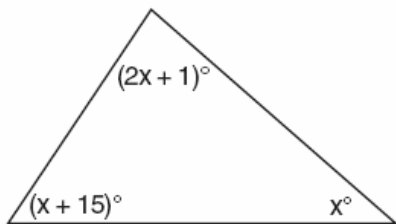


## Section 7-4: Triangles

### Sum of the Measures of the Angles of a Triangle

1. 080216a, P.I. G.G.30

What is the measure of the largest angle in the accompanying triangle?



- [A] 41      [B] 83      [C] 56      [D] 46.5

2. 010538a, P.I. G.G.30

In  $\triangle ABC$ , the measure of  $\angle B$  is 21 less than four times the measure of  $\angle A$ , and the measure of  $\angle C$  is 1 more than five times the measure of  $\angle A$ . Find the measure, in degrees, of *each* angle of  $\triangle ABC$ .

3. 010102a

In right triangle  $ABC$ ,  $m\angle C = 3y - 10$ ,  $m\angle B = y + 40$ , and  $m\angle A = 90$ . What type of right triangle is triangle  $ABC$ ?

- [A] equilateral      [B] scalene  
[C] isosceles      [D] obtuse

4. 010722a

If the measures of the angles of a triangle are represented by  $2x$ ,  $3x - 15$ , and  $7x + 15$ , the triangle is

- [A] a right triangle  
[B] an isosceles triangle  
[C] an equiangular triangle  
[D] an acute triangle

5. 010810a

If the measures, in degrees, of the three angles of a triangle are  $x$ ,  $x + 10$ , and  $2x - 6$ , the triangle must be

- [A] right      [B] isosceles  
[C] scalene      [D] equilateral

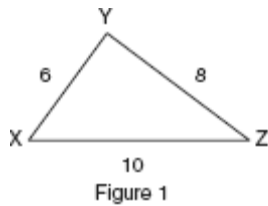
6. 060417a

Which phrase does *not* describe a triangle?

- [A] equilateral equiangular  
[B] isosceles right  
[C] obtuse right      [D] acute scalene

7. 010119a, P.I. G.G.30, G.G.48

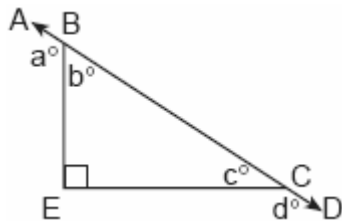
In which of the accompanying figures are segments  $XY$  and  $YZ$  perpendicular?



- [A] figure 1, only      [B] figure 2 only  
[C] both figure 1 and figure 2  
[D] neither figure 1 nor figure 2

8. 010216a, P.I. G.G.36

In the accompanying diagram,  $\overline{ABCD}$  is a straight line, and angle  $E$  in triangle  $BEC$  is a right angle.

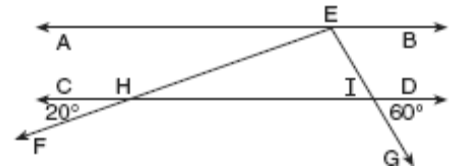


What does  $a^\circ + d^\circ$  equal?

- [A]  $180^\circ$       [B]  $270^\circ$   
[C]  $135^\circ$       [D]  $160^\circ$

9. 060606a, P.I. G.G.36

In the accompanying diagram,  $\overline{AB} \parallel \overline{CD}$ . From point  $E$  on  $\overline{AB}$ , transversals  $\overline{EF}$  and  $\overline{EG}$  are drawn, intersecting  $\overline{CD}$  at  $H$  and  $I$ , respectively.

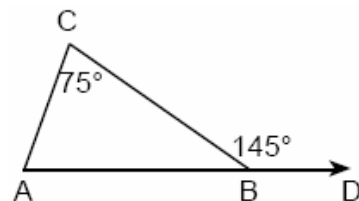


If  $m\angle CHF = 20$  and  $m\angle DIG = 60$ , what is  $m\angle HEI$ ?

- [A] 120      [B] 80      [C] 100      [D] 60

10. 069912a, P.I. G.G.32

In the accompanying diagram of  $\triangle ABC$ ,  $\overline{AB}$  is extended to  $D$ , exterior angle  $CBD$  measures  $145^\circ$ , and  $m\angle C = 75^\circ$ .

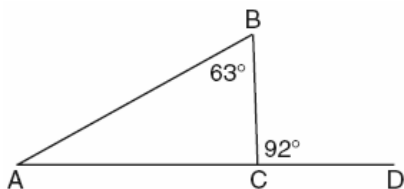


What is  $m\angle CAB$ ?

