

Carlingford High School



Mathematics Year 9 5.3 Term 3 Test 2017

Student Name: _____

Circle your Teacher below.

Mr Jiang

Mrs Lego

Ms Lobejko

Time allowed: 55 minutes

- Complete the examination in blue or black pen.
- Show all necessary working.
- Attempt all questions.
- Extension questions are marked with an asterisk *.
- Diagrams are not to scale.

	Factorising	Geometry	Total	
Questions	/20	/47	/67	
Extension	/3	/3	/6	
Total	/23	/50	/73	%

Factorising

g. $9x^2 - 27 + x^2y - 3y$ 2

1. Factorise the following expressions fully.

a. $8x^2 - 12x$ 1

b. $-12y + 35 + y^2$ 1

c. $x^2 - 2x - 63$ 1

h. $3x^2 + 5x + 2$ 2

i. $8x^2 - 38x + 35$ 2

d. $w^2 - 16$ 1

e. $48x^2 - 3y^2$ 2

* j. $4(x + y)^2 - 64(x - y)^2$ 3

f. $15p^2q^2 - 12pq + 3p^2q$ 1

Geometry

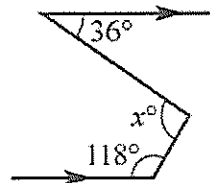
2. Factorise and then simplify.

a. $\frac{x}{x^2+6} + \frac{1}{x}$

b. $\frac{4x+8}{x+5} \div \frac{6x+12}{5x+25}$

c. $\frac{3}{x^2-3x-4} - \frac{2}{x^2-1}$

2 1. The value of x in the following diagram is: 1



- A 82 B 98
C 206 D 262

2 2. The size of an interior angle of a regular hexagon is: 1

- A 60° B 90°
C 120° D 135°

3. Complete each sentence using the word bank below to fill in the missing words. 7

WORD BANK:

Adjacent, Bisect, Complementary, Dissect,
Equal, Parallel, Parallelogram, Perpendicular,
Opposite, Rectangle, Rhombus
(each word can be used more than once)

3

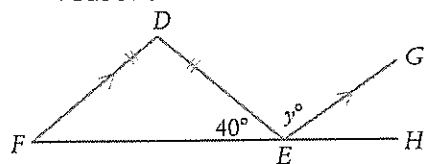
- a. The properties of a rectangle include
all the properties of a _____
- b. In a parallelogram _____
sides are _____
and _____
- c. In a rhombus opposite angles are

- d. The diagonals of a rectangle are
_____ and _____
each other.

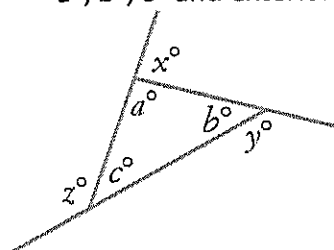
4. Calculate the size of each exterior angle in a regular octagon. **1**
5. Two rectangles have areas in the ratio 36 : 121. If the length of smaller rectangle is 15 cm. what is the length of bigger rectangle? **2**
6. Name the most general quadrilateral with:
- Only one pair of opposite sides parallel. **1**
 - Both pairs of adjacent sides equal. **1**
7. Find the value of y in the diagram below, giving reasons. **3**
8. Write one property of the:
- sides of a Rhombus **1**
 - angles of a parallelogram **1**
 - diagonals of a kite **1**
9. Draw a non-convex pentagon. **1**

10. Find the number of sides of a regular polygon if each interior angle is 108° . **2**

7. Find the value of y in the diagram below, giving reasons.

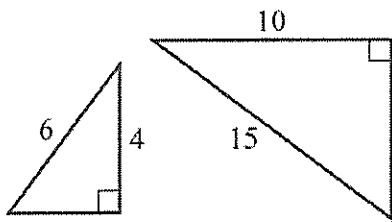


11. Consider this triangle with interior angles $a^\circ, b^\circ, c^\circ$ and exterior angles $x^\circ, y^\circ, z^\circ$.



- What is the value of $a + b + c$? **1**
- What is the value of $a + x$? **1**
- What is the value of $a + x + b + y + c + z$? **1**
- Hence find the value of $x + y + z$, showing working. **1**

Questions 12 and 13 refer to the pair of triangles below.



