0

    D) 9

33. What is the zero property of multiplication?

    A) Multiplying by 1 gives the same number

    B) Multiplying by 0 gives 0

    C) Adding 0 gives the same number

    D) Subtracting 0 gives 0

34. What is the solution to $t - 2 = 10$?

    A) 8

    B) 12

    C) 10

    D) 2

35. What is the commutative property for multiplication?

    A) $a \times b = b \times a$

    B) $(a \times b) \times c = a \times (b \times c)$

    C) $a \times 0 = 0$

    D) $a + b = b + a$

36. If $x = 4$, what is x^2?

    A) 8

    B) 16

    C) 12

    D) 24

37. What is $6 + 7$?

    A) 13

    B) 12

    C) 11

    D) 14

38. What does $x \geq 5$ mean?

    A) x is less than 5

    B) x is greater than 5

    C) x is less than or equal to 5

    D) x is greater than or equal to 5

39. If $z = 9$, what is $z/3$?

   A) 2

   B) 3

   C) 6

   D) 9

40. What is the greatest common factor of 12 and 18?

   A) 2

   B) 3

   C) 6

   D) 12

9. Questions & Answers

1. **What is an exponent?**
   An exponent tells how many times a number (the base) is multiplied by itself.
2. **How do you write 120,000 in scientific notation?**
   1.2×10^5
3. **What is the distributive property?**
   Multiplying a number by a sum: $a(b + c) = ab + ac$.
4. **What is the zero property of multiplication?**
   Any number multiplied by zero is zero.
5. **What is the least common multiple (LCM)?**
   The smallest multiple that two or more numbers share.
6. **What is a variable expression?**
   An expression that contains variables, numbers, and operations.
7. **How do you solve $x + 5 = 12$?**
   Subtract 5 from both sides: $x = 7$.
8. **What does $x > 8$ mean?**
   x is greater than 8.
9. **How do you check your solution in an equation?**
   Substitute your answer back into the original equation.

10. **What is the identity property of addition?**
    Any number plus zero is itself.

10. Post-Test (40 Questions)

1. What is 4^2?
2. Write 0.0003 in scientific notation.
3. What is the value of $(3 + 5) \times 2$?
4. What does the associative property state?
5. Is $ab = ba$ an example of commutative property?
6. What is the identity element for multiplication?
7. What is 12×0?
8. If $a = 5$, what is $a - 2$?
9. Name two multiples of 7.
10. What is the fifth multiple of 4?
11. What is the solution to $x + 3 = 11$?
12. Solve: $5x = 35$
13. What does $x > 6$ mean?
14. If $y = 4$, what is $3y - 2$?
15. What is the least common multiple of 3 and 5?
16. What is the greatest common factor of 20 and 30?
17. What is 2^0?
18. Write 5.7×10^3 in standard form.
19. Is $a + (b + c) = (a + b) + c$ always true?
20. What is the solution to $x - 6 = 9$?
21. Give another example of a variable expression.
22. If $x = 3$, is $x + 7 = 10$ true?
23. What is $6 \times (1 + 2)$?
24. What is the solution to $7y = 49$?
25. What is the second multiple of 8?
26. What is the solution to $x/2 = 9$?
27. What is the value of 3^3?
28. Write 800,000 in scientific notation.
29. If $m = 7$, what is $2m$?
30. Solve: $y + 5 = 17$
31. What is the identity element for addition?
32. What is 15×1?
33. What is the zero property of addition?

34. What is the solution to $t - 8 = 4$?
35. What is the commutative property for addition?
36. If $x = 5$, what is x^2?
37. What is $9 + 6$?
38. What does $y \leq 12$ mean?
39. If $z = 12$, what is $z/4$?
40. What is the greatest common factor of 18 and 30?

Measurements and Units

Customary & Metric Units, Examples, Tests, and More

Customary Units

Units of Length

- Inch (in)
- Foot (ft): 12 inches
- Yard (yd): 3 feet
- Mile (mi): 1,760 yards or 5,280 feet

Units of Liquid Volume

- Fluid Ounce (fl oz)
- Cup (c): 8 fl oz
- Pint (pt): 2 cups
- Quart (qt): 2 pints
- Gallon (gal): 4 quarts

Units of Weight

- Ounce (oz)
- Pound (lb): 16 ounces
- Ton (T): 2,000 pounds

Perimeter

The distance around a shape (measured in units of length, e.g. ft, in).

Area

The amount of surface a shape covers (square inches, square feet, etc.).

Volume of a Solid

The amount of space a solid occupies (cubic inches, cubic feet, etc.).

Time

- 60 seconds = 1 minute
- 60 minutes = 1 hour
- 24 hours = 1 day
- 7 days = 1 week

Temperature

- Measured in degrees Fahrenheit (°F)

Metric Units

Units of Length

- Millimeter (mm)
- Centimeter (cm): 10 mm
- Meter (m): 100 cm
- Kilometer (km): 1,000 m

Units of Liquid Volume

- Milliliter (mL)
- Liter (L): 1,000 mL

Units of Mass

- Milligram (mg)
- Gram (g): 1,000 mg
- Kilogram (kg): 1,000 g

Perimeter, Area, and Volume

- Perimeter: measured in meters, centimeters, etc.
- Area: measured in square meters (m²), square centimeters (cm²), etc.
- Volume: measured in cubic meters (m³), cubic centimeters (cm³), etc.

