7.4 - Parallel Lines and Transversals

MATH *ON THE JOB*

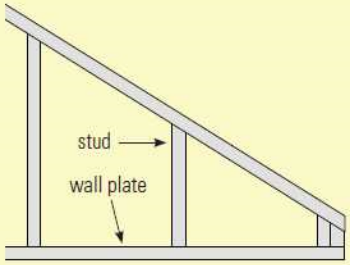
Hal is a carpenter from Bathurst, NB. After graduating from high school he enrolled in the carpentry program at BayTech Institute of Trades and Technology, in Moncton. Shortly after graduating, he began working for his uncle's construction company, building and renovating houses primarily in northern New Brunswick.

Hal often works on wood-framed houses and buildings. The frames are made of studs (parallel, vertical pieces), and wall plates (pieces that are attached along the top and bottom of the studs). Frames are usually constructed on the ground or floor and then erected. The wall plates hold the studs in position.

Carpenters use a variety of tools to do different jobs.

Part of Hal's job is to make sure that the studs are exactly perpendicular to the bottom wall plate and parallel to each other. To do this, he uses a measuring device such as a carpenters' square, which is used to measure and mark off 90° angles.

Hal is constructing a partial wall for the side of a staircase. The top of the wall follows the slope of the staircase. A partial diagram of the framing for the staircase is shown here.



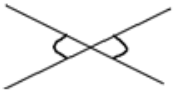
- Decide upon a reasonable angle for the staircase. Staircase angles range between 33° and 42°.
- To make the studs parallel, what angle measure will Hal need to make between the studs and the bottom wall plate?
- To make the ends of the studs align with the top wall plate, what angle will Hal need to make between the studs and the top wall plate?

SOLUTION

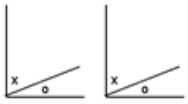
The average rise of a staircase is between 33° and 42°. The studs must be perpendicular (90°) to the bottom wall plate. If the student has drawn a top wall plate at a 33° angle to the horizontal, the left side of each stud must make a 122° angle with the top wall plate. The right side of each stud must make a 58° angle with the top wall plate.

GEOMETRY THEOREMS...

- **ANGLE THEOREMS:**

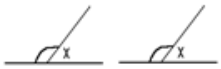


(OAT) Opposite Angle Theorem → If two lines intersect then the opposite angles are equal.



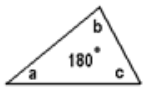
(CAT) Complementary Angle Theorem → If two angles are equal, then their complements are equal.

Note: Complementary angles sum to 90°.



(SAT) Supplementary Angle Theorem → If two angles are equal, then their supplements are equal.

Note: Supplementary angles sum to 180°.

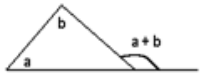


(SATT) Sum of the Angles of a Triangle Theorem → The sum of the interior angles of a triangle is 180°.

Note: When two angles of one triangle are respectively equal to two angles of another triangle, the third angles are equal.

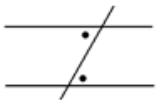
(ITT) Isosceles Triangle Theorem → The angles opposite the equal sides are equal.

Note: Isosceles triangles have 2 equal sides.

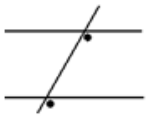


(EAT) Exterior Angle Theorem → An exterior angle of a triangle is equal to the sum of the interior and non-adjacent angles.

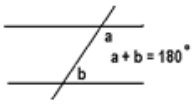
- **TRANSVERSAL PARALLEL THEOREMS**:



(AIA) Alternate Interior Angles → When a transversal intersects a set of parallel lines, the alternate interior angles are equal.
Note: "Z" pattern



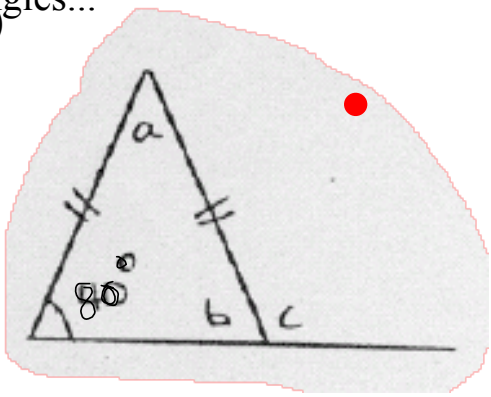
(CA) Corresponding Angles → When a transversal intersects a set of parallel lines, the corresponding angles are equal.
Note: "F" pattern



(CIA) Co-Interior Angles → When a transversal intersects a set of parallel lines, the co-interior angles sum to 180°.
Note: "C" pattern

EXERCISE: Use geometry theroems to determine the measure of missing angles...

