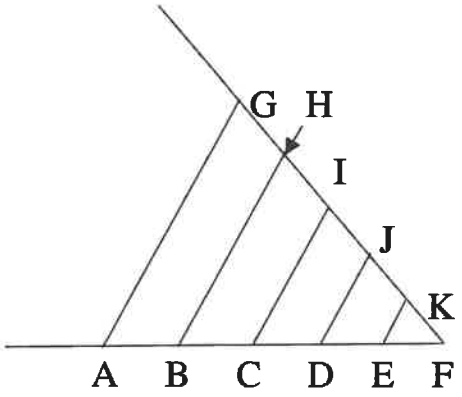
5 Geometric Similarities Oct 2021 (You may use calculators)

3 pts 1. In the drawing $\overline{AG}$, $\overline{BH}$, $\overline{CI}$, $\overline{DJ}$, and $\overline{EK}$ are parallel. If AB = BC = CD = DE = EF and GJ = 39, find HF.

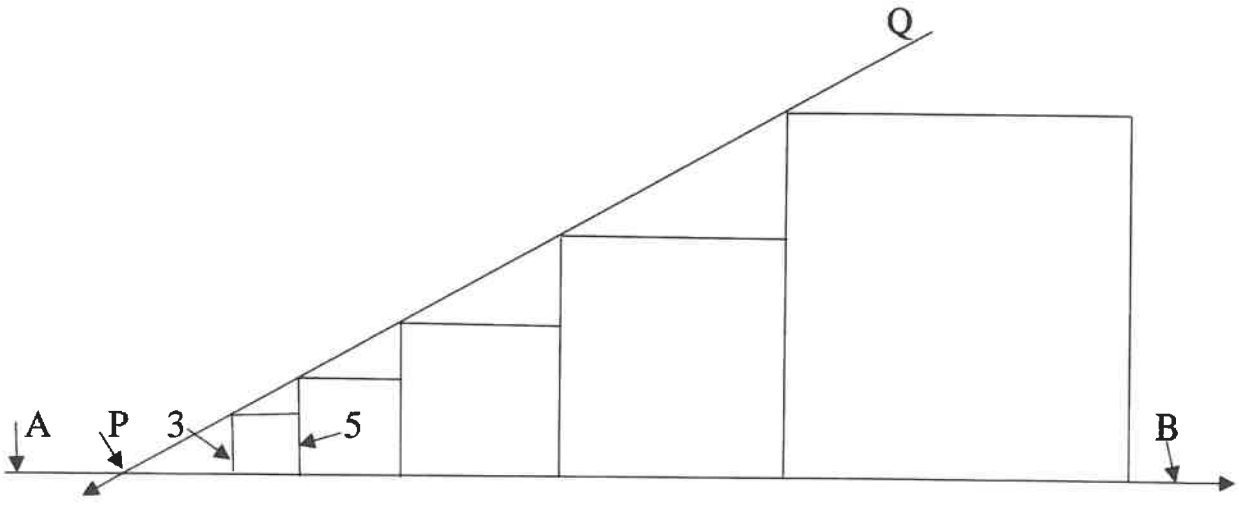


Ans. _____

4 pts 2. A baby red squirrel has exactly similar shape and mass density as her mother but is 5/8 as long. If the mother has a mass of 305 grams, what is the mass of her baby in grams?

Ans. _____

5 pts 3. In the drawing shown, five mutually tangent squares are drawn, each with a bottom side on segment AB and each with a top left vertex on segment PQ. If the side lengths of the first two squares on the left are 3 and 5 respectively, find the side length of the largest square.



