High School
Mathematics Test 2014

Year 9

Enlargement & Similarity

Non Calculator

Skills and Knowledge Assessed:

- Use the enlargement transformation to explain similarity and develop the conditions for triangles to be similar (ACMMG220)
- Solve problems using ratio and scale factors in similar figures (ACMMG221)

Name_____

Section 1 Short Answer Section

Write all working and answers in the spaces provided on this test paper.

1. Complete the statement below.

   If two polygons are similar, then the corresponding _____ of the first are equal to those of the second.

2. Square A is enlarged, with a scale factor of 3, to produce Square B.

   What is the side length of Square B?

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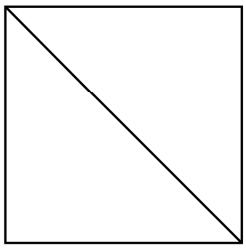
   Square A

   6 cm

   Square B

   NOT TO SCALE

3. Shape 1 is a regular pentagon.
   It is enlarged to produce shape 2.
   What is the enlargement factor?

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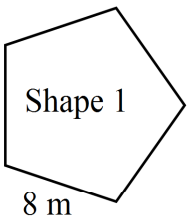
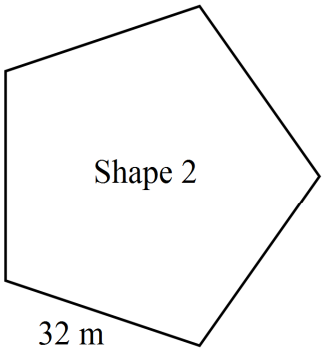
   

   8 m

   32 m

   NOT TO SCALE

4. Two similar rhombuses are shown below.

What is the size of the angle marked θ ?

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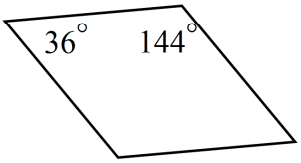
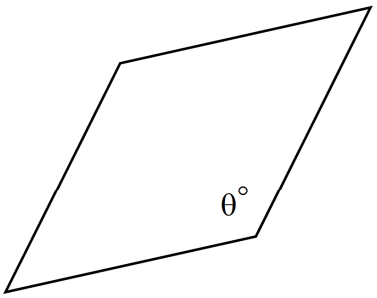


Rhombus E



Rhombus D

5. By measurement and calculation, find the scale factor when the lighter triangle is enlarged to give the darker triangle.

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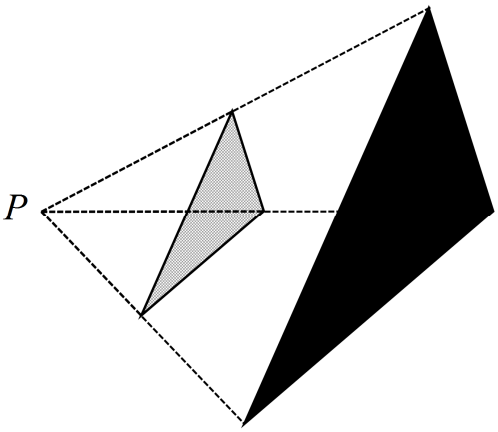

6. Equilateral Triangle X is enlarged, with a scale factor of 2.5, to produce Triangle Y.

What is the side length of Triangle Y?

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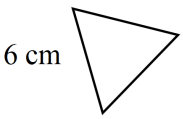
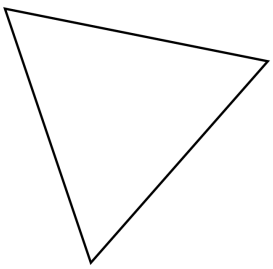
Triangle X

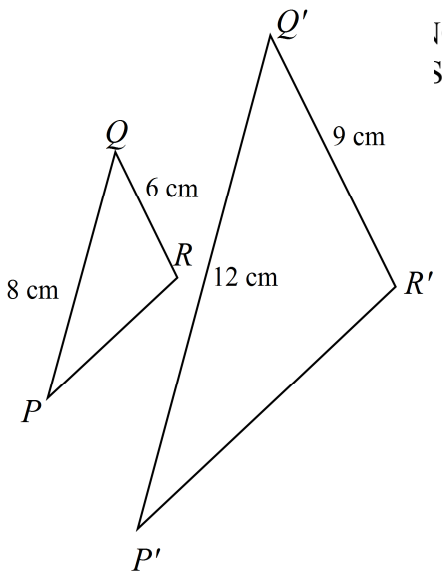


Triangle Y



7. ΔPQR and its image under an enlargement are shown.
What is the enlargement factor?

NOT TO SCALE



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8. Two kites are shown below. Are they similar?
Explain your answer.

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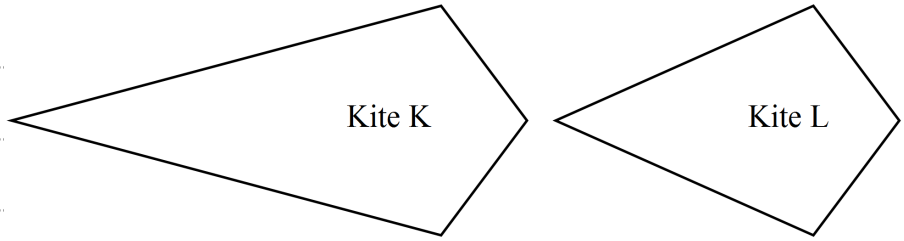
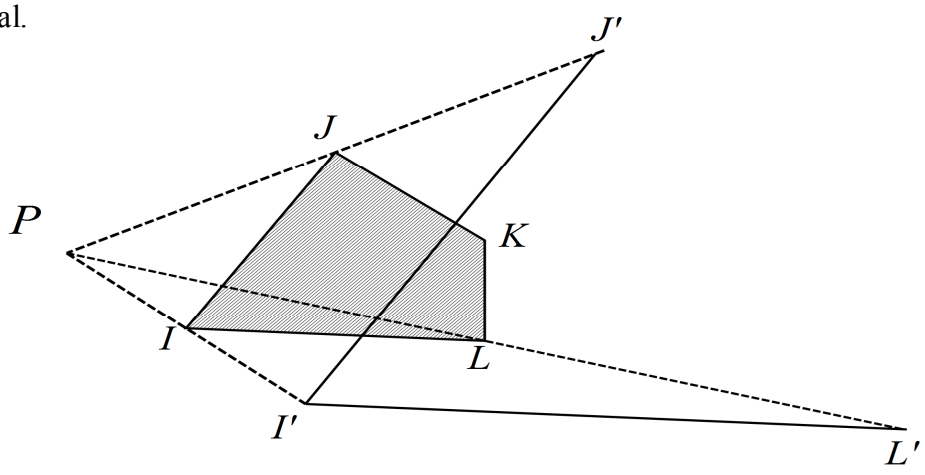
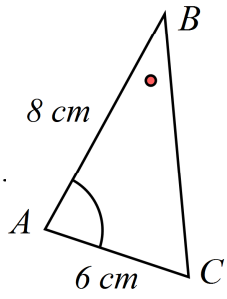