1)



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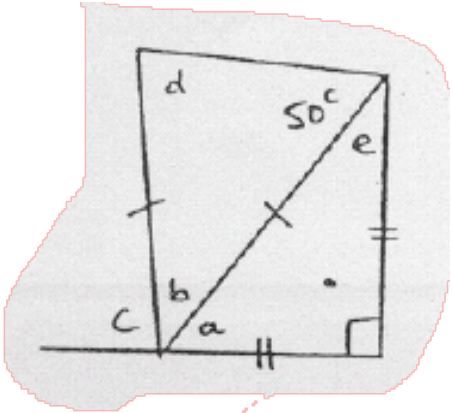
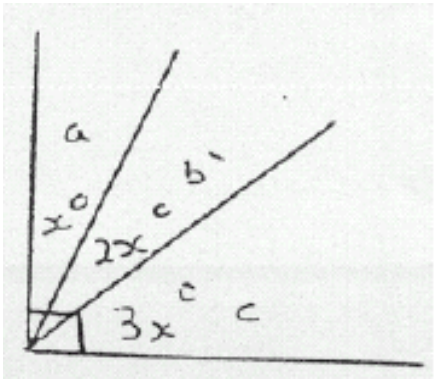
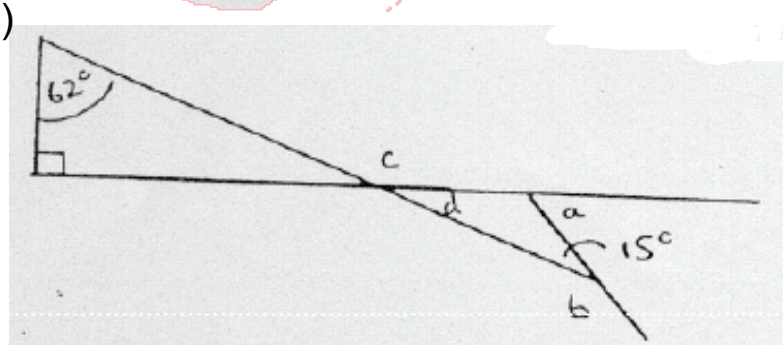
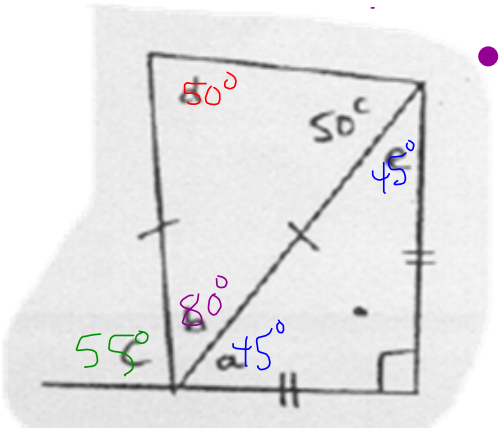


3)



4)





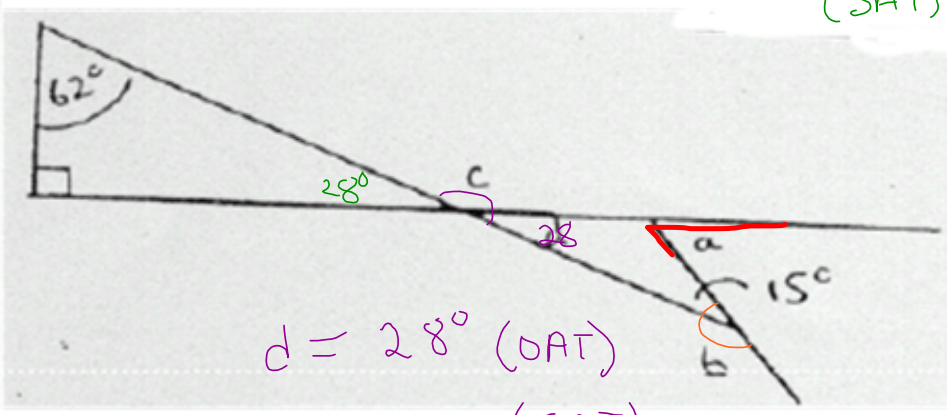
$e = 45^\circ$
$a = 45^\circ$] – (Itt)

