# *High School*
# *Mathematics Test 2015*

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.
YOU WILL NEED A RULER.

1. An equilateral triangle has sides which are 5 cm long. An enlargement of this triangle is drawn, with an enlargement factor of 4.

   Describe the sides and angles of the new shape.

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2. Rhombus *X* is enlarged to produce Rhombus *Y*.

   What is the enlargement factor?

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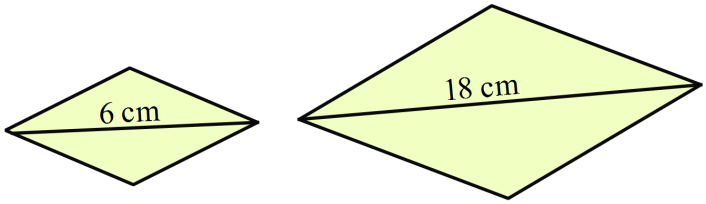
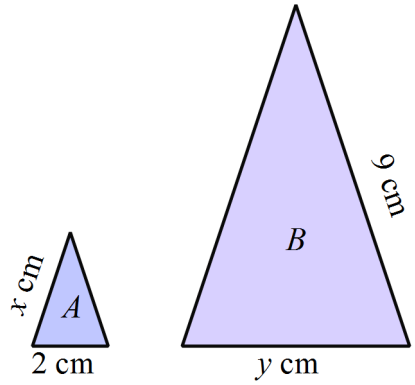
   Rhombus *X* Rhombus *Y*

   *NOT TO SCALE*

3. An isosceles triangle *A* is enlarged with scale factor 3, to produce triangle *B*.

   What are the measurements marked *x* and *y*?

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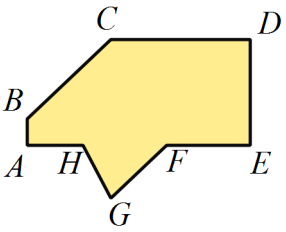
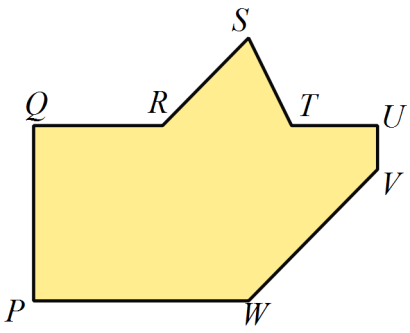
4. The polygons ABCDEFGJ and PQRSTUVW are similar.

Name an angle which is equal to $\angle G$.

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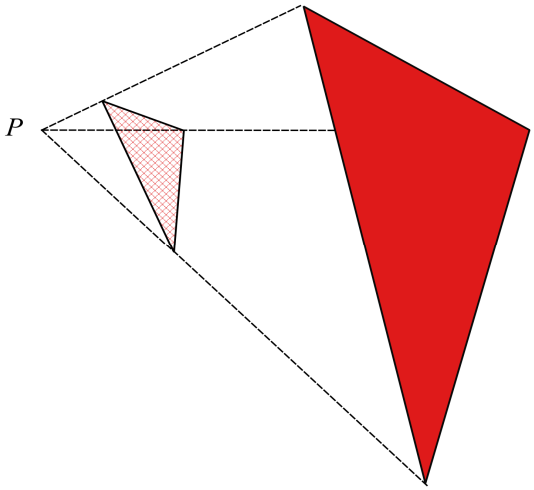
5. By measurement and calculation, find the scale factor when the lighter triangle is enlarged to give the darker triangle.

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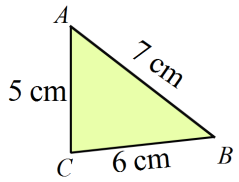
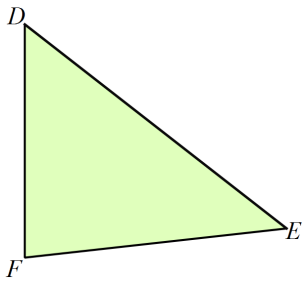
6. Triangle *ABC* is enlarged with a scale factor of 2.5, to produce Triangle *DEF*.
What is the length of *FE*?

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7. Jayden says *"All squares are similar."*
Determine if he is correct and explain why.

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8. The two photo frames are both in the shape of regular octagons.
A photo which measures 20 cm square can be cropped neatly into the smaller frame.
What size photo would be needed for the larger frame?

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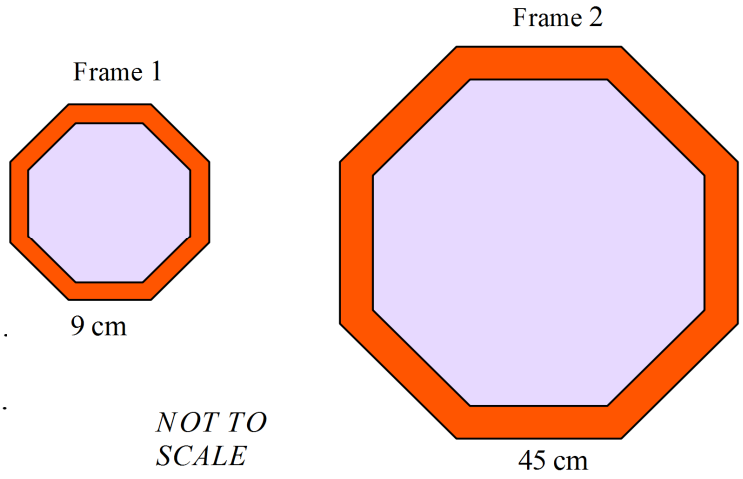
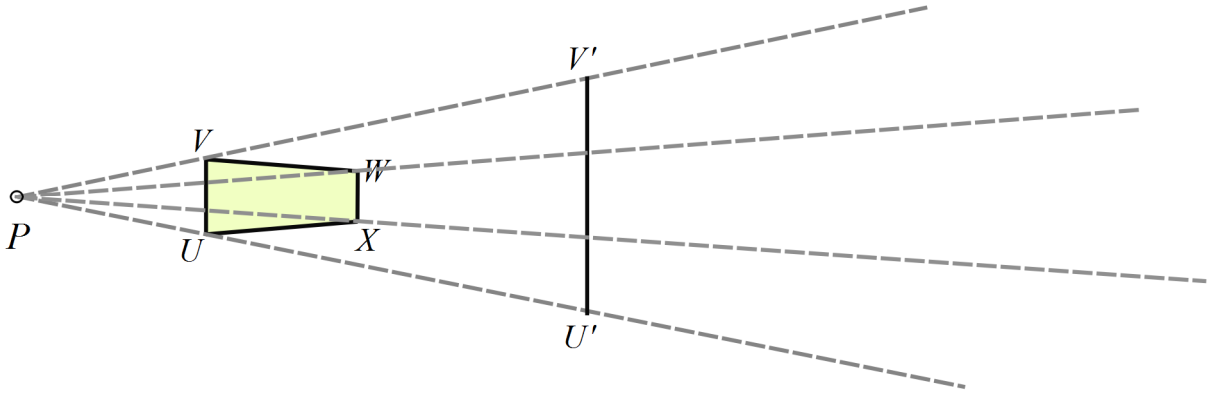
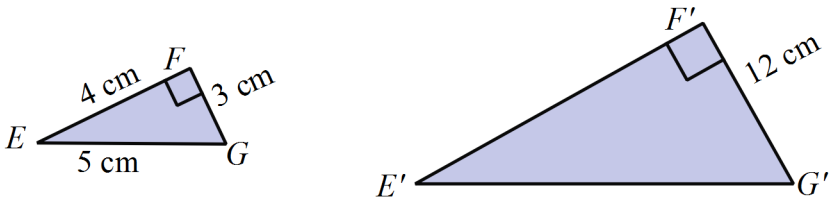



9. Dustin is drawing an enlargement of the quadrilateral $UVWX$ with scale factor 3 from the point $P$.
He has marked the position of the points $U'$ and $V'$.
By measurement and calculation find the position of $W'$ and $X'$ and complete the quadrilateral.