Ans. _____

Geometric Similarities

1. Since the parallel lines cut off congruent segments on transversal AB, they will cut off congruent segments on transversal GF. GJ = 39 so each segment is 13 and HF = 52. **Ans. 52**

2. The mass of the body is 5/8 as great through each of the 3 dimensions, so $305\left(\frac{5}{8}\right)^3 = 74.4629$ $= 74\frac{237}{512} = \frac{38{,}125}{512}$ grams. **Ans. 74.4629 or $74\frac{237}{512}$ or $\frac{38{,}125}{512}$ (grams)**

3. The sides of the squares are 3, 5, $(5 + \frac{2}{3}(5)) = \frac{25}{3}$, $(\frac{25}{3} + \frac{2}{3}(\frac{25}{3}) = \frac{125}{9}$, and the 5th square has a side of $\frac{125}{9} + \frac{2}{3}(\frac{125}{9}) = \frac{625}{27} = 23\frac{4}{27}$. Note: advanced students will notice that the side lengths form a geometric sequence with a common factor of $\frac{5}{3}$, thus $3(\frac{5}{3})^4 = \frac{625}{27}$. **Ans. $\frac{625}{27} = 23\frac{4}{27}$**

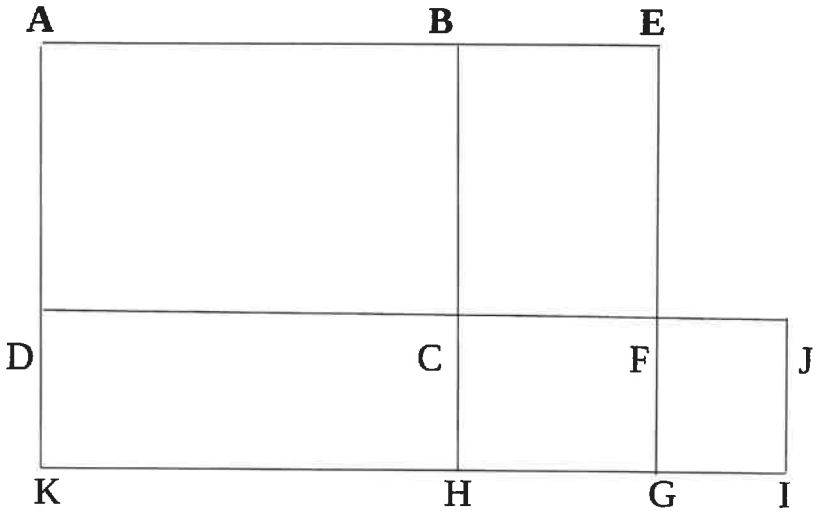
5 Geometric Similarities Oct 2020 (You may use a calculator)

(Calculator usage will require 4 decimal place accuracy for decimal answers.)

3 pts 1. A blueprint has a rectangle $3\frac{3}{4}$ inches wide and 10 inches long. The rectangular floor for the print is 30 feet long. How wide, in feet, is the floor?

Ans. _____

4 pts 2. In the figure below, ABCD ~ BCFE ~ CFGH ~ FGIJ. GI = 18 and JI = 30. How long is segment KI? All the quadrilaterals are rectangles.



Ans. _____

5 pts 3. The short leg of a 30-60-90 triangle is 6 units long. Another 30-60-90 triangle is attached to the first, so that the short leg of second triangle coincides with the hypotenuse of the first. A third 30-60-90 triangle is attached to the second in the same way, and the pattern continues. If there are 11 triangles in all, what length is the long leg of the last triangle attached in this way?

Ans. _____

Geometric Similarities

1. $3\frac{3}{4}$ is to 10 as x is to 30. So $x = (3\frac{3}{4})3 = 45/4 = 11\frac{1}{4}$ ft. **Ans.** $\mathbf{11\frac{1}{4}}$ **(11.25)**

2. The following ratio is used: $\frac{GI}{GF} = \frac{GF}{CF} = \frac{CF}{BC} = \frac{BC}{DC}$. $\frac{GI}{FG} = \frac{18}{30} = \frac{3}{5}$. $\frac{3}{5} = \frac{30}{CF}$, $CF = 30(\frac{5}{3}) =$

$50 = GH$. $\frac{3}{5} = \frac{50}{BC}$, $BC = 50(\frac{5}{3}) = \frac{250}{3}$. $\frac{3}{5} = \frac{\frac{250}{3}}{DC}$, $DC = (\frac{250}{3})\frac{5}{3} = \frac{1250}{9} = 138\frac{8}{9} = KH$.

