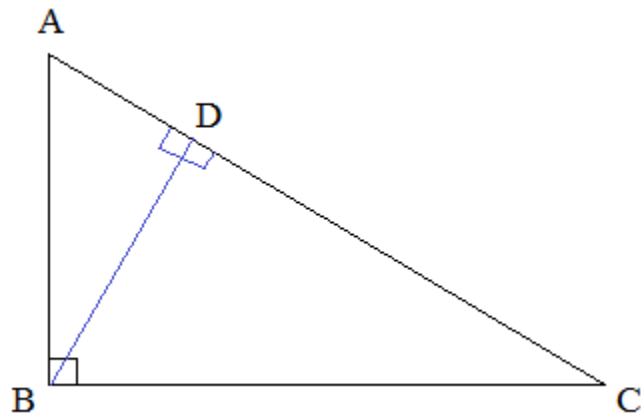
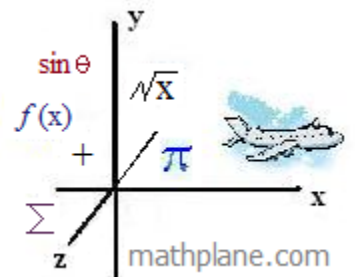


Similar Triangles and Ratios

Notes, Examples, and Practice Test (w/solutions)

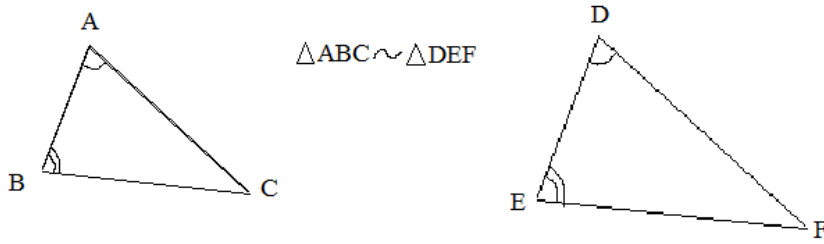


This introduction includes similarity theorems, geometric means, side-splitter theorem, angle bisector theorem, mid-segments, and more.



Similar triangles: Angle - Angle

Definition: If a pair of corresponding angles of 2 triangles are congruent, then the triangles are similar.



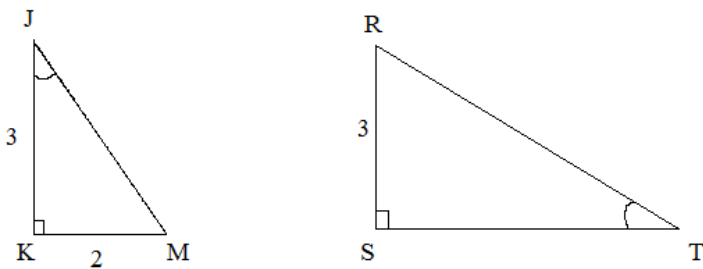
Comments:

- 1) $\triangle ABC \sim \triangle DEF$ --- the angles should be expressed in proper order to indicate which angles are congruent.
- 2) Angles C and F can easily be proven congruent by substitution:

Statements	Reasons
1) $\angle A = \angle D$ $\angle B = \angle E$	1) Given
2) $A + B + C = 180^\circ$ $D + E + F = 180^\circ$	2) Sum of interior angles of triangle is 180 degrees
3) $F = 180^\circ - (D + E)$ $C = 180^\circ - (A + B)$	3) Subtraction
4) $C = 180^\circ - (D + E)$	4) Substitution
5) $C = F$	5) Substitution

- 3) The ratios of the corresponding sides will be equal; and, the ratio of the perimeter will be consistent with the sides.

Example:



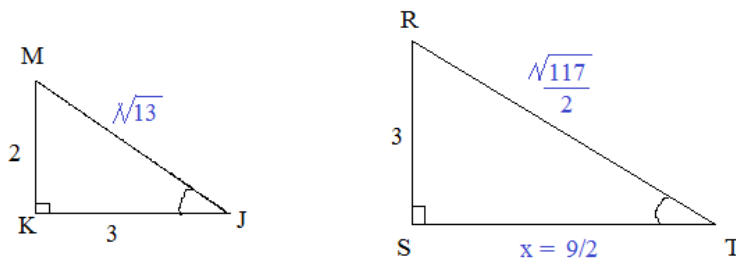
Since K and S are right angles, they are congruent...

and, since J and T are congruent,

$$\triangle MKJ \sim \triangle RST$$

(note: the triangles are expressed in 'corresponding order')

(JKM is rotated and reflected to visually correspond to RST)



perimeter: 8.6 units
area: 3 sq. units

perimeter: 12.9 units
area: 6.75 sq. units

$$\frac{MK}{RS} = \frac{KJ}{ST}$$

$$\frac{MK}{RS} = \frac{2}{3} \quad \frac{KJ}{ST} = \frac{3}{x}$$

$$\frac{2}{3} = \frac{3}{x} \quad x = 9/2$$

ratio of small to large triangle is 2:3

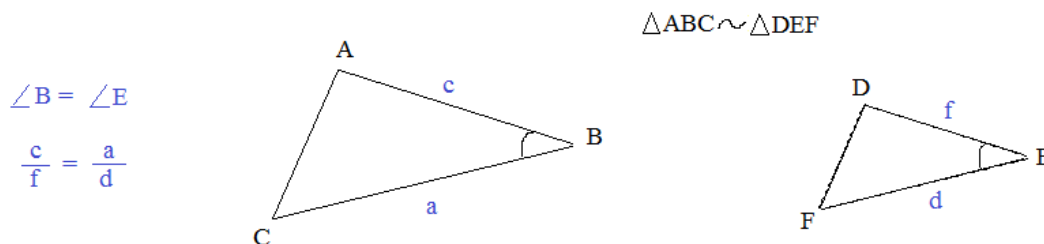
ratio of perimeters is 2:3

ratio of the areas is 4:9

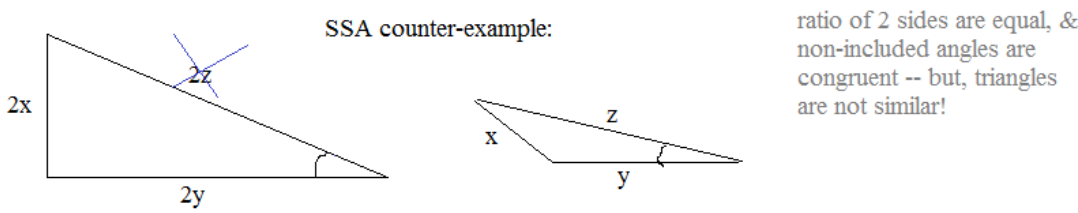
$$(2^2 : 3^2)$$

Similar triangles: Side - Angle - Side

Definition: If a pair of corresponding sides of 2 triangles have the same ratio AND the included angles are congruent, then the triangles are similar.



Comments: 1) SAS: it must be the *included* angle!



2) The ratio between 2 sides of one triangle will be identical to the ratio of the corresponding 2 sides of the other triangle

$$\frac{c}{f} = \frac{a}{d} \longrightarrow af = cd \longrightarrow \frac{af}{c} = d \longrightarrow \frac{a}{c} = \frac{d}{f}$$

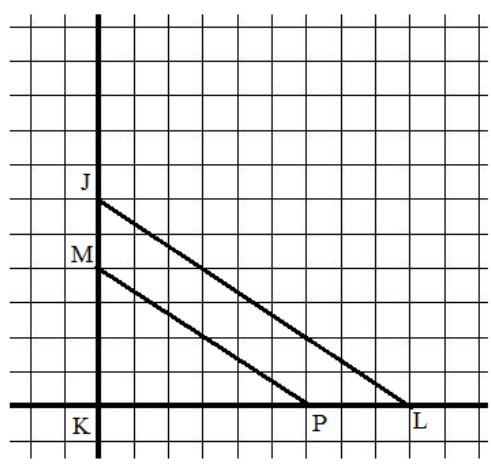
3) $\triangle ABC \sim \triangle DEF$ --- the angles should be expressed in proper order to indicate which angles are congruent.

Example: Using SAS, verify that $\triangle JKL \sim \triangle MKP$

small triangle	KM = 4 units	KP = 6 units	∠K = 90°
large triangle	KJ = 6 units	KL = 9 units	∠K = 90°
	2:3 ratio	2:3 ratio	congruent
	similar triangles.....		