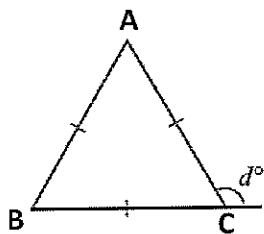
12. Which similarity test proves that the given pair of triangles is similar?

- A. All pairs of matching sides are proportional
- B. Two pairs of matching sides are proportional and included angles equal
- C. Hypotenuse and a pair of shorter sides are proportional in the right angled triangles
- D. Two pairs of matching sides are equal

13. The scale factor of the pair of similar triangles above is:

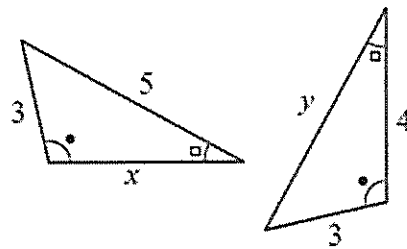
- | | |
|-----------------|-----------------|
| A $\frac{5}{2}$ | B $\frac{4}{3}$ |
| C $\frac{3}{2}$ | D $\frac{5}{4}$ |

14. Find the size of d° , giving reasons.

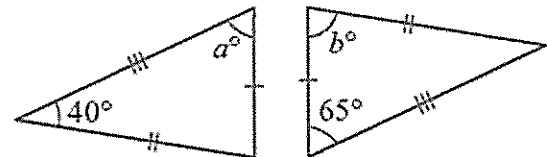


15. Find the values of the pronumerals in these pairs of congruent triangles. Give reasons for the answers.

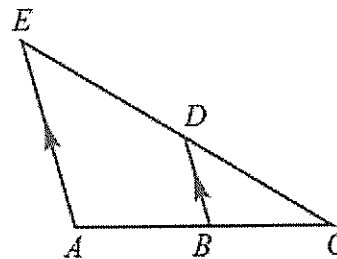
a.



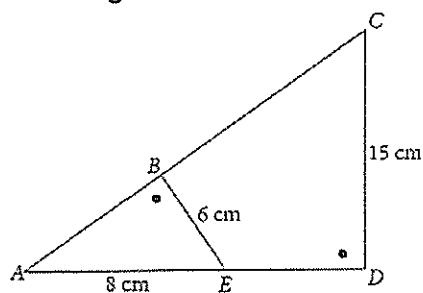
b.



16. Prove that the given pair of triangles is similar.

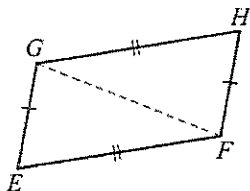


- *17. Find the length of AC in the following triangles.



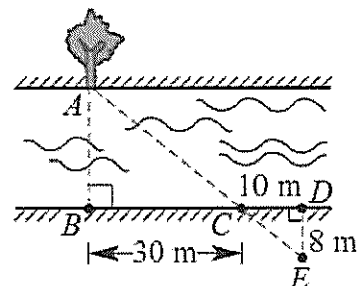
18. Consider the following diagram of quadrilateral EFGH.

a. Prove $\triangle EFG \equiv \triangle HGF$.



b. Hence prove $\angle GEF = \angle GHF$.

- 3 19. Rowan can see a tree on the opposite bank of a river. He decides to place rocks (indicated with dots) on his side of the river to try to calculate the river's width. He measures the distances between some pairs of rocks and finds that $BC = 30$ m, $CD = 10$ m and $DE = 8$ m, as shown in the diagram below.



- a. Show that Rowan has formed a pair of similar triangles by proving $\triangle ABC \sim \triangle EDC$.

2

- b. Hence find the width of the river by calculating the distance AB.

2

2

- 1 20. Sydney Tower is 305m high. What scale has been used in this photo if the scaled side is 45 mm?



Lobejko Factorising
Lego Geo Q₁-Q₃
Q₁₇-Q₂₀
Jiang Q₄-Q₁₆

Mathematics Year 9 5.3 Term 3 Test 2017

Student Name: Solution

Circle your Teacher below.