Unit Conversions

Customary to Metric

- 1 inch ≈ 2.54 cm
- 1 foot ≈ 0.3048 m
- 1 mile ≈ 1.609 km
- 1 ounce ≈ 28.35 g
- 1 pound ≈ 0.4536 kg
- 1 gallon ≈ 3.785 L
- °F to °C: (°F - 32) × 5/9

Metric to Customary

- 1 cm ≈ 0.3937 in
- 1 m ≈ 3.281 ft
- 1 km ≈ 0.6214 mi
- 1 g ≈ 0.03527 oz
- 1 kg ≈ 2.205 lb
- 1 L ≈ 0.2642 gal
- °C to °F: (°C × 9/5) + 32

Examples

- **Customary Length:** 3 feet = 36 inches
- **Metric Length:** 1.5 meters = 150 centimeters
- **Customary Volume:** 2 quarts = 4 pints
- **Metric Volume:** 0.75 liters = 750 milliliters
- **Customary Weight:** 3 pounds = 48 ounces
- **Metric Mass:** 2.5 kg = 2,500 g
- **Perimeter:** Rectangle 4 cm × 6 cm: 2(4+6) = 20 cm
- **Area:** Square with 5 m sides: 5 × 5 = 25 m²
- **Volume:** Box 2 m × 3 m × 4 m: 2 × 3 × 4 = 24 m³
- **Conversion:** 10 inches × 2.54 = 25.4 cm
- **Temperature:** 20°C = (20 × 9/5) + 32 = 68°F

Pre-Test (40 Multiple Choice Questions)