10. Δ $EFG$ and its image under an enlargement are shown.
What is the length of $E'G'$ ?

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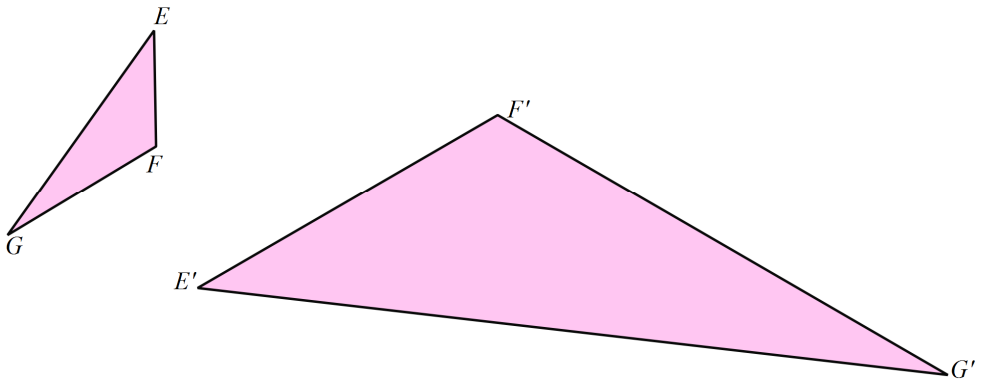
11. $\Delta E'F'G'$ is the image after an enlargement and a rotation of $\Delta EFG$.
By measurement and calculation find the scale factor of the enlargement.

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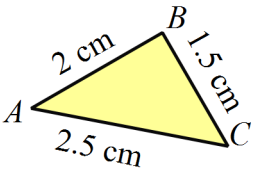
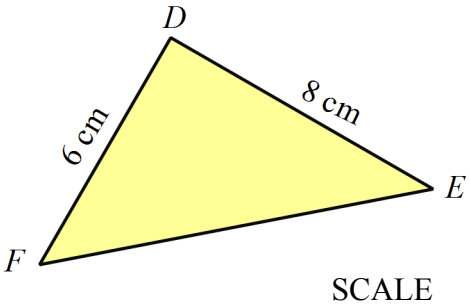
12. $\Delta ABC \;|||\; \Delta EDF$ .
$EF$ is the longest side of $\Delta EDF$.
What is the length of $EF$?

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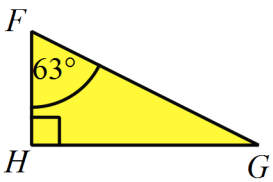
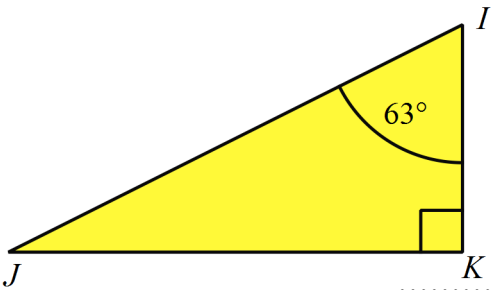
SCALE

13. Explain why $\Delta FGH \;|||\; \Delta IJK$ .

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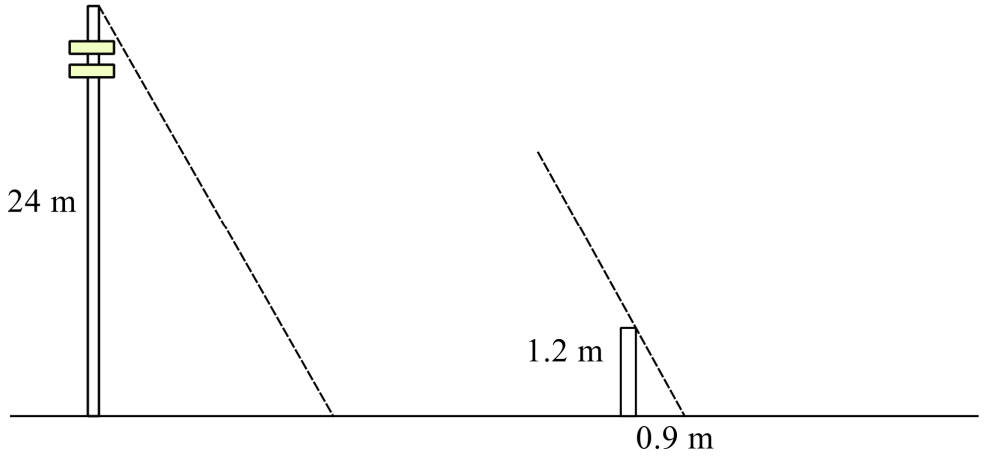
14. A 24 m high electricity pole casts a shadow.
At the same time a 1.2 m high vertical fence post casts a shadow which is 0.9 m long.
Use this information to calculate the length of the shadow of the electricity pole.

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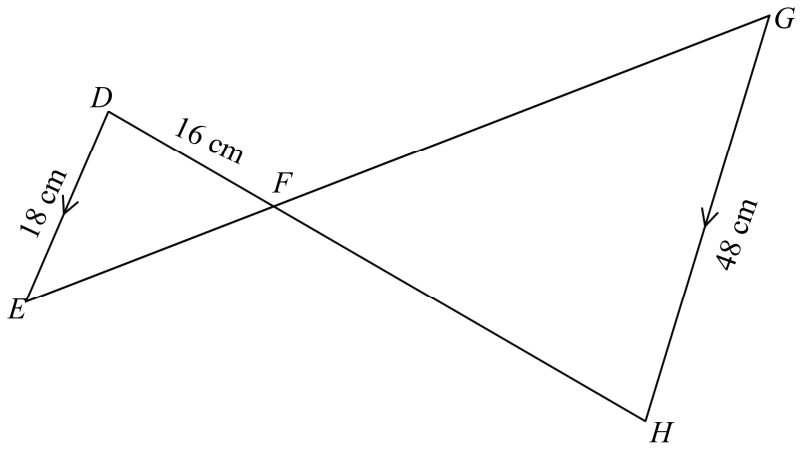
15. $\Delta EDF \parallel\!\parallel \Delta GHF$.
Calculate the distance $FH$.