$KI = KH + GH + GI = 138\frac{8}{9} + 50 + 18 = 206\frac{8}{9}$. **Ans.** $\mathbf{206\frac{8}{9}}$ **(206.8889)**

3. The hypotenuse of the original triangle is 12. The hypotenuse of the first attached triangle is 24. The hypotenuse of the 10^{th} attached triangle is $12(2^{10}) = 12(1024) = 12{,}288$. The short leg is 6,144 and the longer leg is $6144(\frac{\sqrt{3}}{2}) = 3072\sqrt{3}$. **Ans.** ~~**3072** $\sqrt{3}$~~ $6144\sqrt{3}$ **(5320.8601)**

5 Geometric Similarities Oct 2019 (You may use calculators)

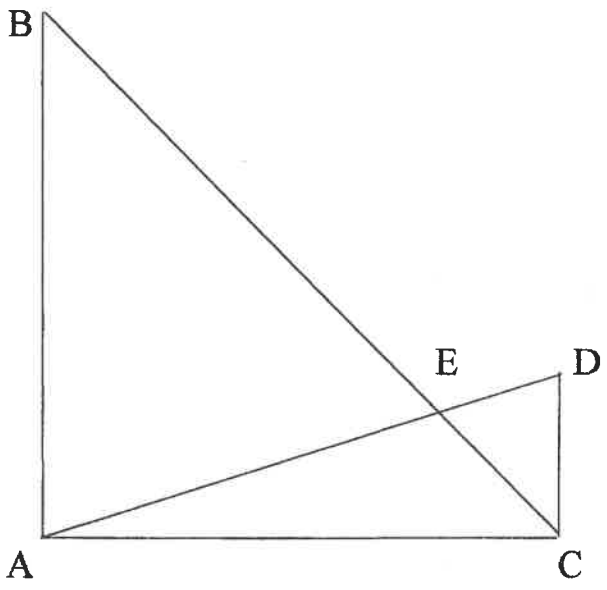
3 pts 1. ΔABC is similar to ΔDEF, $m\angle A = (4x + 13)^o$, $m\angle B = 36^o$ and $m\angle F = (5x + 5)^o$. Find the measure of angle D in degrees.

Ans. _____

4 pts 2. Given ΔABC has point D on $\overline{AB}$ and point E on $\overline{AC}$. $\overline{DE} \parallel \overline{BC}$, AB = 12, AD = 9, BC = 8 and AE = 12. Find the perimeter of quadrilateral BCED.

Ans. _____

5 pts 3. In the figure two poles are driven perpendicularly into the ground. One pole has point B, 80 feet above the ground and meets the ground at point A. The other has point D, 20 feet above the ground and meets the ground at point C. The ground is level and straight wires BC and AD meet at point E. How far above the ground is point E?

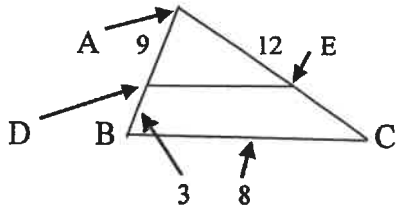


Ans. _____

Geometric Similarities

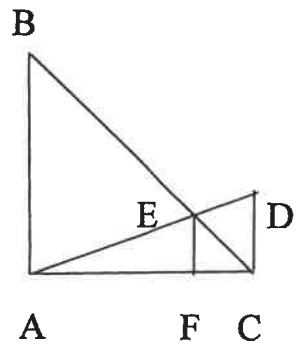
1. $m\angle F = 5x + 5 = m\angle C$. $m\angle A + m\angle C = 180 - m\angle B = 144$. So $4x + 13 + 5x + 5 = 144 \rightarrow$ $9x + 18 = 144 \rightarrow 9x = 126$, $x = 14$. $m\angle D = 4x + 13 = 4(14) + 13 = 56 + 13 = 69$. **Ans. 69**

