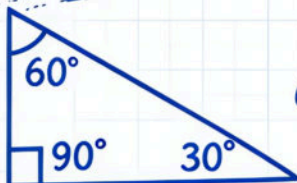


GRADES

9-10



$$a^2 + b^2 = c^2$$



$$A = \pi r^2$$

**BUILD
CONFIDENCE.
ONE REP
AT A TIME.**



Muscle Math Mania



★ GEOMETRY ★

STRONGER SKILLS. EVERY SINGLE REP.



**MASTER
GEOMETRY
CONCEPTS**



**THINK
CRITICALLY**



**BUILD
CONFIDENCE**



**WRITE
REAL PROOFS**



**SOLVE
STEP BY STEP**

**SKILLS YOU NEED.
REPS YOU
CONTROL.**

How to Use This Book

Every lesson has the same five parts, in the same order, on one page: a WARM-UP REP to wake up the skill, COACH NOTES that teach it, a CHECK YOUR FORM box with the mistake people actually make, a WORKED EXAMPLE done in full, and TRY IT for you.

After each lesson comes its worksheet. Every worksheet problem is different from every other one in the book — nothing is padded and nothing repeats.

The last page of each worksheet ends with two CHALLENGE problems. They stay on that lesson's topic, sometimes as the algebraic version of it, and they are extra rather than a replacement for the set above them. Their answers are in the back with everything else.

Diagrams are part of the problem, not decoration. When a figure is there, the measurements written on it are given to you and the ones marked with a question mark are what you are being asked for. Anything unmarked is deliberately unknown.

Every answer is in the back, grouped by unit. Check yourself after each block rather than at the end — a mistake caught early is one page of practice, and a mistake caught late is the whole unit.

WHAT THIS BOOK ASSUMES YOU ALREADY HAVE

The Pythagorean theorem, and how to simplify a radical. Both are taught in earlier Muscle Math Mania books. This book uses them constantly and does not re-teach them.

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UNIT 1

Foundations of Geometry

The Words Everything Else Is Built From

Geometry has a vocabulary problem, and it is not the one you think. The words are short — point, line, plane, between, bisect — and they look like ordinary English. They are not. Each one is a precise instruction, and the whole subject is built on reading them exactly.

This unit is where you learn to read them. Nothing here is hard arithmetic. All of it is the difference between a proof that holds and one that does not.

BY THE END OF THIS UNIT YOU CAN

- Name points, lines, planes and their intersections correctly
- Use the Segment Addition Postulate to find unknown lengths
- Find distance and midpoint on a number line
- Measure and classify angles, and use the Angle Addition Postulate
- Identify complementary, supplementary, vertical and linear-pair angles
- Use segment and angle bisectors, including with algebra

1.1 Points, Lines, and Planes

WARM-UP REP

1. $\overleftrightarrow{SN}$ and $\overleftrightarrow{JK}$ are distinct lines that intersect. How many points do they have in common?

2. $\overleftrightarrow{RC}$ passes through plane P at exactly one point. What is the intersection of $\overleftrightarrow{RC}$ and plane P?

3. Plane U and plane F are distinct planes that intersect. They meet along $\overleftrightarrow{LJ}$. What kind of figure is the intersection of two distinct intersecting planes?

COACH NOTES

A point has no size. A line has no thickness and no ends. A plane is flat, has no thickness, and goes on forever. None of the three can actually be drawn — what you draw is a reminder of one.

Two points determine exactly one line. Three points not on the same line determine exactly one plane. Almost every naming question is one of those two facts asked backwards.

CHECK YOUR FORM

Two lines meet at a POINT. Two planes meet at a LINE. Reach for a point every time and you will get the plane question wrong every time.

WORKED EXAMPLE

Plane U and plane M are distinct planes that intersect. They meet along $\overleftrightarrow{JK}$. What kind of figure is the intersection of two distinct intersecting planes?

Step 1: Two planes that meet do not meet at a single point — they share a whole edge.

Step 2: That shared edge is a line, and it goes on forever in both directions.

Answer: A line

TRY IT

1. $\overleftrightarrow{LP}$ and $\overleftrightarrow{FG}$ are distinct lines that intersect. How many points do they have in common?

2. Plane H and plane K are distinct planes that intersect. They meet along $\overleftrightarrow{RD}$. What kind of figure is the intersection of two distinct intersecting planes?

Worksheet 1.1: Points, Lines, and Planes

Part 1 of 2

- 1.** Points A, P and K all lie on $\overleftrightarrow{AK}$. Are A, P and K collinear?

SET A

- 2.** $\overleftrightarrow{JV}$ passes through plane Q at exactly one point. What is the intersection of $\overleftrightarrow{JV}$ and plane Q?

SET A

- 3.** Plane F and plane G are distinct planes that intersect. They meet along $\overleftrightarrow{KE}$. What kind of figure is the intersection of two distinct intersecting planes?

SET A

- 4.** Plane L and plane H are distinct planes that intersect. They meet along $\overleftrightarrow{VS}$. What kind of figure is the intersection of two distinct intersecting planes?

SET A

- 5.** 11 points are marked on a blueprint and no three of them are collinear. How many distinct rays are determined by these points?

SET B

- 6.** 12 points lie in a plane and no three of them are collinear. How many distinct segments are determined by these points?

SET B

Worksheet 1.1: Points, Lines, and Planes

Part 2 of 2

- 7.** 7 points are pinned on a map and no three of them are collinear. How many distinct lines are determined by these points?

SET B

- 8.** 13 points are plotted on a coordinate grid and no three of them are collinear. How many distinct segments are determined by these points?

