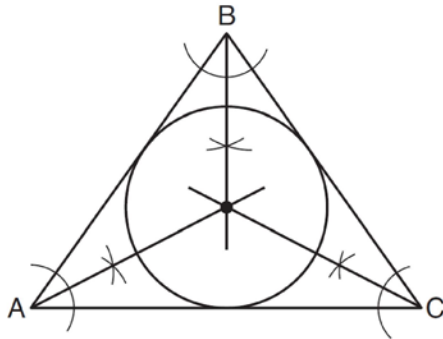


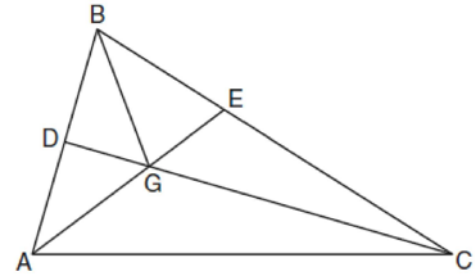
G.CO.C.10: Centroid, Orthocenter, Incenter and Circumcenter

- 1 Which geometric principle is used in the construction shown below?



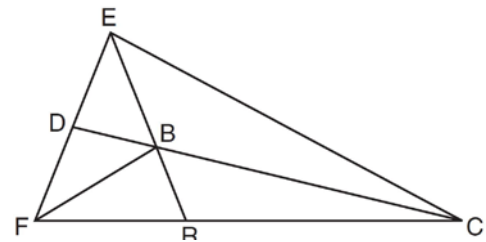
- 1) The intersection of the angle bisectors of a triangle is the center of the inscribed circle.
- 2) The intersection of the angle bisectors of a triangle is the center of the circumscribed circle.
- 3) The intersection of the perpendicular bisectors of the sides of a triangle is the center of the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

- 2 In the diagram below of $\triangle ABC$, \overline{CD} is the bisector of $\angle BCA$, \overline{AE} is the bisector of $\angle CAB$, and \overline{BG} is drawn.



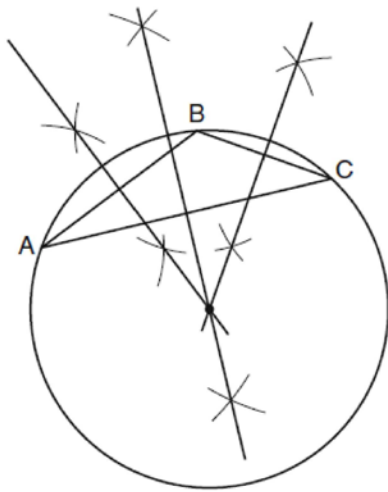
Which statement must be true?

- 1) $DG = EG$
 - 2) $AG = BG$
 - 3) $\angle AEB \cong \angle AEC$
 - 4) $\angle DBG \cong \angle EBG$
- 3 In the diagram below, point B is the incenter of $\triangle FEC$, and \overline{EBR} , \overline{CBD} , and \overline{FB} are drawn.



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

- 4 The diagram below shows the construction of the center of the circle circumscribed about $\triangle ABC$.



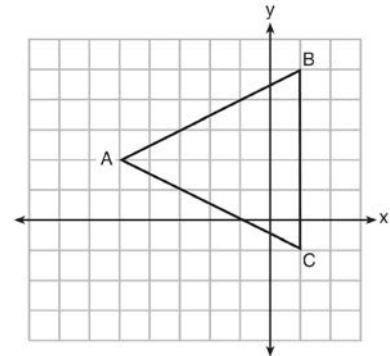
This construction represents how to find the intersection of

- 1) the angle bisectors of $\triangle ABC$
- 2) the medians to the sides of $\triangle ABC$
- 3) the altitudes to the sides of $\triangle ABC$
- 4) the perpendicular bisectors of the sides of $\triangle ABC$

- 5 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

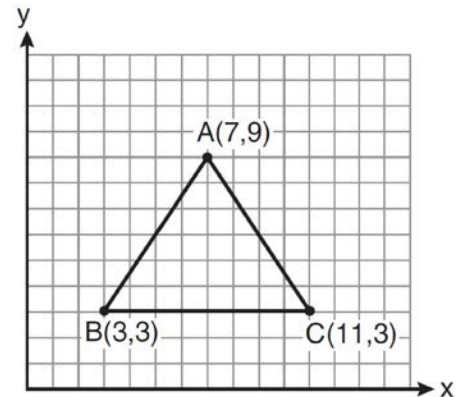
- 6 For a triangle, which two points of concurrence could be located outside the triangle?
- 1) incenter and centroid
 - 2) centroid and orthocenter
 - 3) incenter and circumcenter
 - 4) circumcenter and orthocenter

- 7 Triangle ABC is graphed on the set of axes below.