2. Using the figure: $CE = 4$. $\frac{DE}{8} = \frac{9}{12}$, so $DE = 6$.



$3 + 6 + 4 + 8 = 21$. **Ans 21**

3. Drop a perpendicular from E to segment AC to meet at F.



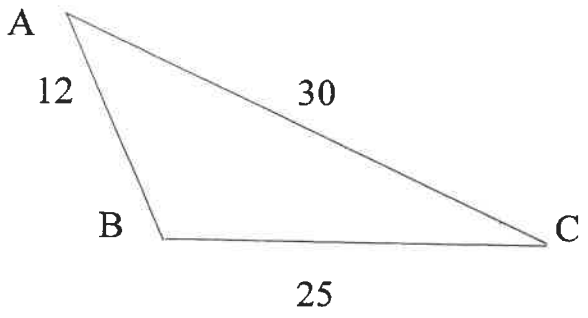
Let $AC = x$, $FC = m$ and $EF = y$. Then $\frac{20}{x} = \frac{y}{x-m}$ or $20x - 20m = xy$.

Also $\frac{m}{y} = \frac{x}{80}$ or $80m = xy$. $20x - 20m = 80m$, $20x = 100m$, $x = 5m$,

so $AF = 4m$. Therefore $\frac{20}{5m} = \frac{y}{4m}$, so $y = 16$. **Ans. 16**

5 Geometric Similarities Oct 2018 (You may use calculators)

3 pts 1. Triangle ABC has side measurements as shown. Another triangle, similar to ABC, has two sides measuring 10 and 12 units. What is the measure of the third side?

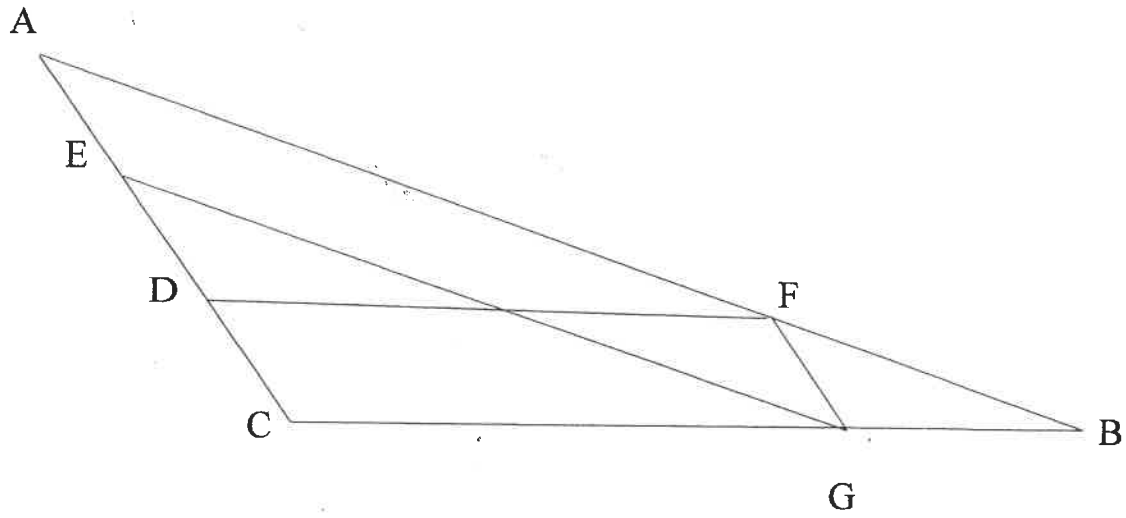


Ans. _____

4 pts 2. A surveyor is standing at point D on a river's edge. He sights a large rock directly across the small river from him at point E. He then walks down the river's edge180 feet to point A. (Assume the river is straight, on this walk.) He turns at right angles to the river and walks a distance of 140 feet to point B. When he turns to look at the rock, he sees a tree on the water's edge at point C on his side of the river blocking his view. He measures the distance from A to C and finds it to be 105 feet. How far is it from B to the rock at E?