(using pythagorean theorem or distance formula)

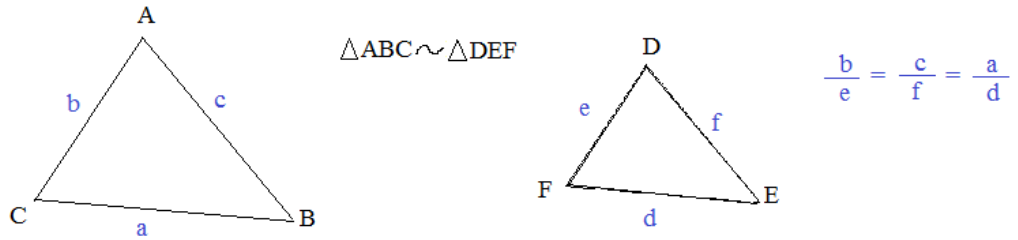
$$\begin{aligned}
 JL &= \sqrt{117} & \frac{2\sqrt{13}}{\sqrt{117}} &= \frac{2}{3} \checkmark \\
 MP &= 2\sqrt{13} & &
 \end{aligned}$$



And, since the triangles are similar, the corresponding angles are congruent, and therefore, \overline{JL} is parallel to \overline{MP}
 (Parallel lines cut by transversals)

Similar triangles: Side - Side - Side

Definitions: If the (three) corresponding sides of 2 triangles are proportional, then the triangles are similar.



Comments: 1) If $xf = c$, then the perimeter of $\triangle ABC = x(\text{perimeter of } \triangle DEF)$

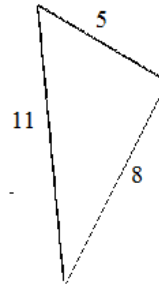
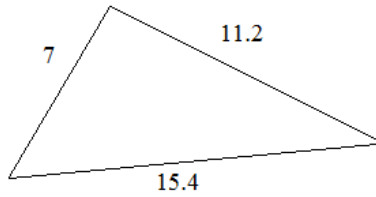
2) Using trigonometry, the angles can be determined from the sides.
(and verified to be congruent)

3) SSS congruency vs. SSS similarity:

If 3 corresponding sides are *proportional*, the triangles are *similar*;

If 3 corresponding sides are *congruent*, then the triangles are *congruent*
(the ratio is 1)

Example: Do the following triangles have the same shape? (are they similar?)



Since we are given the sides, let's compare each pair of sides:

a) smallest sides (opposite smallest angles)

$$\frac{7}{5} = 1.4$$

b) medium sides (opposite middle angles)

$$\frac{11.2}{8} = 1.4$$

c) largest sides (opposite largest angles of each triangle)

$$\frac{15.4}{11} = 1.4$$

The ratio of each pair of sides is 1:1.4

Therefore, the triangles are similar!

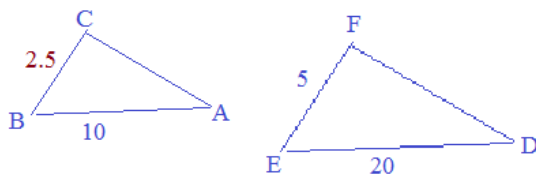
Similar Triangle Geometry Problems

Given: $\triangle ABC \sim \triangle DEF$

$$\frac{\overline{AB}}{\overline{DE}} = \frac{10}{20}$$

$$\frac{\overline{BC}}{\overline{EF}} = \frac{2.5}{5}$$

Find the length of \overline{BC}



Solution:

Step 1: Draw a picture

Step 2: Identify proportions/ratios

$$\frac{\overline{BC}}{\overline{EF}} = \frac{\overline{AB}}{\overline{DE}}$$

$$\frac{\overline{BC}}{5} = \frac{10}{20}$$

Step 3: Solve (cross multiply)

$$20(\overline{BC}) = 5(10)$$

$$\overline{BC} = 2.5$$

Given: $\overline{AE} \parallel \overline{BD}$

Answer the following:

- 1) What are the similar triangles? (explain why)
- 2) Find coordinate of E
- 3) Find and compare the lengths of \overline{AE} and \overline{BD} .

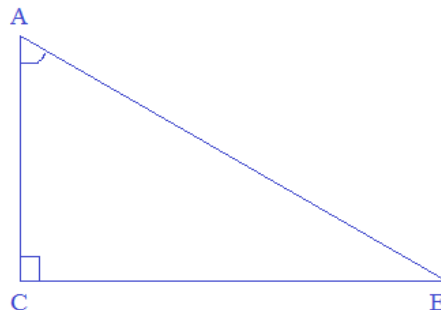
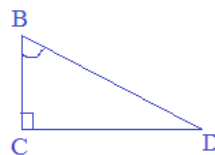
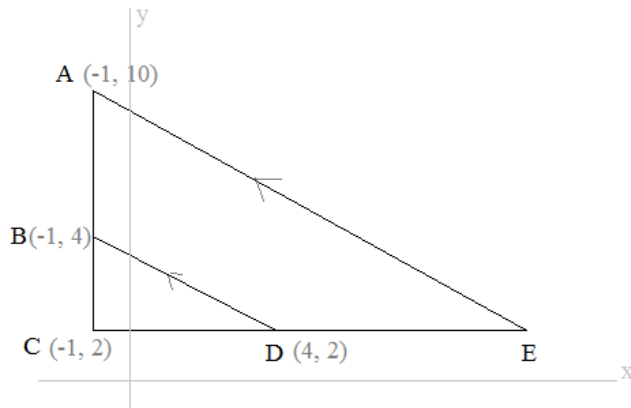
Solutions:

1) $\triangle ACE \sim \triangle BCD$

Angle-Angle theorem: If a pair of corresponding angles are congruent, then the triangles are similar.

$$\angle A = \angle B \quad (\text{parallel lines cut by a transversal})$$

$$\angle C = \angle C \quad (\text{reflexive property})$$



2) Since the triangles are similar, we can use proportions/ratios to find the other coordinate (and lengths).

$$\frac{BC}{AC} = \frac{CD}{CE}$$

$$\frac{2}{8} = \frac{5}{x}$$

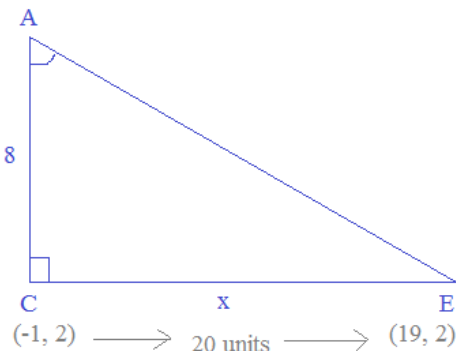
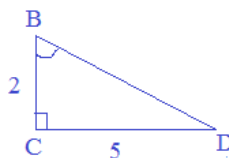
$$2x = 40$$

$$x = 20$$

Since C is at $(-1, 2)$,

a horizontal move 20 units to the right to point E

$\rightarrow (19, 2)$



3) Using the pythagorean theorem,

$$\overline{BD}^2 = \overline{BC}^2 + \overline{CD}^2$$

$$= 4 + 25$$

$$\overline{BD} = \sqrt{29}$$

**Since the ratio of the triangles is 1:4, the length of AE should be $4\sqrt{29}$

$$\overline{AC}^2 + \overline{CE}^2 = \overline{AE}^2$$

$$64 + 400 =$$

$$\overline{AE} = \sqrt{464} = 4\sqrt{29} \checkmark$$

Similar Triangle Word Problems

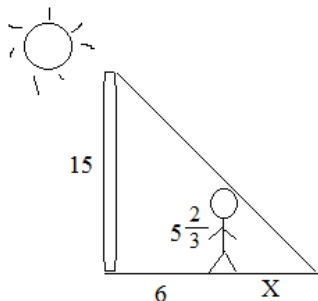
Solving "similar triangle/ratio" problems:

- 1) Draw picture
- 2) Split triangles
- 3) Solve proportion
- 4) Check answer

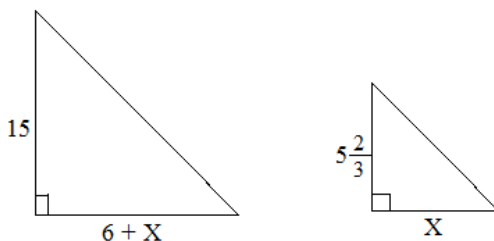
Example: A 5'8" person stands 6 feet from a 15-foot tall lamp post.
If their shadows overlap, how long is the person's shadow?

Solution:

Step 1: Draw a Picture



Step 2: Split the triangles



Step 3: Solve the proportion

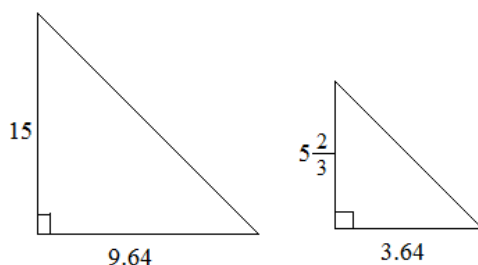
$$\frac{15}{6 + X} = \frac{5\frac{2}{3}}{X}$$

$$15X = 34 + 5\frac{2}{3}X$$

$$9\frac{1}{3}X = 34$$

$$X \approx 3.64 \text{ feet}$$

Step 4: Check answer



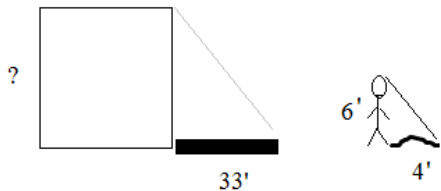
$$\frac{15}{9.64} = 1.56 \checkmark$$

$$\frac{5.6\bar{6}}{3.64} = 1.56 \checkmark$$

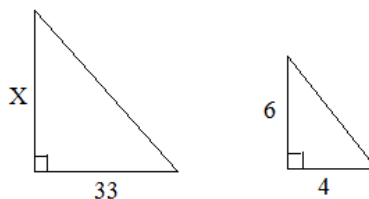
Example: A 6-foot tall man casts a shadow 4 feet. And, a house casts a shadow 33 feet.
What is the height of the house?