What are the coordinates of the point of intersection of the medians of $\triangle ABC$?

- 1) $(-1,2)$
 - 2) $(-3,2)$
 - 3) $(0,2)$
 - 4) $(1,2)$
- 8 The vertices of the triangle in the diagram below are $A(7,9)$, $B(3,3)$, and $C(11,3)$.



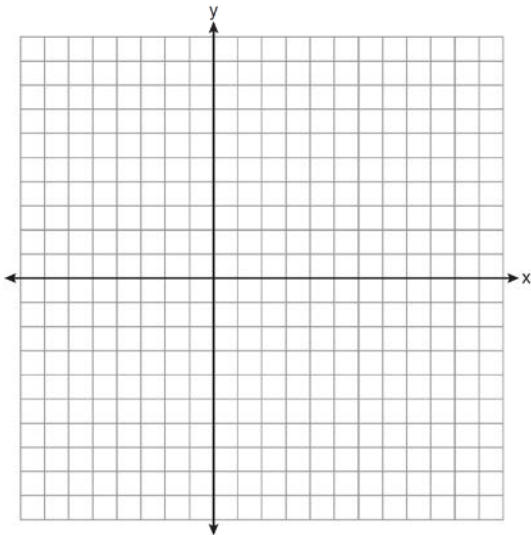
What are the coordinates of the centroid of $\triangle ABC$?

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

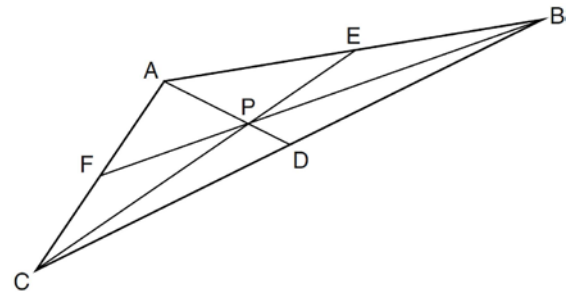
9 In a given triangle, the point of intersection of the three medians is the same as the point of intersection of the three altitudes. Which classification of the triangle is correct?

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

10 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.]



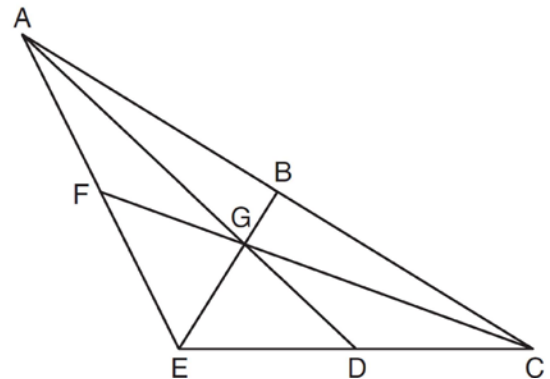
11 In the diagram below of $\triangle ABC$, $\overline{AE} \cong \overline{BE}$, $\overline{AF} \cong \overline{CF}$, and $\overline{CD} \cong \overline{BD}$.



Point P must be the

- 1) centroid
- 2) circumcenter
- 3) Incenter
- 4) orthocenter

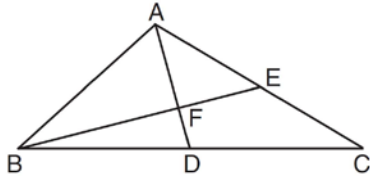
12 In the diagram below of $\triangle ACE$, medians \overline{AD} , \overline{EB} , and \overline{CF} intersect at G . The length of \overline{FG} is 12 cm.



What is the length, in centimeters, of \overline{GC} ?

- 1) 24
- 2) 12
- 3) 6
- 4) 4

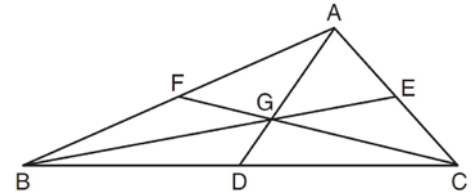
- 13 In the diagram of $\triangle ABC$ below, medians \overline{AD} and \overline{BE} intersect at point F .



If $AF = 6$, what is the length of \overline{FD} ?

- 1) 6
- 2) 2
- 3) 3
- 4) 9

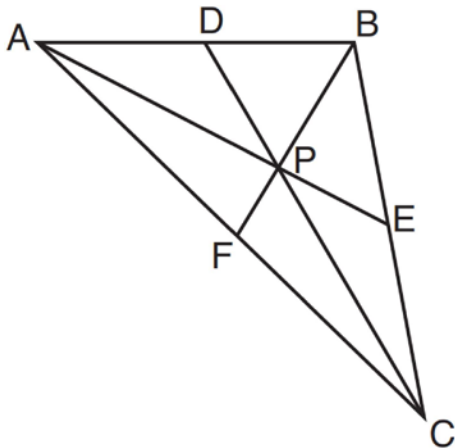
- 15 In the diagram below of $\triangle ABC$, medians \overline{AD} , \overline{BE} , and \overline{CF} intersect at G .