Ans. _____

5 pts 3. In triangle ABC, AB = 16, BC = 12 and AC = 8. Points D and E are on $\overline{AC}$. Point F is on $\overline{AB}$ and point G is on $\overline{BC}$. $\overline{DF} \parallel \overline{CB}$, $\overline{FG} \parallel \overline{AC}$, and $\overline{EG} \parallel \overline{AB}$. If DF = 8, find DE.



Ans. _____

Geometric Similarities

1. Ratio of 10 to 12 is 5 to 6. 25 to 30 is 5 to 6. $\frac{12}{25}=\frac{x}{10} \rightarrow 25x = 120, x = 4\frac{4}{5}$. **Ans.** $4\frac{4}{5}$

2. There are two similar right triangles. The sides of the triangle on the surveyor's side of the river are legs 105 and 140, ratio of 3 to 4, so the hypotenuse id is $5(35) = 175 = BC$. The hypotenuse CE from the tree at the river's edge to the rock: $\frac{75}{CE}=\frac{105}{175}=\frac{3}{5}$, so $CE = 125$. $BC + CE = BE$: $175 + 125 = 300$.

Ans. 300

3. $\Delta ADF \sim \Delta ACB$ with a ratio of 2 to 3. Therefore, $AD = \frac{2}{3}\cdot 8 = \frac{16}{3}$. Since DFGC is a parallelogram and $DF = 8$, CG a/so = 8. $\Delta CEG \sim \Delta CAB$ with a ratio of 2 to 3, so $CE = \frac{16}{3}$. Since $ED = AD + CE - AC$, thus $ED = \frac{16}{3} + \frac{16}{3} - 8 = \frac{8}{3}$.

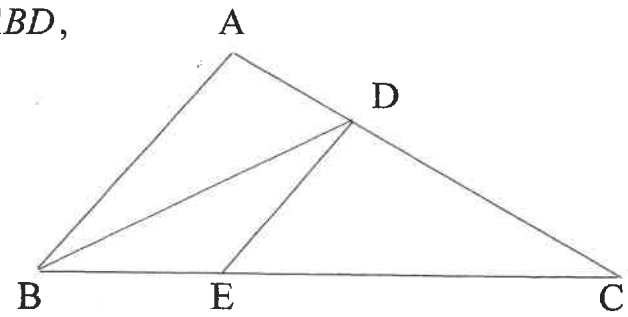
Ans. 8/3

5 Geometric Similarities Oct 2017 (Calculators Allowed)

3 pts 1. A miniature American flag is an exact replica of its original. The length of the miniature flag is one-tenth of its original. Find the ratio of the area of a star on the miniature flag to the area of the star on the original?

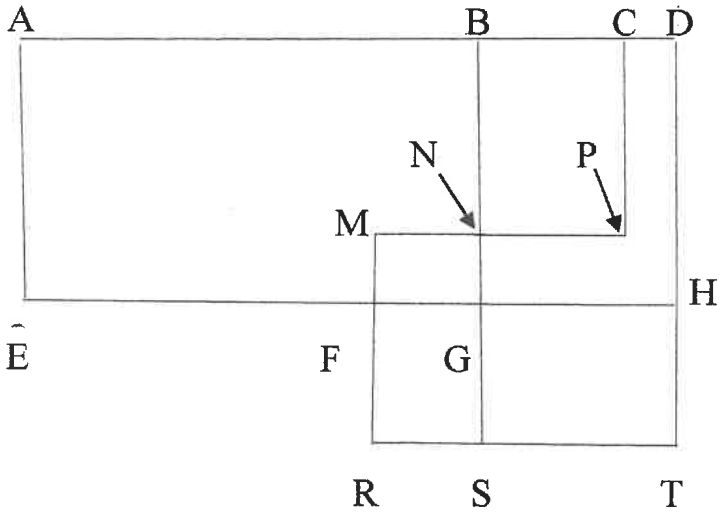
Ans. _____

4 pts 2. In the figure at right $\overline{DE} \parallel \overline{AB}$, $m\angle C = m\angle ABD$, AB = 24, AC = 40 and BC = 52. Find DE.