- [A] 35      [B] 220      [C] 110      [D] 70

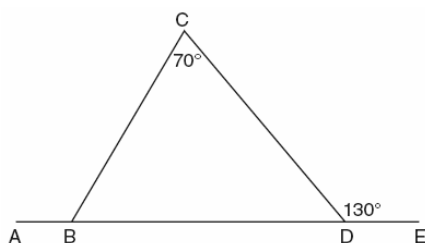
11. 080121a, P.I. G.G.32

Triangle  $ABC$ , with side  $\overline{AC}$  extended to  $D$ , is shown in the accompanying diagram. If  $m\angle ABC = 63$  and  $m\angle BCD = 92$ , what is  $m\angle BAC$ ?



12. 060431a, P.I. G.G.32

In the accompanying diagram of  $\triangle BCD$ ,  $m\angle C = 70$ ,  $m\angle CDE = 130$ , and side  $\overline{BD}$  is extended to  $A$  and to  $E$ . Find  $m\angle CBA$ .



14. 010223a, P.I. G.G.30

Vertex angle  $A$  of isosceles triangle  $ABC$  measures  $20^\circ$  more than three times  $m\angle B$ . Find  $m\angle C$ .

15. 080433a, P.I. G.G.31

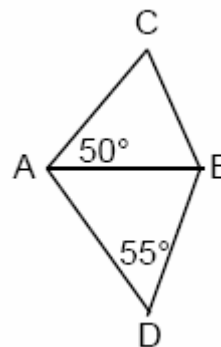
Dylan says that all isosceles triangles are acute triangles. Mary Lou wants to prove that Dylan is *not* correct. Sketch an isosceles triangle that Mary Lou could use to show that Dylan's statement is not true. In your sketch, state the measure of *each* angle of the isosceles triangle.

16. 060027a, P.I. G.G.31

Hersch says if a triangle is an obtuse triangle, then it cannot also be an isosceles triangle. Using a diagram, show that Hersch is incorrect, and indicate the measures of all the angles and sides to justify your answer.

17. 069930a, P.I. G.G.31

In the accompanying diagram,  $\triangle ABC$  and  $\triangle ABD$  are isosceles triangles with  $m\angle CAB = 50$  and  $m\angle BDA = 55$ . If  $AB=AC$  and  $AB=BD$ , what is  $m\angle CBD$ ?



### Properties of Special Triangles

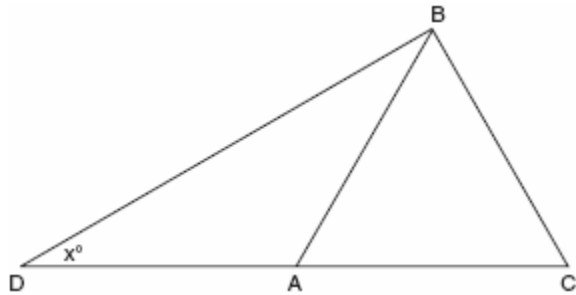
13. 060107a, P.I. G.G.30

In isosceles triangle  $DOG$ , the measure of the vertex angle is three times the measure of one of the base angles. Which statement about  $\triangle DOG$  is true?

- [A]  $\triangle DOG$  is an acute triangle.
- [B]  $\triangle DOG$  is a scalene triangle.
- [C]  $\triangle DOG$  is a right triangle.
- [D]  $\triangle DOG$  is an obtuse triangle.

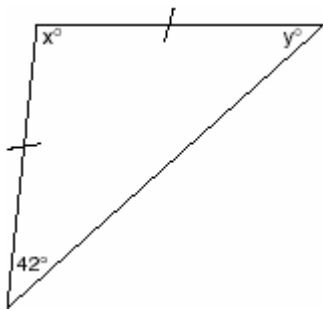
18. 080221a, P.I. G.G.31

In the accompanying diagram of  $\triangle BCD$ ,  $\triangle ABC$  is an equilateral triangle and  $AD = AB$ . What is the value of  $x$ , in degrees?



19. 060510a, P.I. G.G.31

Tina wants to sew a piece of fabric into a scarf in the shape of an isosceles triangle, as shown in the accompanying diagram.

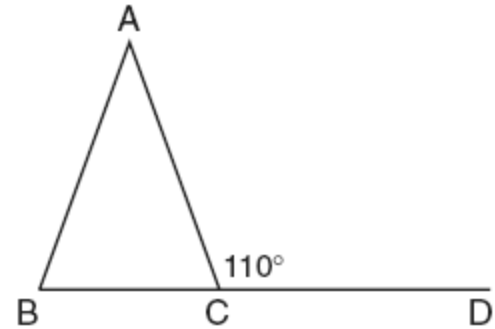


What are the values of  $x$  and  $y$ ?