Solution:

Step 1: Draw a picture



Step 2: Split into triangles



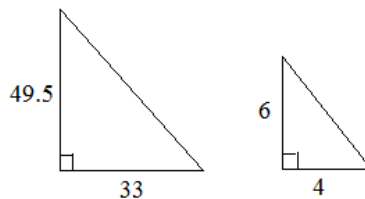
Step 3: Solve proportion

$$\frac{X}{33} = \frac{6}{4}$$

(cross multiply) $4X = 6(33)$

$$X = 49.5 \text{ feet}$$

Step 4: Check answer

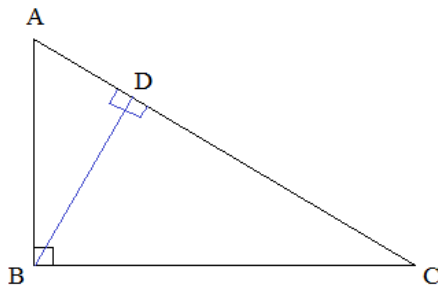


$$\frac{49.5}{33} = 1.5 \checkmark$$

$$\frac{6}{4} = 1.5 \checkmark$$

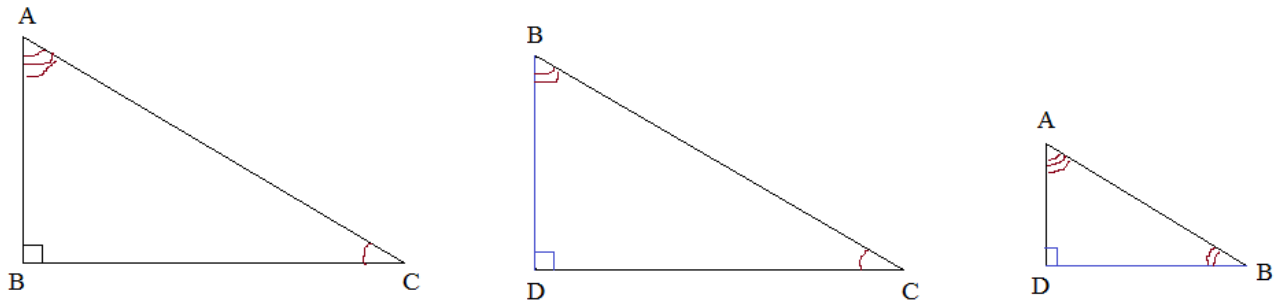
Altitude and 3 similar right triangles

An altitude of a right triangle, extending from the right angle vertex to the hypotenuse, creates 3 similar triangles!



\overline{BD} is an altitude extending from vertex B to \overline{AC}
 (\overline{AB} and \overline{BC} are the other altitudes of the triangle)

Then, displaying the 3 right triangles (facing the same direction), we can observe the congruent parts and the similarity:



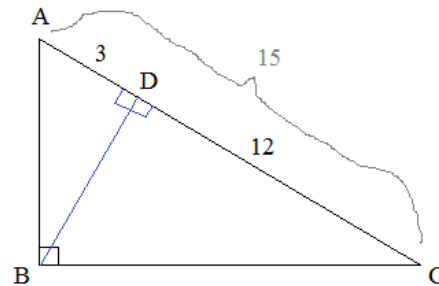
Using Angle-Angle Theorem of similarity proves all 3 triangles are similar (and proportional) to each other....

Example: Given: right triangle ABC with altitude BD

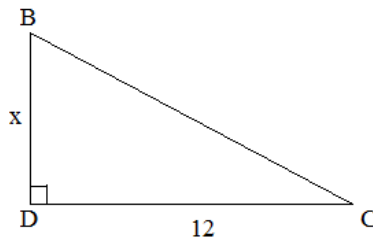
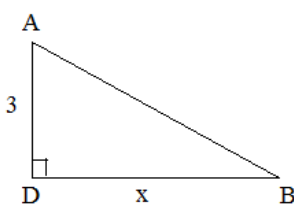
$$\frac{\overline{AD}}{\overline{AC}} = \frac{3}{15}$$

Find the length of the altitude \overline{BD} .

Step 1: Draw the figure; label parts



Step 2: Separate the triangles; set up ratios/proportions



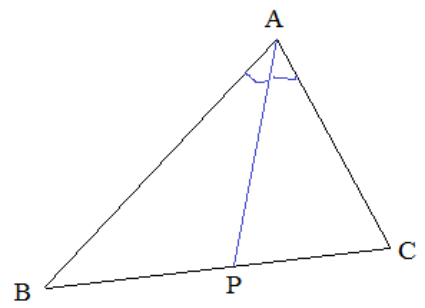
$$\frac{3}{x} = \frac{x}{12}$$

Step 3: Solve $x^2 = 36$
 $x = 6$

The altitude is 6 units...
 Also, the altitude is the *geometric mean* of the 2 segments that form the hypotenuse!

Angle Bisector Theorem

Definition: The angle bisector divides the opposite side into 2 parts with the same relative lengths (ratio) as the other two sides of the triangle.



\overline{AP} is the angle bisector

Opposite side is divided into two parts: \overline{BP} \overline{CP}

Ratio of other two sides of triangle: $\frac{\overline{AC}}{\overline{AB}}$

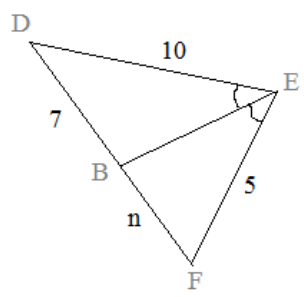
$$\frac{\overline{AC}}{\overline{AB}} = \frac{\overline{CP}}{\overline{BP}}$$

Also, simple algebra can show that ratios of "new triangle sides" are the same!

$$\frac{\overline{AC}}{\overline{AB}} = \frac{\overline{CP}}{\overline{BP}} \longrightarrow \overline{AC} \cdot \overline{BP} = \overline{AB} \cdot \overline{CP} \longrightarrow \frac{\overline{AC} \cdot \overline{BP}}{\overline{CP}} \cdot \frac{1}{\overline{BP}} = \frac{\overline{AB}}{\overline{BP}} \longrightarrow \frac{\overline{AC}}{\overline{CP}} = \frac{\overline{AB}}{\overline{BP}}$$

Example:

What is n?



Since $\angle DEB \cong \angle FEB$, \overline{BE} is an angle bisector...

Therefore, we can use the angle bisector theorem to find n:

$$\frac{\overline{DE}}{\overline{EF}} = \frac{\overline{DB}}{\overline{BF}} \quad \text{or,} \quad \frac{\overline{DE}}{\overline{DB}} = \frac{\overline{EF}}{\overline{BF}}$$

$$\frac{10}{5} = \frac{7}{n} \qquad \frac{10}{7} = \frac{5}{n}$$

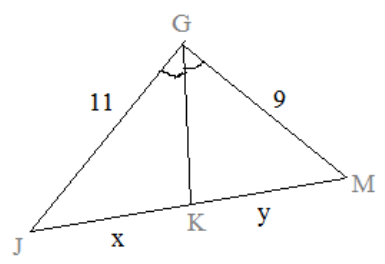
$$n = 3.5 \qquad n = 3.5$$

Example:

Find x and y:

$$x + y = 14$$

$$\angle GKJ \cong \angle GKM$$



Using the angle bisector theorem and substitution:

$$\frac{11}{x} = \frac{9}{(14 - x)}$$

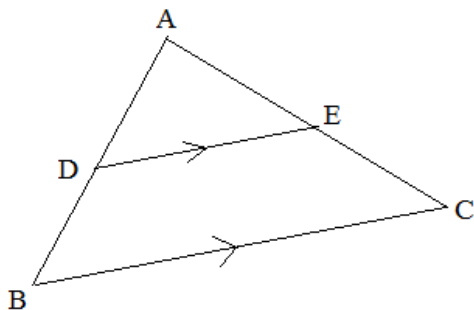
$$9x = 154 - 11x$$

$$20x = 154$$

$$x = 7.7 \quad \text{then,} \quad y = 6.3$$

Side-Splitter Theorem

Definition: If a line is parallel to one side of a triangle, then it splits the other two sides proportionally.