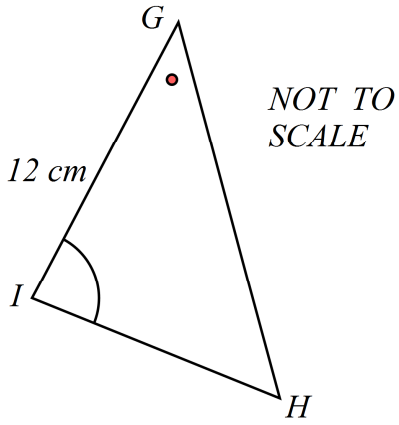
9. Justin is drawing an enlargement of the quadrilateral $IJKL$ from the point P. He has marked the position of the points I', J' and L'. By measurement and calculation find the position of K' and complete the quadrilateral.



10. The two triangles are similar.

What is the length of HI?





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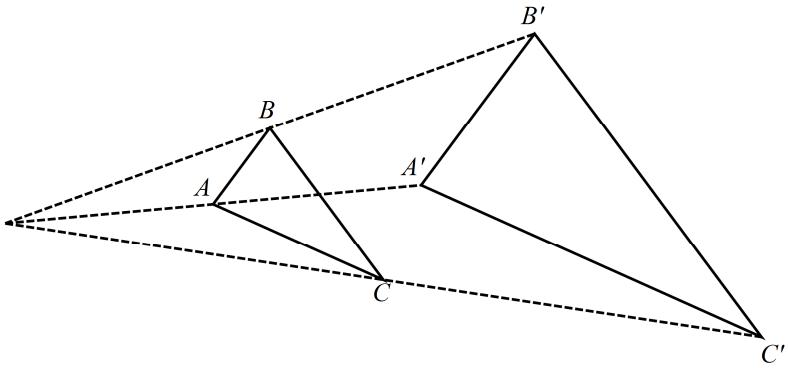
11. By measurement and calculation, find the scale factor when ΔPQR is enlarged to $\Delta P'Q'R'$?



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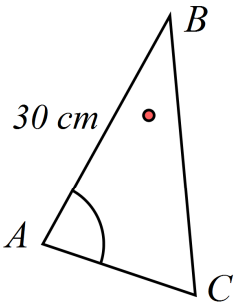
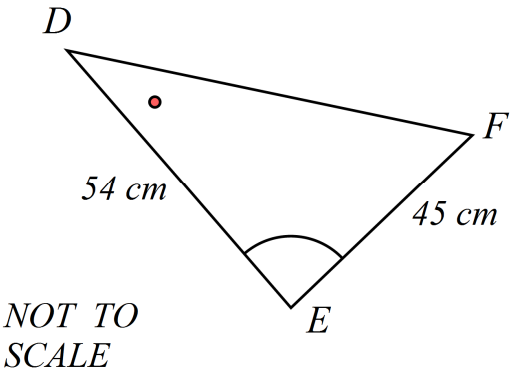
12. $\Delta ABC \;|||\; \Delta EDF$.

What is the length of AC ?





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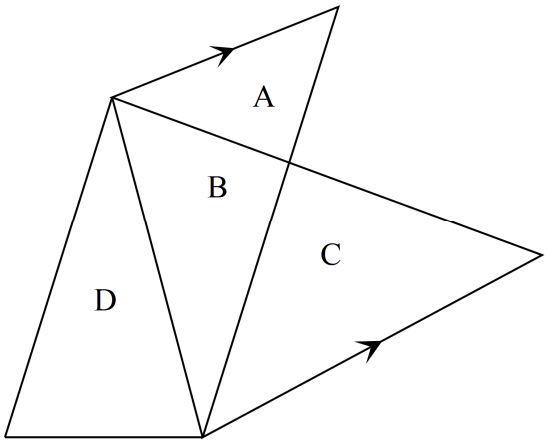
13. Which pair of triangles are similar in the diagram below?

Explain why.



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14. A vertical tree casts a 15 m shadow.
At the same time a 1.5 m high vertical fence post casts a shadow which is 0.6 m long.
Use this information to calculate the height of the tree.

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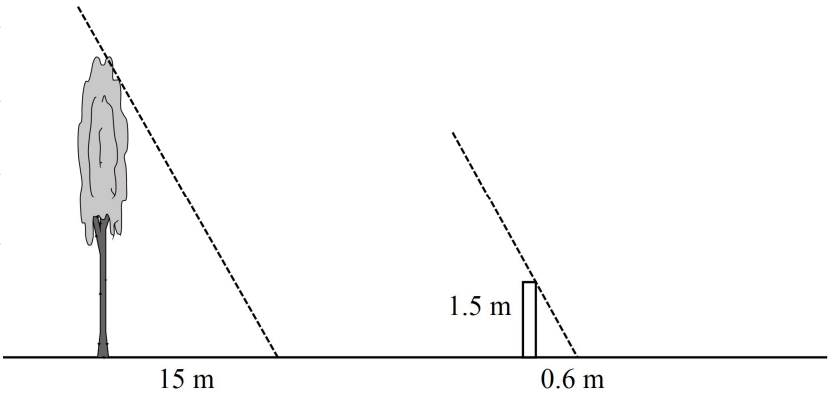
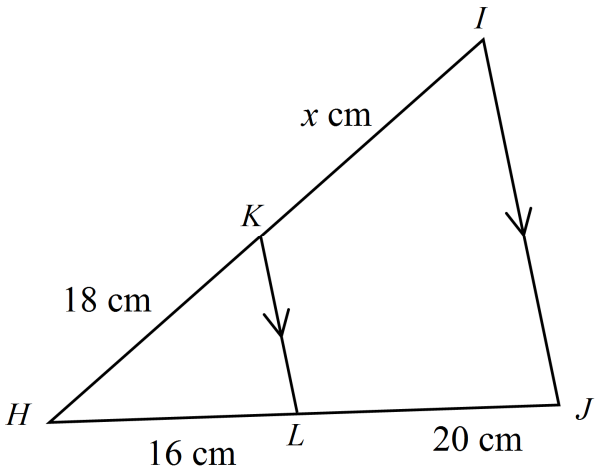


15. $\Delta IJH \;|||\; \Delta KLH$.
Find the value of x.