If $CF = 24$, what is the length of \overline{FG} ?

- 1) 8
- 2) 10
- 3) 12
- 4) 16

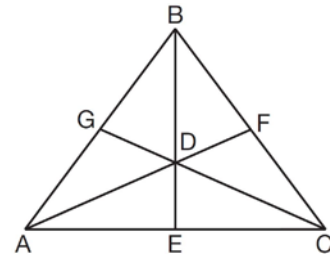
- 14 In $\triangle ABC$ shown below, P is the centroid and $BF = 18$.



What is the length of \overline{BP} ?

- 1) 6
- 2) 9
- 3) 3
- 4) 12

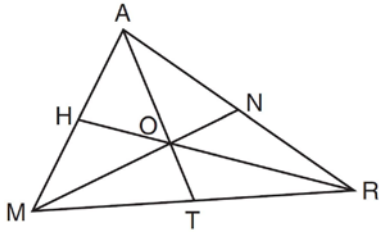
- 16 As shown below, the medians of $\triangle ABC$ intersect at D .



If the length of \overline{BE} is 12, what is the length of \overline{BD} ?

- 1) 8
- 2) 9
- 3) 3
- 4) 4

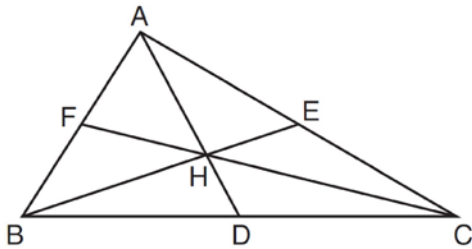
- 17 In the diagram below of $\triangle MAR$, medians \overline{MN} , \overline{AT} , and \overline{RH} intersect at O .



If $TO = 10$, what is the length of \overline{TA} ?

- 1) 30
- 2) 25
- 3) 20
- 4) 15

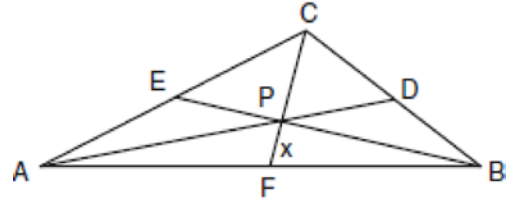
- 18 In the diagram below of $\triangle ABC$, point H is the intersection of the three medians.



If \overline{DH} measures 2.4 centimeters, what is the length, in centimeters, of \overline{AD} ?

- 1) 3.6
- 2) 4.8
- 3) 7.2
- 4) 9.6

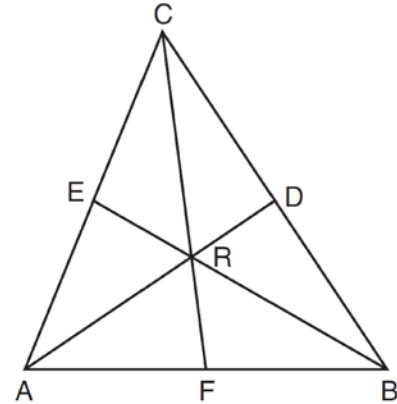
- 19 In the diagram of $\triangle ABC$ below, Jose found centroid P by constructing the three medians. He measured \overline{CF} and found it to be 6 inches.



If $PF = x$, which equation can be used to find x ?

- 1) $x + x = 6$
- 2) $2x + x = 6$
- 3) $3x + 2x = 6$
- 4) $x + \frac{2}{3}x = 6$

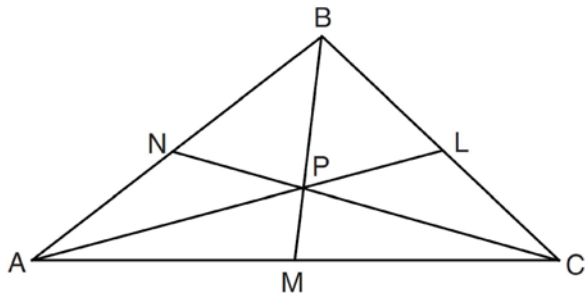
- 20 In $\triangle ABC$ shown below, medians \overline{AD} , \overline{BE} , and \overline{CF} intersect at point R .



If $CR = 24$ and $RF = 2x - 6$, what is the value of x ?

- 1) 9
- 2) 12
- 3) 15
- 4) 27

- 21 In the diagram below, point P is the centroid of $\triangle ABC$.