Mr Jiang

Mrs Lego

Ms Lobejko

Time allowed: 50 minutes

- Complete the examination in blue or black pen.
- Show all necessary working.
- Attempt all questions.
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	Factorising	Geometry	Total	
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Extension	/3	/3	/6	
Total	/23	/50	/73	%

Factorising

1. Factorise the following expressions fully.

a. $8x^2 - 12x$

1

$$= 4x(2x - 3)$$

b. $-12y + 35 + y^2$

1

$$= y^2 - 12y + 35$$

$$= (y - 5)(y - 7)$$

c. $x^2 - 2x - 63$

1

$$= (x - 9)(x + 7)$$

d. $w^2 - 16$

1

$$= (w + 4)(w - 4)$$

e. $48x^2 - 3y^2$

2

$$= 3(16x^2 - y^2)$$

$$= 3(4x + y)(4x - y)$$

f. $15p^2q^2 - 12pq + 3p^2q$

1

$$= 3pq(5pq - 4 + p)$$

g. $9x^2 - 27 + x^2y - 3y$

2

$$= 9x^2 - 27 + x^2y - 3y$$

$$= (x^2 - 3)(9 + y)$$

$$= (x - \sqrt{3})(x + \sqrt{3})(9 + y)$$

h. $3x^2 + 5x + 2$

2

$$= (3x + 2)(x + 1)$$

$\begin{matrix} 3x & 2 \\ x & 1 \end{matrix} \times$

i. $8x^2 - 38x + 35$

2

$$= (4x - 5)(2x - 7)$$

$\begin{matrix} 4x & -5 \\ 2x & -7 \end{matrix} \times$

*

j. $4(x + y)^2 - 64(x - y)^2$

3

$$= 4[(x + y)^2 - 16(x - y)^2]$$

$$= 4(x + y - 4x + 4y)(x + y + 4x - 4y)$$

$$= 4(5y - 3x)(5x - 3y)$$

Geometry

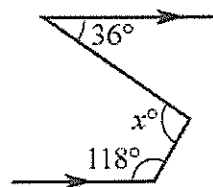
2. Factorise and then simplify.

$$\begin{aligned} \text{a. } & \frac{x}{x^2+6} + \frac{1}{x} \\ &= \frac{x^2}{x(x^2+6)} + \frac{(x^2+6)}{x(x^2+6)} \\ &= \frac{2x^2+6}{x(x^2+6)} \end{aligned}$$

$$\begin{aligned} \text{b. } & \frac{4x+8}{x+5} \div \frac{6x+12}{5x+25} \\ &= \frac{4(\cancel{x+2})}{\cancel{x+5}} \times \frac{5(\cancel{x+5})}{6(\cancel{x+2})} \\ &= \frac{10}{3} \\ &= 3\frac{1}{3} \end{aligned}$$

$$\begin{aligned} \text{c. } & \frac{3}{x^2-3x-4} - \frac{2}{x^2-1} \\ &= \frac{3}{(x-4)(x+1)} - \frac{2}{(x+1)(x-1)} \\ &= \frac{3(x-1)}{(x-4)(x+1)(x-1)} - \frac{2(x-4)}{(x+1)(x-1)(x-4)} \\ &= \frac{3x-3-2x+8}{(x-4)(x+1)(x-1)} \\ &= \frac{x+5}{(x-4)(x+1)(x-1)} \end{aligned}$$

2 1. The value of x in the following diagram is: 1



A 82

B 98

C 206

D 262

2 2. The size of an interior angle of a regular hexagon is: 1

A 60°

B 90°

C 120°

D 135°

3. Complete each sentence using the word bank below to fill in the missing words. 7

WORD BANK:

Adjacent, Bisect, Complementary, Dissect,
Equal, Parallel, Parallelogram, Perpendicular,
Opposite, Rectangle, Rhombus
(each word can be used more than once)

- a. The properties of a rectangle include all the properties of a Parallelogram
- b. In a parallelogram Opposite sides are Parallel and Equal
- c. In a rhombus opposite angles are Equal
- d. The diagonals of a rectangle are Equal and bisect each other.

4. Calculate the size of each exterior angle in a regular octagon.

$$360 \div 8 = 45^\circ$$

5. Two rectangles have areas in the ratio 36 : 121. If the length of smaller rectangle is 15 cm. what is the length of bigger rectangle?

$$\text{Area } 36 : 121$$

$$\text{length } 6 : 11$$

$$\frac{15}{6} \times 11 = \frac{5}{2} \times 11 = 27.5 \text{ cm}$$

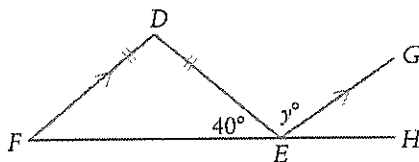
6. Name the most general quadrilateral with:
a. Only one pair of opposite sides parallel.