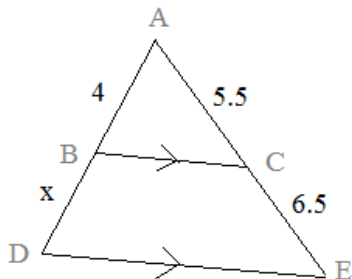


\overline{DE} is parallel to \overline{BC}
 \overline{DE} splits triangle ABC
 $\frac{\overline{AD}}{\overline{DB}} = \frac{\overline{AE}}{\overline{EC}}$

Also, simple algebra can show that the ratio of the "upper parts" is the same as the ratio of the "lower parts".

$$\frac{AD}{DB} = \frac{AE}{EC} \longrightarrow AD \cdot EC = DB \cdot AE \longrightarrow \frac{AD \cdot EC}{AE} = DB \longrightarrow \frac{\overline{AD}}{\overline{AE}} = \frac{\overline{DB}}{\overline{EC}}$$

Example: Find x:



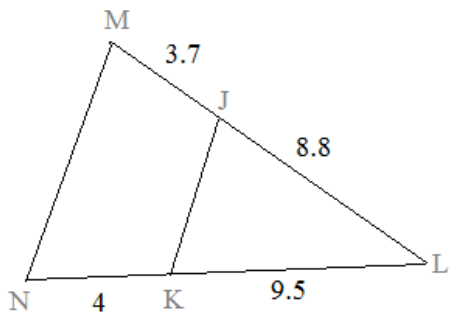
Since $BC \parallel DE$, we can use side-splitter to find x.

$$\frac{AB}{BD} = \frac{AC}{CE}$$

$$\frac{4}{x} = \frac{5.5}{6.5} \quad \boxed{x = 4.72}$$

$$5.5x = 26$$

Example: Is \overline{MN} parallel to \overline{JK} ?



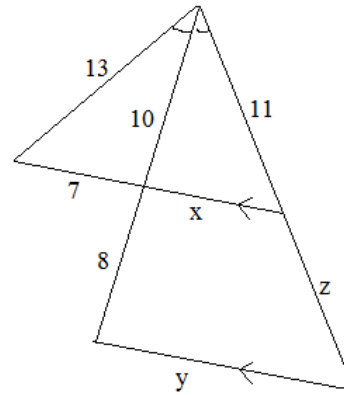
Compare the ratios/proportions:

$$\frac{JL}{JM} = \frac{8.8}{3.7} = 2.\overline{378}$$

$$\frac{KL}{KN} = \frac{9.5}{4} = 2.375$$

The proportions are NOT equal;
 therefore, JK is not parallel to MN!!

Example: Given the labeled diagram,
Find x, y, and z



Find x: (angle bisector theorem)

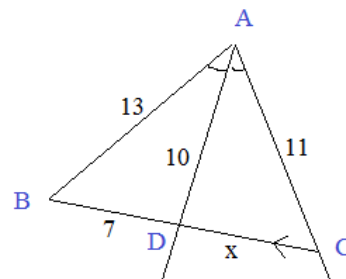
(\overline{AD} bisects angle A)

$$\frac{AB}{BD} = \frac{AC}{DC}$$

$$\frac{13}{7} = \frac{11}{x}$$

$$13x = 77$$

$$x = 5 \frac{12}{13}$$



Find y: (similar triangles)

Since $DC \parallel EF$, $\angle D = \angle E$ $\angle C = \angle F$

(parallel lines cut by transversals)

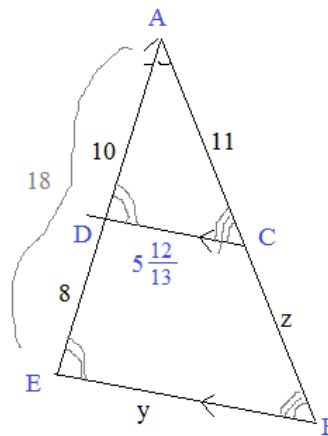
$\triangle ADC \sim \triangle AEF$ (Angle-Angle similarity theorem)

$$\frac{AD}{AE} = \frac{DC}{EF}$$

$$\frac{10}{18} = \frac{5 \frac{12}{13}}{y}$$

$$10y \cong 106.6$$

$$y \cong 10.66$$



Find z: (side-splitter theorem)

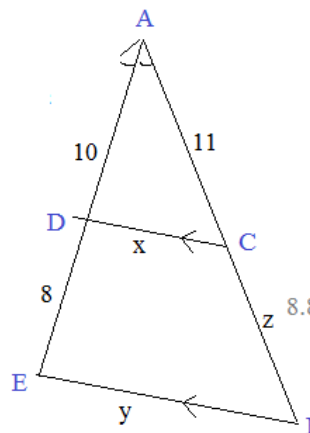
$DC \parallel EF$, so use side-splitter...

$$\frac{AD}{DE} = \frac{AC}{CF}$$

$$\frac{10}{8} = \frac{11}{z}$$

$$10z = 88$$

$$z = 8.8$$



Note: using similar triangles,
we can check $z = 8.8$

$$\frac{AD}{AE} = \frac{10}{18} = .5556 \checkmark$$

$$\frac{AC}{AF} = \frac{11}{19.8} = .5556 \checkmark$$

Triangles, Proportions, and Geometric Mean

Arithmetic Mean between two numbers: the average, midpoint, or middle.

Example: What is the (arithmetic) mean of 6 and 10?

To find the average: $\frac{6 + 10}{2} = 8$

8 is the midpoint: two units from 6 and two units from 10
(a common difference of 2)

Geometric Mean between two numbers: a middle where there is a common ratio between the numbers

Example: What is the geometric mean of 4 and 16?

To find the geometric mean, *multiply the 2 numbers and then take the square root.*

$$4 \times 16 = 64 \quad \sqrt{64} = 8$$

$$8 \text{ is the middle: } \begin{array}{ccc} 4 & 8 & 16 \\ & \times 2 & \times 2 \end{array}$$

(a common ratio of 2)

"Means/Extremes"

Examples: $\frac{3}{7} = \frac{12}{28}$ Means are 7 and 12; Extremes are 3 and 28...

$$3:4 = 12:16 \quad \text{Means are 4 and 12; Extremes are 3 and 16...}$$

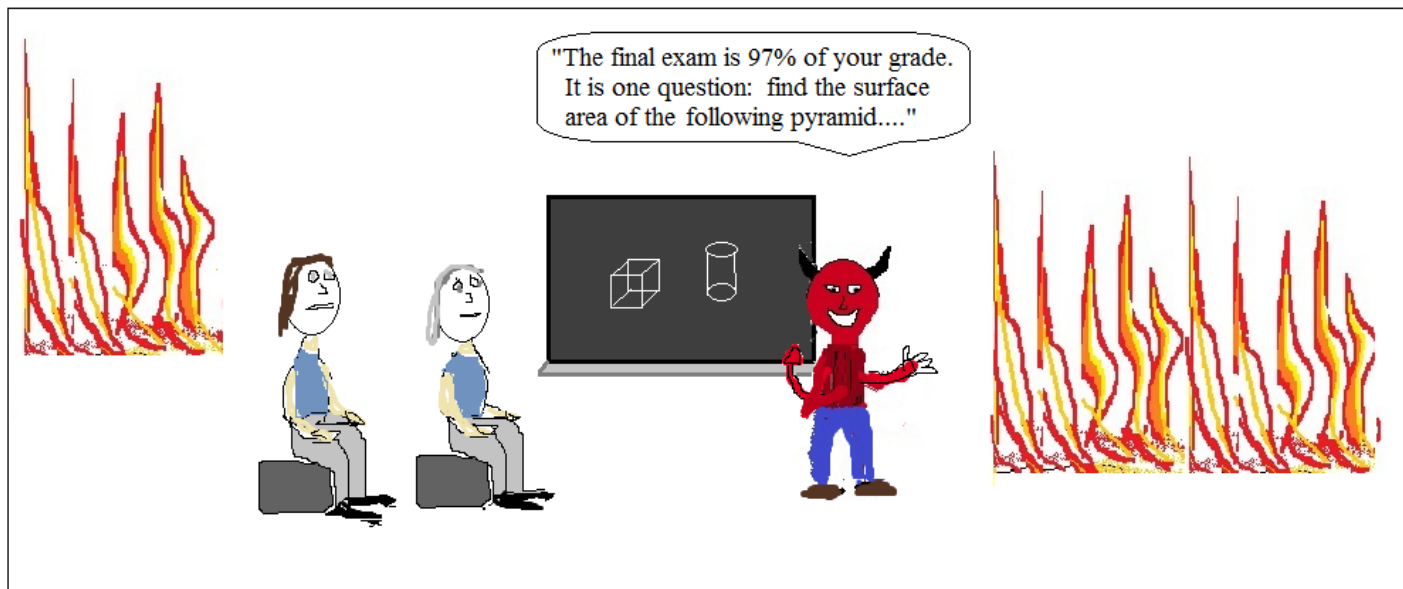
The geometric mean can be found in ratios/proportions..

