Geometry Unit 1: Segments, Length, and Area

Bronx Early College Academy

Christopher J. Huson PhD

8-23 September 2022

1.1 Segment addition 8 September

1.2 Solve for length 9 September

1.3 Terminology and notation 12 September

1.4 Midpoint and bisector 13 September

1.5 Equilateral and isosceles triangles, perimeter 14 September

1.6 Roundtable review 15 September

1.7 Unit conversion, Exit note quiz 16 September

Learning Target: I can measure my world

CCSS: HSG.CO.A.1 Know precise geometric definitions 1.1 Thursday 8 Sept

Do Now: Make simple measurements on paper

1. Diagram the desks closest to you and their distances
2. Early finishers: Calculate diagonal distances

ToDo: add classroom desk image, diagram

Lesson: Points, line segments, length; Segment addition postulate

Homework: Write for me your "math autobiography" on looseleaf (due tomorrow)

Optional homework: spicy absolute value worksheet

A *diagram* is a simplied image representing a situation

This is an example diagram of a desk arrangement

When making diagrams

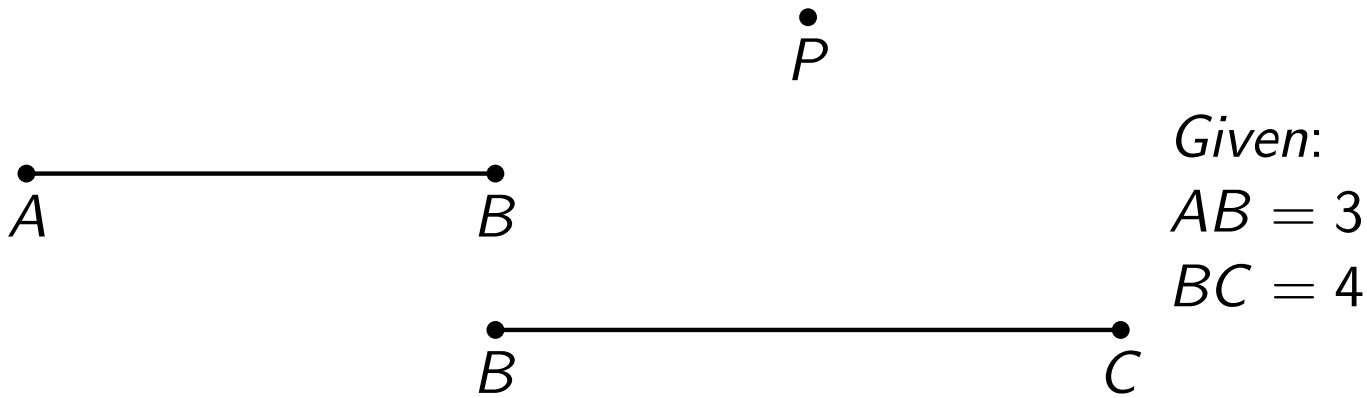
Include common elements: labels, titles, distances

Conventions: standard ways of doing things to make it easier to work with other people

Write down vocabulary and terminology in your notebook with definitions and examples. (I write new terms in *italics*)

Line segments and their *endpoints*

Points P, A, B, C, and line segments $\overline{AB}$, $\overline{BC}$ are shown.

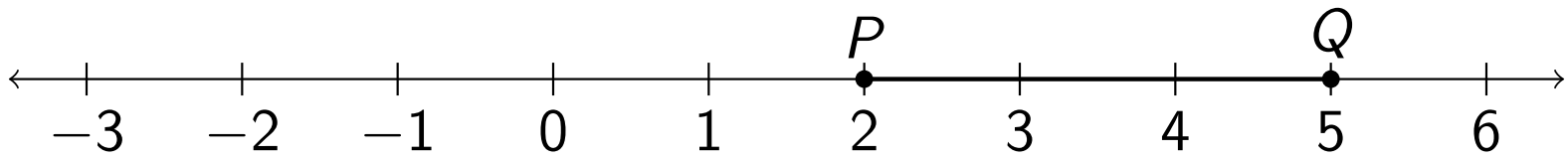


The *length* of a line segment is the distance between the two endpoints. The length of segment $\overline{AB}$ is written AB (no bar over).

A *number line* is useful for calculating length or distance

Take the difference in the points' values

Given $\overline{PQ}$ as shown on the number line.



Find the distance on the number line between the points P and Q.

A *number line* is useful for calculating length or distance

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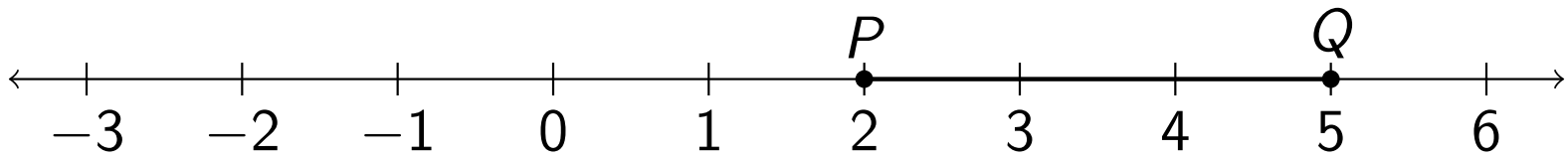


Find the distance on the number line between the points P and Q.

$$PQ = 5 - 2 = 3$$

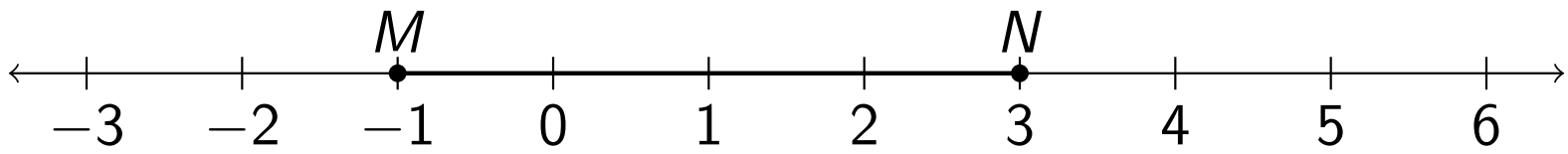
Can a length be a negative number?

Most of the lengths on our problem sets are in centimeters.

Negative number practice on a number line

Take the difference in the points' values. Check by counting the marks.

Given $\overline{MN}$ with $M(-1)$ and $N(3)$, as shown on the number line.



What is the length of the segment $\overline{MN}$? Show your work as an equation.