Ans. _____

5 pts 3. Rectangles ABGE, BGHD, BNPC, GHTS, FRSG, and FGNM below are all similar. AB = 81 and AE = 54. Find the length of line segment CD.



Ans. _____

Geometric Similarities

1. Area of Area of replica to original = 1 to 10. Ratio of areas = 1 to 100. **Ans. 1:100**

2. $\Delta ABC \sim \Delta ADB \sim \Delta DEC$, so $\frac{AD}{AB} = \frac{AB}{AC} \rightarrow \frac{AD}{24} = \frac{24}{40} \rightarrow 40AD = 24(24) = 14\frac{2}{5}$.

$DC = 40 - 14\frac{2}{5} = 25\frac{3}{5}$. Now $\frac{DE}{DC} = \frac{AB}{AC} \rightarrow \frac{DE}{25\frac{3}{5}} = \frac{24}{40} = \frac{3}{5} \rightarrow DE = 25\frac{3}{5}(\frac{3}{5}) = 15\frac{9}{25}$. **Ans. $15\frac{9}{25}$**

3. $\frac{54}{81} = \frac{2}{3}$. $GH = \frac{2}{3}BG$, $GS = \frac{2}{3}GH$, $FG = \frac{2}{3}GS$ and $NG = \frac{2}{3}FG$, so $NG = 54(\frac{2}{3})^4 = \frac{32}{3} = 10\frac{2}{3}$. $BN = 54 - 10\frac{2}{3} = 43\frac{1}{3}$. $BC = 43\frac{1}{3}(\frac{2}{3}) = \frac{86}{3} + \frac{2}{9} = \frac{260}{9} = 28\frac{8}{9}$. $CD = BD - BC =$

$\frac{2}{3}(54) - 28\frac{8}{9} = 36 - 28\frac{8}{9} = 7\frac{1}{9}$. **Ans. $7\frac{1}{9}$**

Team

1. $\frac{11}{w} = \frac{w}{5.5} \rightarrow w^2 = 11(11/2) = \frac{11\sqrt{2}}{2}$. **Ans. $\frac{11\sqrt{2}}{2}$**

3 pts 1. The Washington Monument casts a shadow 145 ft. long at the same time that a person 152 cm. tall casts a shadow that is 40 cm. long. What is the height of the Washington Monument? Express answer in feet.

Ans. _____

4 pts 2. Right triangles ABC and DEF are similar with $m\angle A = m\angle D = 90^0$. If BC = 25 in., AC = 10 in., and EF = 60 ft., find the length of DE. Give exact answer in simplest radical form.

Ans. _____

5 pts 3. Two trees of heights 20 m and 30 m have ropes running from the top of one to the bottom of the other. How high above the ground do the ropes intersect? Assume the ropes have no sag.

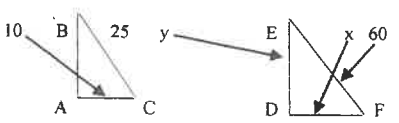
Ans. _____

Geometric Similarities

1. $\frac{Shadow}{Height} = \frac{40}{152} = \frac{145}{x}$. $40x = 152(145) \rightarrow x = \frac{145 \cdot 152}{5 \cdot 8} = 29(19) = 551$. **Ans. 551**

2. $\frac{60}{25} = \frac{x}{10}$, so $x = 24$. $60^2 - 24^2 = y^2$.