NOT TO SCALE

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High School
Mathematics Test 2014

Year 9

Enlargement & Similarity

Calculator Allowed

Name_____

Section 2 Multiple Choice Section

Mark all your answers on the accompanying multiple choice answer sheet, not on this test paper. You may do any working out on this test paper. Calculators are allowed for this section.

1. Which is always true about a pair of similar figures?

A. The corresponding sides are equal in length.

B. Their areas are equal.

C. The corresponding angles are equal.

D. Their perimeters are equal.

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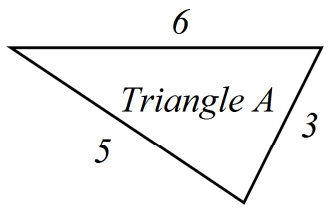
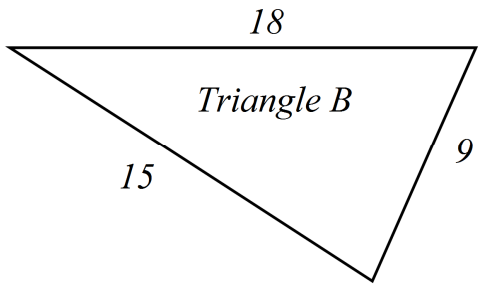
2. What is the enlargement factor from *Triangle A* to *Triangle B*?





NOT TO SCALE.

A. $\frac{1}{3}$ B. 3 C. 6 D. 12

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3. A square with sides 12 cm is enlarged with scale factor of 4.
What are the side lengths of the new square?

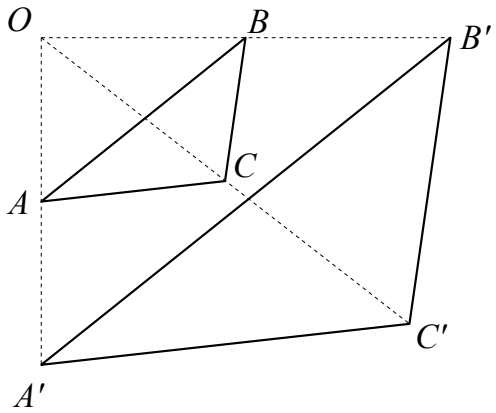
A. 3 cm B. 16 cm C. 24 cm D. 48 cm

4. Robin takes a photograph which measures 8 cm by 10 cm, to the printers to make a poster.
The poster is 8 times the size of the photograph.
What is the measurement of the poster on its shorter side?

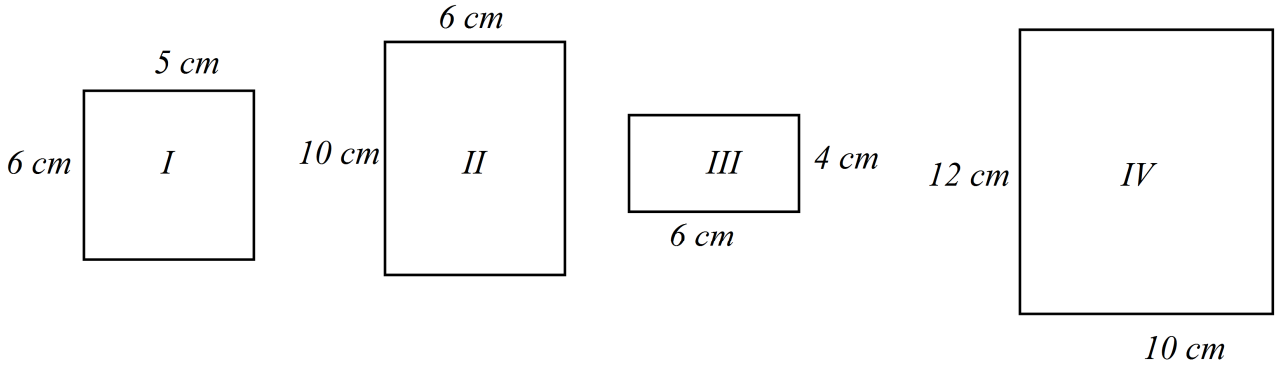
A. 64 cm B. 72 cm C. 80 cm D. 160 cm.

5. What is the scale factor when ΔABC is enlarged to $\Delta A'B'C'$?

A. 1
B. 2
C. 3
D. 4



6. Four rectangles are shown below.



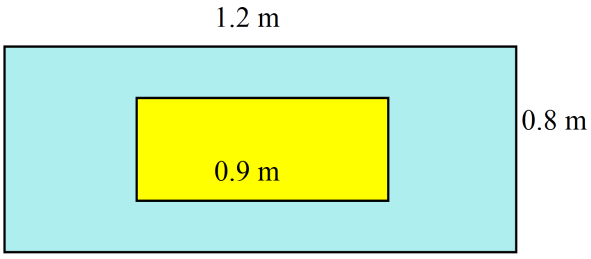
Which two are similar?

A. *I* and *IV* B. *II* and *III* C. *II* and *IV* D. *III* and *IV*

7. Which is **not** always true?

A. All circles are similar.
B. All equilateral triangles are similar.
C. All rectangles are similar.
D. All squares are similar.

8. The design on a towel has two similar rectangles. What is the width of the smaller rectangle?



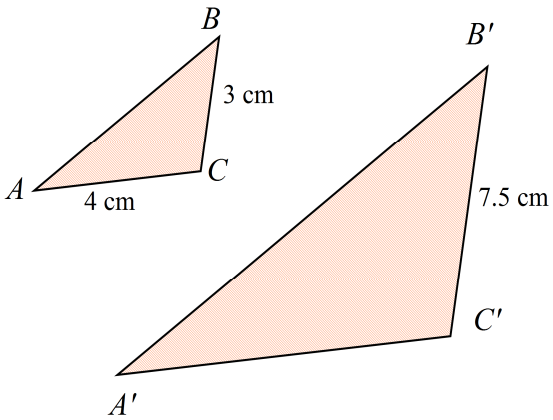
A. 0.4 m B. 0.6 m

C. 0.8 m D. 0.9 m

9. The plan of a building is drawn to a scale of 1 : 50. If the width of the building on the plan is 320 mm, what is the width of the actual building?