Negative number practice on a number line

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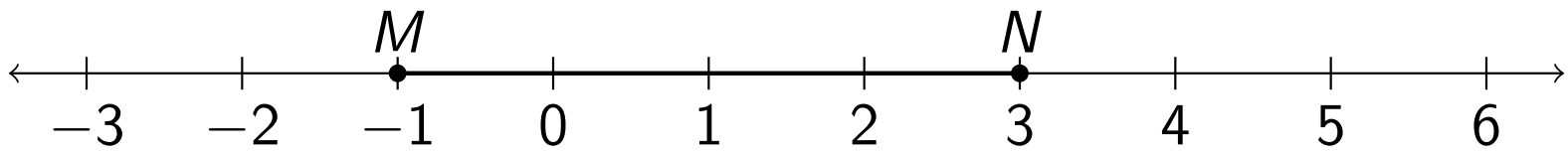


What is the length of the segment $\overline{MN}$? Show your work as an equation.

$$MN = 3 - (-1) = 4$$

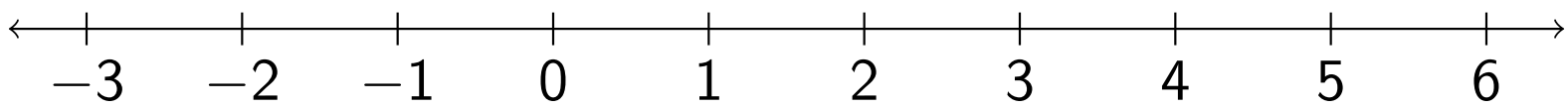
Why is "minus a negative" like adding a positive?

Decimal practice on a number line

Mark the points then take the difference in the points' values.

Given $\overline{GH}$ with $G(1)$ and $H(4.5)$.

1. Mark and label the points and segment on the number line.
2. What is the length of the segment $\overline{GH}$? Show your work as an equation.



Decimal practice on a number line

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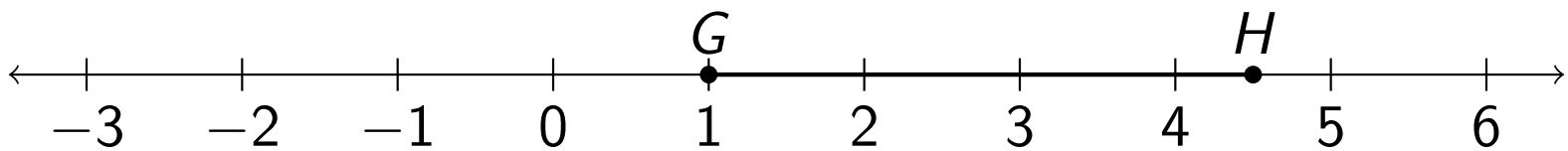


$$GH = 4.5 - 1 = 3.5$$

Take class notes in a composition book

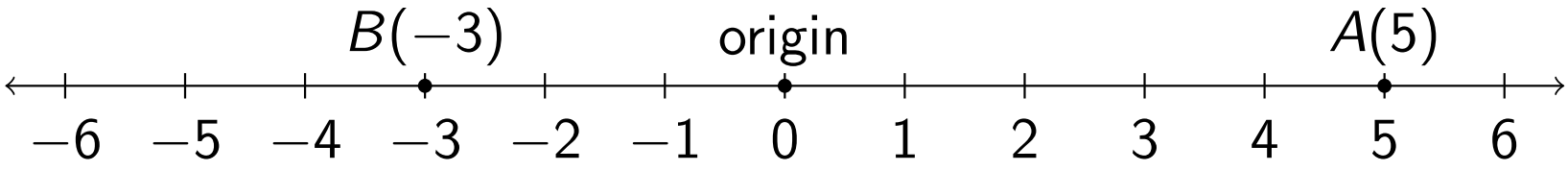
Copy definitions using your own words. Write down example diagrams and problems

Definitions:

Point	A location, has no size; label with capital letter, P
Endpoint	A point at the end of a line segment
Line segment	Two points and all the points between them; label with *endpoints* and a bar, e.g. $\overline{AB}$
Distance	The positive difference between two points on a number line (length is the same thing). $AB = 3$ inches
Conventions	Standard ways of doing things to make it easier to work with other people
Diagram	Simplified image of a situation
Number line	A line with lengths marked on it

Spicy: *Absolute value* is the distance from a point to zero

"Spicy", or extension topics, must be written in your notebook, but homework and tests are optional.



The absolute value of 5 is 5. $|5| = 5$

The absolute value of -3 is 3. $|-3| = 3$

The absolute value of a number is always a positive number, or zero

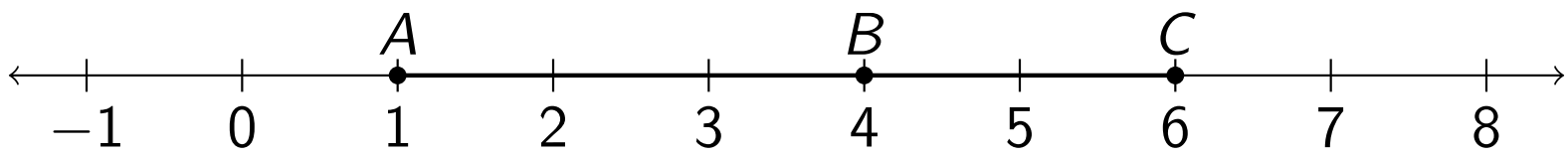
Write the absolute value of a number x using vertical bars $|x|$ or $abs(x)$

Learning Target: I can solve for segment lengths

CCSS: HSG.CO.A.1 Know precise geometric definitions 1.2 Friday 9 September

Do Now: Given $A(1)$, $B(4)$, $C(6)$.

Write down AB, BC, and AC.



Lesson: segment addition, solving algebraic models

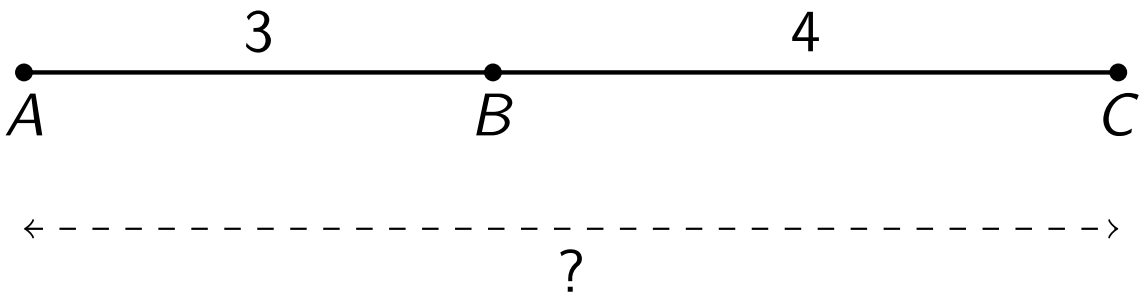
Homework: problem set 1.2 (plus optional spicy worksheet)

Lengths add up on a straight line

Segment Addition Postulate

Shown *collinear* points A, B, C. Given $AB = 3$, $BC = 4$.