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# *High School*
# *Mathematics Test 2015*

Year 9 *Enlargement & Similarity*

**Calculator Allowed**

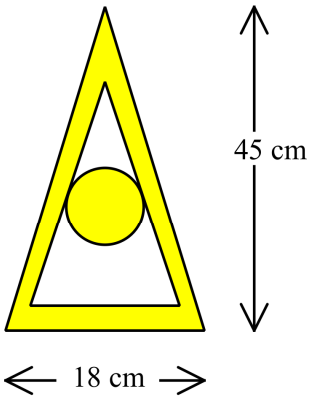
Name_____

**Section 2** Multiple Choice Section

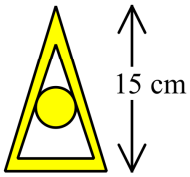
Mark all your answers on the accompanying multiple choice answer sheet, not on this test paper. You may do any working out on this test paper. Calculators are allowed for this section.

YOU WILL NEED A RULER.

1. The team trophy for a netball competition is triangular in shape, with the measurements shown. The individual trophies are similar to the team trophy and are 15cm tall.



Team Trophy

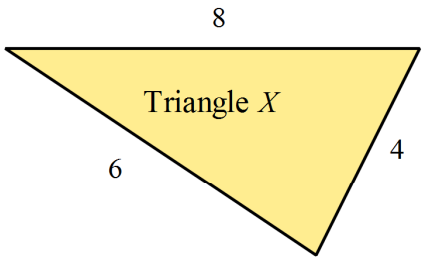


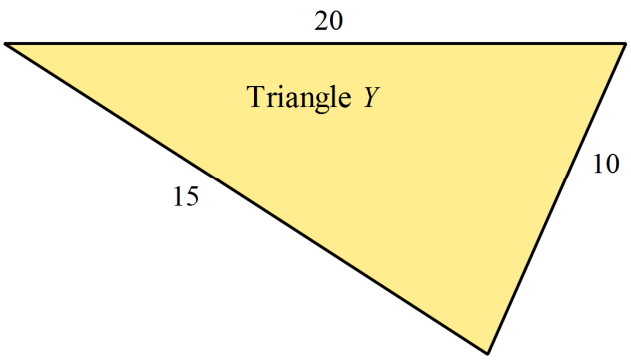
Individual Trophy

How wide is the base of the individual trophy?

A. 5 cm B. 6 cm C. 7.5 cm D. 9 cm

2. What scale factor would enlarge *Triangle X* to *Triangle Y*?
(All measurements are in cm).




A. $1\frac{1}{2}$ B. 2 C. $2\frac{1}{2}$ D. $3\frac{1}{2}$

3. An isosceles triangle with sides 18 cm, 18 cm and 15 cm is enlarged with scale factor of 3.

What are the side lengths of the new triangle?

A. 6 cm, 6 cm and 5 cm.

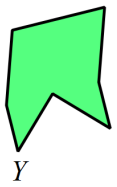
B. 21 cm, 21 cm and 18 cm.

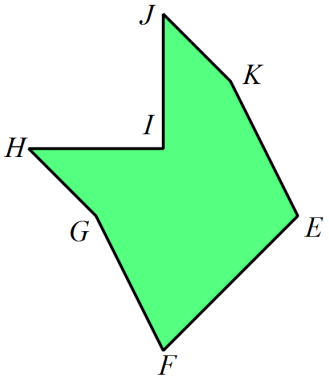
C. 36 cm, 36 cm and 30 cm.

D. 54 cm, 54 cm and 45 cm.

4. Two similar polygons are shown.

Which angle in the larger polygon would be equal in size to angle *Y* in the smaller polygon?




A. Angle E

B. Angle F

C. Angle H

D. Angle J

5. Which two words (in order) complete this statement correctly?

In a pair of similar triangles the corresponding _____ are equal and the corresponding _____ are in the same ratio.

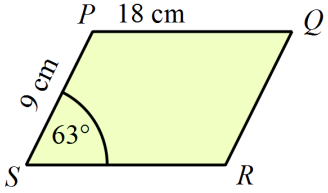
A. angles, sides

B. areas, sides

C. sides, angles

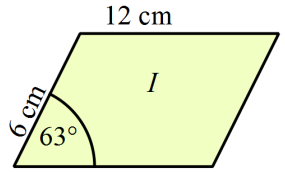
D. sides, areas

6. Which of the four parallelograms shown below is similar to parallelogram *PQRS*?

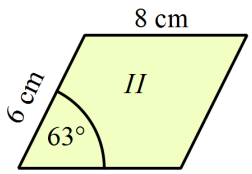



NOT TO SCALE

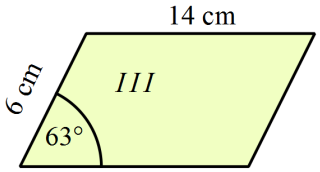
A.



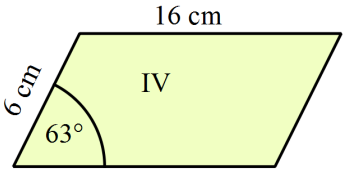

B.



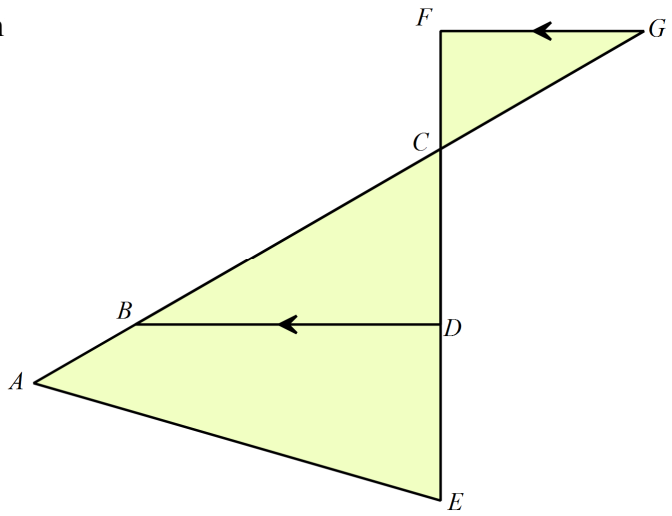

C.




D.



7. Which two triangles are similar in this diagram




A. $\Delta ACE \,|||\, \Delta GCF$.

B. $\Delta ACE \,|||\, \Delta BCD$.

C. $\Delta BCD \,|||\, \Delta GCF$.

D. $\Delta DCB \,|||\, \Delta ECA$.

8. When comparing triangles, which statement is true?

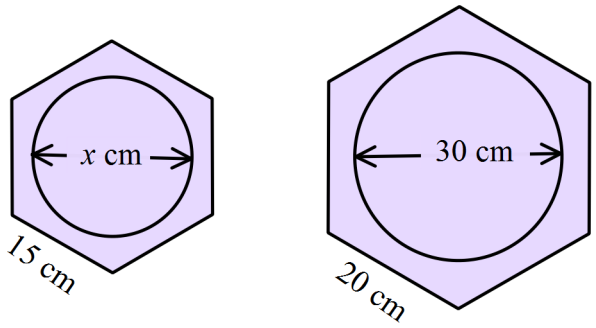
A. All triangles are similar.