1. How many inches are in a foot?

   ○ 10

   ○ 12

   ○ 14

   ○ 16

2. How many feet are in a yard?

- ○ 2
- ○ 3
- ○ 4
- ○ 5

3. How many yards are in a mile?

- ○ 760
- ○ 1,760
- ○ 5,280
- ○ 3,280

4. How many fluid ounces are in a cup?

- ○ 6
- ○ 8
- ○ 12
- ○ 16

5. How many pints are in a quart?

- ○ 1
- ○ 2
- ○ 4
- ○ 8

6. How many quarts are in a gallon?

- ○ 2
- ○ 4
- ○ 8
- ○ 16

7. How many ounces are in a pound?

○ 8

○ 10

○ 12

○ 16

8. How many pounds are in a ton?

○ 1,000

○ 2,000

○ 2,200

○ 5,000

9. What is the perimeter of a rectangle with sides 5 ft and 7 ft?

○ 24 ft

○ 26 ft

○ 30 ft

○ 12 ft

10. What is the area of a rectangle 3 in by 4 in?

○ 7 in²

○ 12 in²

○ 14 in²

○ 24 in²

11. Find the volume of a box 2 ft × 1 ft × 1 ft.

○ 2 ft³

○ 4 ft³

○ 1 ft³

○ 8 ft³

12. How many minutes are in an hour?

○ 50

○ 60

○ 100

○ 24

13. Convert 100°F to Celsius.

○ 38°C

○ 40°C

○ 50°C

○ 60°C

14. What is 1 kilometer in meters?

○ 10

○ 100

○ 1,000

○ 10,000

15. How many millimeters in a centimeter?

○ 1

○ 5

○ 10

○ 100

16. How many centimeters in a meter?

○ 10

○ 50

○ 100

○ 1,000

17. Convert 2 liters to milliliters.

- ○ 200
- ○ 2,000
- ○ 20,000
- ○ 200,000

18. How many grams in a kilogram?

- ○ 10
- ○ 100
- ○ 1,000
- ○ 10,000

19. What is the area of a square with side 6 cm?

- ○ 12 cm²
- ○ 24 cm²
- ○ 36 cm²
- ○ 42 cm²

20. What is the perimeter of a triangle with sides 3 m, 4 m, and 5 m?

- ○ 12 m
- ○ 14 m
- ○ 15 m
- ○ 16 m

21. Convert 10 inches to centimeters.

- ○ 20.54 cm
- ○ 22.54 cm
- ○ 25.4 cm
- ○ 30.4 cm

22. Convert 5 feet to meters.

○ 1.524 m

○ 2.524 m

○ 3.524 m

○ 4.524 m

23. Convert 3 miles to kilometers.

○ 3.218 km

○ 4.828 km

○ 5.218 km

○ 6.218 km

24. Convert 500 grams to pounds.

○ 1.1 lb

○ 1.5 lb

○ 2.2 lb

○ 2.5 lb

25. Convert 2 liters to gallons.

○ 0.528 gal

○ 0.728 gal

○ 0.928 gal

○ 1.128 gal

26. Convert 20°C to Fahrenheit.

○ 68°F

○ 70°F

○ 72°F

○ 74°F

27. Convert 50 yards to meters.

○ 45.72 m

○ 40.72 m

○ 35.72 m

○ 50.72 m

28. How many cups are in a gallon?

○ 10

○ 12

○ 16

○ 20

29. How many ounces are in a quart?

○ 16

○ 24

○ 32

○ 40

30. Convert 1 meter to feet.

○ 2.281 ft

○ 3.281 ft

○ 4.281 ft

○ 5.281 ft

31. Convert 100 milliliters to liters.

○ 0.01 L

○ 0.1 L

○ 1 L

○ 10 L

32. Convert 250 milligrams to grams.

○ 0.025 g

○ 0.25 g

○ 2.5 g

○ 25 g

33. Find the volume of a cube with a side of 4 cm.

○ 16 cm³

○ 32 cm³

○ 64 cm³

○ 128 cm³

34. How many seconds are in an hour?

○ 3,000

○ 3,600

○ 6,000

○ 6,600

35. Convert 1 liter to fluid ounces.

○ 16.91 fl oz

○ 33.81 fl oz

○ 35.81 fl oz

○ 40.81 fl oz

36. Convert 1 kilogram to ounces.

○ 16.35 oz

○ 28.35 oz

○ 35.27 oz

○ 45.36 oz

37. Convert 25°C to Fahrenheit.

○ 77°F

○ 78°F

○ 79°F

○ 80°F

38. Convert 60 miles to kilometers.

○ 96.56 km

○ 97.56 km

○ 98.56 km

○ 99.56 km

39. How many weeks are in a year?

○ 48

○ 50

○ 52

○ 54

40. What is the area of a rectangle 2 m by 5 m?

○ 7 m²

○ 8 m²

○ 10 m²

○ 12 m²

Submit   **Reset**

Questions and Answers

After you complete the pre-test, any incorrect answers will appear here with explanations.

Post-Test (40 Multiple Choice Questions)

1. How many feet are in a yard?
   - ○ 2
   - ○ 3
   - ○ 4
   - ○ 5

2. How many yards are in a mile?
   - ○ 760
   - ○ 1,760
   - ○ 5,280
   - ○ 3,280

3. How many quarts are in a gallon?
   - ○ 2
   - ○ 4
   - ○ 8
   - ○ 16

4. How many ounces are in a pound?
   - ○ 8
   - ○ 10
   - ○ 12
   - ○ 16

5. How many pints are in a gallon?
   - ○ 4
   - ○ 6
   - ○ 8

○ 16

6. How many inches are in a yard?

○ 24
○ 30
○ 36
○ 48

7. What is the perimeter of a square with side 4 ft?

○ 12 ft
○ 14 ft
○ 16 ft
○ 18 ft

8. What is the area of a rectangle 5 m by 2 m?

○ 7 m²
○ 8 m²
○ 10 m²
○ 12 m²

9. What is the volume of a cube with side 3 in?

○ 9 in³
○ 18 in³
○ 27 in³
○ 36 in³

10. How many seconds are in a minute?

○ 30
○ 45
○ 60

○ 90

11. Convert 5 miles to kilometers.

   ○ 7.03 km
   ○ 8.05 km
   ○ 8.23 km
   ○ 9.05 km

12. Convert 10 meters to feet.

   ○ 23.81 ft
   ○ 30.81 ft
   ○ 32.81 ft
   ○ 40.81 ft

13. Convert 2 gallons to liters.

   ○ 4.785 L
   ○ 5.785 L
   ○ 6.785 L
   ○ 7.785 L

14. Convert 100 grams to ounces.

   ○ 2.35 oz
   ○ 3.53 oz
   ○ 4.53 oz
   ○ 5.53 oz

15. Convert 1 liter to milliliters.

   ○ 10 mL
   ○ 100 mL
   ○ 1,000 mL

○ 10,000 mL

16. How many centimeters in a kilometer?

○ 1,000
○ 10,000
○ 100,000
○ 1,000,000

17. Convert 20 inches to centimeters.

○ 40.48 cm
○ 50.80 cm
○ 60.08 cm
○ 70.20 cm

18. Convert 3 kilograms to pounds.

○ 4.35 lb
○ 5.85 lb
○ 6.61 lb
○ 7.05 lb

19. Convert 32°F to Celsius.

○ 0°C
○ 10°C
○ 20°C
○ 32°C

20. Convert 0°C to Fahrenheit.

○ 0°F
○ 32°F
○ 50°F

○ 100°F

21. How many cups in a quart?

○ 2

○ 3

○ 4

○ 6

22. How many pints in a quart?

○ 1

○ 2

○ 3

○ 4

23. How many milliliters in a liter?

○ 10

○ 100

○ 1,000

○ 10,000

24. Convert 5 feet to inches.

○ 50 in

○ 56 in

○ 60 in

○ 72 in

25. Convert 100 milligrams to grams.

○ 0.01 g

○ 0.1 g

○ 1 g

○ 10 g

26. Convert 3 liters to gallons.

○ 0.792 gal
○ 1.92 gal
○ 2.12 gal
○ 3.92 gal

27. Find the perimeter of a triangle with sides 5 cm, 7 cm, and 8 cm.

○ 18 cm
○ 19 cm
○ 20 cm
○ 21 cm

28. Find the area of a square with side 10 m.

○ 10 m²
○ 20 m²
○ 50 m²
○ 100 m²

29. Find the volume of a box 1 m × 2 m × 3 m.

○ 3 m³
○ 5 m³
○ 6 m³
○ 7 m³

30. How many days are in a week?

○ 5
○ 6
○ 7

○ 8

31. How many months in a year?

○ 10

○ 11

○ 12

○ 13

32. How many weeks in a year?

○ 48

○ 50

○ 52

○ 54

33. Convert 1 kilogram to grams.

○ 10

○ 100

○ 1,000

○ 10,000

34. Convert 1 mile to feet.

○ 1,280 ft

○ 2,280 ft

○ 5,280 ft

○ 6,280 ft

35. How many yards in a foot?

○ 1/2

○ 1/3

○ 1/4

O 1/5

36. Convert 3 quarts to cups.

O 6

O 8

O 10

O 12

37. Convert 100°F to Celsius.

O 36°C

O 37.8°C

O 38°C

O 40°C

38. Convert 25°C to Fahrenheit.

O 77°F

O 78°F

O 79°F

O 80°F

39. How many ounces in a gallon?

O 32

O 64

O 96

O 128

40. How many feet in a mile?

O 1,280

O 3,280

O 5,280

○ 7,280

Submit   Reset

Planar Geometry: Complete Study Guide

Points & Lines

Line Segments & Rays

Measuring Angles

Types of Angles

Triangles

Quadrilaterals

Polygons

Circles

Solid Figures

Surface Area

Graphing Figures

Explained Concepts

Examples

Pre-Test

Q & A

Planar Geometry: Points and Lines

- **Point:** An exact location in space, no size or dimension.
- **Line:** Extends infinitely in both directions, has length but no thickness.