Find AC.



Definitions:

Collinear Points that lie on the same straight line

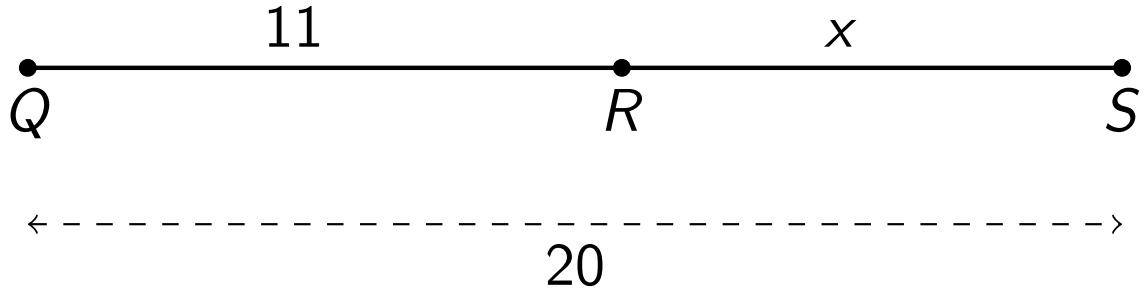
Postulate A rule that we assume is true

Use a variable (x) to represent an unknown value

An equation is a *model* of a situation

Given collinear points Q, R, S, with $QR = 11$, $QS = 20$.

Find RS.

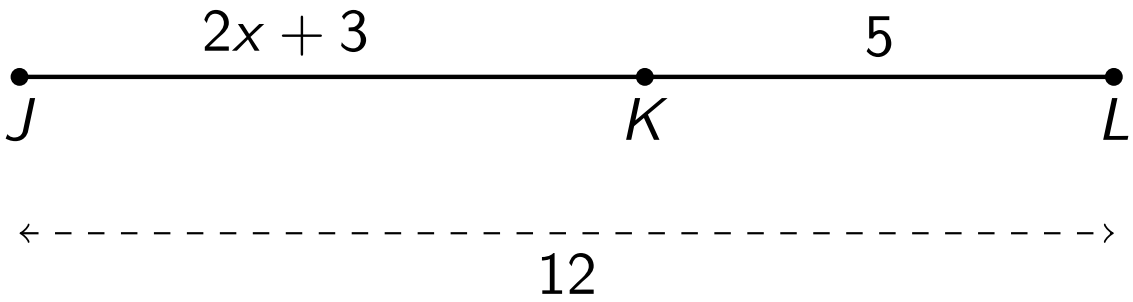


1. How would you check your answer?
2. Which equation represents the situation?

$$11 + x = 20 \qquad x = 20 - 11$$

Step-by-step modeling

Given $\overline{JKL}$, $JK = 2x + 3$, $KL = 5$, $JL = 12$. Find x.

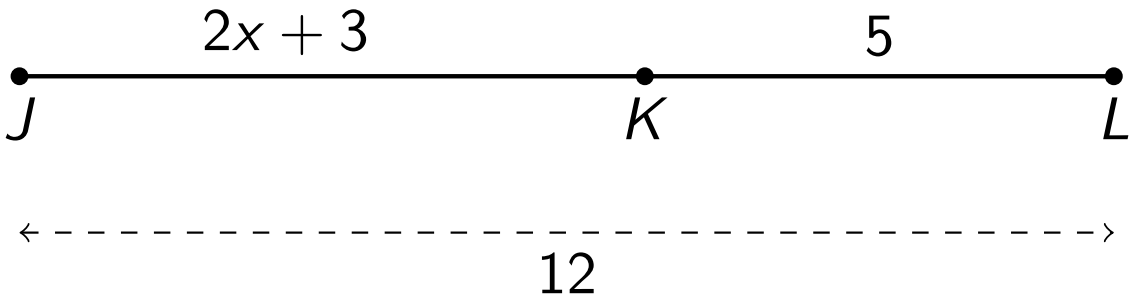


1. Write down an equation to represent the situation.
2. Solve for x.
3. Check your answer.

The diagram may be given, or you may have to sketch it

Write the steps in your notebook

Given $\overline{JKL}$, $JK = 2x + 3$, $KL = 5$, $JL = 12$. Find x.



$$JK + KL = JL$$

$$(2x + 3) + 5 = 12$$

$$2x + 8 = 12$$

$$2x = 4$$

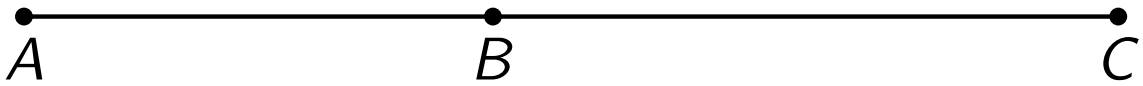
$$x = 2$$

$$2(2) + 3 + 5 = 12?$$

1. Sketch and label the situation
2. Write a geometric equation
3. Substitute algebraic values
4. Solve for x
5. Answer the question
6. Check your answer

Mark the diagram, find x, answer $AB =$?

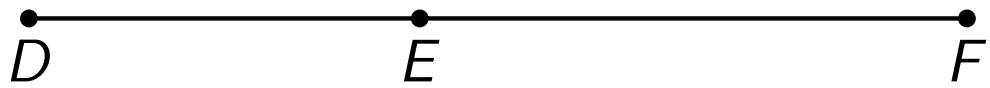
Given $\overline{ABC}$, $AB = 3x - 7$, $BC = x + 5$, $AC = 14$.



Find AB.

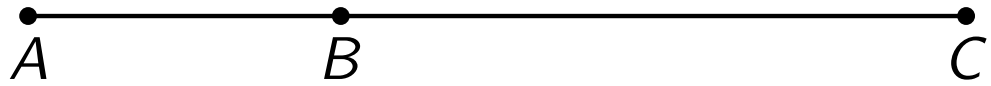
More practice: Solve an equation with x on both sides

Given $\overrightarrow{DEF}$, $DE = x + 1$, $EF = 9$, $DF = 3x$. Find DE.



Spicy: Fractional *coefficients*

Given $\overline{ABC}$, $AB = \frac{1}{2}x$, $BC = x$, $AC = 21$. Find x.