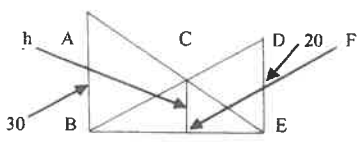
$y^2 = 3024$, so $y = \sqrt{3024} = 12\sqrt{21}$



Ans. $12\sqrt{21}$

3. $\Delta BCF \sim \Delta DCE$ with a ratio of 3:2. $\frac{BC}{CD} = \frac{3}{2}$ and $\frac{BC}{BD} = \frac{3}{5}$.

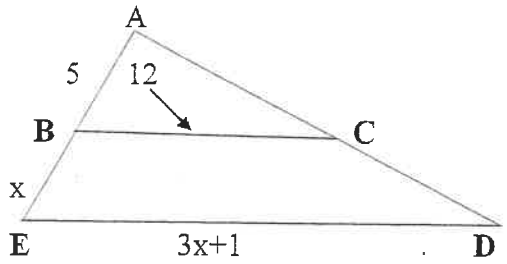
$\Delta BCF \sim \Delta BDE$, so $\frac{BC}{BD} = \frac{CF}{DE} \rightarrow \frac{3}{5} = \frac{h}{20}$ or $h = 12$.



Ans. 12

5 Geometric Similarities Oct 2015 (You may use calculators)

3 pts 1. In the diagram, segment BC is parallel to segment ED. Segment AB = 5, segment BC = 12, BE = x and DE = 3x + 1. Find the length of segment AE.



Ans. _____

4 pts 2. The areas of two similar triangles are 96 and 6 respectively. If the perimeter of the larger triangle is 48, what is the perimeter of the smaller triangle?

Ans. _____

5 pts 3. In right triangle ABC, the altitude to the hypotenuse AB is drawn intersecting the hypotenuse at point E. If BC = $3\sqrt{5}$ and BE = 5, find the length of segment AC.

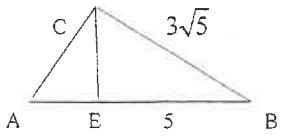
Ans. _____

Geometric Similarities

1. $\frac{BC}{DE} = \frac{AB}{AE} \rightarrow \frac{12}{3x+1} = \frac{5}{x+5} \rightarrow$ 12x + 60 = 15x + 5 => 55 = 3x, so x = 55/3. AE = 5 + 55/3 = 70/3 or $23\frac{1}{3}$. **Ans. 70/3 or $23\frac{1}{3}$**

2. Area ratio: $\frac{96}{6} = \frac{16}{1}$. So ratio of perimeters is 4:1. Therefore smaller is 12. **Ans. 12**

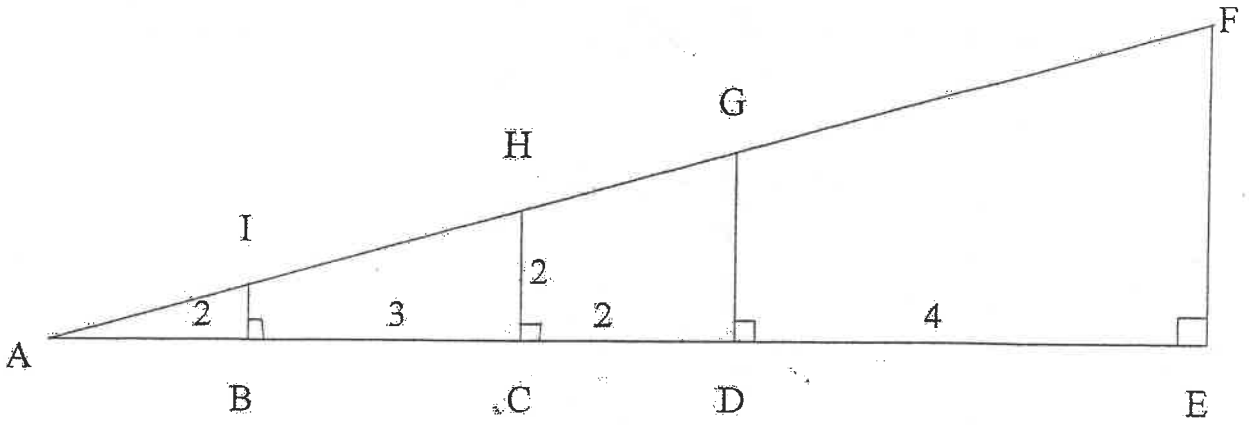
3. Use figure at right. $\frac{BE}{BC} = \frac{BC}{AB}$ or $\frac{5}{3\sqrt{5}} = \frac{3\sqrt{5}}{AB} \rightarrow$ 5AB = 45, so AB = 9.



