

MTH 211, Math for Architects, Spring 2014

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QUESTION 1. Draw a reasonable line segment and call it AB . Construct a point C on the line segment AB such that $\frac{|AC|+|CB|}{|AC|} = 4.25 \frac{|AC|}{|CB|}$. What is the numerical value of this ratio? STATE the steps CLEARLY and try to be BRIEF to the point. Illustrate the steps by diagrams.

QUESTION 2. Draw a reasonable line segment and call it AB . Find the mid-point of AB and call it M . Draw a semi-circle centered at M with radius $|MB|$ (To construct your semi-circle, just take the upper-half of the circle centered at M with radius $|MB|$). Now construct a rectangle $ELFD$ where E, L are points on AB (call EL the width of the rectangle), F, D are points on the semi-circle you constructed (Call LF the length of the rectangle) such that $|LF| = 2.5|EL| + 0.25|MK|$, where MK is perpendicular to AB at M and intersects the semi-circle at the point K . STATE the steps CLEARLY and try to be BRIEF to the point. Illustrate the steps by diagrams.

QUESTION 3. Draw an angle and call it θ . State clearly the steps that you will use in order to divide θ into four equal parts.

QUESTION 4. a) Can we construct a 18 degree angle? Explain.

b) Construct a pentagon inside a circle. Now use the constructed pentagon in order to construct 20-regular gon.

QUESTION 5. It is impossible to divide a 60 degree angle into 3 equal parts, but it is possible to divide a 60 degree angle into 5 equal parts. WHY? explain. State the steps that you will use to divide a 60 degree angle into 5 equal parts.

QUESTION 6. a) State the steps that you will use to construct a golden spiral.

c) Draw a line segment AB . Now divide AB into 5 segments, say S_1, S_2, S_3, S_4, S_5 such that $|S_1| = |S_2| = |S_3|$, $|S_4| = 0.25|S_1|$ and $|S_5| = 0.5|S_1|$.

d) Draw a circle and call it C . Inside C construct a 45 degree angle. Can we divide the arch of the circle that corresponds to the 45 degree angle into 3 equal parts? I hope that your answer is yes. Now construct 24-regular gon.

e) Given A, B, C not on the same line. State the steps that you will use to construct a circle passes through A, B, C .

g) Construct a line segment of length 18cm (use marked ruler). NOW HIDE your marked ruler. Construct a line segment of length $\sqrt{18}$ and construct a line segment of length $\sqrt[4]{18}$.

f) Draw AB . Let F be a point not on AB . Construct a line segment passes through F and parallel to AB .

QUESTION 7. a) Draw two line segments AB and CD . Let $M = \sqrt{|AB|^2 + |CD|^2}$. Construct a line segment of length $\frac{|AB|^2}{M}$, a line segment of length $\frac{|CD|^2}{M}$, and a line segment of length $\frac{|AB||CD|}{M}$.

b) Draw two line segments AB and CD . Assume that you are given a line segment of length 0.5cm. State the steps the you will use in order to construct a line segment of length $|AB||CD|/3$.

b) State the steps that you will use to construct acute golden (obtuse) golden triangle. What are the angles of each triangle?

QUESTION 8. a) Can we construct a 140 degrees angle? a 35 degrees angle? a 75 degrees angle? a 30-regular gon? EXPLAIN

b) Can we construct a 51-regular gon? a 66-regular gon? a 21-regular gon? a 50-regular gon? EXPLAIN

c) Given $a_0 = 1$, $a_1 = 1$, and $a_n = a_{n-1} + 6a_{n-2}$ for each $n \geq 2$. First calculate a_3, a_4 . Find a general formula for a_n . Now use the formula to find a_3, a_4, a_{10} .

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