Term An expression representing a number, for example $\frac{1}{2}x$

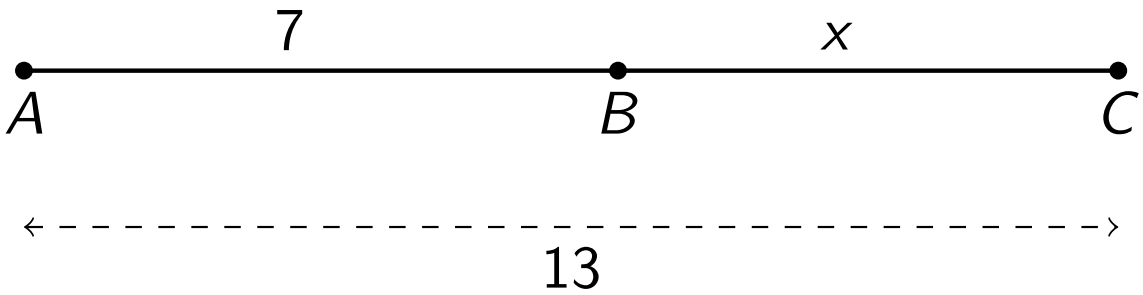
Variable The unknown value represented by a letter (x)

Coefficient The fixed number in front of the variable. (e.g. $\frac{1}{2}$)

Learning Target: I can use geometric conventions

CCSS: HSG.CO.A.1 Know precise geometric definitions 1.3 Monday 12 Sept

Do Now: Given collinear points A, B, C, with $AB = 7$, $AC = 13$.



1. Circle the equation that most simply represents the situation.

$$7 + x = 13 \qquad x = 13 - 7$$

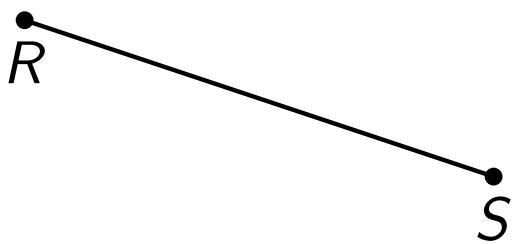
2. Find BC.

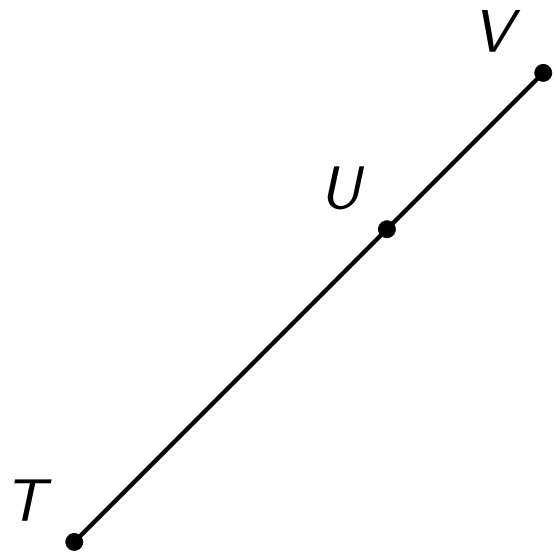
Lesson: Vocabulary and notation

Write down an example of each geometric object.

Use proper notation.

1. point
2. line segment
3. endpoint
4. three collinear points

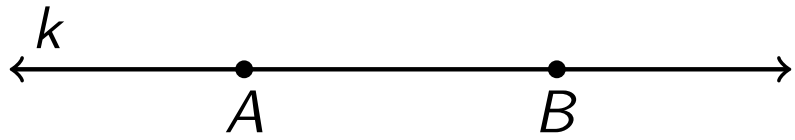




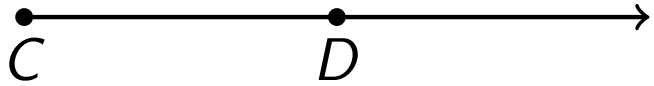
5. Given $TU = 1.4$, $UV = 0.6$. Find TV. (label the diagram first)

More definitions: lines, rays, planes

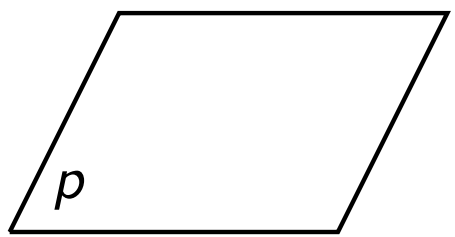
A *line* extends infinitely in both directions, $\overleftrightarrow{AB}$.
(sometimes labeled with a small letter, for example, line k)



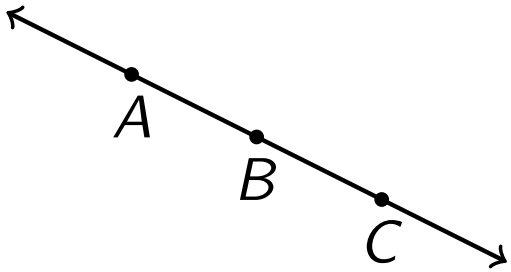
A *ray* has one endpoint and extends infinitely in one direction, $\overrightarrow{CD}$.



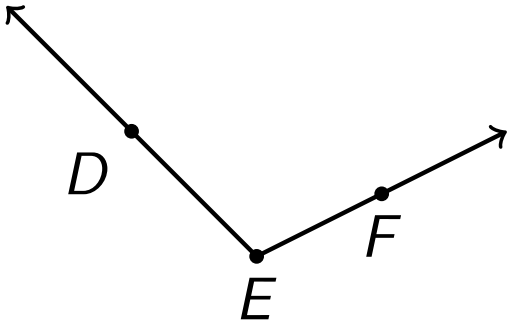
A *plane* is flat and extends infinitely in two directions, p.



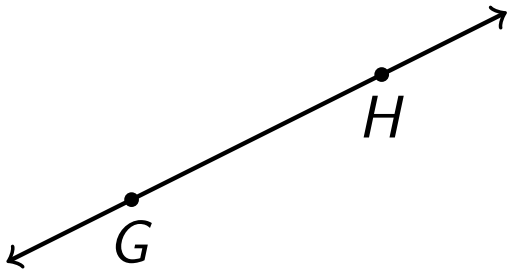
Opposite rays are collinear rays with a common endpoint.



$\overrightarrow{BA}$ and $\overrightarrow{BC}$ are opposite rays.



