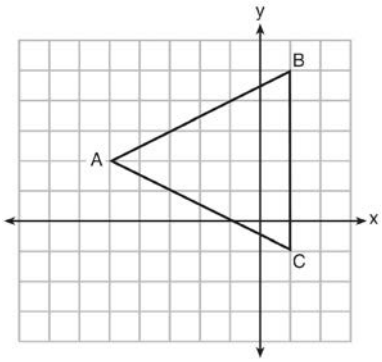
Name: _____

G.G.21: Centroid, Orthocenter, Incenter and Circumcenter: Investigate and apply the concurrence of medians, altitudes, angle bisectors, and perpendicular bisectors of triangles

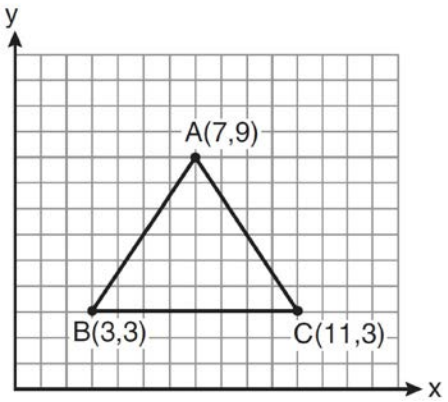
1 Triangle ABC is graphed on the set of axes below.



What are the coordinates of the point of intersection of the medians of ΔABC?

1) $(-1, 2)$
2) $(-3, 2)$
3) $(0, 2)$
4) $(1, 2)$

2 The vertices of the triangle in the diagram below are $A(7, 9)$, $B(3, 3)$, and $C(11, 3)$.



What are the coordinates of the centroid of ΔABC?

1) $(5, 6)$
2) $(7, 3)$
3) $(7, 5)$
4) $(9, 6)$

3 In a given triangle, the point of intersection of the three medians is the same as the point of intersection of the three altitudes. Which classification of the triangle is correct?

1) scalene triangle
2) isosceles triangle
3) equilateral triangle
4) right isosceles triangle

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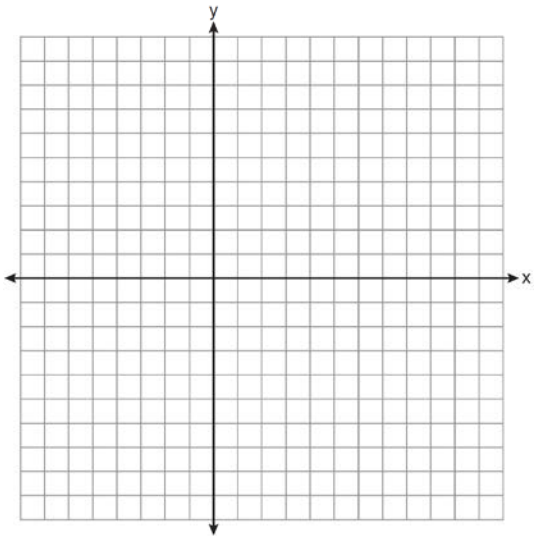
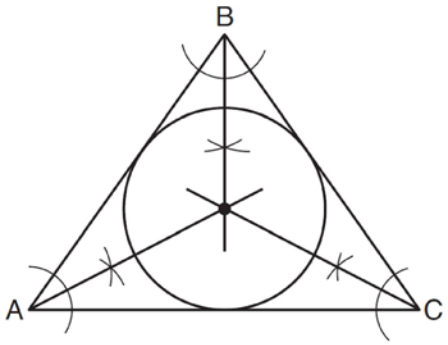
4 Triangle ABC has vertices $A(3,3)$, $B(7,9)$, and $C(11,3)$. Determine the point of intersection of the medians, and state its coordinates. [The use of the set of axes below is optional.]

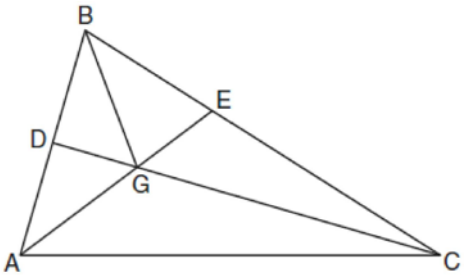


5 Which geometric principle is used in the construction shown below?



1) The intersection of the angle bisectors of a triangle is the center of the inscribed circle.
2) The intersection of the angle bisectors of a triangle is the center of the circumscribed circle.
3) The intersection of the perpendicular bisectors of the sides of a triangle is the center of the inscribed circle.
4) The intersection of the perpendicular bisectors of the sides of a triangle is the center of the circumscribed circle.