$d = 50^\circ$ (Itt)

$b = 80^\circ$ (SATT)

$C = 55^\circ$ (SAT)

4)



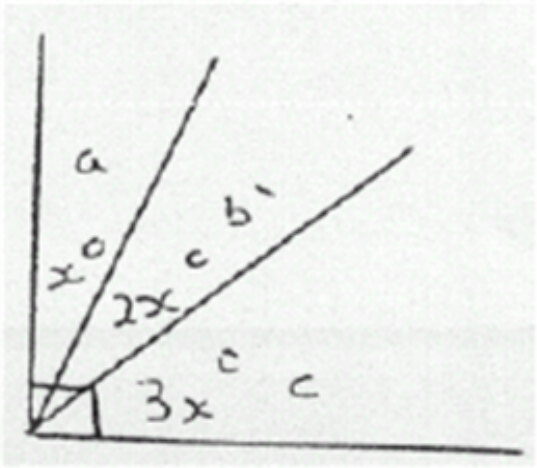
$c° = 152°$ (EAT) (SAT)

$d = 28°$ (OAT) (SAT)

$a = 43°$ SAT

$b = 165°$ (SAT)

3)



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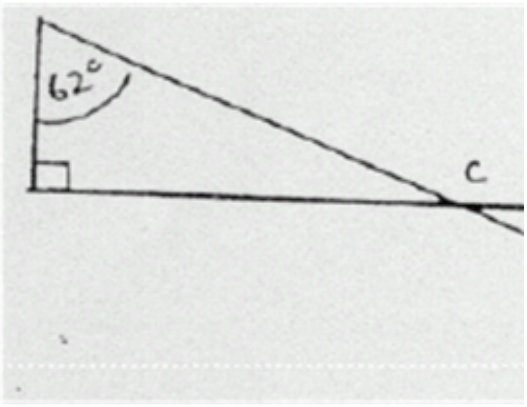


$x^\circ \Rightarrow$ CAT°

$3x + 2x + x = 90^\circ$

$6x = 90^\circ$

$x^\circ = 15^\circ$

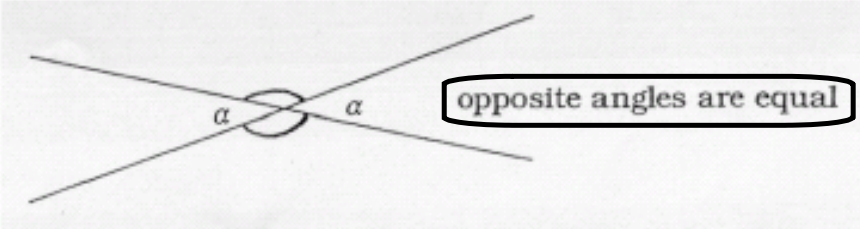
$2x = 30^\circ$

$3x^\circ = 45^\circ$

CAT

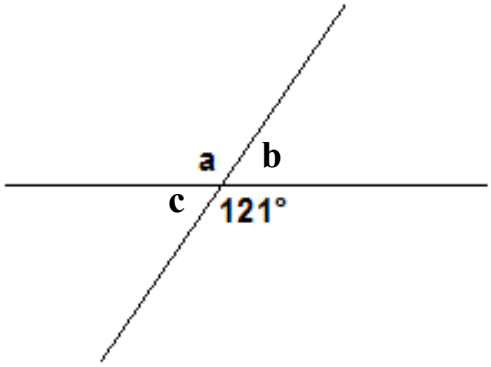
Opposite Angle Theorem... Vertically

When 2 straight lines cross, 2 pairs of opposite angles are formed. Opposite angles are equal in size