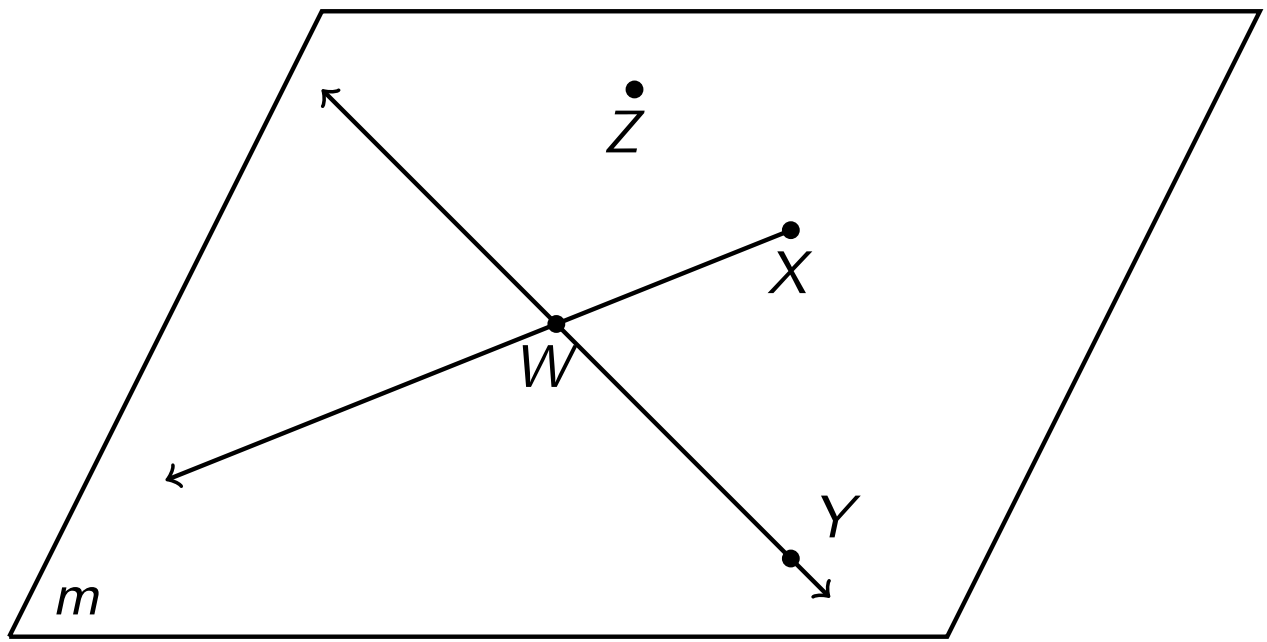
These rays do not make a straight line.



The rays $\overrightarrow{GH}$ and $\overrightarrow{HG}$ do not share a common endpoint.

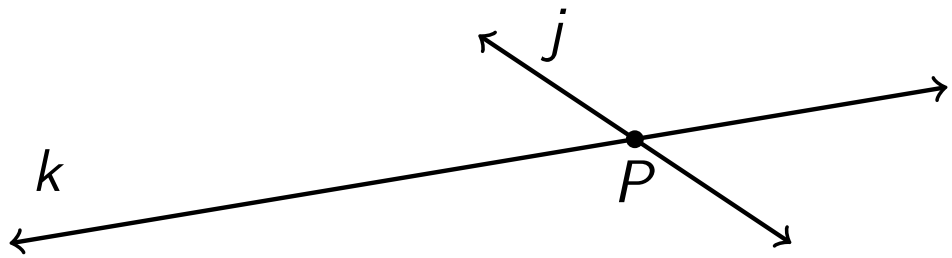
Several objects are shown in a plane

1. T F The name of the plane is m.
2. T F The line $\overleftrightarrow{WY}$ is in the plane.
3. T F The ray $\overrightarrow{WX}$ is shown in the plane.
4. T F Points W, X, and Z are collinear.
5. T F $\overleftrightarrow{WY}$ and $\overleftrightarrow{YW}$ are the same line.

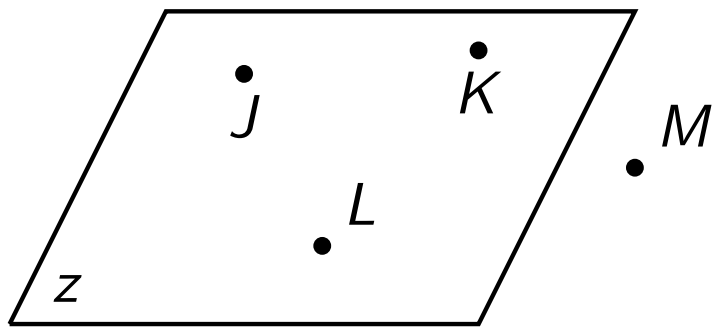


More definitions: intersections, coplanar

Two lines *intersect* if they cross. Their common point is the *intersection*. (shown here, lines j and k intersect at point P)



Coplanar means to lie in the same plane. Three points are always coplanar, but four points may not be.



Learn and practice using formal language and notation

Line An infinite collection of points extending straight in both directions indefinitely, $\overleftrightarrow{AB}$ or l

Ray An endpoint and half of a straight line extending away from the endpoint, $\overrightarrow{JK}$

Plane A flat surface extending infinitely in two dimensions, p

Opposite rays Collinear rays with a common endpoint.

Coplanar Points or objects all in the same plane

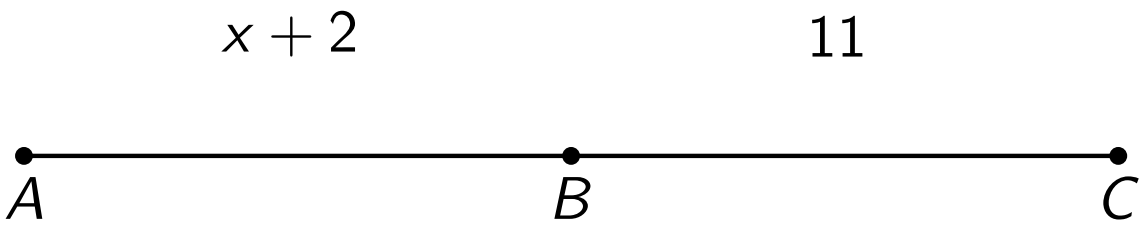
Intersection Where two lines cross, the common point

Learning Target: I can *bisect* a length

CCSS: HSG.CO.A.1 Know precise geometric definitions 1.4 Tuesday 13 Sept

Do Now: Point B is in the exact middle between A and C

Given $AB = x + 2$, $BC = 11$. Find x.