Trapezium

- b. Both pairs of adjacent sides equal.

Kite

7. Find the value of y in the diagram below, giving reasons.



$$\therefore DF = DE$$

$$\therefore \angle DFE = \angle DEF = 40^\circ$$

(Equal angles opposite to equal sides)

$$\therefore DF \parallel EG$$

$$\therefore \angle DFE = \angle GEH = 40^\circ$$

(corresponding angles equal)

$$y = 180^\circ - 40^\circ - 40^\circ = 100^\circ$$

(Angles at the straight line are supplementary)

8. Write one property of the:

- a. sides of a Rhombus

All sides equal

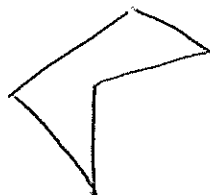
- b. angles of a parallelogram

opposite angles equal

- c. diagonals of a kite

Diagonals perpendicular

9. Draw a non-convex pentagon.



10. Find the number of sides of a regular polygon if each interior angle is 108° .

Method 1

$$108 \times n = 180(n-2)$$

$$72n = 360$$

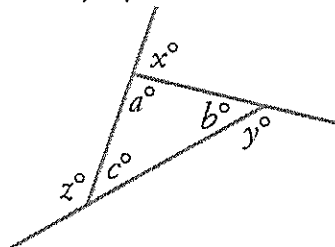
$$n = 5$$

Method 2

$$180 - 108 = 72^\circ$$

$$360 \div 72 = 5$$

11. Consider this triangle with interior angles $a^\circ, b^\circ, c^\circ$ and exterior angles $x^\circ, y^\circ, z^\circ$.



- a. What is the value of $a + b + c$?

$$180^\circ$$

- b. What is the value of $a + x$?

$$180^\circ$$

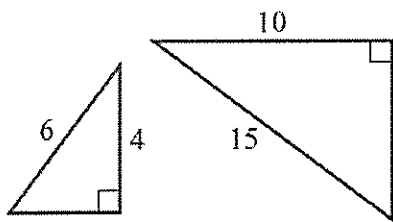
- c. What is the value of $a + x + b + y + c + z$?

$$540^\circ$$

- d. Hence find the value of $x + y + z$, showing working.

$$540 - 180 = 360^\circ$$

Questions 12 and 13 refer to the pair of triangles below.



12. Which similarity test proves that the given pair of triangles is similar?

- A. All pairs of matching sides are proportional
- B. Two pairs of matching sides are proportional and included angles equal

C. Hypotenuse and a pair of shorter sides are proportional in the right angled triangles

D. Two pairs of matching sides are equal

13. The scale factor of the pair of similar triangles above is:

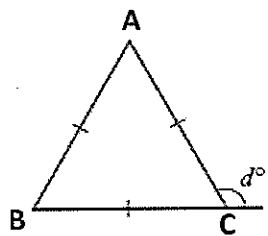
A $\frac{5}{2}$

B $\frac{4}{3}$

C $\frac{3}{2}$

D $\frac{5}{4}$

14. Find the size of d° , giving reasons.

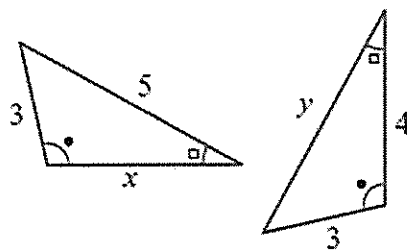


$\therefore AB = AC = BC$
 $\therefore \angle ACB = 60^\circ$ (angle equal to 60° in equilateral triangle)

$\therefore d = 180^\circ - 60^\circ$
 $= 120^\circ$
 (supplementary angle)
 on the straight line

15. Find the values of the pronumerals in these pairs of congruent triangles. Give reasons for the answers.

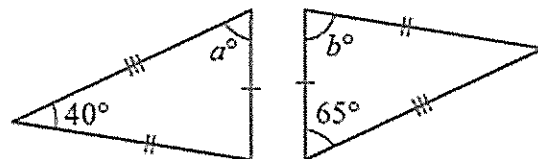
a.