B. All equilateral triangles are similar.

C. All isosceles triangles are similar.

D. All scalene triangles are similar.

9. A set of plates are in the shape of regular hexagons with a circular insert.
They are all similar and are made in two different sizes as shown.

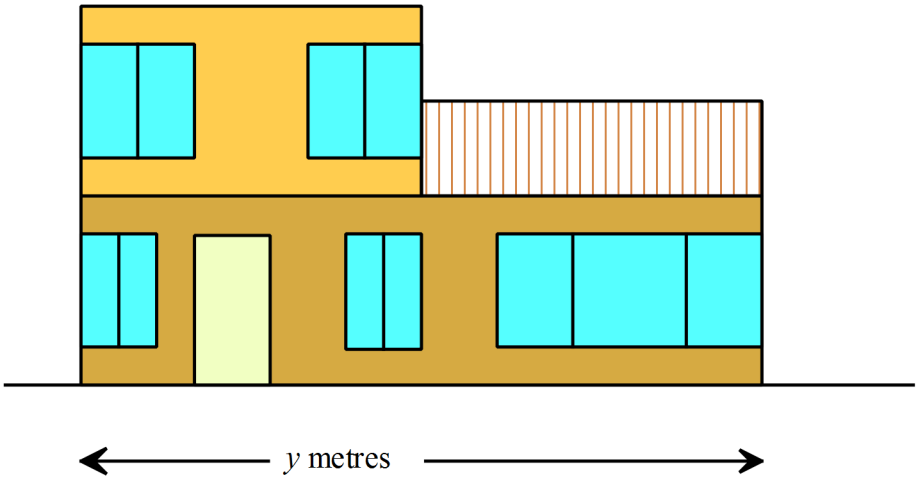



NOT TO SCALE

What is the value of $x$?

A. 20 cm B. 22.5 cm C. 25 cm D. 27.5 cm

10. The elevation of this building is drawn to a scale of 1 : 120.




What is the width of the actual building?

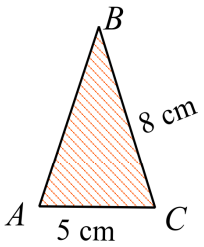
A. 9.0 m B. 10.8 m C. 12.5 m D. 13.3 m

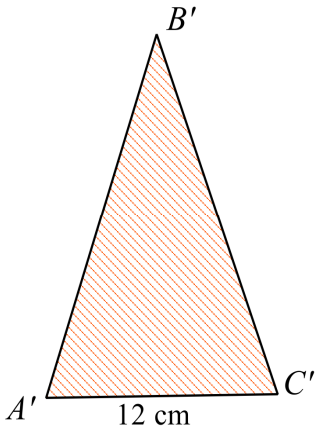
11. $\Delta ABC$ and its image under an enlargement are shown.

What is the length of $B'C'$?

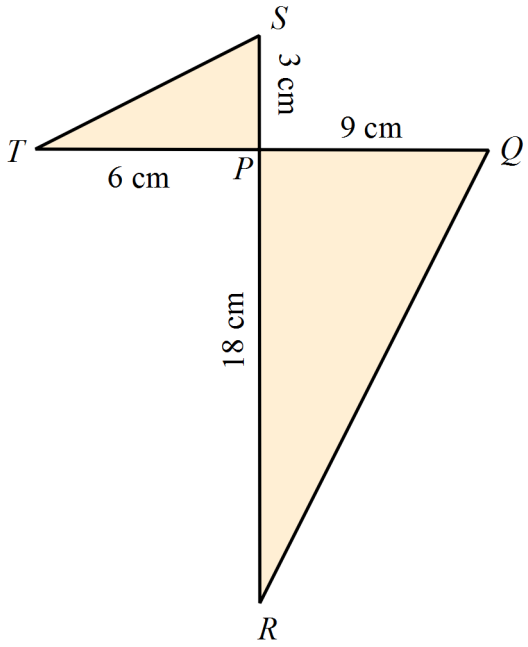
A. 7.5 cm
B. 18.0 cm
C. 19.2 cm
D. 24.0 cm

NOT TO SCALE



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




NOT TO SCALE

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.

13. $\Delta PQR$ is an enlargement of $\Delta XYZ$.

The longest side of $\Delta XYZ$ measures 20 cm.
What is the scale factor of the enlargement?

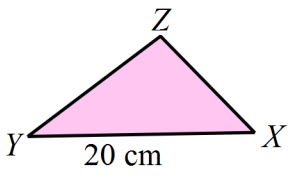
NOT TO SCALE

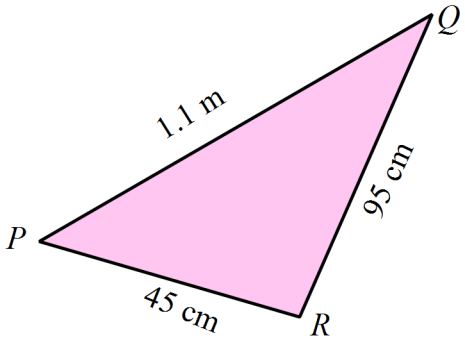
A. 2.25

B. 4.75

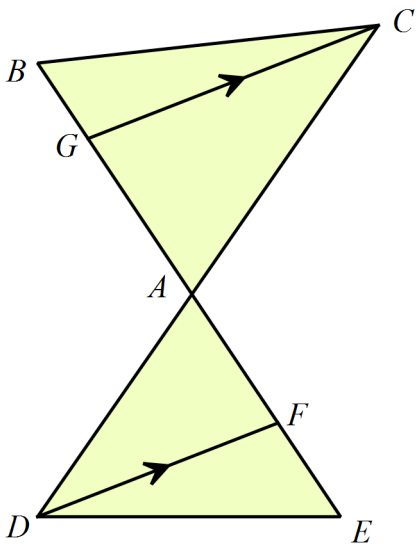
C. 5.25

D. 5.5



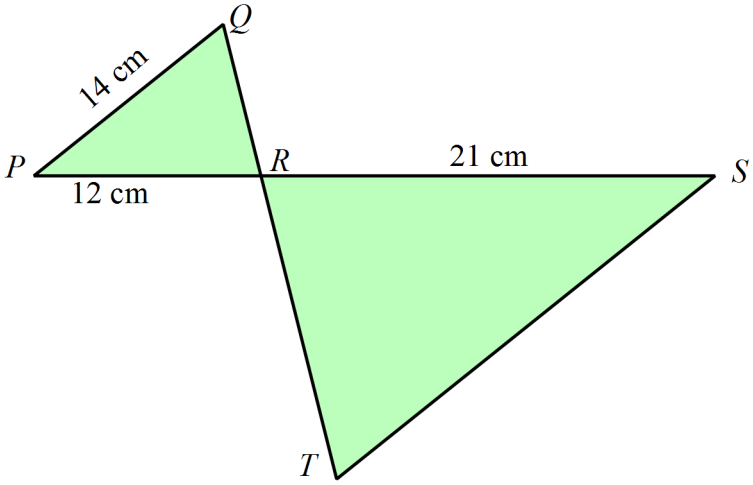
14. In the diagram $BE$ intersects $DC$ at $A$.
$GC \parallel DF$.