6 In the diagram below of ΔABC, $\overline{CD}$ is the bisector of $\angle BCA$, $\overline{AE}$ is the bisector of $\angle CAB$, and $\overline{BG}$ is drawn.



Which statement must be true?
1) $DG = EG$
2) $AG = BG$
3) $\angle AEB \cong \angle AEC$
4) $\angle DBG \cong \angle EBG$

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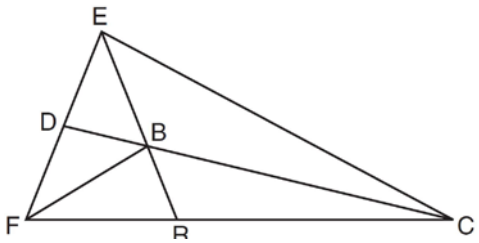
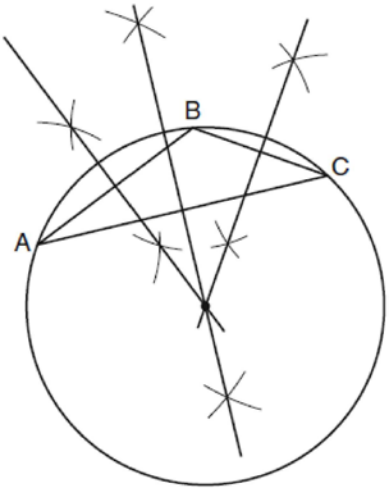
7 In the diagram below, point B is the incenter of ΔFEC, and $\overline{EBR}$, $\overline{CBD}$, and $\overline{FB}$ are drawn.



If $m\angle FEC = 84$ and $m\angle ECF = 28$, determine and state $m\angle BRC$.

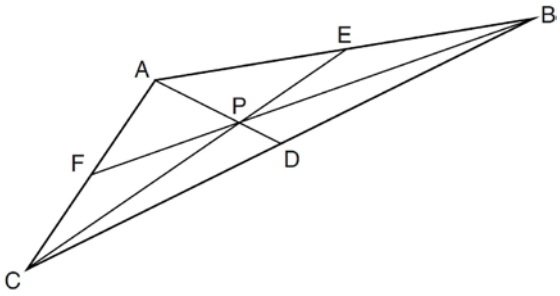
8 The diagram below shows the construction of the center of the circle circumscribed about ΔABC.



This construction represents how to find the intersection of

1) the angle bisectors of ΔABC
2) the medians to the sides of ΔABC
3) the altitudes to the sides of ΔABC
4) the perpendicular bisectors of the sides of ΔABC

9 In the diagram below of ΔABC, $\overline{AE} \cong \overline{BE}$, $\overline{AF} \cong \overline{CF}$, and $\overline{CD} \cong \overline{BD}$.



Point P must be the

1) centroid
2) circumcenter
3) incenter
4) orthocenter

10 In which triangle do the three altitudes intersect outside the triangle?

1) a right triangle
2) an acute triangle
3) an obtuse triangle
4) an equilateral triangle

11 For a triangle, which two points of concurrence could be located outside the triangle?

1) incenter and centroid
2) centroid and orthocenter
3) incenter and circumcenter
4) circumcenter and orthocenter

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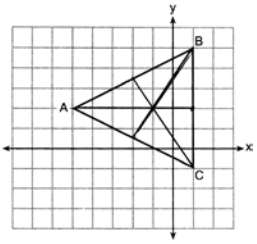
Answer Section

1 ANS: 1

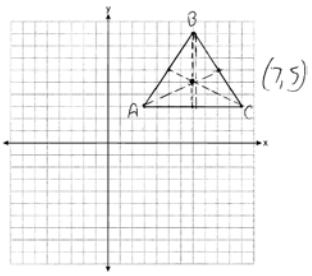


REF: 011516ge

2 ANS: 3 REF: 011110ge

3 ANS: 3 REF: 011202ge

4 ANS:



$(7,5)$ $m_{\overline{AB}} = \left(\frac{3+7}{2}, \frac{3+9}{2} \right) = (5,6)$ $m_{\overline{BC}} = \left(\frac{7+11}{2}, \frac{9+3}{2} \right) = (9,6)$

REF: 081134ge

5 ANS: 1 REF: 081028ge

6 ANS: 4

$\overline{BG}$ is also an angle bisector since it intersects the concurrence of $\overline{CD}$ and $\overline{AE}$

REF: 061025ge

7 ANS:

$180 - \left(\frac{84}{2} + 28 \right) = 180 - 70 = 110$

REF: 061534ge

8 ANS: 4 REF: 080925ge

9 ANS: 1 REF: 061214ge

10 ANS: 3 REF: fall0825ge

11 ANS: 4 REF: 081224ge