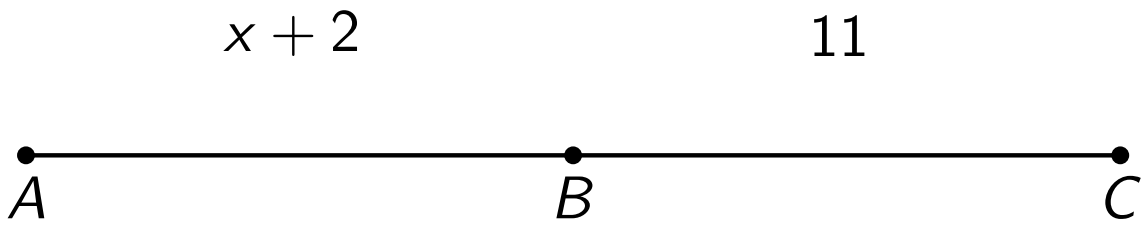


Hint: The line segment is split into two equal lengths.

The point B *bisects* the segment $\overline{AC}$

Point B is in the exact middle between A and C

Given $AB = x + 2$, $BC = 11$. Find x.

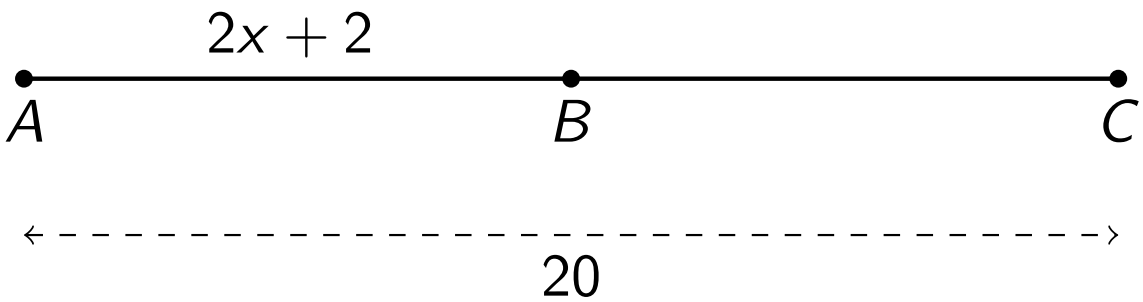


Hint: The line segment is split into two equal lengths.

The *midpoint* of a line segment

Given $\overline{ABC}$, with $AB = 2x + 2$, $AC = 20$. $AB = BC$

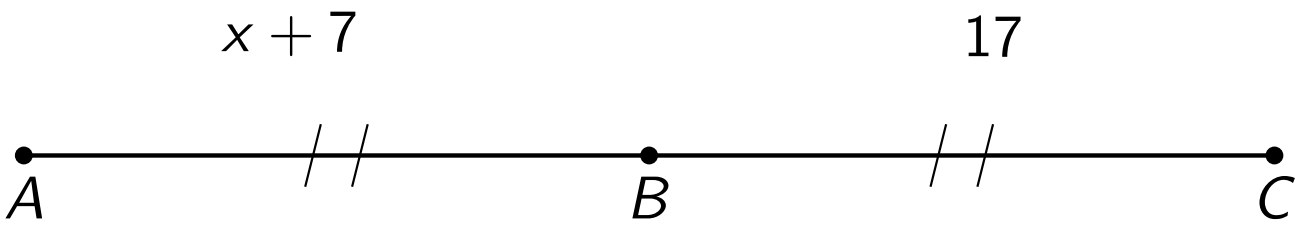
Find x.



A *bisector* creates two line segments with the same length

Congruent line segments are the same length

Given point B is the midpoint of $\overline{AC}$, with $AB = x + 7$, $BC = 17$. Find x.



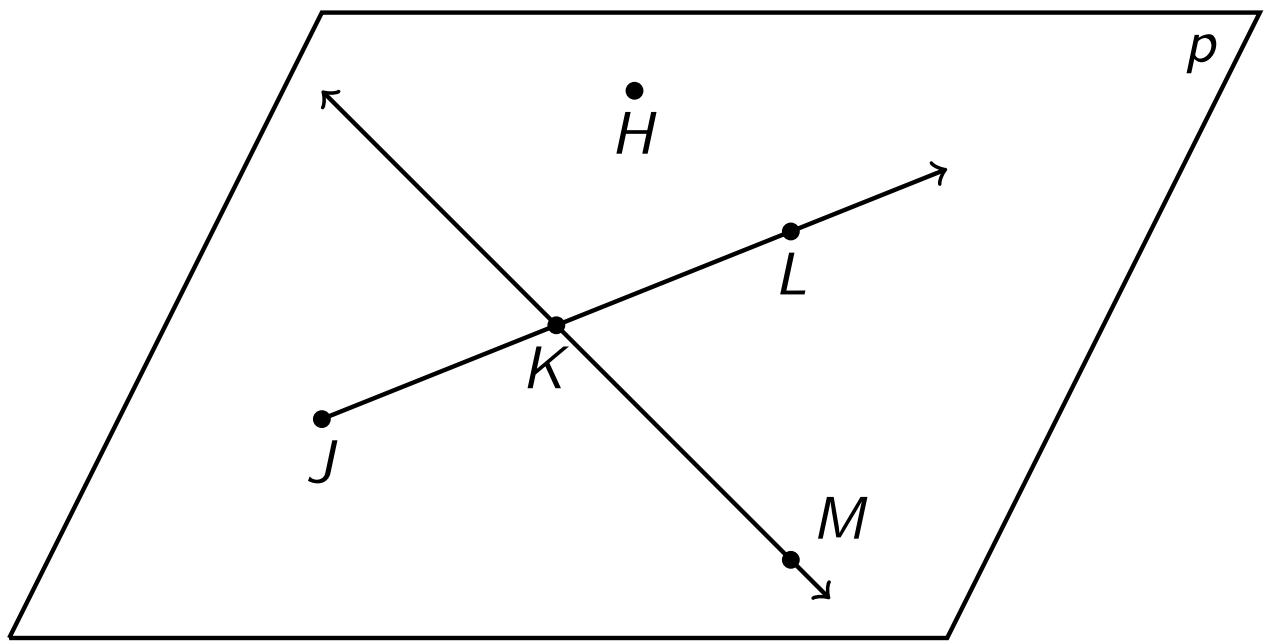
The *midpoint* or *bisector* of a line segment divides it exactly in half.

Congruent means equal in length, $\overline{AB} \cong \overline{BC}$ (also $AB = BC$)
Mark congruent segments in diagrams with cross "*hash*" marks.