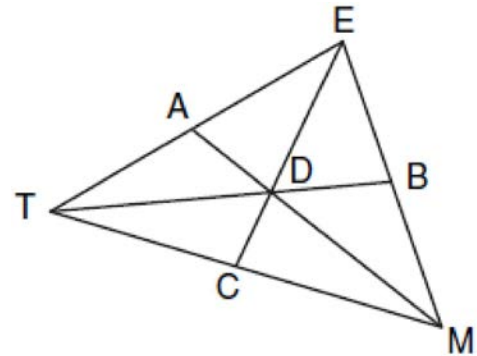
If $PM = 2x + 5$ and $BP = 7x + 4$, what is the length of \overline{PM} ?

- 1) 9
- 2) 2
- 3) 18
- 4) 27

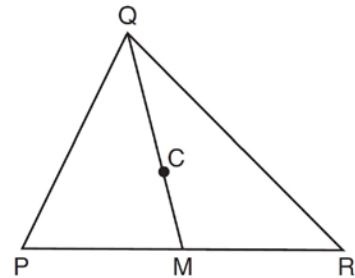
- 22 The three medians of a triangle intersect at a point. Which measurements could represent the segments of one of the medians?

- 1) 2 and 3
- 2) 3 and 4.5
- 3) 3 and 6
- 4) 3 and 9

- 23 In the diagram below of $\triangle TEM$, medians \overline{TB} , \overline{EC} , and \overline{MA} intersect at D , and $TB = 9$. Find the length of \overline{TD} .



- 24 In the diagram below, \overline{QM} is a median of triangle PQR and point C is the centroid of triangle PQR .



If $QC = 5x$ and $CM = x + 12$, determine and state the length of \overline{QM} .

G.CO.C.10: Centroid, Orthocenter, Incenter and Circumcenter

Answer Section

1 ANS: 1 REF: 081028ge

2 ANS: 4

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

REF: 061025ge

3 ANS:

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

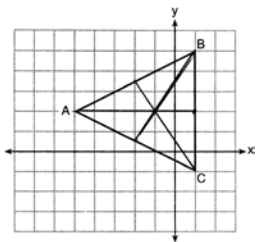
REF: 061534ge

4 ANS: 4 REF: 080925ge

5 ANS: 3 REF: fall0825ge

6 ANS: 4 REF: 081224ge

7 ANS: 1



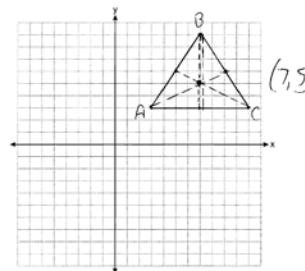
REF: 011516ge

8 ANS: 3 REF: 011110ge

9 ANS: 3 REF: 011202ge

10 ANS:

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



REF: 081134ge

11 ANS: 1 REF: 061214ge

12 ANS: 1 REF: 061104ge

13 ANS: 3

The centroid divides each median into segments whose lengths are in the ratio 2 : 1.

REF: 081307ge

14 ANS: 4

The centroid divides each median into segments whose lengths are in the ratio 2 : 1.

REF: 081220ge

15 ANS: 1

The centroid divides each median into segments whose lengths are in the ratio 2 : 1.

$$\overline{GC} = 2\overline{FG}$$

$$\overline{GC} + \overline{FG} = 24$$

$$2\overline{FG} + \overline{FG} = 24$$

$$3\overline{FG} = 24$$

$$\overline{FG} = 8$$

REF: 081018ge

16 ANS: 1

$$2x + x = 12. \quad \overline{BD} = 2(4) = 8$$

$$3x = 12$$

$$x = 4$$

REF: 011408ge

17 ANS: 1

REF: 061527ge

18 ANS: 3

$$2.4 + 2(2.4) = 7.2$$

REF: 081526ge

19 ANS: 2

The centroid divides each median into segments whose lengths are in the ratio 2 : 1.

REF: 060914ge

20 ANS: 1

$$2(2x - 6) = 24$$

$$2x - 6 = 12$$

$$2x = 18$$

$$x = 9$$

REF: 011619ge

21 ANS: 1

$$7x + 4 = 2(2x + 5). \quad PM = 2(2) + 5 = 9$$

$$7x + 4 = 4x + 10$$

$$3x = 6$$

$$x = 2$$

REF: 011226ge

22 ANS: 3 REF: 061424ge

23 ANS:

6. The centroid divides each median into segments whose lengths are in the ratio 2 : 1. $\overline{TD} = 6$ and $\overline{DB} = 3$

REF: 011034ge

24 ANS:

$$5x = 2(x + 12) \quad QM = 5(8) + (8) + 12 = 60$$

$$5x = 2x + 24$$

$$3x = 24$$

$$x = 8$$

REF: 081433ge