Which statement names a pair of similar triangles?

A. $\Delta AGC \,|||\, \Delta AFD$
B. $\Delta ABC \,|||\, \Delta AED$
C. $\Delta ABC \,|||\, \Delta ADE$
D. $\Delta DFE \,|||\, \Delta$ CGB

15. In the diagram $PQ \parallel TS$.




What is the length of $TS$?

A. 8.0 cm
B. 18.0 cm
C. 24.5 cm
D. 27.5 cm

# High School Mathematics Test 2015

Year 9

## Enlargement & Similarity

Calculator Allowed

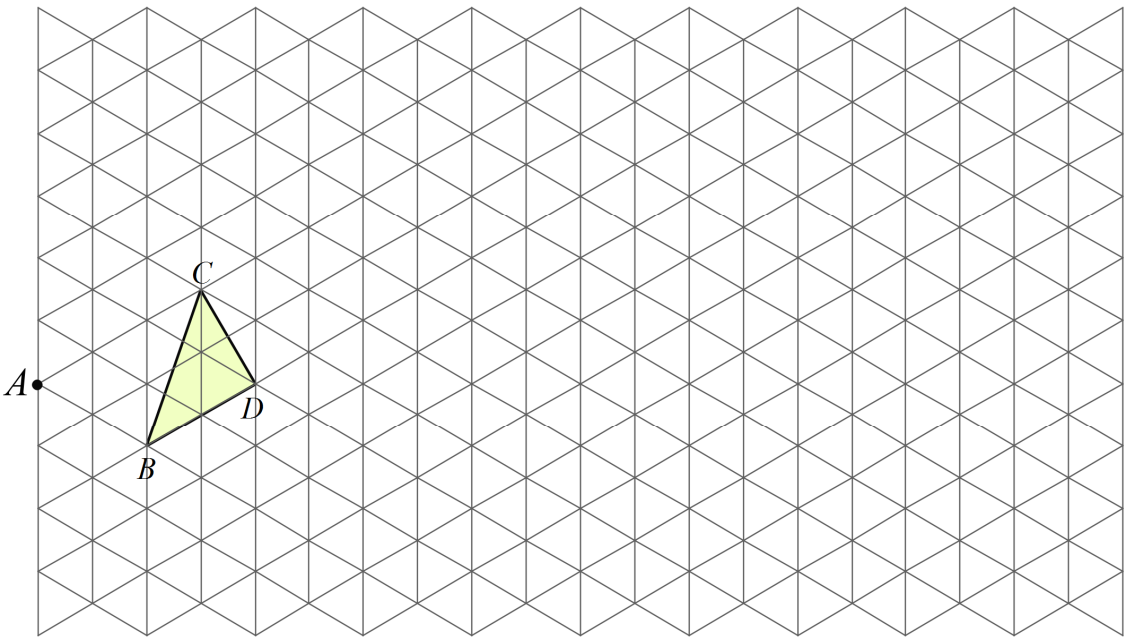
Name_____

**Section 3** Longer Answer Section

Write all working and answers in the spaces provided on this test paper.
YOU WILL NEED A RULER.

**Marks**

1. Enlarge the triangle *BCD* with the centre of the enlargement at *A*, and a scale factor of 4. Label the image *B'C'D'*. **3**



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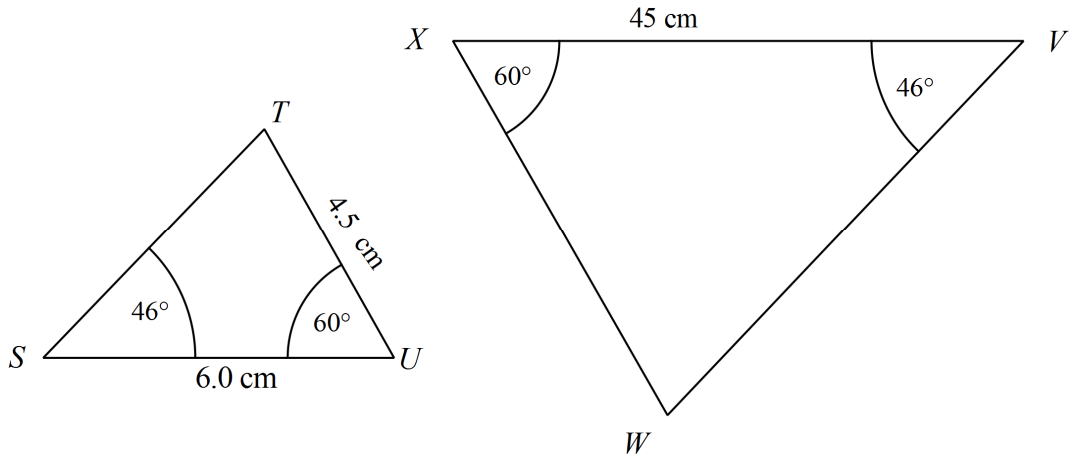


a) Explain why $\Delta STU \;|||\; \Delta VWX$. **1**

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b) What is the ratio of the corresponding sides? **1**

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c) Find the length of $WX$. **2**

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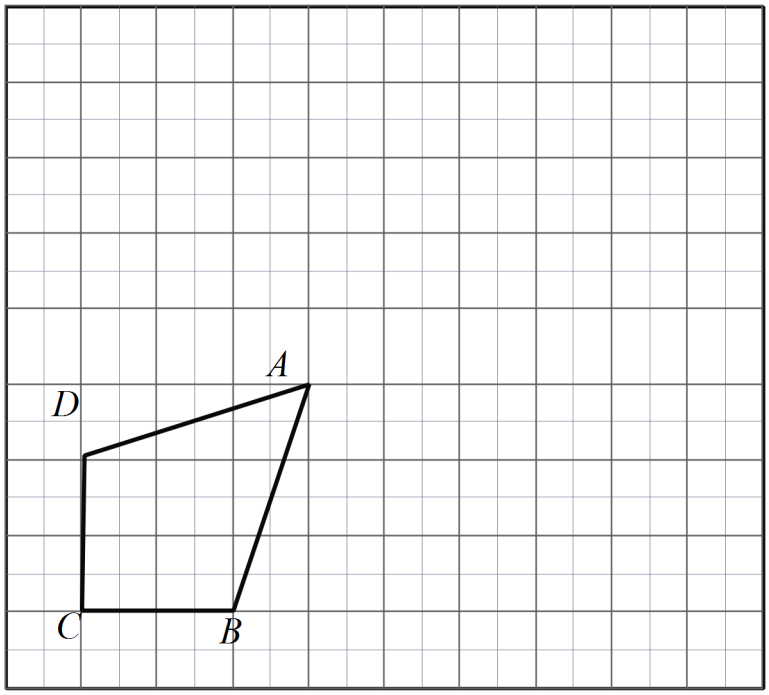
3. Using the grid provided, or otherwise, draw the image of quadrilateral *ABCD* after an enlargement with scale factor 2.5 with centre *C*. **3**




b) The perimeter of the original quadrilateral is 104 mm. **1**
What is the perimeter of the enlarged quadrilateral?