Line Segments and Rays

- **Line Segment:** Part of a line with two endpoints.
- **Ray:** Has one endpoint, extends infinitely in one direction.

Measuring Angles

- **Angle:** Formed by two rays meeting at a vertex.
- **Measured in degrees (°) with a protractor.**

Types of Angles

- **Acute:** Less than 90°
- **Right:** Exactly 90°
- **Obtuse:** More than 90° but less than 180°
- **Straight:** 180°
- **Reflex:** More than 180° but less than 360°

Triangles

- **Types by sides:** Equilateral (all equal), Isosceles (two equal), Scalene (none equal).
- **Types by angles:** Acute (all <90°), Right (one 90°), Obtuse (one >90°).
- Sum of angles: 180°

Quadrilaterals

- Has 4 sides.
- Examples: Square, Rectangle, Parallelogram, Rhombus, Trapezoid.
- Sum of angles: 360°

Polygons

- Closed figures with 3 or more straight sides.
- Regular: all sides and angles equal.
- Sum of angles: (n-2)×180° (n = number of sides)

Circles

- Set of points equidistant from a center.
- Parts: radius, diameter, chord, arc, sector, tangent.
- Area: πr^2. Circumference: $2\pi r$.

Solid Figures

- 3D shapes: Cube, Cuboid, Sphere, Cylinder, Cone, Pyramid, Prism.
- Have volume and surface area.

Surface Area

- Sum of areas of all faces of a 3D object.
- Cube: $6a^2$, Sphere: $4\pi r^2$, Cylinder: $2\pi r(h+r)$.

Graphing Figures

- Placing points and shapes on coordinate plane (x, y).
- Distance between two points: $\sqrt{(x2-x1)^2 + (y2-y1)^2}$

Explained Concepts

- **Parallel Lines:** Never meet, always same distance apart.
- **Perpendicular Lines:** Meet at 90° angle.

- **Congruent Figures:** Same size and shape.
- **Similar Figures:** Same shape, different size (proportional sides, equal angles).
- **Transversal:** A line that crosses two or more lines, forming angles.
- **Diagonal:** A line joining non-adjacent vertices of a polygon.

Examples

1. Sum of angles in a hexagon: (6-2)×180° = 720°
2. Area of triangle (base=6, height=9): ½×6×9 = 27
3. Area of circle (radius=4): $\pi×4^2$ = 16π ≈ 50.27
4. Distance between (1,2) and (4,6): $\sqrt{[(4-1)^2 + (6-2)^2]}$ = √(9+16) = 5
5. Volume of cube (side=3): 3^3 = 27
6. Surface area of cylinder (r=2, h=5): 2π×2×(2+5) = 28π ≈ 87.96
7. Identify the diameter in a circle diagram: Line through center, touching both points on circle.
8. What is a sector: Region bounded by two radii and an arc.
9. Area of rectangle (l=8, w=3): 8×3 = 24
10. Diagonals in a pentagon: 5×2/2 = 5

Pre-Test (40 MCQs)

Q1. Which object in geometry has no size or dimension?
○ Point
○ Line
○ Surface
○ Solid

Q2. A line segment has:
○ One endpoint
○ Two endpoints
○ No endpoints
○ Infinite endpoints

Q3. A ray:
○ Has two endpoints
○ Extends infinitely in one direction
○ Is a closed figure
○ Has no endpoint

Q4. Which tool measures angles?

○ Compass
○ Ruler
○ Divider
○ Protractor

Q5. An obtuse angle measures:
○ Less than 90°
○ Exactly 90°
○ More than 90° but less than 180°
○ Exactly 180°

Q6. The sum of angles in a triangle is:
○ 90°
○ 180°
○ 360°
○ 270°

Q7. Which shape is a polygon?
○ Circle
○ Triangle
○ Sphere
○ Cylinder

Q8. A quadrilateral has:
○ 3 sides
○ 4 sides
○ 5 sides
○ 6 sides

Q9. A regular polygon has:
○ All sides equal
○ All angles equal
○ Both sides and angles equal
○ No equal sides

Q10. What is the center of a circle called?
○ Arc
○ Radius
○ Diameter
○ Center

Q11. A chord of a circle:

○ Passes through the center
○ Joins two points on the circle
○ Is always a diameter
○ Is the same as a tangent

Q12. The diameter of a circle is:
○ Twice the radius
○ Half the radius
○ Equal to the radius
○ A chord not passing through center

Q13. A cube has how many faces?
○ 4
○ 6
○ 8
○ 10

Q14. Surface area of a cube with side a is:
○ a^2
○ $4a^2$
○ $6a^2$
○ a^3

Q15. Which is NOT a solid figure?
○ Sphere
○ Cube
○ Rectangle
○ Cylinder

Q16. Which is a right angle?
○ 45°
○ 60°
○ 90°
○ 120°

Q17. A triangle with all sides equal is called:
○ Scalene
○ Isosceles
○ Equilateral
○ Right