A. 3.2 m B. 6.4 m C. 8 m D. 16 m

10. ΔABC and its image under an enlargement are shown. What is the length of $A'C'$?



NOT TO SCALE

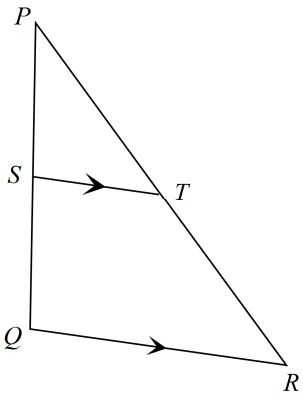
A. 2.5 cm

B. 6 cm

C. 10 cm

D. 12 cm

11. Which reason could be used to prove that $\Delta PQR \;|||\; \Delta PST$?



A. The three corresponding angles of the triangles are equal.

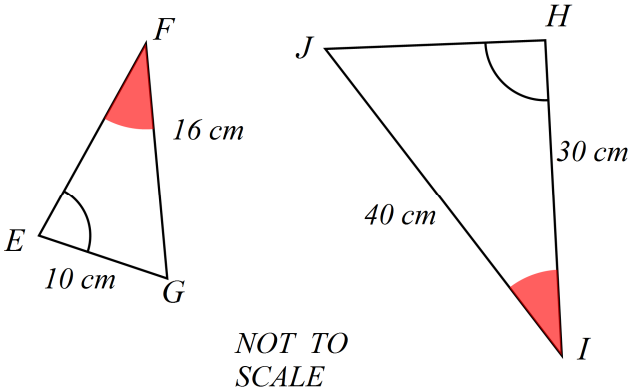
B. The three corresponding angles of the triangles are in proportion.

C. The three corresponding sides of the triangles are in proportion.

D. Two corresponding sides of the triangles are in proportion and the included angle is equal.

12. ΔEFG has been enlarged to produce ΔHIJ.

What is the scale factor of the enlargement?

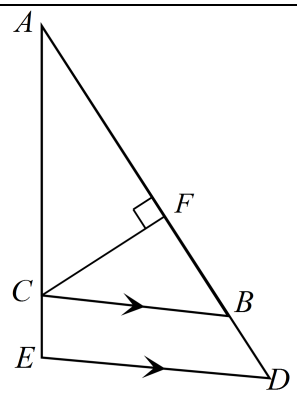


NOT TO SCALE

A. $1\frac{7}{8}$ B. $2\frac{1}{2}$

C. 3 D. 4

13. One pair of similar triangles is shown in the diagram.



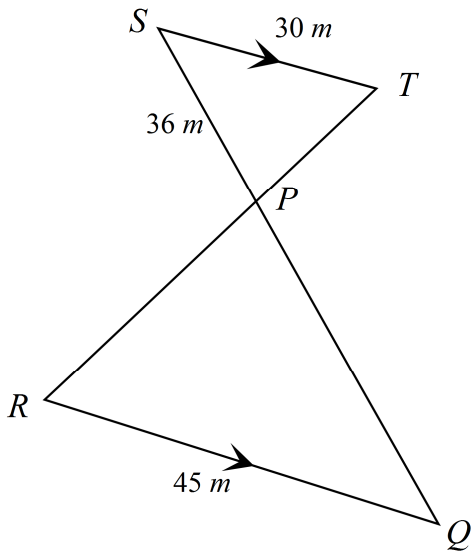
Which statement names the similar triangles with vertices in corresponding order?

A. $\Delta ABC \,|||\, \Delta ADE$ B. $\Delta ABC \,|||\, \Delta AFE$

C. $\Delta ABC \,|||\, \Delta AED$ D. $\Delta AED \,|||\, \Delta ACF$

14. In the diagram, $ST \,||\, RQ$.

What is the length of PQ?



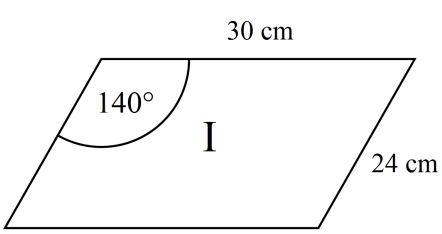
A. 15 cm

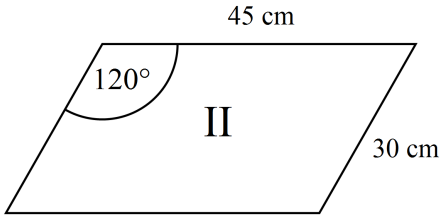
B. 45 cm

C. 54 cm

D. 60 cm

15. Which two parallelograms are similar?





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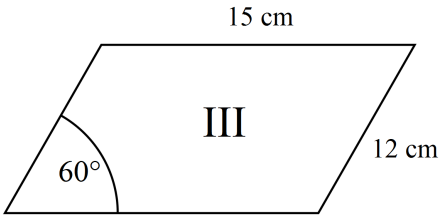
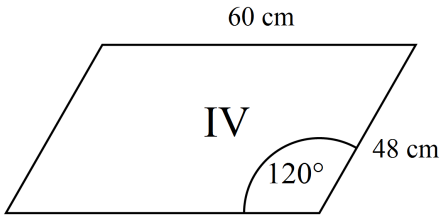