- [A]  $x = 96$  and  $y = 42$
- [B]  $x = 90$  and  $y = 48$
- [C]  $x = 42$  and  $y = 96$
- [D]  $x = 69$  and  $y = 69$

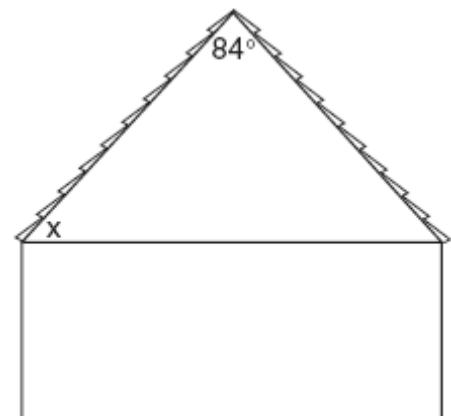
20. 080734a, P.I. G.G.31

In the accompanying diagram of isosceles triangle  $ABC$ ,  $\overline{AB} \cong \overline{AC}$ , and exterior angle  $ACD = 110^\circ$ . What is  $m\angle BAC$ ?



21. 060615a, P.I. G.G.31

The accompanying diagram shows the roof of a house that is in the shape of an isosceles triangle. The vertex angle formed at the peak of the roof is  $84^\circ$ .

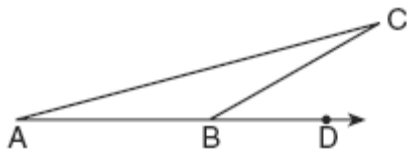


What is the measure of  $x$ ?

- [A]  $48^\circ$  [B]  $84^\circ$  [C]  $138^\circ$  [D]  $96^\circ$

22. 010613a, P.I. G.G.31

In the accompanying diagram of  $\triangle ABC$ ,  $\overline{AB}$  is extended through  $D$ ,  $m\angle CBD = 30$ , and  $\overline{AB} \cong \overline{BC}$ .



What is the measure of  $\angle A$ ?

[A]  $75^\circ$  [B]  $150^\circ$  [C]  $30^\circ$  [D]  $15^\circ$

24. 060734a, P.I. G.G.18

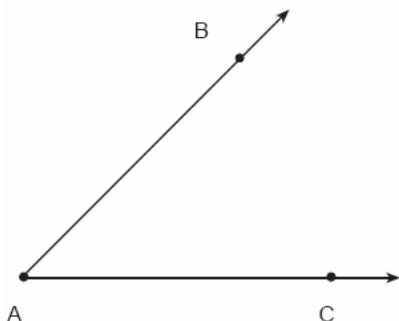
Using a compass and straightedge, construct the perpendicular bisector of  $\overline{AB}$  shown below. Show all construction marks.



### Hands-On Activities

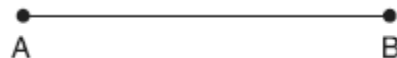
23. 060022a, P.I. G.G.17

Using only a ruler and compass, construct the bisector of angle  $BAC$  in the accompanying diagram.



25. 060435a, P.I. G.G.18

Using only a compass and a straightedge, construct the perpendicular bisector of  $\overline{AB}$  and label it  $c$ . [Leave all construction marks.]



[1] B

[4]  $m\angle A = 20$ ,  $m\angle B = 59$ , and  $m\angle C = 101$ ,  
and appropriate work is shown.

[3] Appropriate work is shown, but one  
computational error is made.

or [3] A correct equation is written and  
solved, and the correct measures for the  
angles are found, but they are not labeled or  
are labeled incorrectly.

[2] Appropriate work is shown, but two or  
more computational errors are made.

or [2] Appropriate work is shown, but one  
conceptual error is made.

or [2] A correct equation is written and solved  
for  $x$ , but the measures of the angles are not  
found.

or [2] An incorrect equation of equal  
difficulty is solved appropriately, and the  
three angles are found.

[1] Appropriate work is shown, but one  
conceptual error and one computational error  
are made.

or [1] A correct equation is written, but no  
further correct work is shown.

or [1]

$m\angle A = 20$ ,  $m\angle B = 59$ , and  $m\angle C = 101$ ., but  
no work is shown.

[0]  $m\angle A = 20$  or  $m\angle B = 59$  or  $m\angle C = 101$ ,  
but no work is shown.

or [0] A zero response is completely  
incorrect, irrelevant, or incoherent or is a  
correct response that was obtained by an

[2] obviously incorrect procedure.

[3] B

[4] B

[5] C

[6] C

[7] C

[8] B

[9] C

[10] D

[2] 29, and appropriate work is shown, such  
as  $92 - 63 = 29$ .

[1] The correct application of the exterior  
angle theorem is shown, but one or more  
computational errors are made.

or [1] The correct application of  
supplementary angles and the sum of the  
angles of a triangle are shown, but one or  
more computational errors are made.

or [1]  $m\angle BCA$  is calculated incorrectly, but  
the sum of the angles in a triangle is used  
appropriately.

or [1] 29, but no work is shown.

[0] A zero response is completely incorrect,  
irrelevant, or incoherent or is a correct  
response that was obtained by an obviously

[11] incorrect procedure.