Examples: $1:3 = 3:9$ Means -- 3 (middle) Extremes = 1 and 9 (outer)

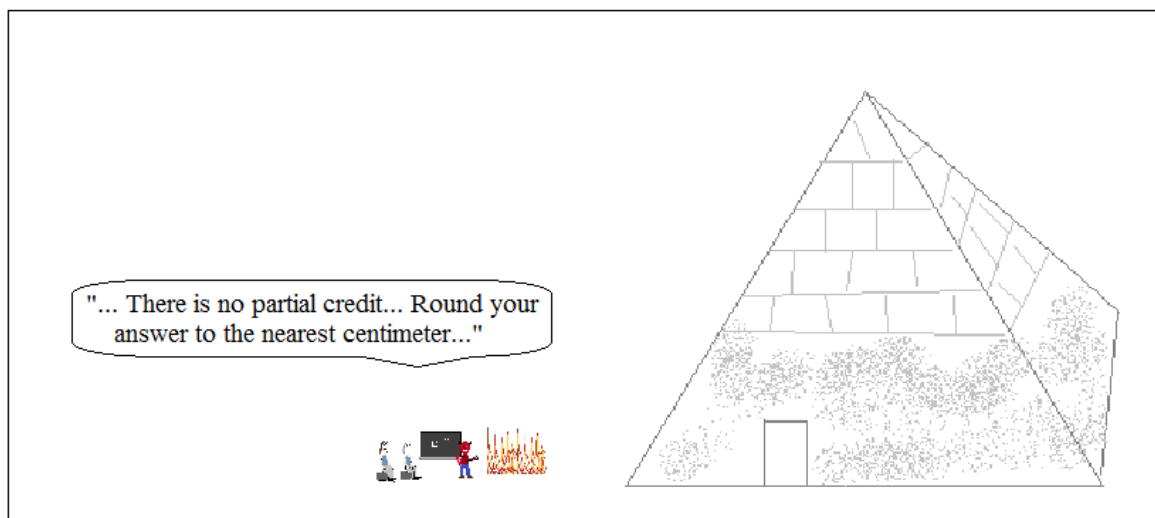
The means are both 3; therefore, 3 is the geometric mean of 1 and 9

$$\frac{4}{8} = \frac{8}{16} \quad \text{The mean is 8, and the extremes are 4 and 16...}$$

The *geometric mean* of 4 and 16 is 8



Math in Hell



In its 1000 year history, no one ever passed Mr. Devlin's Geometry class.

LanceAF #39 7-1-12
www.mathplane.com

Practice Exercises ->

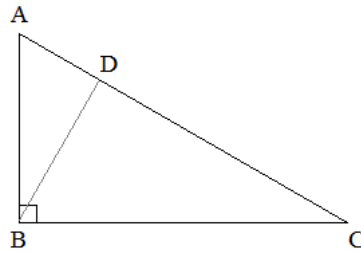
Similar Triangles, Ratios, and Geometric Mean

I. Means

- 1) What is the arithmetic mean of 6 and 96?
- 2) What is the geometric mean of 6 and 96?
- 3) Given: $k = 4$ $m = 20$
 - a) If m is the arithmetic mean of k and p , what is p ?
 - b) If m is the geometric mean between k and r , what is r ?

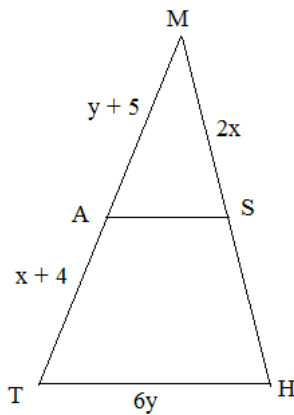
II. Ratios and Proportions

- 1) $10:x$ and $x:20$ have the same ratios. What is x ?
- 2) $\frac{3}{12} = \frac{x}{60}$
- 3) The hypotenuse of triangle ABC is 20 units; If \overline{AD} is 4 units, what is the length of altitude \overline{BD} ?



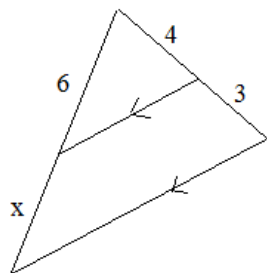
- 4) Given: $\overline{MT} \cong \overline{MH}$
 \overline{AS} bisects \overline{MH}
 \overline{AS} bisects \overline{MT}

What is the perimeter of $\triangle MTH$?

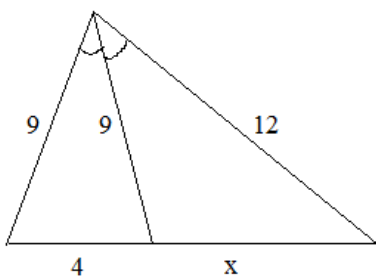


III. Similar triangles and Theorems

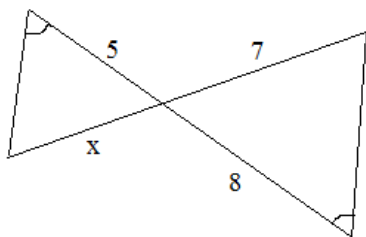
Find x: 1)



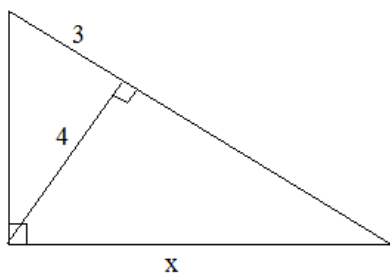
2)



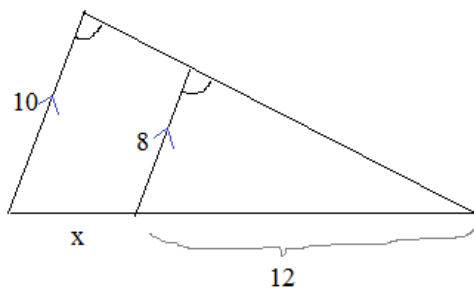
3)



4)

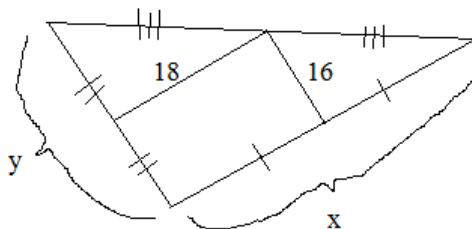


5)



IV. Midsegments and More...

1) What is x ?



What is y ?

2) The coordinates of the vertices of a triangle are $A(1, 3)$, $B(5, 7)$, $C(3, -1)$

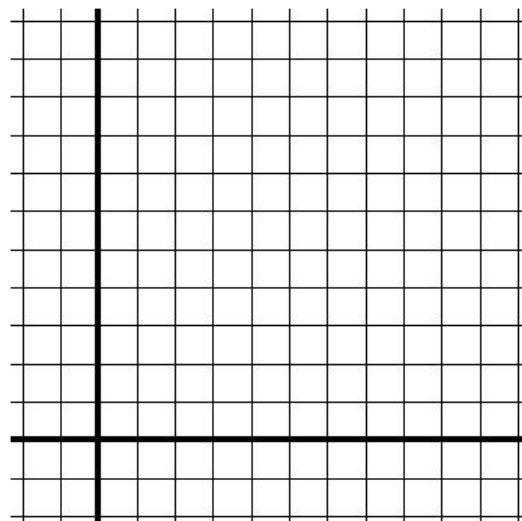
If H is the midpoint of \overline{AC} and J is the midpoint of \overline{BC} ,

a) Find H ; Find J

b) Graph the triangle, and label the points

c) Verify (algebraically) that \overline{AB} is parallel to \overline{HJ}

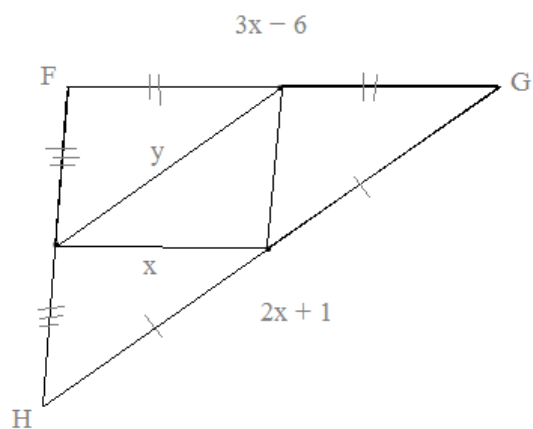
d) Verify $\overline{HJ} = \frac{1}{2}\overline{AB}$