A. I and II. B. I and III.

C. II and IV. D. III and IV.

High School Mathematics Test 2014

Year 9

Enlargement & Similarity

Calculator Allowed

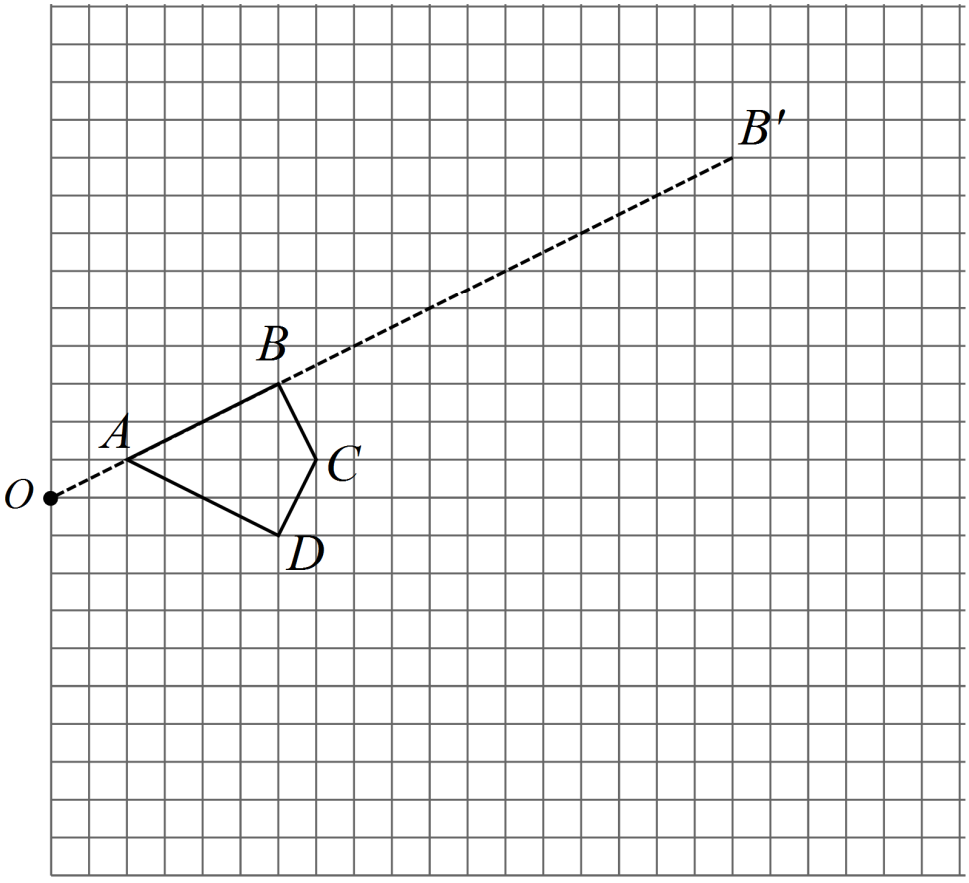
Name_____

Section 3 Longer Answer Section

Answers should be supported by relevant mathematical reasoning and/or calculations.
Write all working and answers in the spaces provided on this test paper.

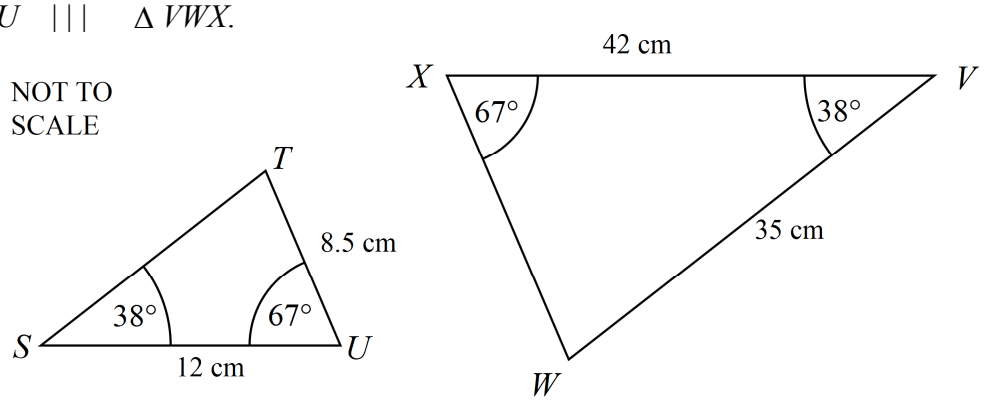
Marks

1. Enlarge the kite $ABCD$ with the centre of the enlargement at O, and a scale factor of 3. The position of B' has already been drawn. **2**



Marks

2. $\Delta STU \;|||\; \Delta VWX$. **1**



a) What is the ratio of the corresponding sides?

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b) Find the length of ST **2**

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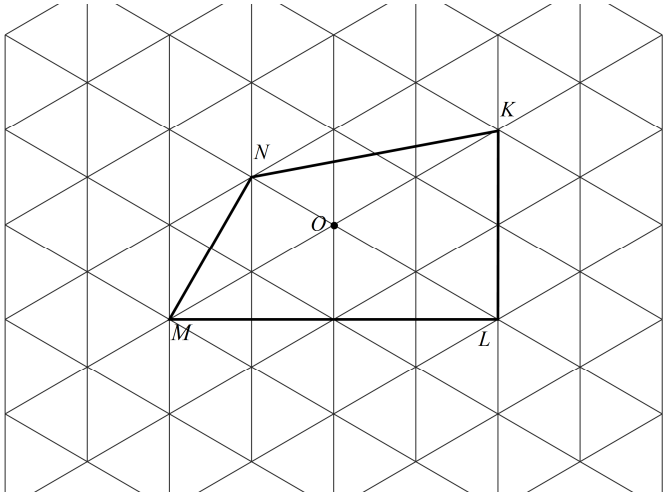
3. Using the grid provided, or otherwise, draw the image of quadrilateral $KLMN$ after an enlargement with scale factor 1.5 and centre O. **2**



b) The perimeter of the original quadrilateral is 172 mm. **1**
What is the perimeter of the enlarged quadrilateral?

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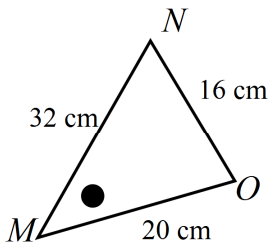

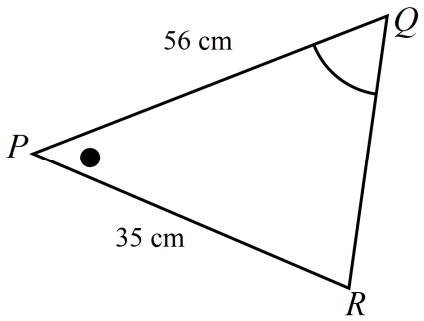

NOT TO SCALE

a) Prove that $\Delta MNO \,|||\, \Delta PQR$.

b) Find the length of QR. **5**

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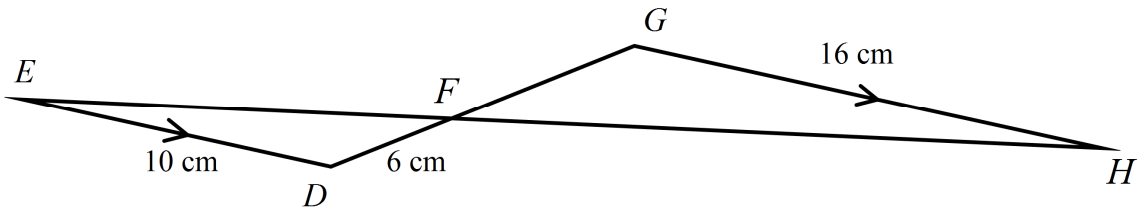

NOT TO SCALE

a) Prove that $\Delta DEF \,|||\, \Delta GHF$.

b) Find the length of FG. **5**

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High School
Mathematics Test 2014

Multiple Choice Answer Sheet

Name _____

Completely fill the response oval representing the most correct answer.