[2] 120, and appropriate work is shown, such  
as  $m\angle CDB = 180 - 130 = 150$  and  
 $m\angle CBA = 70 + 50 = 120$  or correctly labeled  
angles in a diagram.

[1] Appropriate work is shown, but one  
computational error is made.

or [1] Appropriate work is shown, but one  
conceptual error is made.

or [1]  $m\angle CBD = 60$  is found, but no further  
correct work is shown.

or [1] 120, but no work is shown.

[0] A zero response is completely incorrect,  
irrelevant, or incoherent or is a correct  
response that was obtained by an obviously

[12] incorrect procedure.

[13] D

- [2] 32, and appropriate work is shown, such as a diagram or “let” statements and an appropriate equation, such as  $5x + 20 = 180$ .  
or [2] 32, and an appropriate trial-and-error method with at least two trials and appropriate checks are shown.  
[1] Appropriate work is shown, but one computational error is made.  
or [1] An incorrect equation set equal to  $180^\circ$  is shown, but it is solved appropriately, such as  $4x + 20 = 180$ ; or an incorrect equation set equal to  $360^\circ$  is shown, such as  $5x + 20 = 360$ .  
or [1] 32, and an appropriate trial-and-error method with less than two trials and appropriate checks are shown.  
or [1] 32, but no work is shown.  
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- [14] incorrect procedure.
- [2] An isosceles triangle that is not acute is drawn, and its three angles are labeled, such as 20, 20, 140 or 45, 45, 90.  
[1] An isosceles triangle is drawn that shows an angle that is not acute, but the base angles are not labeled.  
or [1] The three angles are stated correctly, but no triangle is drawn.  
[0] The triangle that is drawn and labeled is not isosceles or is acute.  
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- [15] obviously incorrect procedure.
- [3] The student draws an obtuse triangle and all sides and all angles are correctly calculated, such as by using  $120^\circ$ ,  $30^\circ$ , and  $30^\circ$  and sides 4, 4, and 10.  
[2] The student has the angles correctly indicated and the two congruent sides marked, but the length of the longest side is incorrect or is missing.  
or [2] All sides are correctly marked, but the angles do not add to  $180^\circ$ , but an obtuse angle and two congruent angles are shown.  
[1] Only the angles are correctly shown.  
or [1] Only the sides are correctly shown.  
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- [16] incorrect procedure.
- [3] 135 and appropriate work is shown.  
[2] The two correct angles of  $65^\circ$  and  $70^\circ$  are found, but their sum is not identified as the answer to the question.  
or [2]  $65^\circ$  or  $70^\circ$  and an appropriate sum is found.  
[1] Either the  $65^\circ$  or the  $70^\circ$  is correctly identified.  
or [1] Two incorrect angle measures are found, but they are added correctly.  
or [1] 135 and no work is shown.  
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- [17] incorrect procedure.
- [2] 30, and appropriate work is shown or an appropriate explanation is given.  
[1] Angles of the equilateral triangle are shown to be  $60^\circ$ , but  $x$  is not determined or is determined incorrectly.  
or [1] 30, but no work is shown or no explanation is given.  
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- [18] incorrect procedure.
- [19] A

[2] 40, and appropriate work is shown, such as  $x = 180 - (70 + 70)$  or correctly labeling all the angles in the diagram.

[1] Appropriate work is shown, but one computational error is made.

or [1] Appropriate work is shown, but one conceptual error is made.

or [1] A correct equation is written, but no further correct work is shown.

or [1] The measures of  $\angle ACB$  and  $\angle ABC$  are both found to be  $70^\circ$ , but no further correct work is shown.

or [1] An incorrect equation of equal difficulty is solved appropriately.

or [1] 40, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[20] incorrect procedure.

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[21] A

---

[22] D

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[2] A correct construction is drawn to find the midpoint of  $\overline{BC}$ , showing both sets of arcs and a line connecting A with the midpoint.

[1] A correct construction is drawn to find the midpoint of  $\overline{BC}$ , but the median is not drawn.

or [1] The construction is appropriate, but a compass and a straightedge are not used.

[0] No construction arcs are shown.

or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an

[23] obviously incorrect procedure.

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[2] A correct construction is drawn, showing the arcs intersecting above and below  $\overline{AB}$ , and the perpendicular line is drawn.

[1] All of the construction arcs are drawn, but the perpendicular line is not drawn.

[0] A drawing that is not an appropriate construction is shown.

or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an

[24] obviously incorrect procedure.

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[2] A correct construction is drawn, showing the arcs intersecting above and below  $\overline{AB}$ , and line c is drawn.

[1] A correct construction is drawn, but line c is not labeled.

[0] A drawing that is not a construction is shown with arc marks sketched.

or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an

[25] obviously incorrect procedure.

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