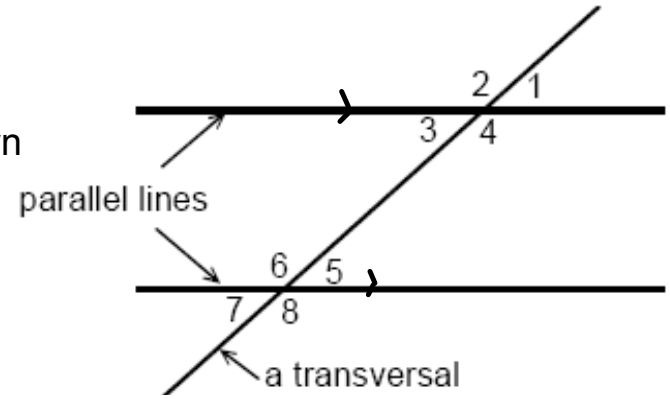
In geometry, angles or lines marked with the same symbol are the same size.

Example:



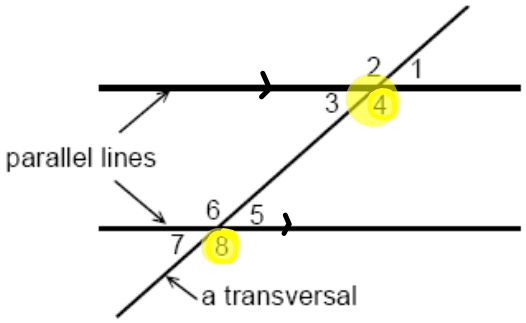
Parallel Line Theorems

A transversal is a third line that crosses two or more lines, as shown in the illustration to the right.



Corresponding Angles:

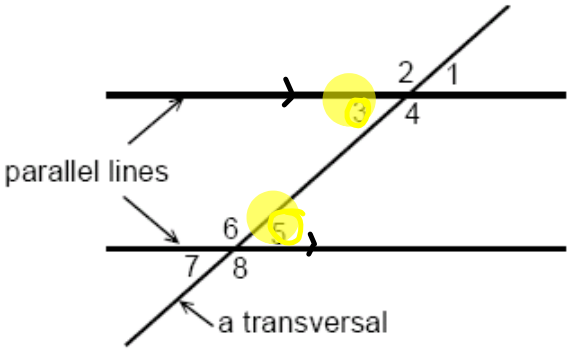
Pairs of angles on the same side of a transversal and the same side of the parallel lines



CORRESPONDING ANGLES ARE EQUAL

Alternate Interior Angles:

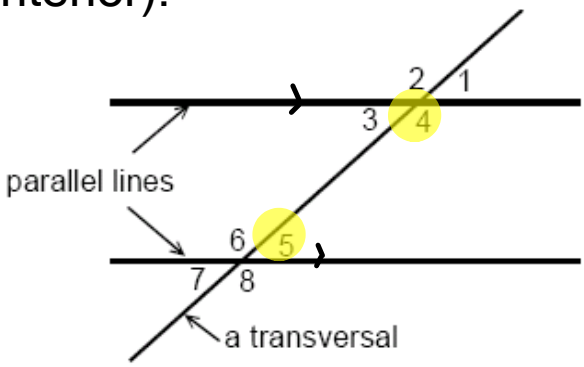
Pairs of angles on the opposite sides of a transversal and between the parallel lines



ALTERNATE INTERIOR ANGLES ARE EQUAL

Co-Interior Angles (Same-side Interior):

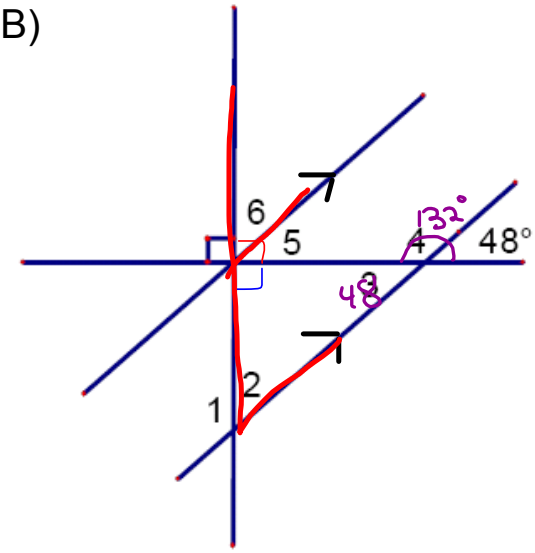
Pairs of angles on the same side of a transversal and between the parallel lines



CO-INTERIOR ANGLES ARE SUPPLEMENTARY

EXERCISE: Practice...