Now $\frac{AE}{AC} = \frac{AC}{AB}$ or $\frac{4}{AC} = \frac{AC}{9} \rightarrow (AC)^2 = 36$, so AC = 6. **Ans. 6**

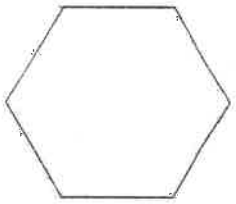
5 Geometric Similarities Oct 2014 (You may use calculators)

3 pts 1. Find the sum of the lengths of line segments $\overline{BI}$, $\overline{CH}$, $\overline{DG}$ and $\overline{EF}$ in triangle AEF. AB = 2, BC = 3. CD = 2, DE = 4, and HC = 2.



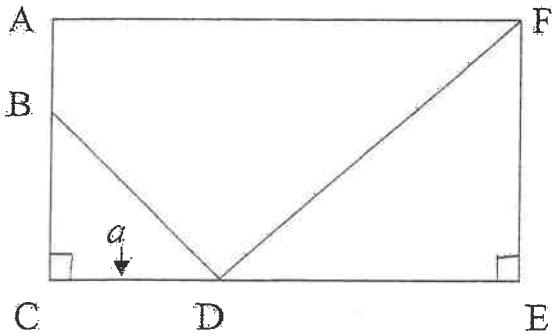
Ans. _____

4 pts 2. Inside a regular hexagon, all 9 diagonals are drawn. This creates 24 polygons, none of which is crossed by a diagonal line. How many distinct polygons are there among these 24 polygons? Consider two polygons distinct, if they are not congruent.



Ans. _____

5 pts 3. Given: Angles C, E, and FAC are each 90^o, CE = 8, CD = a, $0 < a \leq 4$, $\angle BDC \cong \angle FDE$, and $\frac{BC}{CD} = q$. Find the area of quadrilateral ABDF in terms of a and q.



Ans. _____

Geometric Similarities

1. Since $\frac{CH}{AC} = \frac{2}{5}$, and all Δ's are similar, then $\frac{2}{5}(2+5+7+11) = \frac{2}{5}(25) = 10$. **Ans. 10**

2. After putting in all diagonals, you will find 6 congruent quadrilaterals with vertices at the center of the hexagon, 6 congruent triangles involving sides of the hexagon and 12 congruent right triangles. Thus there are 3. **Ans. 3**

3. By AA, $\Delta BDC \approx \Delta FDE$. Therefore: $\frac{FE}{DE} = \frac{BC}{CD} = q$. Since $8 - a = ED$, $FE = (8-a)q$ and the area of rectangle AFEC is $(64 - 8a)q$. The area of ΔBCD is $\frac{1}{2}(a)(aq) = \frac{1}{2}a^2 q$. The area of ΔFED is $\frac{1}{2}(8-a)(8-a)q = \frac{1}{2}(a^2 - 16a + 64)q$.. The area of quadrilateral ABDF is: $(64 - 8a)q - \frac{1}{2}(a^2 - 16a + 64)q = (32 - a^2)q$. **Ans. $(32 - a^2)q$**