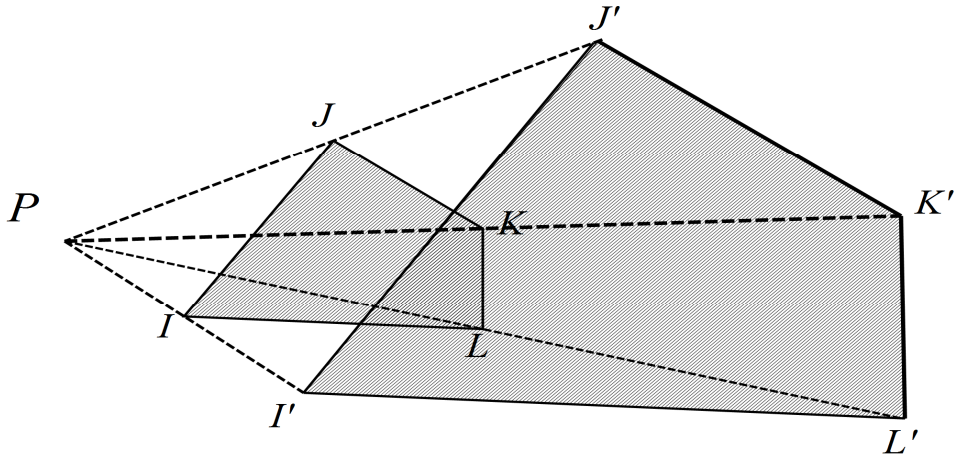
1.	A ⬭	B ⬭	C ⬭	D ⬭
2.	A ⬭	B ⬭	C ⬭	D ⬭
3.	A ⬭	B ⬭	C ⬭	D ⬭
4.	A ⬭	B ⬭	C ⬭	D ⬭
5.	A ⬭	B ⬭	C ⬭	D ⬭
6.	A ⬭	B ⬭	C ⬭	D ⬭
7.	A ⬭	B ⬭	C ⬭	D ⬭
8.	A ⬭	B ⬭	C ⬭	D ⬭
9.	A ⬭	B ⬭	C ⬭	D ⬭
10.	A ⬭	B ⬭	C ⬭	D ⬭
11.	A ⬭	B ⬭	C ⬭	D ⬭
12.	A ⬭	B ⬭	C ⬭	D ⬭
13.	A ⬭	B ⬭	C ⬭	D ⬭
14.	A ⬭	B ⬭	C ⬭	D ⬭
15.	A ⬭	B ⬭	C ⬭	D ⬭

Enlargement & Similarity

ANSWERS

Section 1 (1 mark each)	
	Working and Answers
1.	If two polygons are similar, then the corresponding **angles** of the first are equal to those of the second.
2.	Side length of B = $= 3 \times$ side lengths of A $= 3 \times 6$ $= 18$ cm
3.	Enlargement factor $= \frac{\text{Image length}}{\text{Original Length}}$ $= \frac{32}{8}$ $= 4$
4.	$\theta = 144^\circ$ (Corresponding angles equal)
5.	Scale factor $= \frac{\text{Image length}}{\text{Original Length}}$ $= \frac{6}{3} = \frac{4.4}{2.2} = \frac{2.8}{1.4}$ $= 2$
6.	Side length of Y = $= 2.5 \times$ side lengths of X $= 2.5 \times 6$ $= 15$ cm
7.	Enlargement factor $= \frac{\text{Image length}}{\text{Original Length}}$ $= \frac{12}{8} = \frac{9}{6}$ $= 1\frac{1}{2}$
8.	By Measurement, the corresponding angles are not equal, and the corresponding sides are not in the same ratio. The kites are **not similar**.

9.



10.

$$\text{Scale factor} = \frac{\text{Image length}}{\text{Original Length}}$$

$$= \frac{12}{8}$$

$$= 1\tfrac{1}{2}$$

Side length of GHI = $= 1.5 \times$ side lengths of BCA

$= 1.5 \times 6$

$= 9$ cm

11.

$$\text{Scale factor} = \frac{\text{Image length}}{\text{Original Length}}$$

$$= \frac{5}{2.5} = \frac{2.5}{1.25}$$

$$= 2$$

12.

$$\text{Scale factor} = \frac{\text{Image length}}{\text{Original Length}}$$

$$= \frac{54}{30}$$

$$= 1.8$$

Length of AC = $=$ Length of EF $\div 1.8$

$$= \frac{45}{1.8}$$

$= 25$ cm

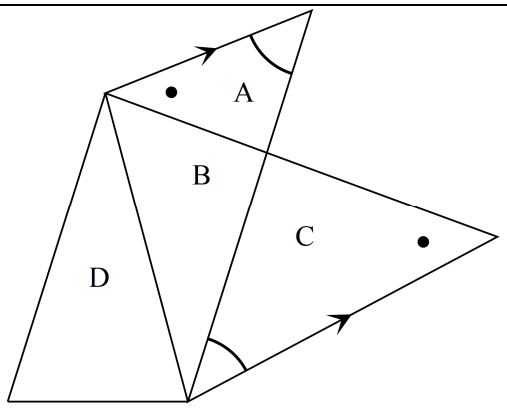
13.

Because of the parallel lines, there are two pairs of equal alternate angles (marked on the diagram).

These lie in triangles A and C.

With two angles equal in the triangles, the third angle is also equal.