$y = 5$ $x = 4$

(Matching sides equal)

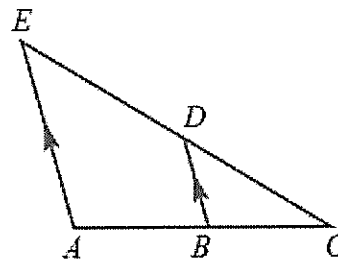
b.



$a = 65^\circ$ $b = 75^\circ$

(Matching angles equal)

16. Prove that the given pair of triangles is similar.



$\therefore AE \parallel BD$

$\therefore \angle AEC = \angle BDC$

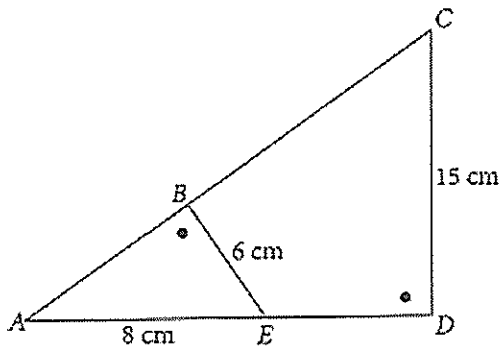
(Corresponding angles equal)

$\therefore \angle DCB$ is a common angle

$\therefore \triangle CBD \sim \triangle ACE$

(Two pair of matching angles equal)

- *17. Find the length of AC in the following triangles.



$$\angle ABE = \angle ADC \text{ (given)}$$

$\angle A$ is a common angle

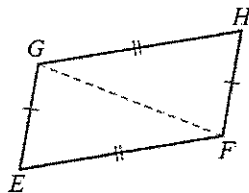
$$\therefore \triangle ABE \sim \triangle ADC$$

(Two pair of matching angles are equal)

$$\therefore \frac{AE}{AC} = \frac{BE}{CD} = \frac{6}{15}$$

(Matching sides are in the same ratio)

18. Consider the following diagram of quadrilateral EFGH.



- a. Prove $\triangle EFG \equiv \triangle HGF$.

$$GH = GF \text{ (given)}$$

$$GE = HF$$

GF is a common side

$$\therefore \triangle EFG \equiv \triangle HGF$$

(SSS)

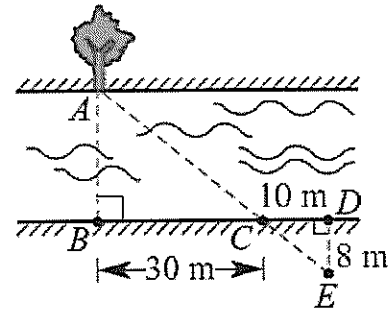
- b. Hence prove $\angle GEF = \angle GHF$.

From a) $\therefore \triangle EFG \equiv \triangle HGF$

$$\therefore \angle GEF = \angle GHF$$

(Matching sides are equal)

- 3 19. Rowan can see a tree on the opposite bank of a river. He decides to place rocks (indicated with dots) on his side of the river to try to calculate the river's width. He measures the distances between some pairs of rocks and finds that $BC = 30$ m, $CD = 10$ m and $DE = 8$ m, as shown in the diagram below.



- a. Show that Rowan has formed a pair of similar triangles by proving

$$\triangle ABC \sim \triangle EDC.$$

$$\angle ABC = \angle CDE \text{ (given)}$$

$\angle ACB = \angle DCE$ (vertically opposite angle equal)

$$\therefore \triangle ABC \sim \triangle EDC$$

(Two pair of matching angles are equal)

- b. Hence find the width of the river by calculating the distance AB.

$$\frac{AB}{DE} = \frac{BC}{CD} \text{ (Matching sides are in the same ratio equal)}$$

$$\frac{AB}{8} = \frac{30}{10} \quad AB = 24 \text{ m}$$

20. Sydney Tower is 305m high. What scale has been used in this photo if the scaled is 45 mm?

$$305 \text{ m} = 305000 \text{ mm}$$

$$305000 : 45$$

$$= 61000 : 9$$