Q18. A parallelogram has:

○ Only one pair of parallel sides
○ Both pairs of opposite sides parallel
○ All sides equal
○ No parallel sides

Q19. The sum of angles in a quadrilateral is:
○ 180°
○ 360°
○ 270°
○ 90°

Q20. A straight angle measures:
○ 90°
○ 180°
○ 360°
○ 0°

Q21. A pentagon has how many sides?
○ 4
○ 5
○ 6
○ 7

Q22. A regular hexagon's internal angle is:
○ 120°
○ 108°
○ 135°
○ 90°

Q23. Which is NOT a polygon?
○ Circle
○ Octagon
○ Hexagon
○ Quadrilateral

Q24. Which solid has only one curved surface?
○ Cube
○ Cylinder
○ Cone
○ Sphere

Q25. Distance formula between (0,0) and (3,4):

○ 5

○ 7

○ 6

○ 4

Q26. The sum of angles in a pentagon is:

○ 360°

○ 540°

○ 720°

○ 900°

Q27. Which figure has exactly one pair of parallel sides?

○ Trapezoid

○ Rectangle

○ Rhombus

○ Square

Q28. A circle's area formula is:

○ πr

○ πr^2

○ $2\pi r$

○ πd

Q29. The volume of a cube (side a):

○ a^2

○ a^3

○ $6a^2$

○ $2a^3$

Q30. A reflex angle measures:

○ >180°

○ <90°

○ =90°

○ =180°

Q31. A rectangle's opposite sides are:

○ Equal

○ Unequal

○ Sometimes equal

○ Never equal

Q32. A rhombus is a:

○ Quadrilateral
○ Triangle
○ Polygon
○ Both A and C

Q33. A sector of a circle is:
○ A slice between two radii
○ A full circle
○ A chord
○ A tangent

Q34. A transversal intersects:
○ One line
○ Two or more lines
○ No lines
○ Circle

Q35. Parallel lines:
○ Never meet
○ Meet once
○ Always meet
○ Are not straight

Q36. Congruent figures have:
○ Same shape and size
○ Only same shape
○ Only same size
○ Different shape

Q37. Similar figures have:
○ Same shape, different size
○ Same size
○ Different shapes
○ No relation

Q38. Which is NOT a quadrilateral?
○ Square
○ Triangle
○ Trapezium
○ Rhombus

Q39. Sum of angles in a hexagon:

- ○ 720°
- ○ 540°
- ○ 900°
- ○ 360°

Submit

Questions and Answers (from your last Pre-Test)

Take the Pre-Test. Each incorrect answer will appear here.

Post-Test (40 MCQs)

Q1. A point is:
- ○ A location with no size
- ○ A line
- ○ A plane
- ○ A solid

Q2. A line extends:
- ○ Infinitely in both directions
- ○ Ends at points
- ○ Forms a closed figure
- ○ Is a segment

Q3. A line segment has:
- ○ No endpoints
- ○ One endpoint
- ○ Two endpoints
- ○ Infinite endpoints

Q4. A ray extends:
- ○ In one direction
- ○ Both directions

○ No direction
○ Forms a loop

Q5. An angle is formed by:
○ Two rays
○ Two lines
○ A line and a point
○ One segment

Q6. A right angle is:
○ 45°
○ 60°
○ 90°
○ 120°

Q7. An angle greater than 90° but less than 180° is:
○ Acute
○ Right
○ Obtuse
○ Straight

Q8. A triangle with all sides equal:
○ Scalene
○ Isosceles
○ Equilateral
○ Right

Q9. The sum of angles in a triangle:
○ 90°
○ 180°
○ 270°
○ 360°

Q10. A quadrilateral has:
○ 3 sides
○ 4 sides
○ 5 sides
○ 6 sides

Q11. A rectangle's diagonals are:
○ Unequal
○ Equal

○ Curved

○ None

Q12. A regular polygon:
○ All sides and angles equal
○ Only sides equal
○ Only angles equal
○ No equal sides

Q13. A circle is:
○ A polygon
○ Not a polygon
○ A quadrilateral
○ A triangle

Q14. The longest chord in a circle is:
○ Radius
○ Diameter
○ Arc
○ Tangent

Q15. A cube has how many edges?
○ 8
○ 10
○ 12
○ 14

Q16. Surface area of a sphere (radius r):
○ $2\pi r$
○ $4\pi r^2$
○ πr^2
○ πr^3

Q17. A solid figure with a circular base and one vertex:
○ Cube
○ Sphere
○ Cone
○ Cylinder

Q18. What is area of a rectangle (l × w):
○ Add l and w
○ Multiply l and w

○ Divide l by w

○ Subtract w from l

Q19. How many axes does a coordinate plane have?
○ 1
○ 2
○ 3
○ 4

Q20. A polygon with 8 sides is called:
○ Hexagon
○ Octagon
○ Heptagon
○ Nonagon

Q21. A triangle with two sides equal is:
○ Scalene
○ Equilateral
○ Isosceles
○ Right

Q22. A parallelogram has:
○ All sides equal
○ Both pairs of opposite sides parallel
○ No parallel sides
○ Only one pair parallel

Q23. A sector of a circle is:
○ A full circle
○ Region between two radii and arc
○ A tangent
○ A diameter