3) Find x and y

$$FG = 3x - 6$$

$$GH = 2x + 1$$

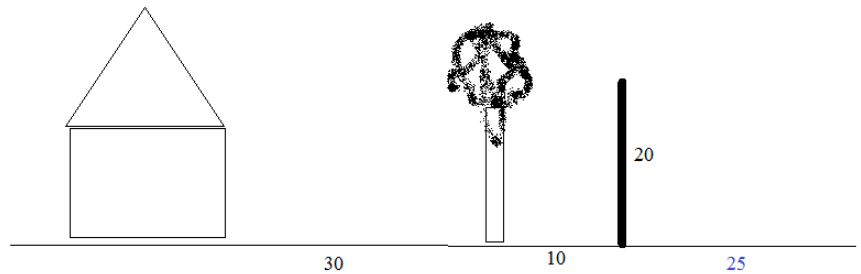


Shadow Questions

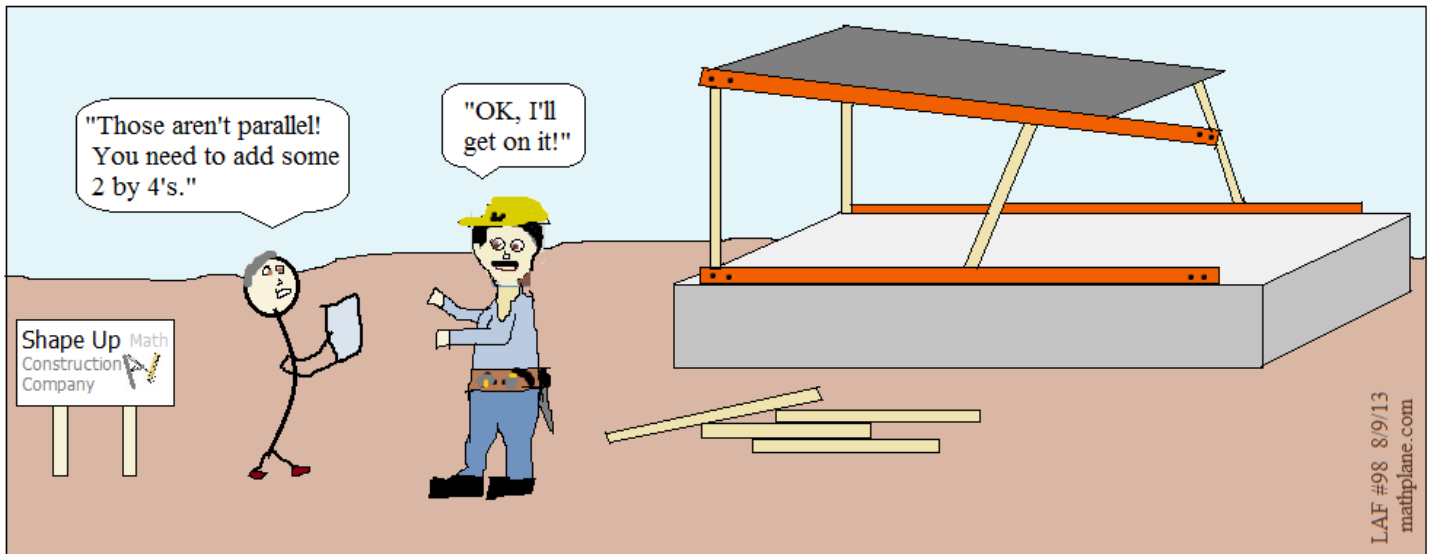
- 1) Giant Gene is 8 feet tall...
When he stands near a 20' light pole, he casts a 6' shadow...
If he walks 2' closer to the light pole, what is his shadow length?

- 2) A 20-meter pole makes a 25-meter shadow...
In the same line, a tree makes a 35-meter shadow...
The tree stands 30 meters from a building; and, 10 meters from the pole...

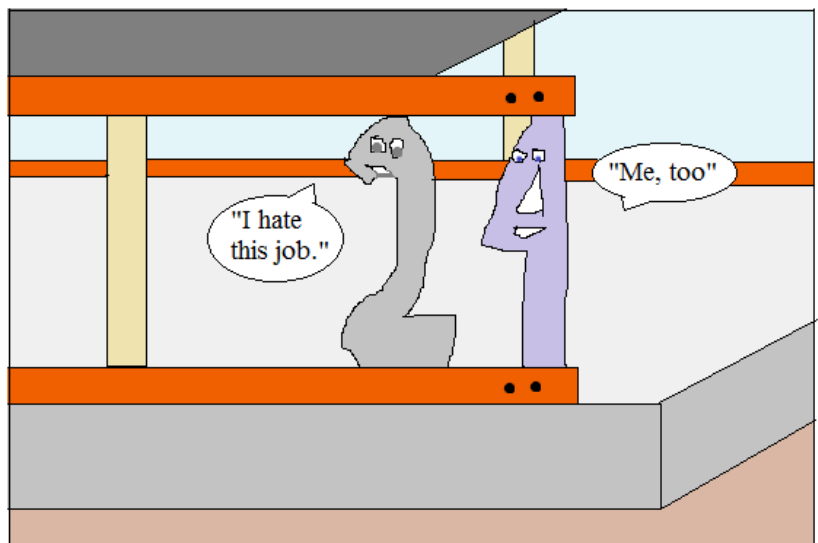
If the tree falls toward the house, would it damage the house?



- 3) When a 9' shed casts a 5'3" shadow, a house casts an 11-foot shadow.
What is the height of the house? What assumptions must be made?



The Math Guy misunderstood the Architect's suggestion...



Building Materials

SOLUTIONS ->

I. Means

1) What is the arithmetic mean of 6 and 96?

$$\frac{6 + 96}{2} = 51$$

$$\begin{array}{ccc} 6 & 51 & 96 \\ +45 & +45 & \end{array}$$

2) What is the geometric mean of 6 and 96?

$$\sqrt{6 \times 96} = 24$$

$$\begin{array}{ccc} 6 & 24 & 96 \\ \times 4 & \times 4 & \end{array}$$

3) Given: $k = 4$ $m = 20$

a) If m is the arithmetic mean of k and p , what is p ?

$$\begin{array}{ccc} k & m & p \\ 4 & 20 & p \\ +16 & +16 & \end{array} \quad \boxed{p = 36}$$

$$\begin{aligned} \frac{k+p}{2} &= m \\ 4+p &= 40 \end{aligned}$$

b) If m is the geometric mean between k and r , what is r ?

$$\begin{array}{ccc} k & m & r \\ 4 & 20 & r \\ \times 5 & \times 5 & \end{array} \quad \boxed{r = 100}$$

$$\begin{aligned} \sqrt{kr} &= m \\ \sqrt{4r} &= 20 \end{aligned}$$

II. Ratios and Proportions

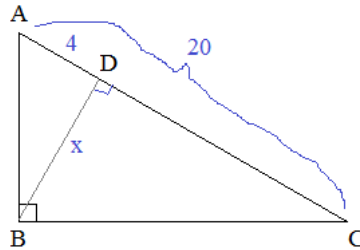
1) $10:x$ and $x:20$ have the same ratios. What is x ?

$$\frac{10}{x} = \frac{x}{20} \quad x^2 = 200 \quad \boxed{x = 10\sqrt{2} \text{ or } -10\sqrt{2}}$$

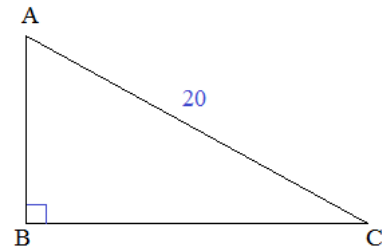
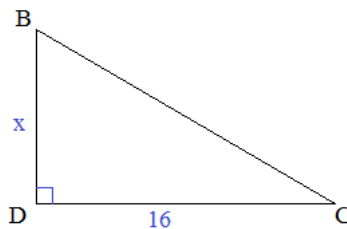
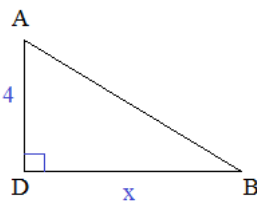
2) $\frac{3}{12} = \frac{x}{60}$

$$12x = 180 \quad \boxed{x = 15}$$

3) The hypotenuse of triangle ABC is 20 units; If \overline{AD} is 4 units, what is the length of altitude \overline{BD} ?



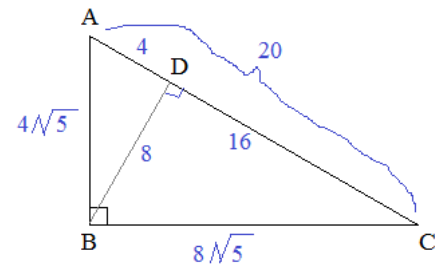
Separate the right triangles:



Use the first 2 triangles and ratios:

$$\frac{4}{x} = \frac{x}{16} \quad x^2 = 64 \quad \boxed{x = 8}$$

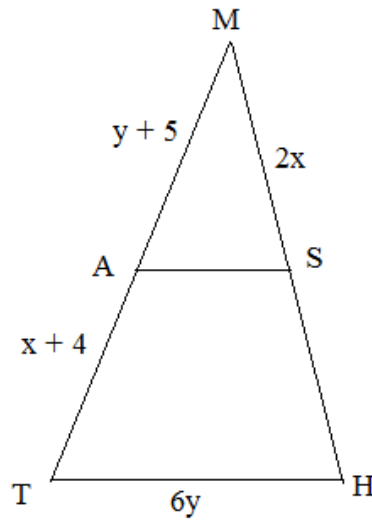
Check answers and other sides:



Solution

- 4) Given: $\overline{MT} \cong \overline{MH}$
 \overline{AS} bisects \overline{MH}
 \overline{AS} bisects \overline{MT}

What is the perimeter of $\triangle MTH$?



