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Review MTH 211, Final spring 2014

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QUESTION 1. (i) To tile a floor, we may use pieces of a regular 8-gon with pieces of one of the following regular n-gon :

a) regular 4-gon b) regular 6-gon c) regular 5-gon d) regular 3-gon.

(ii) To tile a floor, we may use pieces of regular 4-gon with:

a) pieces of regular 6-gon and pieces of regular 3-gon b) nothing else (only pieces of regular 4-gon) c) pieces of regular 6-gon and pieces of regular 8-gon. d) pieces of regular 3-gon and pieces of regular 8-gon

(iii) To a tile a floor, we may use pieces of regular 8-gon with:

a) pieces of regular 3-gon b) pieces of regular 4-gon c) pieces of regular 12-gon d) nothing else (only pieces of regular 8-gon)

(iv) Let K_n be a sequence such that $K_1 = 1$, $K_2 = 3$, and $K_n = K_{n-1} + 2K_{n-2}$ for each $n \geq 3$. Then $K_4 =$

a) 4 b) 7 c) 5 d) 11

(v) The general formula for K_n is :

a) $2^n - 1$ b) $2^n + 1$ c) $2^n + (-1)^n$ d) $2^n + (3^n)$

(vi) Let $h : R^2 \longrightarrow R^2$ such that $h(z) = (2, 2).z$. Then $h((2, 2)) =$

a) (0, 8) b) (0, 4) c) (4, 4) d)(0, $\sqrt{8}$)

(vii) The angle of rotation of the above h is :

a)90 b) 45 c) 180 d) 30

(viii) The stretching factor of h above is :

a)2 b) 4 c) $\sqrt{8}$ d) 8

(ix) Let C be a circle of radius 3 centered at O, and A is a point inside C such that $\mid OA \mid= 1$. Then $\mid OInv(A) \mid$ =

a) 9 b) 3 c) 4.5 d) we can not tell.

(x) Let C be a circle centered at O and D is another circle inside C and D is passing through O. Then the inversion of D with respect to C is :

a) an infinite line passing through O b) a circle that is completely outside C c) an infinite line that is completely outside C d) a circle inside C passing through O but exactly in the opposite side of D.

(xi) Let C be a circle centered at O. Given A, B are points such that $\mid OA \mid<\mid OB \mid$ and O, A, B lie on the same line. Then

a) $\mid Inv(A)Inv(B) \mid=\mid AB \mid$ b) $\mid OInv(A) \mid<\mid OInv(B) \mid$ c) $\mid OInv(B) \mid<\mid OInv(A) \mid$ d) We can not tell

(xii) The measurement of each interior angle of a regular 10-gon is

a) 36 (b) 144 c) 100 108

(xiii) The measurement of each center angle of a regular 15-gon is

a) 156 b) 12 c) 24 d) 225

(xiv) One of the following is constructible by unmarked ruler and a compass:

a) regular 21-gon b) regular 22-gon c) regular 34-gon d) regular 50-gon

(xv) Given C is a circle centered at O and with radius 6 cm. Let A be a point such that $\mid OA \mid= 3$. Let $Inv(A)$ be the inversion of A with respect to C. Then $\mid OInv(A) \mid$ =

a) 2 b)12 c) 9 d) 4.5

(xvi) If a regular n-gon is constructible, then the angle (180/n) is constructible.

a) True b) False

(xvii) If an angle α is constructible, then the angle $\alpha/16$ is constructible.

a) True b) False

(xviii) Let C be a circle centered at O and with radius 3. Given A is a point such that $\mid OA \mid = 1$ and D is a circle orthogonal to C and passing through A. Then one of the following values is a possibility for the radius of D:

a)3 b)5 c) 3.5 d) 2

(xix) Let H be the horizon circle (the model for non-Euclidean) with radius 4 and centered at O. Let A be a point in H such that $\mid OA \mid = 3$. Then the non-Euclidean distance between O and A is :

a) ln(3) b) ln(7) c) ln(9) = 2ln(3) d) ln(4)

(xx) In non-Euclidean (hyperbolic) geometry, if a, b are two points, then

a) There are infinitely many lines pass through a and b b) There is exactly one circle passes through a and b c) There is exactly one line passes through a but not through b d) There is exactly one line passes through a and b.

(xxi) In non-Euclidean Geometry, the sum of all interior angles of a regular 4-gon is

a) 180 b) less than or equal to 180 c) 360 d) less than 360

(xxii) Let C be a circle with radius 4 and centered at O. Let Q be a point on C. Draw a circle call it D centered at Q with radius 4 again (note that D passes through O). The two circles intersect in two points, say A and B. Now choose a point say Z on D such that the line segment OZ is a diameter of D. Now the line segment AB intersects the diameter OZ in a point say M (note that AB is perpendicular to OZ). The inversion of M with respect to the circle C is

a) the point Z b) a point outside the circle D c) a point outside C but inside D and not on D d) is the mid point of the line segment QZ.

(xxiii) In the previous question, the length of AZ is

a) 4 b) $4\sqrt{3}$ c) 6 d) $2\sqrt{3}$

(xxiv) The length of AQ in question XIII is

a) 2 b) $\sqrt{2}$ c) $2\sqrt{3}$ d)$4\sqrt{3}$

(xxv) Let K be the mid-point of the line segment OM as in question XIII. The inversion of K with respect to C is

a) a point inside D but outside C b) the mid-point meter OZ c) the mid-point of QZ d) a point outside D but on the line extension of OZ

QUESTION 2. Fill in the blank

(i) Let C be a circle of radius 3 centered at O, A and B are points such that $|AO| = |BO| = 1$ and the angle AOB is a right angle at O. The radius of the circle that passes through $A, Inv(B)$ and orthogonal to C is ______________________________

(ii) Let C be a circle of radius 3 centered at O, D is a circle centered at F such that $|FO| = 1$ and of radius 4. Then the Inv(D) with respect to C is a circle centered at B where $|AB| =$ ________________- and it has radius ______________________________

(iii) Let C be a circle of radius 3 centered at O, D is a circle centered at F such that $|FO| = 5$ and of radius 5. The Inv(D) with respect to C is ______ that is perpendicular to the line OF and intersects OF at a point W such that $|OW| =$ ____________________________-

(iv) Let C be a circle with radius 5 and centered at $(0, 0)$. the inversion of the point $(6, 8)$ with respect to C is the point __________ and the inversion of the point $(-2, 1)$ is the point ______________-

(v) Given a line segment AB of length x. The following steps will be used to construct a line segment of length $\sqrt{5}x$ ____________________- and the following steps are used to construct a line segment of length $\frac{4x}{\sqrt{5}}$. In addition, if a line segment of length y is given, the following steps are used to construct a line segment of length $\sqrt{2xy}$ ________________ ___________________________________.

If $x > 1$ and a line segment of length one is given, then the following steps are used to construct a line segment of length z such that $xz = y$. If $x > 8$, then the following steps are used in order to construct the golden cut on AB ....

(vi) Construct a hyperbolic non-Euclidean square, pentagon, 6-gon.

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