Q24. The volume of a cube (side a):
○ a^2
○ a^3
○ $6a^2$
○ a

Q25. The sum of angles in a pentagon:
○ 360°
○ 540°

○ 720°
○ 900°

Q26. A rhombus is:
○ A triangle
○ A quadrilateral
○ A polygon
○ Both B and C

Q27. A trapezium has:
○ One pair of parallel sides
○ No parallel sides
○ Two pairs of parallel sides
○ All sides equal

Q28. Which is NOT a polygon?
○ Triangle
○ Quadrilateral
○ Circle
○ Pentagon

Q29. A chord of a circle:
○ Passes through center
○ Joins any two points on circle
○ Is always a diameter
○ Is a tangent

Q30. What is the value of π (pi) up to 2 decimal places?
○ 3.00
○ 3.14
○ 2.14
○ 3.41

Q31. Surface area of a cube (side a):
○ a^2
○ $6a^2$
○ $4a^2$
○ a^3

Q32. A line that crosses two or more lines is called:
○ Parallel
○ Transversal

○ Tangent
○ Chord

Q33. A pair of lines that never meet:
○ Intersecting
○ Parallel
○ Perpendicular
○ Skew

Q34. Figures with same shape and size are:
○ Congruent
○ Similar
○ Both
○ None

Q35. Figures with same shape but different size:
○ Congruent
○ Similar
○ Both
○ None

Q36. Area of a triangle (base=8, height=5):
○ 13
○ 25
○ 20
○ 30

Q37. The area of a circle (radius r):
○ πr
○ πr^2
○ $2\pi r$
○ πd

Q38. The sum of angles in a hexagon:
○ 540°
○ 720°
○ 900°
○ 1080°

Q39. A nonagon has how many sides?
○ 6
○ 7

○ 8

○ 9

Submit

Train a Single Neuron: Linear Regression Demo

1. Introduction to Linear Regression

Linear regression is a foundational technique in machine learning used to model the relationship between a dependent variable (y) and one independent variable (x). The goal is to find the best-fitting straight line, which is mathematically expressed as **y = wx + b**, where **w** is the weight (slope) and **b** is the bias (intercept).
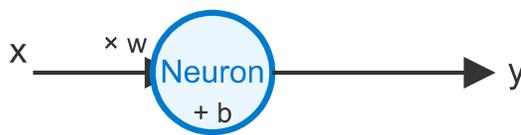

*Diagram: Single neuron for linear regression. Input **x** is multiplied by weight **w**, bias **b** is added, and the output is **y**.*

Example: Suppose you want to predict the price of a slice of pizza (**y**) by its size in inches (**x**). If every extra inch adds \$2, and a plain slice (0 inches) costs \$1, the model is:

```
y = 2x + 1
```

So, a 4-inch slice (**x=4**) would cost **y = 2×4 + 1 = 9** dollars.

2. Train a Single Neuron for Linear Regression

In this section, we use TensorFlow.js to train a single neuron (with just one input and one output) to learn the relationship between *x* and *y* as described above.

Train Model

3. Discussion: TensorFlow.js for JavaScript

TensorFlow.js is an open-source library that enables you to define, train, and run machine learning models directly in your browser or in a JavaScript environment such as Node.js. It supports both training from scratch and running pre-trained models and leverages GPU acceleration for efficient computation.

- **In-browser ML:** No server needed; everything runs on your device.
- **Interactivity:** You can build live, interactive demos.
- **Privacy:** Data can stay on the user's machine.
- **Hardware acceleration:** Uses WebGL for faster computation.

In this demo, TensorFlow.js powers the training and prediction process right in your browser!

Training a Convolutional Neural Network in the Browser

Introduction to Convolutional Neural Networks (CNNs)

Convolutional Neural Networks (CNNs) are a class of deep learning models widely used for analyzing visual imagery, such as images or videos. CNNs use convolutional layers that automatically learn spatial hierarchies of features from input images, making them highly effective for image classification, object detection, and related tasks. A typical CNN architecture consists of convolutional layers, pooling layers, and fully connected layers.

- **Convolutional Layers:** Apply filters to extract features like edges, textures, and shapes.
- **Pooling Layers:** Reduce the spatial dimensions, retaining the most important information.
- **Fully Connected Layers:** Perform classification based on the extracted features.

Training a CNN involves feeding labeled images into the model, computing the loss between predictions and ground truth, and updating the model's weights using backpropagation and optimization algorithms (commonly stochastic gradient descent or Adam).

Training a CNN

To train a CNN, you need:

- A dataset of labeled images (e.g., MNIST for handwritten digit recognition).
- A defined CNN architecture (number of layers, filter sizes, activation functions, etc.).
- A loss function (e.g., categorical crossentropy for classification tasks).
- An optimizer (e.g., Adam or SGD).

Training proceeds in epochs, where the entire dataset is passed through the network multiple times. After each batch of data, the model's weights are updated to minimize the loss, improving its predictions.