$y + 5 = x + 4$
(because A is the midpoint of MT)

$2x = y + 5$
(because S is midpoint of MH and $MT = MH$)

Since we have 2 equations and 2 unknowns, we can solve:

(rewrite equations)

$$x - y = 1$$

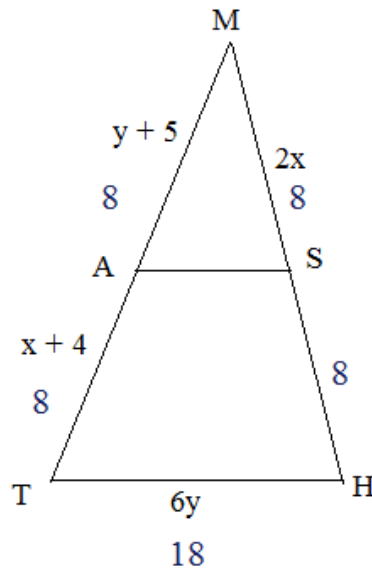
$$2x - y = 5$$

(elimination method)

$$-x = -4$$

$$x = 4$$

$$y = 3$$



Substitute into the triangle,

add up the segments:

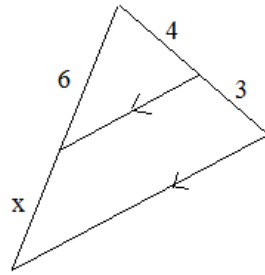
$$8 + 8 + 18 + 8 + 8 = 50$$

III. Similar triangles and Theorems

Solutions

Similar Triangles, Ratios, and Geometric Mean

Find x: 1)



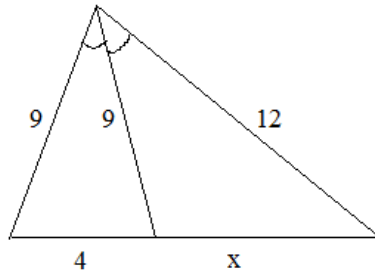
Use Side-splitter theorem:

$$\frac{6}{x} = \frac{4}{3}$$

$$4x = 18$$

$$x = 4.5$$

2)



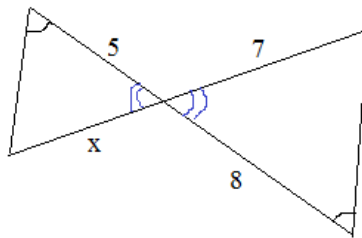
Use Angle bisector theorem:

$$\frac{9}{4} = \frac{12}{x}$$

$$9x = 48$$

$$x = 5 \frac{1}{3}$$

3)



Use Angle-Angle theorem and similar triangles:

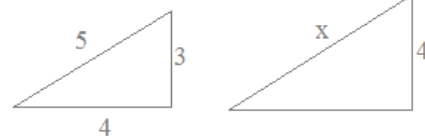
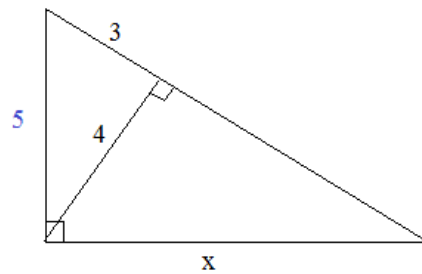
$$\frac{5}{8} = \frac{x}{7}$$

$$8x = 35$$

$$x = 4.375$$

4)

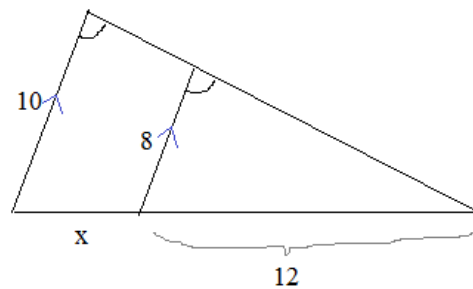
pythagorean triplet 3-4-5



$$\frac{5}{x} = \frac{3}{4}$$

$$x = 6 \frac{2}{3}$$

5)



Since corresponding angles are congruent, the line segments must be parallel...

$$\frac{8}{10} = \frac{12}{x + 12}$$

$$x + 12 = 15$$

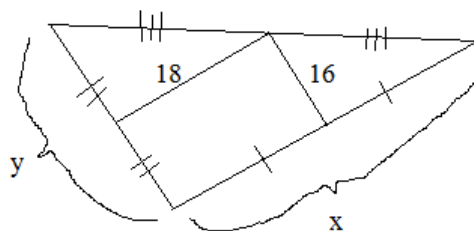
$$x = 3$$

IV. Midsegments and More...

SOLUTIONS

1) What is x? 36 (18 x 2)

What is y? 32 (16 x 2)



2) The coordinates of the vertices of a triangle are A (1, 3) B (5, 7) C (3, -1)
If H is the midpoint of AC and J is the midpoint of BC,

a) Find H; Find J midpoint of A and C:
H (2, 1)

midpoint formula $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ midpoint of B and C:
J (4, 3)

b) Graph the triangle, and label the points

c) Verify (algebraically) that AB is parallel to HJ

If 2 segments are ||, slope of AB: $\frac{7-3}{5-1} = 1$ ✓
then slopes are =

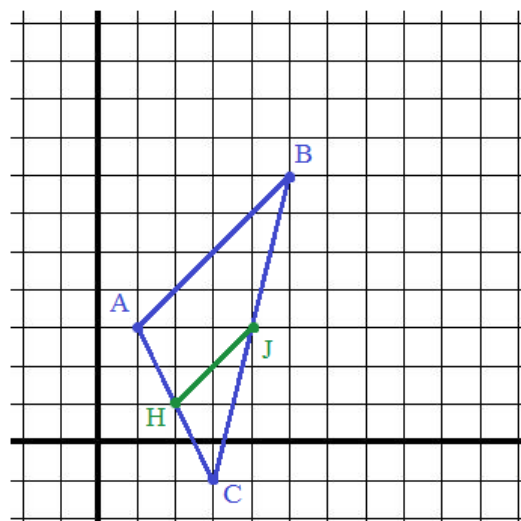
slope of HJ: $\frac{4-2}{3-1} = 1$ ✓

d) Verify $HJ = (1/2)AB$

since HJ || AB using distance formula:
and H and J are midpoints,
HJ = (1/2)AB

$$HJ = \sqrt{(4-2)^2 + (3-1)^2} = \sqrt{8} = 2\sqrt{2} \quad \checkmark$$

$$AB = \sqrt{(1-5)^2 + (3-7)^2} = \sqrt{32} = 4\sqrt{2} \quad \checkmark$$



3) Find x and y

Using midsegment/side-splitter theorems,

$$FG = 3x - 6$$

we know $x = (1/2)(3x - 6)$

$$GH = 2x + 1$$

$$x = \frac{3x}{2} - 3$$

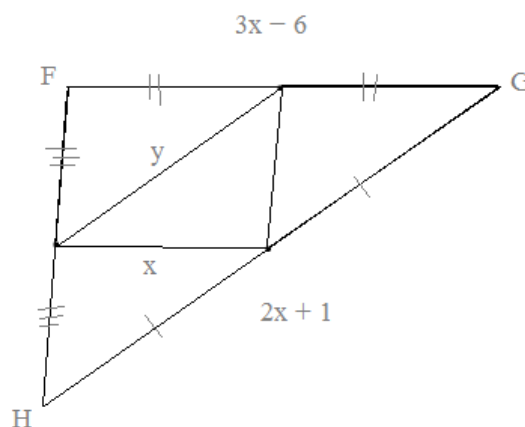
$$\frac{-x}{2} = -3$$

$$x = 6$$

since $x = 6$,

$$HG = 2(6) + 1 = 13$$

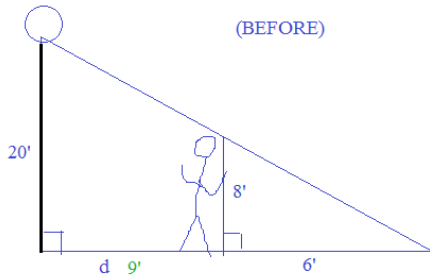
therefore, $y = 13/2$



Shadow Questions

SOLUTIONS

- 1) Giant Gene is 8 feet tall...
 When he stands near a 20' light pole, he casts a 6' shadow....
 If he walks 2' closer to the light pole, what is his shadow length?



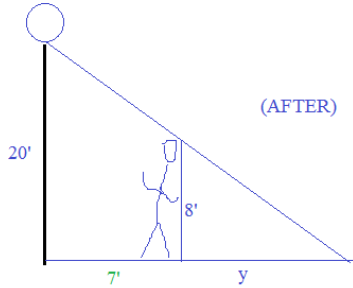
First, we'll find the distance Gene stands from the pole....

$$\frac{20}{d+6} = \frac{8}{6} \quad \begin{array}{l} \text{"left"} \\ \text{"base"} \end{array}$$

$$120 = 8d + 48$$

$$72 = 8d$$

distance $d = 9$ feet from pole...