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c) The area of the original quadrilateral is 6 cm$^2$. **1**
What is the area of the enlarged quadrilateral?

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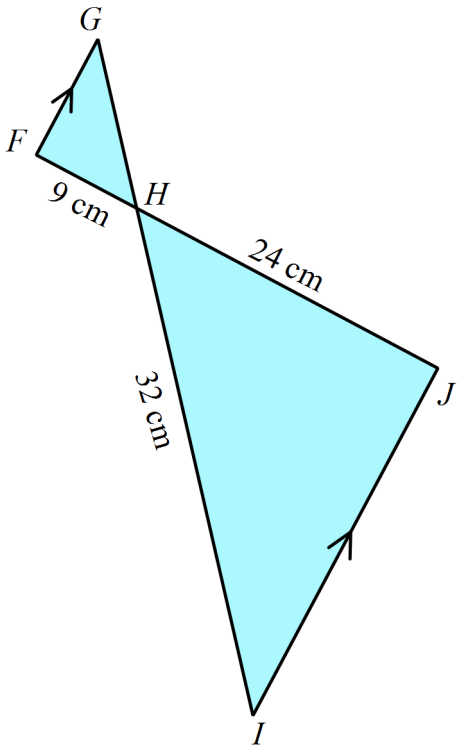
4. (a) Prove that $\Delta FGH \,|||\, \Delta JIH$. **2**

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(b) Find the length of $GH$. **2**

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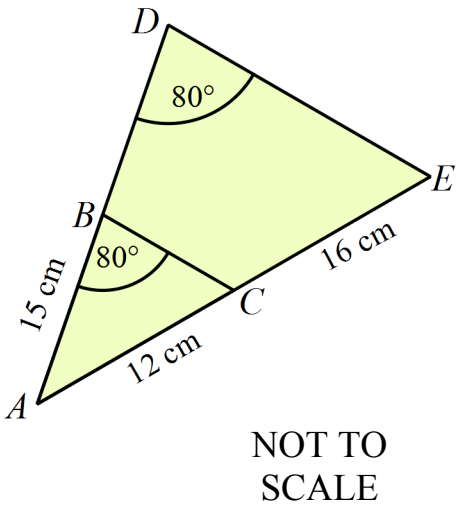
5. (a) Prove that $\Delta ABC \,|||\, \Delta$ ADE. **2**




NOT TO SCALE

……

……

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……

……

(b) Find the length of $BD$. **2**

……

……

# *High School*
# *Mathematics Test 2015*

## *Multiple Choice Answer Sheet*

## *Enlargement & Similarity*

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 ⬭ |

# High School Mathematics Test 2015

Year 9

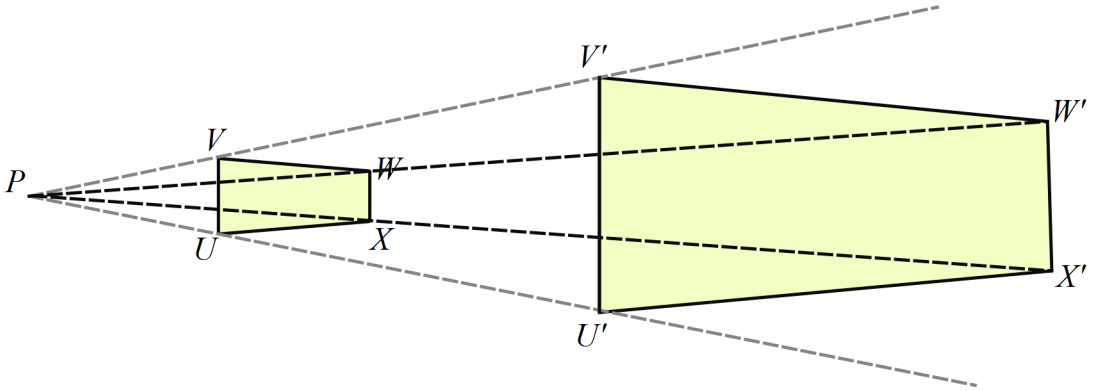
## Enlargement & Similarity

Non Calculator

**Section 1** Short Answer Section

## ANSWERS

| No. | WORKING | ANSWER |
|---|---|---|
| 1. | It would have sides which are $5 \times 4 = 20$cm and the angles would be unchanged at $60^o$. | Sides 20 cm<br>Angles all $60^o$ |
| 2. | 6cm enlarges to 18 cm, so enlargement factor = $\frac{18}{6} = 3$. | 3 |
| 3. | $y = 2 \times 3 = 6$<br>$x = 9 \div 3 = 3$ | $x = 3$<br>$y = 6$ |
| 4. | Since corresponding angles are equal, the angle equal to $\angle G$ is $\angle S$. | $\angle S$ |
| 5. | The sides if the smaller triangle measure 1 cm, 1.5 cm and 2 cm, and the larger are 3 cm, 4.5 cm and 6 cm, so the scale factor is 3. i.e. $\frac{6}{2} = \frac{4.5}{1.5} = \frac{3}{1} = 3$ | 3 |
| 6. | CB correspond to FE, so $FE = 6 \times 2.5 = 15$ cm | 15 cm |
| 7. | Since squares have all sides the same any square will have all sides in the same ratio to another square, similarly as all squares have all angles right angles, the corresponding angles of all squares will be equal, so he is correct. | He is correct, see explanation. |
| 8. | The scale factor = $\frac{45}{9} = 5$<br>A photo measuring 20 cm across would be enlarged to $20 \times 5 = 100$ cm | 100 cm or 1 metre |