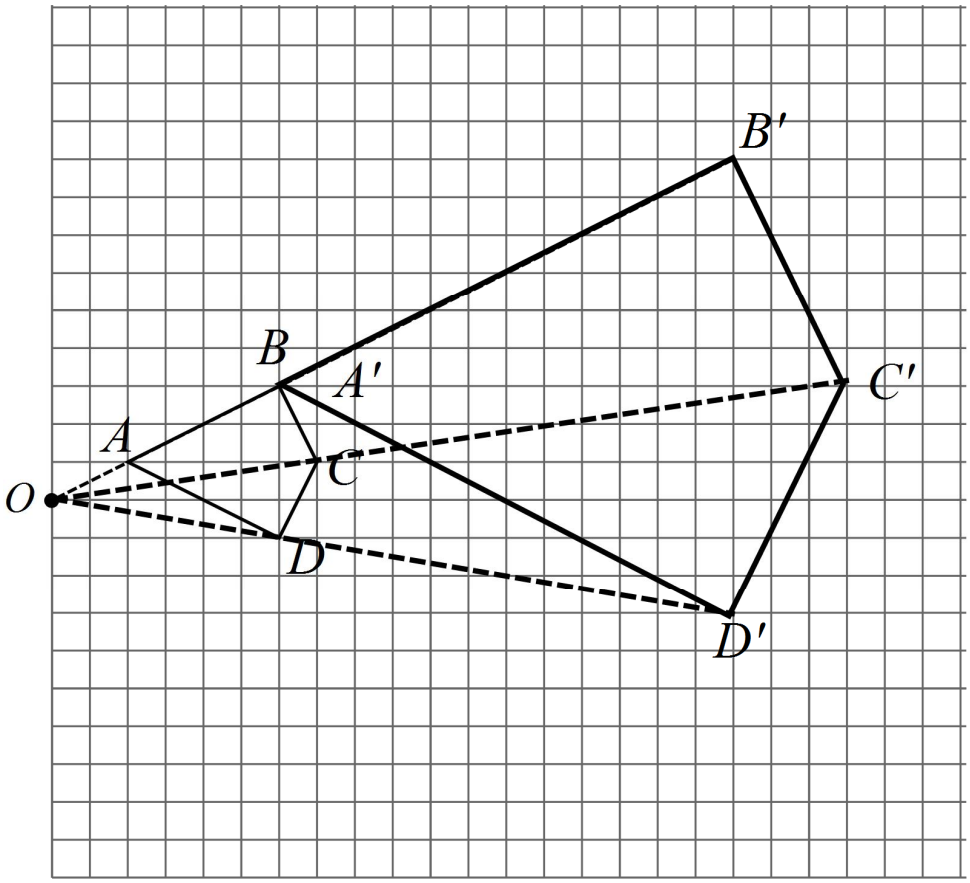
Triangles A and C are similar because all corresponding angles are equal.

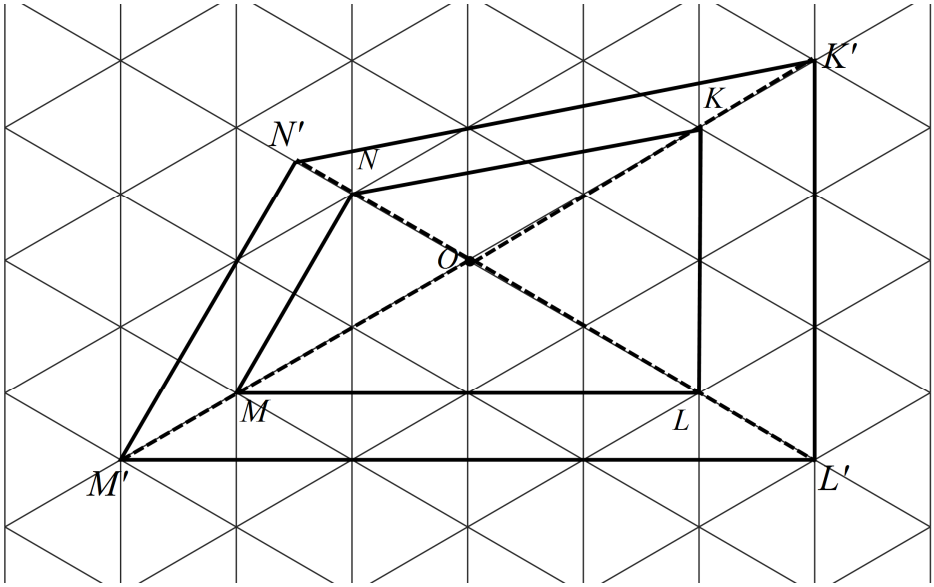


14.	Because of the parallel rays of the sun, the angles of elevation are equal. Because the tree and post are vertical, the right angles are equal. So the triangles are equal and the corresponding sides are in the same ratio. Scale factor $= \frac{\text{Tree shadow}}{\text{Post Shadow}}$ $= \frac{15}{0.6}$ $= 25$ Height of Tree $=$ $=$ Height of Post $\times 25$ $= 1.5 \times 25$ $= 37.5\ m$ OR $\frac{\text{Tree height}}{\text{Post height}} = \frac{\text{Tree shadow}}{\text{Post Shadow}}$ $\frac{h}{1.5} = \frac{15}{0.6}$ $h = 1.5 \times \frac{15}{0.6}$ $= 37.5\ m$
15.	Because the triangles are similar, the corresponding sides are in the same ratio. $\frac{HI}{HK} = \frac{HJ}{HL}$ $\frac{x+18}{18} = \frac{36}{16}$ $x + 18 = \frac{36}{16} \times 18$ $x + 18 = 40.5$ cm $x = 40.5 - 18$ $x = 22.5$ cm

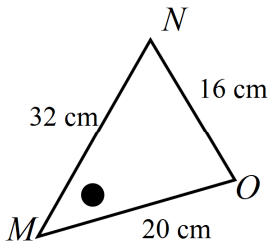
Section 2 (1 mark each)		
	Working	Answers
1.	Only C is true of all pairs of similar figures.	C
2.	Enlargement factor $= \frac{\text{Image length}}{\text{Original Length}}$ $= \frac{18}{6} = \frac{9}{3} = \frac{15}{5}$ $= 3$	B
3.	Side length of new square = $= 4 \times$ side lengths of old square $= 4 \times 12$ $= 48$ cm	D
4.	Side length of poster = $= 8 \times$ side lengths of photo $= 8 \times 8$ $= 64$ cm	A
5.	Scale factor $= \frac{\text{Image length}}{\text{Original Length}}$ $= \frac{76}{38} = \frac{54}{27} = \frac{42}{21}$ $= 2$	B
6.	If square I is enlarged with scale factor 2, it gives square IV. I and IV are similar	A
7.	As circles all have the same shape, they are similar to one another. As all squares and equailateral trianglles have all angles equal, they are similar, since the corresponding sides are always equal and since they have all sides equal, the corresponding sides are always in the same ratio. Rectangles have angles equal, but the sides can be different lengths, so they are not always in the same ratio.	C
8.	The restangles are similar, so sides are in the same ratio. $\frac{\text{Longer width}}{\text{Shorter width}} = \frac{\text{Larger length}}{\text{Shorter length}}$ $\frac{W}{0.8} = \frac{0.9}{1.2}$ $h = 0.8 \times \frac{0.9}{1.2}$ $= 0.6\ m$	B
9.	Width of Building = $= 50 \times$ Width of drawing $= 50 \times 320$ mm $= 16000$ mm $= 16$ m	D
10.	$\frac{A'C'}{4} = \frac{7.5}{3}$ $A'C' = 4 \times \frac{7.5}{3}$ $= 10$ cm	C