Then, we'll find the new shadow length...

$$\frac{20}{y+7} = \frac{8}{y} \quad \begin{array}{l} \text{"left"} \\ \text{"base"} \end{array}$$

$$20y = 8y + 56$$

$$12y = 56$$

$$y = 4 \frac{2}{3}$$

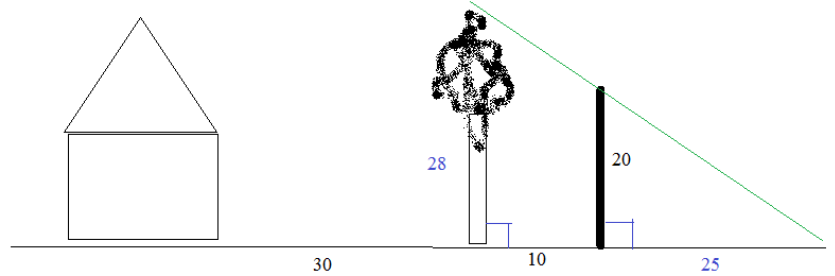
- 2) A 20-meter pole makes a 25-meter shadow...
 In the same line, a tree makes a 35-meter shadow...
 The tree stands 30 meters from a building; and, 10 meters from the pole...

If the tree falls toward the house, would it damage the house?

We need to find the height of tree....

$$\frac{20}{25} = \frac{x}{35}$$

$x = 28$ since tree is 28 meters tall, it would not damage the building 30 meters away!



- 3) When a 9' shed casts a 5'3" shadow, a house casts an 11-foot shadow.

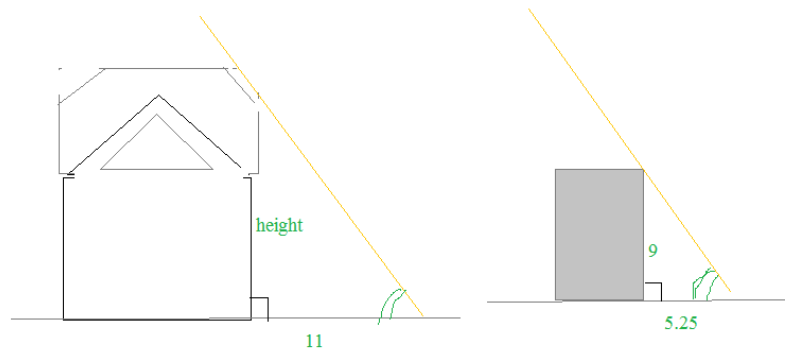
What is the height of the house? What assumptions must be made?

Notice, 5'3" is NOT 5.3 feet... It's 5.25 feet...

We are assuming the house and shed are not leaning ----> both are perpendicular to ground (forming similar triangles)

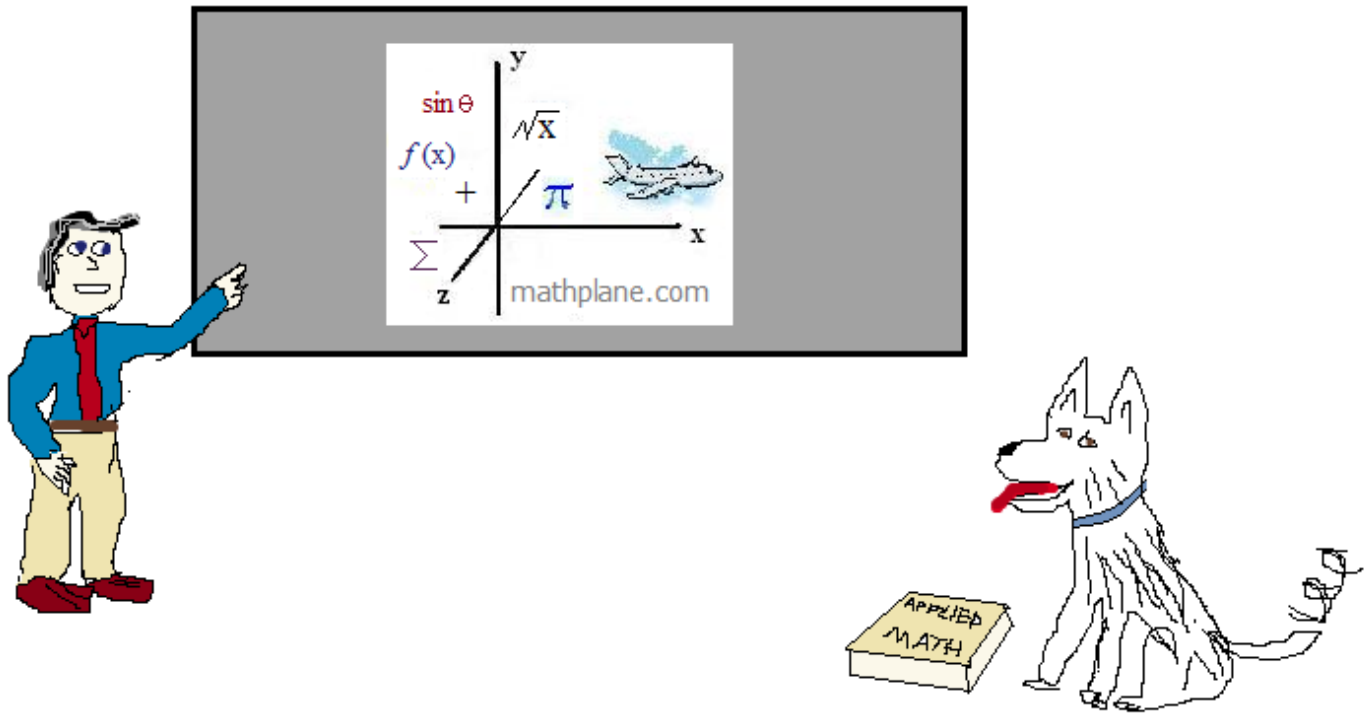
$$\frac{\text{height}}{11} = \frac{9}{5.25}$$

$$\text{height} = \frac{99}{5.25} = 18.86 \text{ feet} \\ \text{or } 18 \text{ feet } 10 \text{ inches (approx)}$$



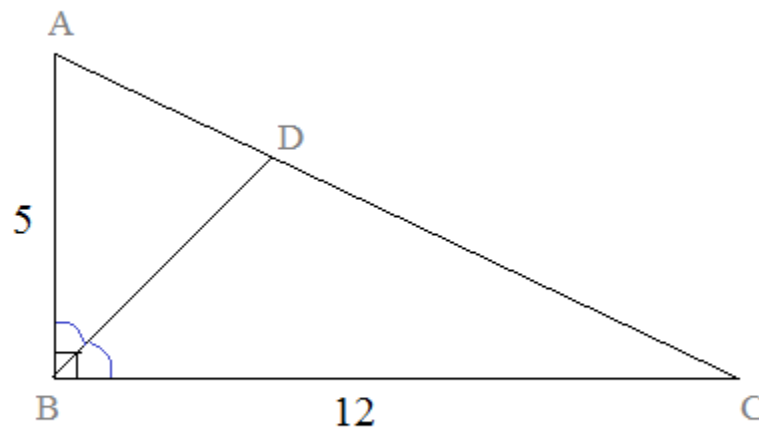
Thanks for visiting. (Hope it helped!)

If you have suggestions, questions, or requests, let us know. Enjoy!



ONE MORE QUESTION:

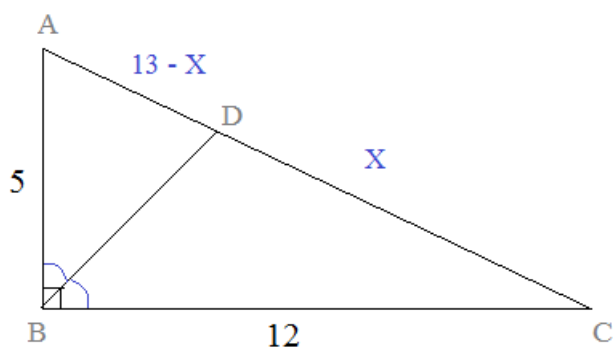
Find the length of \overline{CD} :



ABC is a right triangle, where $\angle ABD \cong \angle CBD$

(ANSWER on next page)

Find the length of \overline{CD} :



ABC is a right triangle, where $\angle ABD \cong \angle CBD$

Answer:

Since ABC is a right triangle with legs 5 and 12, we know the hypotenuse is 13...

If $\overline{CD} = X$, then $\overline{AD} = 13 - X$

Since \overline{BD} is a bisector, we can use the (triangle) angle bisector theorem

$$\frac{AB}{BC} = \frac{AD}{DC}$$

$$\frac{5}{12} = \frac{13 - X}{X}$$

$$5X = 156 - 12X$$

$$17X = 156$$

$$X \approx 9.176$$