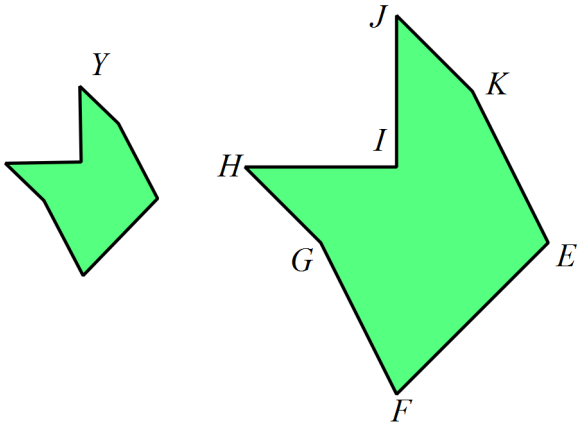
| | | |
|---|---|---|
| 9. | $PX = PW \approx 4.5$ cm<br>$PX' = PW' \approx 4.5 \times 3 = 13.5$ cm<br>  <br> | |
| 10. | $FG$ =3 cm enlarges to $F'G'$=12 cm,<br>so enlargement factor = $\frac{12}{3} = 4$.<br>$EG$ =5 cm, so $E'G' = 5 \times 4 = 20$ cm. | 20 cm |
| 11. | The sides of EFG are 2 cm, 3 cm and 4.4 cm, which correspond to 6 cm, 9 cm and 13.2 cm.<br>So the scale factor is 3. i.e. $\frac{6}{2} = \frac{9}{3} = \frac{13.2}{4.4} = 3$ | 3 |
| 12. | $\frac{EF}{AC} = \frac{ED}{AB} = \frac{DF}{BC}$<br>$\frac{EF}{2.5} = \frac{8}{2} = \frac{6}{1.5} = 4$<br>$EF = 2.5 \times 4 = 10$ | EF = 10 cm |
| 13. | The corresponding angles are equal,<br>$\angle F = \angle I = 63°$, $\angle H = \angle K = 90°$ and<br>$\angle G = \angle J = 27°$ | The triangles are similar because the corresponding angles are equal. |
| 14. | If shadow is $s$ then $\frac{s}{0.9} = \frac{24}{1.2} = 20$<br>$s = 20 \times 0.9$<br>$= 18$ m | 18 m |
| 15. | $\frac{FH}{16} = \frac{48}{18}$<br>$FH = \frac{48 \times 16}{18}$<br>$= \frac{8 \times 16}{3}$<br>$= \frac{128}{3}$<br>$= 42\frac{2}{3}$ | $42\frac{2}{3}$ cm |

# High School Mathematics Test 2015

Year 9 **Enlargement & Similarity** Calculator Allowed

**Section 2** Multiple Choice Section

ANSWERS

| No. | WORKING | ANSWER |
|---|---|---|
| 1. | Enlargement factor $= \frac{15}{45} = \frac{1}{3}$<br>Base of ind trophy $= \frac{1}{3} \times 18 = 6$ cm | B |
| 2. | $\frac{20}{8} = \frac{10}{4} = \frac{15}{6} = 2\frac{1}{2}$ | C |
| 3. | Original sides are 18 cm, 18 cm and 15 cm, so new sides are<br>18 × 3 cm, 18 × 3 cm and 15 × 3 cm = 54 cm, 54 cm, and 45 cm | D |
| 4. | When compared in the same orientation angle Y is equal to angle J.<br>  | D |
| 5. | *In a pair of similar triangles the corresponding **angles** are equal and the corresponding **sides** are in the same ratio.*<br>Words are (in order) angles, sides | A |
| 6. | Since one angle is equal and shapes are parallelograms, all corresponding angles are equal.<br>So the ratio of sides needs to be the same ratio of shorter to longer in PQRS is 9 : 18 = 1: 2<br>Only one with same ratio is A where 6 : 12 = 1 : 2. | A |
| 7. | In $\Delta BCD$ and $\Delta GCF$<br>$\angle BCD = \angle GCF$ (vert opp $\angle$)<br>$\angle CDB = \angle CFG$ ( alt $\angle$ on $\parallel$ lines)<br>$\angle CBD = \angle CGF$ ( alt $\angle$ on $\parallel$ lines)<br>$\therefore \Delta BCD \parallel\parallel \Delta GCF$. ( corr $\angle$ equal ) | C |

| | | |
|---|---|---|
| 8. | All equilateral triangles are similar since they have all angles $60^o$ which when enlarged remain the same, and since all sides are equal, the corresponding sides are always in the same ratio. | B |
| 9. | Using ratios of corresponding dimensions<br>$\frac{x}{30} = \frac{15}{20}$<br>$x = \frac{30 \times 15}{20}$<br>$= 22.5$ cm | B |
| 10. | Width as measured = 90 mm.<br>Width of actual building = $90 \times 120 = 10\,800$ mm $= 10.8$ m | B |
| 11. | $\frac{B'C'}{8} = \frac{12}{5}$<br>$(B'C') = \frac{8 \times 12}{5}$<br>$= 19.2$ cm | C |
| 12. | The two sides given are in a ratio $\frac{18}{6} = \frac{9}{3} = \frac{3}{1}$ so two sides in the same ratio.<br>The angles between them are a pair of vertically opposite angles, so reason is : *Two corresponding sides of the triangles are in proportion and the included angle is equal* | D |
| 13. | The sides XY and PQ are corresponding and have measurements.<br>So enlargement factor $= \frac{1.1 \text{ m}}{20\text{cm}} = \frac{110}{20} = 5.5$ | D |
| 14. | In $\Delta AGC$ and $\Delta AFD$<br>$\angle AGC = \angle AFD$ *(Alt $\angle$ on $\|\|$lines)*<br>$\angle GCA = \angle FDA$ *(Alt $\angle$ on $\|\|$lines)*<br>$\angle GAC = \angle FAD$ *(vert opp angles )*<br>$\Delta AGC \|\|\| \Delta AFD$ *( corresponding angles equal* | A |
| 15. | In $\Delta PQR$ and $\Delta$ STR<br>$\angle PQR = \angle$ STR *(Alt $\angle$ on $\|\|$lines)*<br>$\angle QPR = \angle$ TSR *(Alt $\angle$ on $\|\|$lines)*<br>$\angle$ PRQ $= \angle$ SRT *(vert opp angles )*<br>$\Delta PQR \|\|\| \Delta$ STR *( corresponding angles equal )*<br>so $\frac{TS}{QP} = \frac{RS}{RP}$<br>$\frac{TS}{14} = \frac{21}{12}$<br>$TS = \frac{14 \times 21}{12}$<br>$= 24.5$ cm | C |

# *High School*
# *Mathematics Test 2015*

## *Multiple Choice Answer Sheet*

## *Enlargement & Similarity*

Name _____ANSWERS_____

Completely fill the response oval representing the most correct answer.

