Full NAME: (BLOCK CAPITALS)

> STUDENT NUMBER:\_\_\_ TUTORIAL GROUP NUMBER:

### 4CCM122A Geometry I: Test 4

#### CALCULATORS MAY NOT BE USED

ANSWER GRID: put a cross in ONE BOX for the correct answer for each question. If you change your mind and want to correct your answer, obliterate your incorrect answer by shading its box, and put a new cross in the box for the correct answer.

	a	b	с	d	е
1					
2					
3					
4					

MARKS: each correct answer = +5, incorrect = -1, none (or more than one) = 0.

Do any rough working on the back of this sheet, or on a NAMED separate sheet. You are strongly advised to draw diagrams.

- 1. Let  $T_1$  and  $T_2$  be two isometries and let  $P_1$  and  $P_2$  be two distinct points such that  $T_1(P_1) = T_2(P_1)$  and  $T_1(P_2) = T_2(P_2)$ . Suppose that there exists a point Q such that  $T_1(Q) \neq T_2(Q)$ . Then there exists an isometry  $T_3$  such that  $T_1 = T_3 \circ T_2$  and ... (complete the sentence)
  - (a)  $T_3$  is a rotation.

(b)  $T_3$  is a reflection across a line.

(c)  $T_3$  is a translation.

(d)  $T_3$  is a reflection after a translation

- (e) None of the above.
- **2.** Let g be the counter-clockwise rotation defined by g(z) = -z + 2. Then the angle of the rotation is
  - (b)  $-\frac{\pi}{4}$ (d)  $\frac{\pi}{2}$ (a)  $\pi$ (c)  $\frac{\pi}{3}$ (e) None of the above.
- 3. What is the equation of the hyperbolic line in the Poincaré disk model containing the points  $(\frac{1}{2}, 0)$  and  $(0, -\frac{1}{2})$ ?
  - (b)  $x^2 + y^2 \frac{5}{2}x + \frac{5}{2}y + 1 = 0$ (d)  $x^2 + y^2 \frac{1}{2}x + \frac{1}{2}y = 0$ (a) -2x + 2y + 1 = 0(c)  $x^2 + y^2 + 1 = 0$
  - (e) None of the above.
- 4. Let ABCD be a trapezoid such that  $AB \parallel DC$ ,  $DC = 2\sqrt{3}$ , BC = 2,  $\angle ADB = 80^{\circ}$  and  $\angle DCB = 90^{\circ}$ . What is  $\angle BAD$ ?

(a) 110°	(b) 150°
(c) 90°	(d) 70°

(e) None of the above.

END OF TEST

### Solutions

	a	b	с	d	е
1		×			
2	×				
3		×			
4				×	

**Note:** Your answers, if correct, will *not* have given the above pattern, because (as a guard against cheating) there were several versions of the question paper, with the possible answers arranged in various orders.

- 1. (b)  $T_3 = T_2^{-1} \circ T_1$ . The hypotheses give that  $T_3$  has 2 fixed points but it is not the identity.
- **2.** (a) The center of the rotation is the solution of z = g(z), that is 1. g(0) = 2 therefore the answer is (a).
- **3.** (b) The equation of an hyperbolic line that is not a diameter is  $x^2 + y^2 2ax 2by + 1 = 0$ . Therefore it can only be (b) or (c). The given points are solutions of equation (b) but not (c).
- 4. (d) Since DCB is half of an equilateral triangle.  $\angle CDB = 30^{\circ}$ . Therefore,  $\angle ABD = 30^{\circ}$  and  $\angle DAB = 180^{\circ} 80^{\circ} 30^{\circ}$

G. Tinaglia—January 2011

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- 1. Let  $T_1$  and  $T_2$  be two isometries and let  $P_1$  and  $P_2$  be two distinct points such that  $T_1(P_1) = T_2(P_1)$  and  $T_1(P_2) = T_2(P_2)$ . Suppose that there exists a point Q such that  $T_1(Q) \neq T_2(Q)$ . Then there exists an isometry  $T_3$  such that  $T_1 = T_3 \circ T_2$  and ... (complete the sentence)
  - (a)  $T_3$  is a rotation. (b)  $T_3$  is a reflection across a line.
  - (c)  $T_3$  is a translation.

(d)  $T_3$  is a reflection after a translation

- (e) None of the above.
- 2. Let g be the counter-clockwise rotation defined by g(z) = -z + 2. Then the angle of the rotation is
  - (a)  $-\frac{\pi}{4}$ (b)  $\pi$ (d)  $\frac{\pi}{2}$ (c)  $\frac{\pi}{2}$ (e) None of the above.
- 3. What is the equation of the hyperbolic line in the Poincaré disk model containing the points  $(\frac{1}{2}, 0)$  and  $(0, -\frac{1}{2})$ ?
  - (b)  $x^2 + y^2 \frac{1}{2}x + \frac{1}{2}y = 0$ (d)  $x^2 + y^2 \frac{5}{2}x + \frac{5}{2}y + 1 = 0$ (a)  $x^2 + y^2 + 1 = 0$ (c) -2x + 2y + 1 = 0(e) None of the above.
- 4. Let ABCD be a trapezoid such that AB  $\parallel DC$ ,  $DC = 2\sqrt{3}$ , BC = 2,  $\angle ADB = 80^{\circ}$  and  $\angle DCB = 90^{\circ}$ . What is  $\angle BAD$ ?

(a) $70^{\circ}$	(b) 90°
(c) $150^{\circ}$	(d) 110°
(e) None of the above.	