B)



$\angle 3 = 48°$ (OAT)

$\angle 4 = 132°$ (SAT)

$\angle 2 = 42°$ (SATT)

$\angle 5 = 48°$ (AIA CIA

$\angle 6 = 42°$ (CAT)

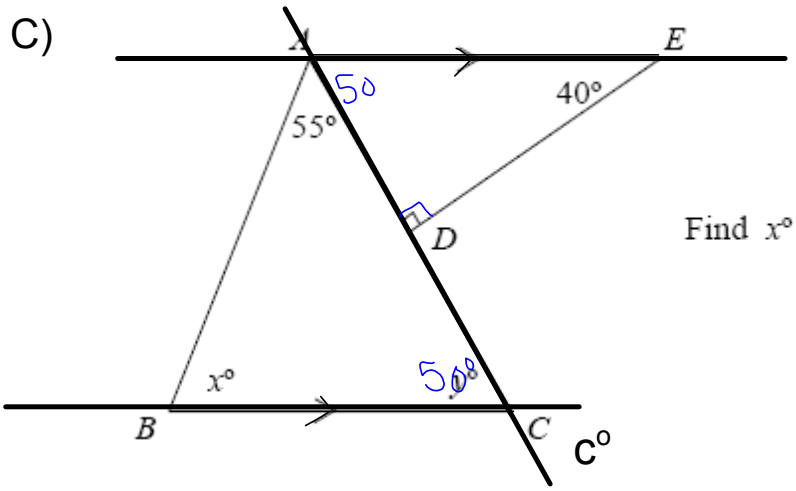
$\angle 1 = 138°$ (SAT)

$y° = 50°$ (AIA)

$C° = 50°$ (AT)

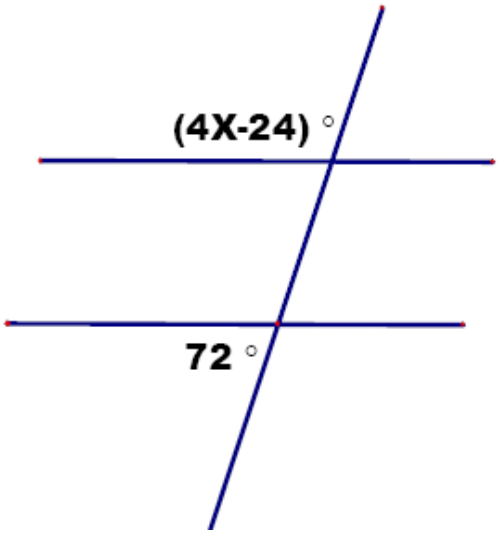
$x° = 75°$ (SATT)

C)

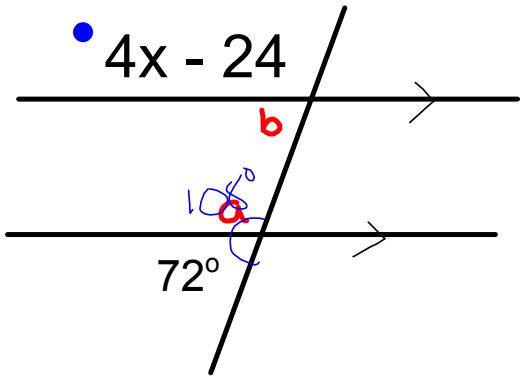


Find $x°$ and $y°$.

D)



x = _____



x= ____

$a° = 108°$ (SAT)

$4x - 24 = 108°$ (CA)

$+24 \quad +24$

$4x = 132°$

$x = 33°$

Attachments

Notes - Geometry Theorems.doc

Worksheet - Angle Properties.pdf

Worksheet Solutions - Angle Properties.pdf

Worksheet - Parallel Lines and Transversals.pdf

Worksheet Solutions - Parallel Lines and Transversals.pdf

In-Class Assignment - Parallel Lines and Transversals.pdf

7.4 - Build Your Skills Detailed Solutions.pdf