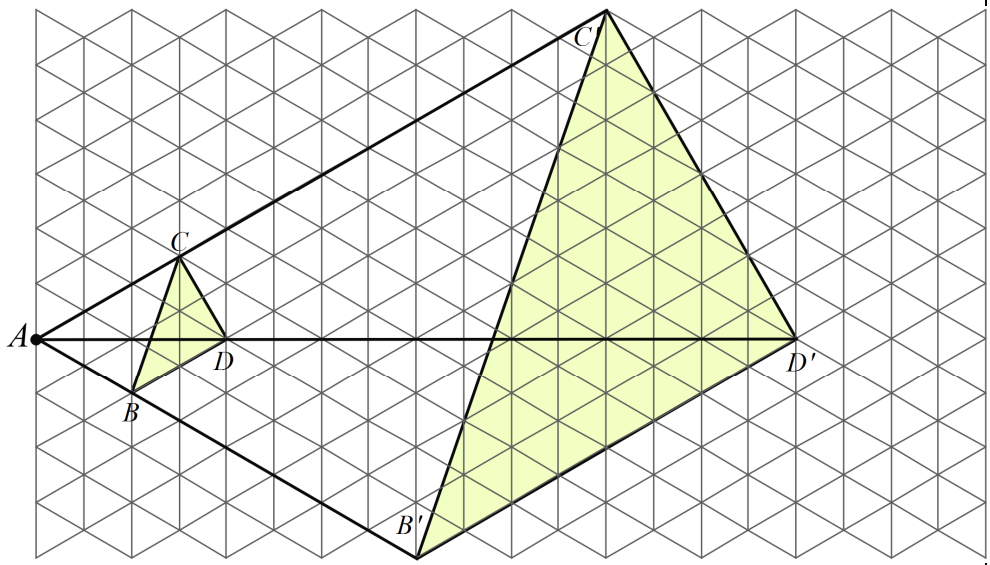
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. | A | ○ | B | ● | C | ○ | D ○ |
| 2. | A | ○ | B | ○ | C | ● | D ○ |
| 3. | A | ○ | B | ○ | C | ○ | D ● |
| 4. | A | ○ | B | ○ | C | ○ | D ● |
| 5. | A | ● | B | ○ | C | ○ | D ○ |
| 6. | A | ● | B | ○ | C | ○ | D ○ |
| 7. | A | ○ | B | ○ | C | ● | 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 ○ |

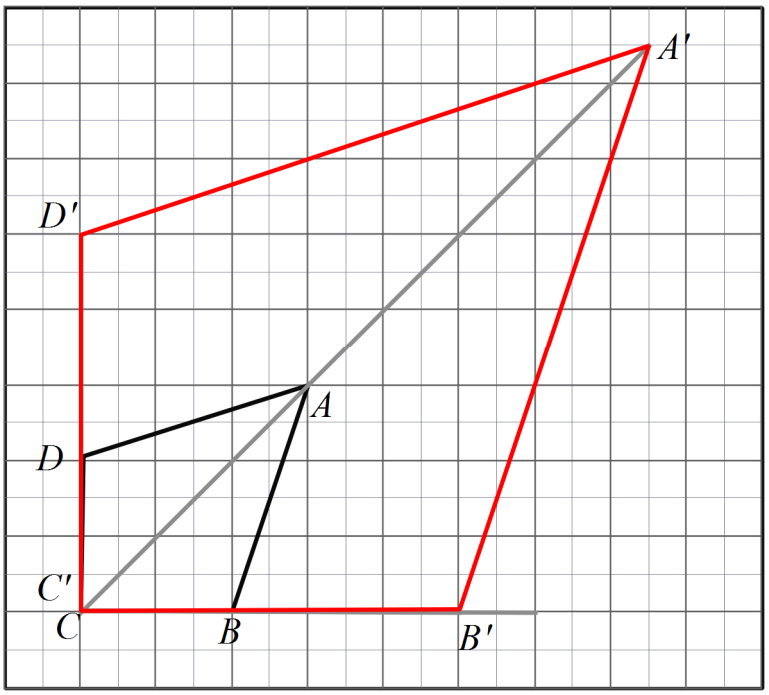
# High School Mathematics Test 2015

| Year 9 | Enlargement & Similarity | Calculator Allowed |
|---|---|---|

**Section 3** Longer Answer Section

## ANSWERS

| | | Marks |
|---|---|---|
| 1. |  | **3 marks**<br><br>**2 marks for correct triangle with evidence of construction.**<br><br>**1 mark for labelling image** |
| 2. | (a) $\angle S = \angle V = 46°$<br>$\angle U = \angle X = 60°$<br>$\therefore \quad \angle T = \angle W = 74°$<br>$\therefore \Delta STU \,\|\|\| \Delta VWX$. ( corresponding angles equal ) | **Formal proof not required for 1 mark, just an explanation that corresponding angles are equal** |
| | (b) Ratio of corresponding sides $= \frac{VX}{SU} = \frac{45}{6} = \frac{15}{2} = 7.5:1$ | **Ratio in any format for 1 mark** |

| | | |
|---|---|---|
| | (c) $\frac{WX}{TU} = \frac{XV}{SU}$<br>$\frac{WX}{4.5} = \frac{45}{6.0}$<br>$WX = 4.5 \times \frac{45}{6.0}$<br>$= 4.5 \times 7.5$<br>$= 33.75$ cm | **2 marks for correct answer.**<br><br>**1 mark for an attempt at the solution that includes equal ratios** |
| 3. | (a)  | **2 for sketch** |
| | (b) Perimeter of image is 2.5 times that of the original<br>Perimeter = $2.5 \times 104 = 260$ mm | **1 for answer** |
| | (c) Area of image is $2.5^2$ times that of the original ( $2.5^2 = 6.25$ )<br>Area = $6.25 \times 6 = 37.5$ cm$^2$ | **1 for answer** |

| | | |
|---|---|---|
| 4. | (a)<br>In $\Delta FGH$ and $\Delta JIH$<br>$\angle F = \angle J$ ( alt $\angle$ on $\parallel$ lines)<br>$\angle G = \angle I$ ( alt $\angle$ on $\parallel$ lines)<br>$\angle FHG = \angle JHI$ ( vert opp $\angle$ )<br>$\therefore \Delta FGH \vert\vert\vert \Delta JIH$ ( corresp $\angle$ equal ) | **2 marks for an answer which includes at least 2 pairs of equal angles and a conclusion.**<br><br>**1 mark for a partial answer or minor error** |
| | (b)<br>$\frac{GH}{HI} = \frac{FH}{HJ}$<br>$\frac{GH}{32} = \frac{9}{24}$<br>$GH = \frac{9 \times 32}{24}$<br>$= 12$ cm | **2 marks for an answer which includes required ratio and correct answer.**<br><br>**1 mark for a partial answer or minor error** |
| 5. | (a)<br>In $\Delta ABC$ and $\Delta ADE$<br>$\angle ABC = \angle ADE = 80°$ (given)<br>$\angle BAC = \angle DAE$ (common *or* coincident)<br>$\angle BCA = \angle DEA$ ( $\angle$ sum $\Delta$)<br>$\therefore \Delta ABC \vert\vert\vert \Delta ADE$ ( corresponding angles equal ) | **2 marks for an answer which includes at least 2 pairs of equal angles and a conclusion.**<br><br>**1 mark for a partial answer or minor error** |
| | (b)<br>BD + AB = AD<br>BD + 15 = AD<br>AE = AC + CE = 12 + 16 = 28<br>$\frac{AD}{AB} = \frac{AE}{AC}$ ( corres sides in same ratio )<br>$\frac{BD + 15}{15} = \frac{28}{12}$<br>$BD + 15 = \frac{28 \times 15}{12}$<br>BD + 15 = 35<br>BD = 35 – 15 = 20 cm | **2 marks for an answer which includes required ratio and correct answer.**<br><br>**1 mark for a partial answer or minor error** |