Visualizing a CNN Structure
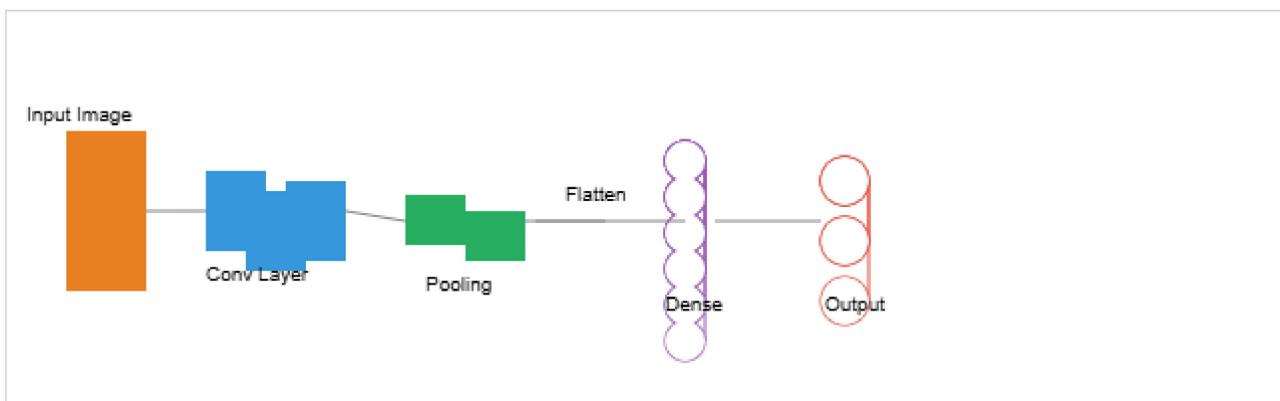
Easy-to-Understand Example

Imagine teaching a computer to recognize handwritten numbers, like distinguishing a '5' from a '3'. Here's how a CNN learns this task:

1. **Input:** The CNN receives an image of a handwritten digit (for example, a 28x28 pixel grayscale image).
2. **Convolution:** The first layer applies small filters that scan the image, detecting simple patterns like lines and curves.
3. **Pooling:** The next layer reduces the size of the data, keeping only the most important information.
4. **Flatten & Dense:** The condensed information is flattened into a vector and passed through fully connected ("dense") layers, which learn to associate patterns with specific digits.
5. **Output:** The network outputs the probability for each digit (0-9). The highest probability is the model's guess.

With enough training examples, the CNN learns which patterns correspond to each digit, just like how you learned to recognize handwriting!

TensorFlow.js for CNN Training in JavaScript

[TensorFlow.js](#) is a JavaScript library for training and deploying machine learning models in the browser or Node.js. It allows you to define, train, and run neural networks entirely in JavaScript, leveraging GPU acceleration via WebGL.

- **Model Definition:** Use `tf.sequential()` or `tf.model()` to construct models.
- **Layers:** Use `tf.layers.conv2d()`, `tf.layers.maxPooling2d()`, and `tf.layers.dense()` for CNN architectures.
- **Training:** Call `model.compile()` to set the optimizer and loss, and `model.fit()` to train the network.
- **Data:** You can use built-in datasets, load images, or use data generated in the browser.

TensorFlow.js enables real-time model training and inference directly in the browser, making it ideal for interactive machine learning demos and educational purposes.

Try it: Train a Simple CNN on MNIST Digits

The demo below will automatically download a sample of the MNIST dataset, define a small CNN, and train it right in your browser.

Libraries for Model Definition, Training, and Visualization

Several JavaScript libraries are available to help you define, train, and visualize neural network models in the browser:

- **TensorFlow.js** — An open-source library for defining, training, and running machine learning models entirely in the browser using JavaScript.
  `https://cdn.jsdelivr.net/npm/@tensorflow/tfjs@1.7.4/dist/tf.min.js`

- **Plotly.js** — A high-level, interactive charting library for visualizing data and model training progress directly on web pages.
  `https://cdn.jsdelivr.net/npm/plotly.js@1.54.7/dist/plotly.min.js`

These libraries can be used together to build, train, and visualize neural network models directly in your web browser.

Run

Discussion: The MNIST Image Dataset and Labels

The MNIST dataset is a classic benchmark in machine learning, featuring grayscale images of handwritten digits (0 through 9). Each image is 28x28 pixels (784 total), and the goal is to train a model to recognize the digit each image represents.

- **Image File:** mnist_images.png
  This single PNG image contains 65,000 stacked digit images in row-major order (each row is a 28x28 square).
- **Labels File:** mnist_labels_uint8
  This binary file contains the digit label (0–9) for each image, stored as unsigned 8-bit integers.

These files are commonly used for training and evaluating image classification models. By pairing images with their correct labels, we can teach a neural network to recognize handwritten digits.

Load MNIST Dataset

Visualize MNIST Data Samples

Now that the dataset `cleanedData` is loaded, you can browse and visualize any digit and its label below. Use the input to select an index (from 0 to ?).

Sample Index: 0   Show Sample

Splitting the Dataset into Training and Testing Sets

In machine learning, it is important to divide your dataset into two separate parts: a **training set** and a **testing set**. The training set is used to train the model, while the testing set is used to evaluate its performance on unseen data. A common split is 80% for training and 20% for testing, but the ratio can be adjusted as needed. This helps ensure the model generalizes well and does not simply memorize the examples.

Defining a Convolutional Neural Network (CNN) Model

Now that the data is ready, let's define a Convolutional Neural Network (CNN) model in JavaScript using TensorFlow.js. CNNs are especially effective for image recognition tasks such as classifying handwritten digits from the MNIST dataset.

Define CNN Model

Understanding the CNN Model

The Convolutional Neural Network (CNN) is designed for image recognition. It works in several steps:

1. **Convolution:** Learns small patterns (like edges or curves) in the image using sliding "filters".
2. **Pooling:** Reduces the size of the image while keeping important information, helping the model to focus on major features.
3. **Dense (Fully Connected) Layers:** These combine patterns detected in earlier layers to make the final prediction.