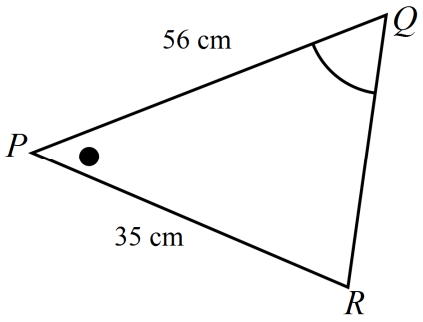
11.	$\angle P$ is common $\angle PQR = \angle$ PST (Corr angles on || lines) $\angle PRQ = \angle$ PTS (Corr angles on || lines) Triangles are similar because of corresponding angles being equal.	A
12.	Using corresponding angles to match sides. $\frac{HI}{EF} = \frac{IJ}{FG} = \frac{JH}{GE}$ $\frac{30}{EF} = \frac{40}{16} = \frac{JH}{10}$ $\therefore$ Scale factor $= \frac{40}{16} = 2\frac{1}{2}$	B
13.	Angle A is common and because of the parallel lines $\angle ABC = \angle$ ADE and $\angle ACB = \angle AED$. So in order $\Delta ABC \,\|\|\| \, \Delta ADE$	A
14.	$\frac{PQ}{36} = \frac{45}{30}$ $PQ = 36 \times \frac{45}{30}$ $PQ = 54\ m$	C
15.	A. Corresponding angles are not equal. B. Corresponding sides not in the same ratio. C. Corresponding sides not in the same ratio. D. Corresponding sides in the same ratio and corresponding angles equal.	D

Section 3		
	Working and Answers	Marks
1.		2 marks for correct image. 1 mark if wrong scale factor. Or 1 mark if correct ratio but errors in measurement are made.
2.	a) What is the ratio of the corresponding sides? The only pair of corresponding sides for which measurements are given are SU and VX The ratio of sides is given by: $\frac{SU}{VX} = \frac{12}{42} = \frac{2}{7}$ Or as a ratio $SU : VX = 12 : 42 = 2 : 7$	1 mark for either form of the ratio.
	b) Find the length of ST ST corresponds to VW. OR ST corresponds to VW $\frac{ST}{VW} = \frac{2}{7}$ $\frac{ST}{35} = \frac{2}{7}$ $ST = 35 \times \frac{2}{7}$ $= 10$ cm Scale factor $= 3\frac{1}{2}$ $ST = 35 \div 3\frac{1}{2}$ $ST = 10$ cm	2 mark for the correct result or a result obtained correctly from an incorrect answer to a). 1mark for an answer with a single error in calculation or in reasoning

3.	Using the grid provided, or otherwise, draw the image of quadrilateral *KLMN* after an enlargement with scale factor 1.5 and centre *O*.  	2 marks for correct image. 1 mark if wrong scale factor. Or 1 mark if correct ratio but errors in measurement are made.
	b) The perimeter of the original quadrilateral is 172 mm. What is the perimeter of the enlargement? Each side of the enlarged quadrilateral is 1.5 times that of the original, so the perimeter is also 1.5 times that of the original. Perimeter = 1.5 × 172 = 258 mm	1 mark for correct answer

4.





NOT TO SCALE

a) Prove that $\Delta MNO \,|||\, \Delta PQR$.

In ΔMNO and ΔPQR

$\frac{MN}{PQ} = \frac{32}{56} = \frac{4}{7}$

$\frac{MO}{PR} = \frac{20}{35} = \frac{4}{7}$

$\angle M = \angle P$

$\therefore \Delta MNO \,|||\, \Delta PQR$

(Two corresponding pairs of sides in the same ratio and the include angle equal.)

b) Find the length of QR.

Since all corresponding sides are in the same ratio,

$\frac{QR}{NO} = \frac{7}{4}$

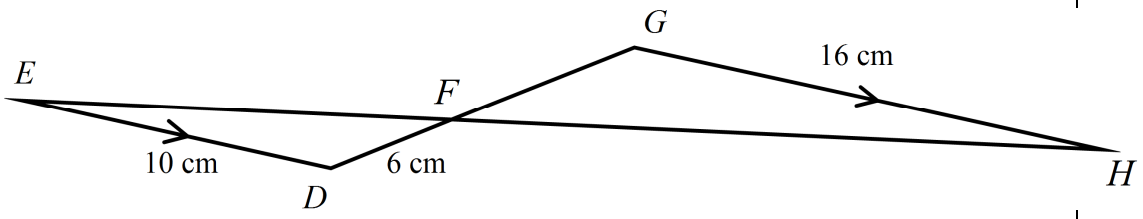
$\frac{QR}{16} = \frac{7}{4}$

$QR = 16 \times \frac{7}{4}$

$QR = 28$ cm.

a) 3 marks for full proof.
2 marks if single error is made
1 mark if basic attempt made
b) 2 marks for correct answer
1 mark if a single error made

5.



NOT TO SCALE

	a) Prove that $\Delta DEF \mid\mid\mid \Delta GHF$. In Δ DEF and ΔGHF $\angle E = \angle H$ (Alt ang on $\parallel$ lines) $\angle D = \angle G$ (Alt ang on $\parallel$ lines) $\angle EFD = \angle HFG$ (Vert opp ang) $\therefore \Delta MNO \mid\mid\mid \Delta PQR$ (Three corresponding pairs of angles are equal.)	b) Find the length of FG. Since corresponding sides are in the same ratio $\frac{FG}{6} = \frac{16}{10}$ $FG = 6 \times \frac{16}{10}$ $FG = 9.6$ cm	**a)** 3 marks for full proof. 2 marks if single error 1 mark if basic attempt made **b)** 2 marks for correct answer 1 mark if a single error made

High School
Mathematics Test 2014

Multiple Choice Answer Sheet

Name Marking Sheet

Completely fill the response oval representing the most correct answer.