Review: Identifying objects in a plane

Circle or mark each item

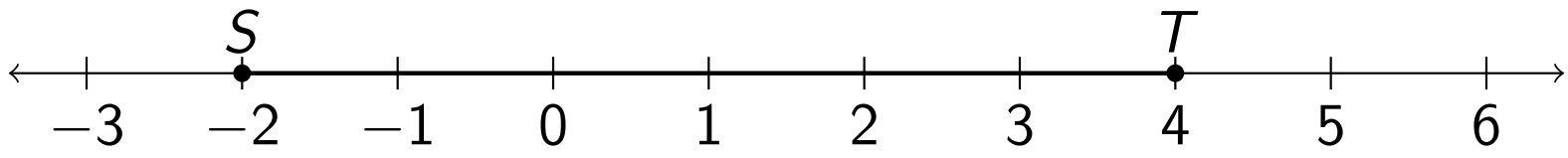
1. The point H
2. The ray $\overrightarrow{JL}$
3. The name of the plane shown



Learning Target: I can work with objects having congruent parts

CCSS: HSG.CO.A.1 Know precise geometric definitions 1.5 Wednesday 14 Sept

Do Now: Given $\overline{ST}$ with $S(-2)$ and $T(4)$



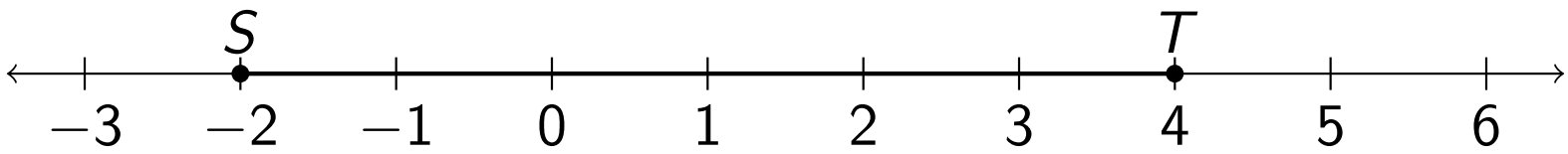
What is the length of the segment $\overline{ST}$? Show your work as an equation.

Lesson: Perimeter, congruent line segments in rectangles & isosceles triangles

Negative number practice on a number line

Take the difference in the points' values. Check by counting the marks.

Given $\overline{ST}$ with $S(-2)$ and $T(4)$, as shown on the number line.

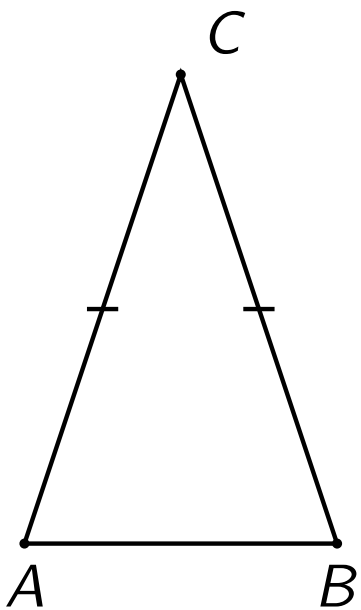


What is the length of the segment $\overline{ST}$? Show your work as an equation.

Why is "minus a negative" the same as add a positive?

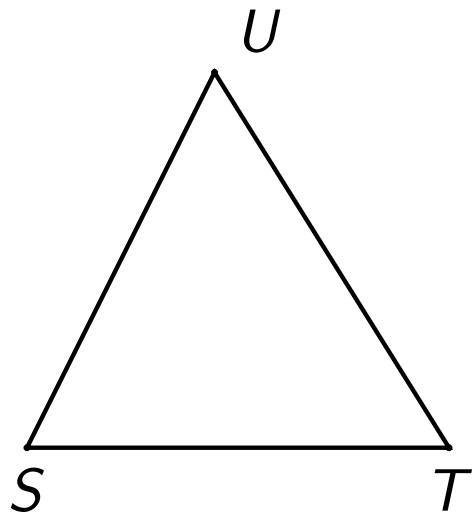
Use proper notation (including the line over the letters)

Given $\triangle ABC$ write down two congruent line segments using proper notation.



On the diagram mark the congruent line segments with tick marks.

Given $\triangle STU$ with $\overline{ST} \cong \overline{TU}$.



Sketch an isosceles triangle

Mark the congruent sides with tick marks.

ToDo: equilateral $\triangle$, isosceles, perimeter, quadrilaterals

Formal meanings of sketch, draw, and construct

1. *Sketch* is to make a freehand diagram of important features.

   Use a pencil to write carefully in your notebook or on paper.

2. *Draw* is to depict with accurate measures using ruler, protractor, and compass.

   For example, draw a diagram of your room.

3. *Construct* is a formal, logical process to create geometric figures using only a straightedge and compass.

4. Drawn to *scale* means that all of the lengths are proportional. (e.g. a "scale model")

   Tests will often warn that diagrams are "not drawn to scale"

Learning Target: I can collaborate in review

CCSS: HSG.CO.A.1 Know precise geometric definitions 1.6 Thursday 15 September

Do Now: Draw a ray. (careful! which direction does it go?)

Given the points X and Y, draw $\overrightarrow{YX}$.