Here's an illustration of how a CNN processes an image:
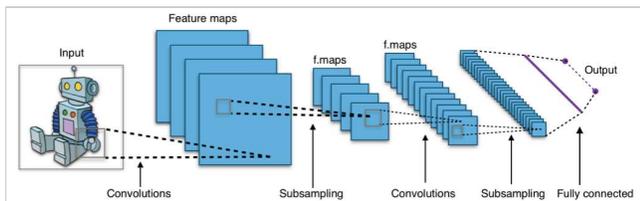
- **Left:** Input image (28x28 pixels)
- **Middle:** Filters detect features (edges, shapes)
- **Right:** Final layers combine features for classification

Animation and more interactive visualizations of CNNs can be found on [CNN Explainer](#).

Training the CNN Model

Now that the CNN model is defined, the next step is to train it using the training dataset. During training, the model learns to recognize patterns in the data by adjusting its internal weights to minimize prediction errors. This is done over multiple cycles called **epochs**. After each epoch, the model's performance on the training data is measured by loss (error) and accuracy (correct predictions).

Train the Model

How Model Training Works

Training is the process where the model learns by comparing its predictions to the known correct answers in the training data. The model adjusts its internal settings (weights and biases) to make better predictions. This cycle repeats for multiple epochs to gradually improve accuracy.

Training process illustration

Above: Each training epoch moves the model's predictions closer to the correct result, like stepping down a hill to reach the lowest point (minimal error).

Testing the CNN Model

After training, it's important to evaluate how well the model performs on unseen data. This is called **testing** the model. Testing uses a separate portion of the dataset that was not used during training. It helps determine if the model has learned general patterns or just memorized the training data.

Test the Model

How Model Testing Works

During testing, the model makes predictions on new data it has never seen before. The results are compared to the actual labels to calculate **loss** (how far off the predictions are) and **accuracy** (how often it gets the right answer). High accuracy and low loss on the test set mean the model can generalize well to real-world data.

Precision and recall illustration

Above: Evaluating a model involves measuring how often it makes correct predictions on new, unseen data.
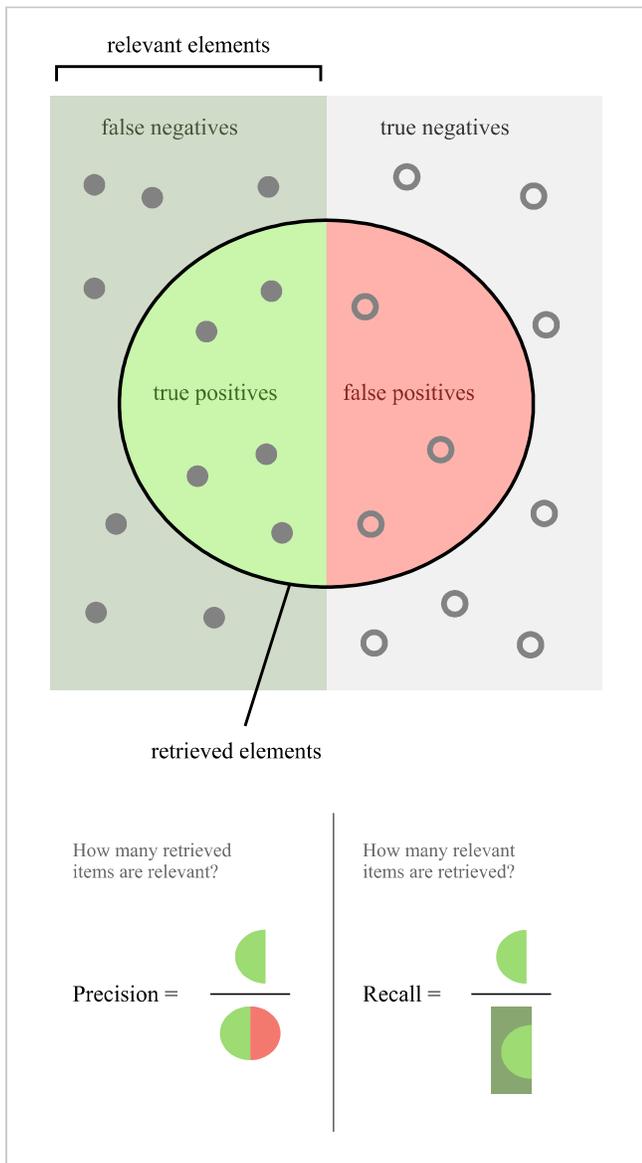
Understanding the Confusion Matrix

The **confusion matrix** is a table used to describe the performance of a classification model on a set of data for which the true values are known. It shows how many predictions were correct and where errors occurred, breaking down predictions by each class. The matrix helps you identify if the model is confusing certain classes, and is especially useful for multi-class problems like digit recognition.

- **Rows**: Actual labels (ground truth)
- **Columns**: Predicted labels by the model
- The **main diagonal** shows correct predictions, while off-diagonal values indicate misclassifications.

Confusion Matrix

How to Interpret the Confusion Matrix

The confusion matrix helps you see which classes the model is predicting well and where it makes mistakes. For example, if many actual "3"s are misclassified as "5", you'll see a higher count in the row for "Actual 3" and the column for "Pred 5".

relevant elements

false negatives

true negatives

true positives

false positives

retrieved elements

How many retrieved items are relevant?

How many relevant items are retrieved?

Precision =

Recall =

Diagonal cells are correct predictions. Off-diagonal cells represent mistakes and reveal which classes the model confuses.