SET B

CHALLENGE

- 1.** 4 points are plotted on a coordinate grid and no three of them are collinear. How many distinct lines are determined by these points?

CH

- 2.** 7 points are marked on a blueprint and no three of them are collinear. How many distinct lines are determined by these points?

CH

1.5 Angle Pairs

WARM-UP REP

1. Find the measure of the complement of an angle measuring 57° .

2. Find the measure of the supplement of an angle measuring 27° .

3. Find the measure of the supplement of an angle measuring 73° .

COACH NOTES

Complementary angles add to 90. Supplementary angles add to 180. A LINEAR PAIR is two angles side by side on a straight line, so a linear pair is always supplementary.

VERTICAL angles are the pair opposite each other where two lines cross, and they are always congruent. That fact is free every single time two lines meet, and it is the workhorse of Unit 3.

CHECK YOUR FORM

Complementary = Corner (90). Supplementary = Straight (180). If you mix them up, you will be exactly 90° wrong, every time.

WORKED EXAMPLE

Find the measure of the supplement of an angle measuring 164° .

Step 1: Supplements add to 180° .

Step 2: Subtract the given angle: $180 - 164$.

Step 3: The answer is 16° .

Answer: 16°

TRY IT

1. Find the measure of the complement of an angle measuring 49° .

2. Find the measure of the complement of an angle measuring 5° .

Worksheet 1.5: Angle Pairs

Part 1 of 2

- 1.** Find the measure of the complement of an angle
SET A measuring 31° .

- 2.** Find the measure of the supplement of an angle
SET A measuring 19° .

- 3.** Find the measure of the supplement of an angle
SET A measuring 44° .

- 4.** $\angle 1$ and $\angle 2$ are complementary. $m\angle 1 = 4x + 9^\circ$ and $m\angle 2 =$
SET B $x + 36^\circ$. Find x .

- 5.** $\angle 1$ and $\angle 2$ are supplementary. $m\angle 1 = 2x + 7^\circ$ and $m\angle 2 =$
SET B $4x + 113^\circ$. Find x .

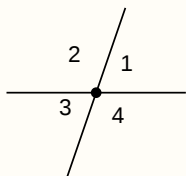
- 6.** $\angle 1$ and $\angle 2$ are supplementary. $m\angle 1 = 2x + 20^\circ$ and $m\angle 2 =$
SET B $4x + 88^\circ$. Find x .

Worksheet 1.5: Angle Pairs

Part 2 of 2

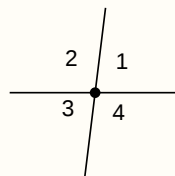
- 7.** Two lines intersect, forming $\angle 1$, $\angle 2$, $\angle 3$ and $\angle 4$ in order around the point. $m\angle 1 = 71^\circ$. Find $m\angle 2$.

SET C



- 8.** Two lines intersect, forming $\angle 1$, $\angle 2$, $\angle 3$ and $\angle 4$ in order around the point. $m\angle 1 = 83^\circ$. Find $m\angle 2$.

SET C



CHALLENGE

- 1.** $\angle 1$ and $\angle 3$ are vertical angles. $m\angle 1 = 4x + 9^\circ$ and $m\angle 3 = x + 18^\circ$. Find x .

CH

- 2.** $\angle 1$ and $\angle 3$ are vertical angles. $m\angle 1 = 5x + 4^\circ$ and $m\angle 3 = 4x + 7^\circ$. Find x .

CH

Answer Key — Unit 1: Foundations of Geometry

Lesson 1.1 — Warm-Up

- Exactly one
- A point
- A line

Lesson 1.1 — Try It

- Exactly one
- A line

Worksheet 1.1

- Yes — they lie on one line
- A point
- A line
- A line
- 110
- 66
- 21
- 78

Lesson 1.1 — Challenge

- 6
- 21

Lesson 1.2 — Warm-Up

- 23
- 4
- 20

Lesson 1.2 — Try It

- 31
- 12

Worksheet 1.2

- 7
- 17
- 24
- 10
- 9
- 2
- 7
- 11

Lesson 1.2 — Challenge

- 5
- 4

Lesson 1.3 — Warm-Up

- 13
- 11
- 6

Lesson 1.3 — Try It

- 8

- 2

Worksheet 1.3

- 8
- 6
- 9
- 4
- 5
- 13
- 18
- 17

Lesson 1.3 — Challenge

- 4
- 32

Lesson 1.4 — Warm-Up

- Right
- Obtuse
- Acute

Lesson 1.4 — Try It

- Acute
- Acute

Worksheet 1.4

- Obtuse
- Right
- Right
- Right
- 55°
- 84°
- 95°
- 99°

Lesson 1.4 — Challenge

- 26°
- 42°

Lesson 1.5 — Warm-Up

- 33°
- 153°
- 107°

Lesson 1.5 — Try It

- 41°
- 85°

Worksheet 1.5

- 59°
- 161°
- 136°
- 9

- 10
- 12
- 109°
- 97°

Lesson 1.5 — Challenge

- 3
- 3

Lesson 1.6 — Warm-Up

- 54°
- 154°
- 134°

Lesson 1.6 — Try It

- 26°
- 34°

Worksheet 1.6

- 41°
- 24°
- 22°
- 3
- 6
- 7
- 58
- 56

Lesson 1.6 — Challenge

- 130
- 34

Unit 1 Review

- Exactly one
- 91
- 24
- 5
- 4
- 8
- 4
- Acute
- 80°
- 62°
- 6
- 102°
- 86°
- 12
- 180



THAT WAS THE WARM-UP.

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