Groupwork review for quiz tomorrow

"Roundtable" of four students, with four topics assigned

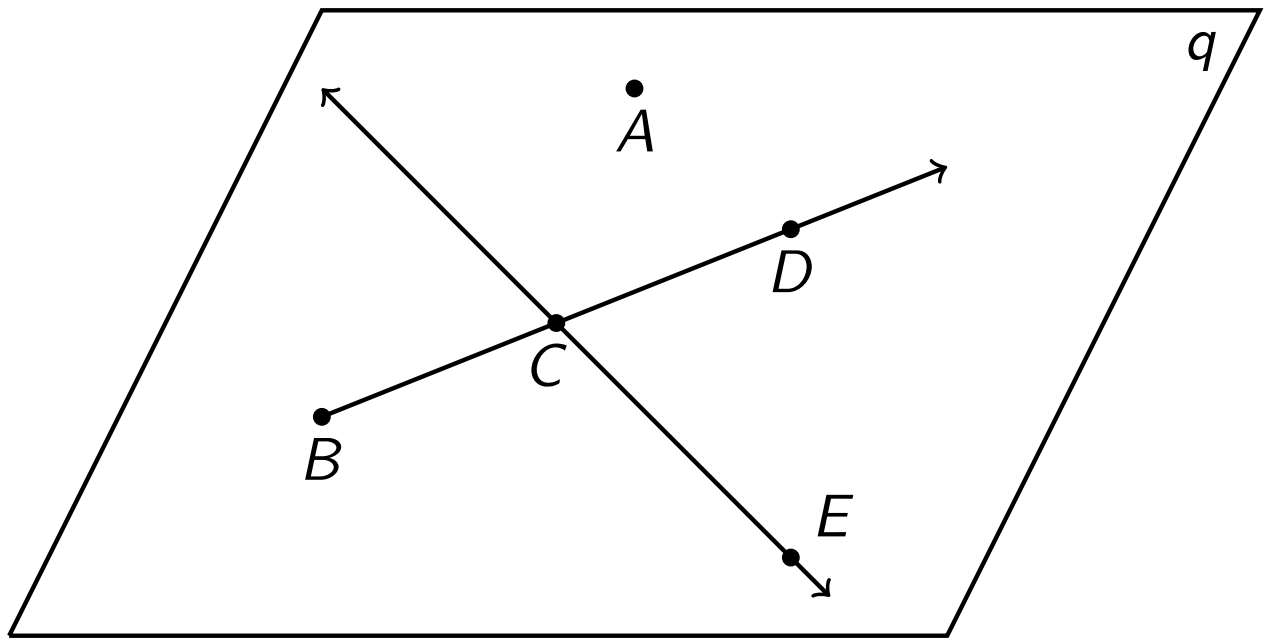
Geometry skills to study / teach

1. Conventions: terminology, notation, diagramming
2. Perimeter and special shapes:
   - Scalene, isosceles, and equilateral $\triangle$s
   - Squares, rectangles, rhombuses, kites
3. Modeling situations with algebra
4. Solving algebraic equations for one variable

Identify each item.

Example of Topic 1: Conventions: terminology, notation, diagramming

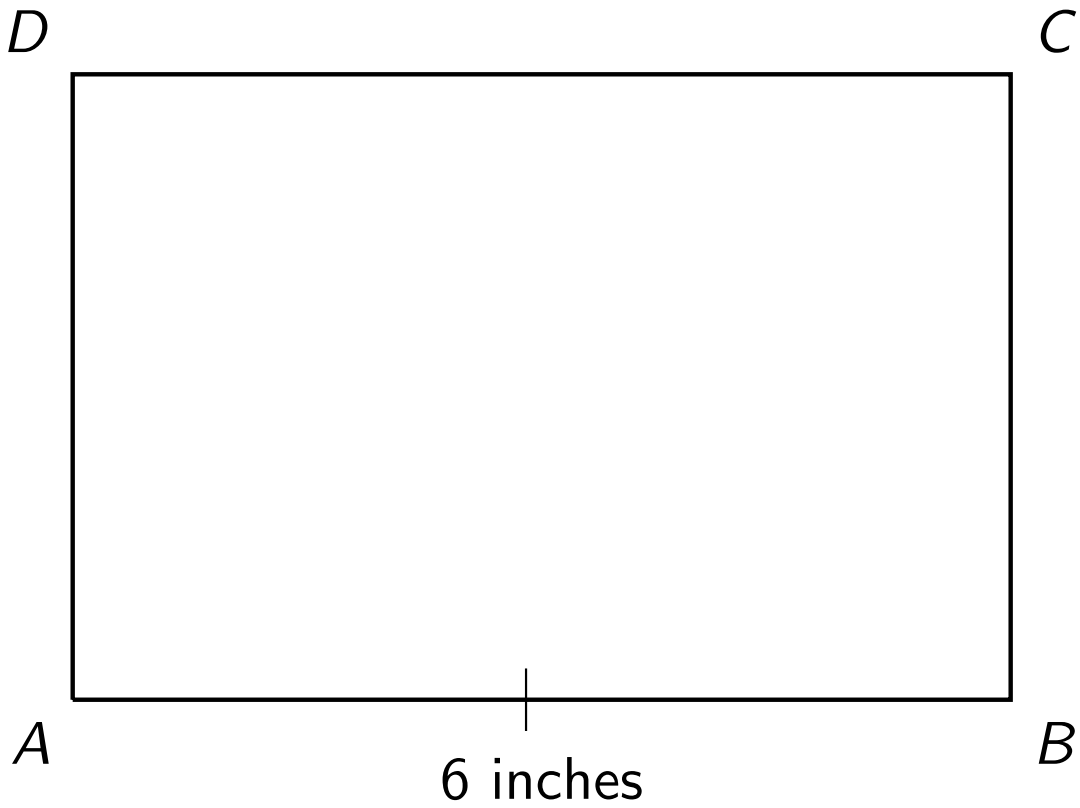
1. The point A
2. The ray $\overrightarrow{BD}$
3. The name of the plane



Find the perimeter of the rectangle *ABCD* finish

Example of Topic 2: Perimeter and special triangles and quadrilaterals

Given $AB = 6$ inches, $BC = 4$ inches.



Write down an equation to represent the situation

Example of Topic 3: Modeling situations with algebra

Given M is the midpoint of $\overline{AB}$, $AM = 4x + 2$, $AB = 20$.

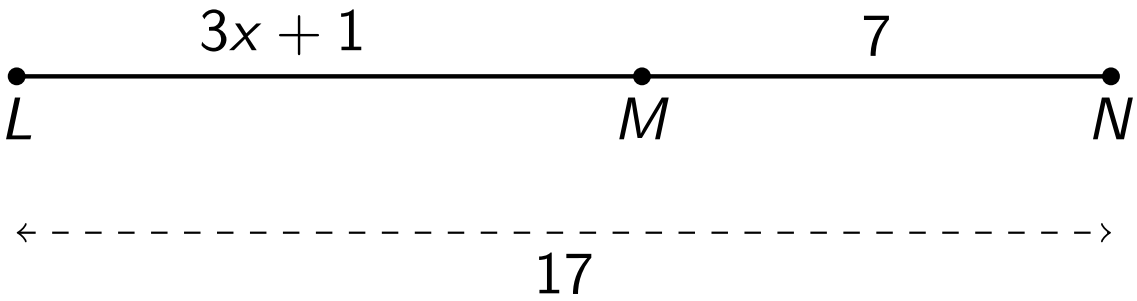
First mark the diagram with hash marks and values.

Sometimes you will not be asked to solve the equation.

Solve for x

Example of Topic 4: Solving algebraic equations for one variable

Given $\overline{LMN}$, $LM = 3x + 1$, $MN = 7$, $LN = 17$.



$$3x + 7 = 17$$

You must check the solution.

Learning Target: I can change units of length

CCSS: HSG.CO.A.1 Know precise geometric definitions 1.7 Friday 16 September

Do Now: Mike is six feet tall. How many inches is that?

Conversion ratio: 1 foot $=$ 12 inches

Exit note quiz today