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  - (a)  $T_3$  is a reflection across a line.
  - (c)  $T_3$  is a reflection after a translation
- (b)  $T_3$  is a rotation. (d)  $T_3$  is a translation.
- (e) None of the above.
- 2. Let g be the counter-clockwise rotation defined by g(z) = -z + 2. Then the angle of the rotation is
  - (b)  $\frac{\pi}{2}$ (d)  $-\frac{\pi}{4}$ (a)  $\frac{\pi}{3}$ (c)  $\pi$ (e) None of the above.
- 3. What is the equation of the hyperbolic line in the Poincaré disk model containing the points  $(\frac{1}{2}, 0)$  and  $(0, -\frac{1}{2})$ ?
  - (b)  $x^{2} + y^{2} + 1 = 0$ (d) -2x + 2y + 1 = 0(a)  $x^2 + y^2 - \frac{1}{2}x + \frac{1}{2}y = 0$ (c)  $x^2 + y^2 - \frac{5}{2}x + \frac{5}{2}y + 1 = 0$ (e) None of the above.
- 4. Let ABCD be a trapezoid such that AB  $\parallel DC$ ,  $DC = 2\sqrt{3}$ , BC = 2,  $\angle ADB = 80^{\circ}$  and  $\angle DCB = 90^{\circ}$ . What is  $\angle BAD$ ?

(a) 110°	(b) 150°
(c) 90°	(d) $70^{\circ}$
(e) None of the above.	

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## 4CCM122A Geometry I: Test 4

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  - (a)  $T_3$  is a translation. (b)  $T_3$  is a reflection after a translation
  - (c)  $T_3$  is a rotation.

(d)  $T_3$  is a reflection across a line.

- (e) None of the above.
- 2. Let g be the counter-clockwise rotation defined by g(z) = -z + 2. Then the angle of the rotation is
  - (b)  $\frac{\pi}{3}$ (a)  $\frac{\pi}{2}$ (c)  $-\frac{\pi}{4}$ (d)  $\pi$ (e) None of the above.
- 3. What is the equation of the hyperbolic line in the Poincaré disk model containing the points  $(\frac{1}{2}, 0)$  and  $(0, -\frac{1}{2})$ ?
  - (b)  $x^2 + y^2 \frac{5}{2}x + \frac{5}{2}y + 1 = 0$ (d)  $x^2 + y^2 \frac{1}{2}x + \frac{1}{2}y = 0$ (a) -2x + 2y + 1 = 0(c)  $x^2 + y^2 + 1 = 0$ (e) None of the above.
- 4. Let ABCD be a trapezoid such that  $AB \parallel DC$ ,  $DC = 2\sqrt{3}$ , BC = 2,  $\angle ADB = 80^{\circ}$  and  $\angle DCB = 90^{\circ}$ . What is  $\angle BAD$ ?

(a) 150°	(b) 110°
(c) 70°	(d) 90°

(e) None of the above.

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\_Tutorial Group Number:\_\_\_\_

(d)  $T_3$  is a rotation.

# 4CCM122A Geometry I: Test 4

### CALCULATORS MAY NOT BE USED

ANSWER GRID: put a cross in ONE BOX for the correct answer for each question. If you change your mind and want to correct your answer, obliterate your incorrect answer by shading its box, and put a new cross in the box for the correct answer.

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- **1.** Let  $T_1$  and  $T_2$  be two isometries and let  $P_1$  and  $P_2$  be two distinct points such that  $T_1(P_1) = T_2(P_1)$  and  $T_1(P_2) = T_2(P_2)$ . Suppose that there exists a point Q such that  $T_1(Q) \neq T_2(Q)$ . Then there exists an isometry  $T_3$  such that  $T_1 = T_3 \circ T_2$  and ... (complete the sentence)
  - (a)  $T_3$  is a reflection after a translation (b)  $T_3$  is a translation.
  - (c)  $T_3$  is a reflection across a line.
  - (e) None of the above.
- 2. Let g be the counter-clockwise rotation defined by g(z) = -z + 2. Then the angle of the rotation is
  - (a)  $\pi$  (b)  $-\frac{\pi}{4}$ (c)  $\frac{\pi}{3}$  (d)  $\frac{\pi}{2}$ (e) None of the above.
- **3.** What is the equation of the **hyperbolic** line in the Poincaré disk model containing the points  $(\frac{1}{2}, 0)$  and  $(0, -\frac{1}{2})$ ?
  - (a)  $x^2 + y^2 \frac{5}{2}x + \frac{5}{2}y + 1 = 0$ (b) -2x + 2y + 1 = 0(c)  $x^2 + y^2 - \frac{1}{2}x + \frac{1}{2}y = 0$ (d)  $x^2 + y^2 + 1 = 0$ (e) None of the above.
- **4.** Let *ABCD* be a trapezoid such that  $AB \parallel DC$ ,  $DC = 2\sqrt{3}$ , BC = 2,  $\angle ADB = 80^{\circ}$  and  $\angle DCB = 90^{\circ}$ . What is  $\angle BAD$ ?

(a) 90°	(b) $70^{\circ}$
(c) 110°	(d) $150^{\circ}$
(e) None of the above.	

### CM122A Geometry I Test 4 (08/09) Marking grids

	a	b	C	d	е
1		×			
2		×			
3				×	
4	×				

Test 010

	a	b	с	d	е
1	×				
2			×		
3			×		
4				×	

Test 011

	a	b	с	d	е
1				×	
2				×	
3		×			
4			×		

Toot	100
rest	100

	a	b	с	d	е
1			×		
2	×				
3	×				
4		×			