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G.G.31: Investigate, justify, and apply the isosceles triangle theorem and its converse

1. fall0809ge, P.I. G.G.31

The vertices of $\triangle ABC$ are $A(-1,-2)$, $B(-1,2)$ and $C(6,0)$. Which conclusion can be made about the angles of $\triangle ABC$?

- [A] $m\angle ABC = 60$ [B] $m\angle A = m\angle C$
[C] $m\angle A = m\angle B$ [D] $m\angle ACB = 90$

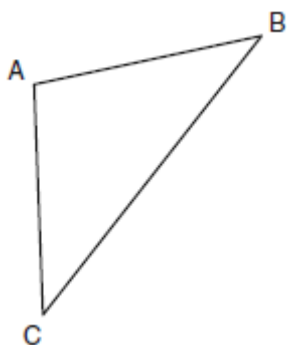
2. 060107a, P.I. G.G.31

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

3. 080903ge, P.I. G.G.31

In the diagram of $\triangle ABC$ below, $\overline{AB} \cong \overline{AC}$. The measure of $\angle B$ is 40° .

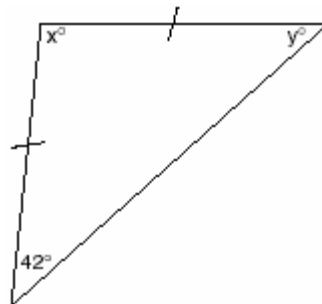


What is the measure of $\angle A$?

- [A] 50° [B] 100° [C] 70° [D] 40°

4. 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.

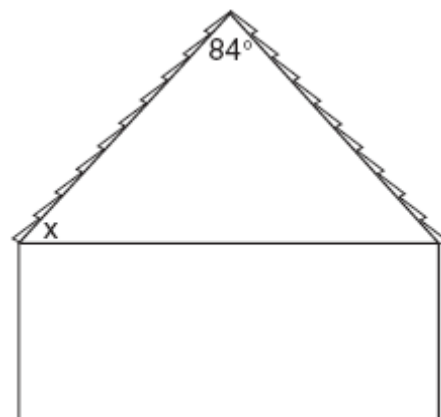


What are the values of x and y ?

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

5. 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° .



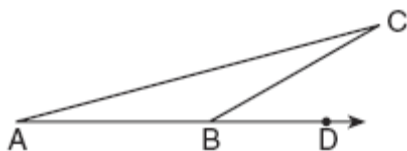
What is the measure of x ?

- [A] 48° [B] 96° [C] 84° [D] 138°

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6. 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] 30° [B] 15° [C] 75° [D] 150°

7. 080433a, P.I. G.G.31

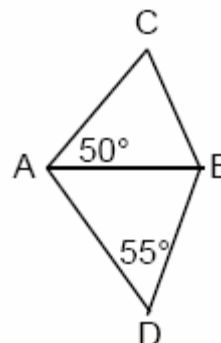
Dylan says that all isosceles triangles are acute triangles. Mary Lou wants to prove that Dylan is *not* correct. Sketch an isosceles triangle that Mary Lou could use to show that Dylan's statement is not true. In your sketch, state the measure of *each* angle of the isosceles triangle.

8. 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.

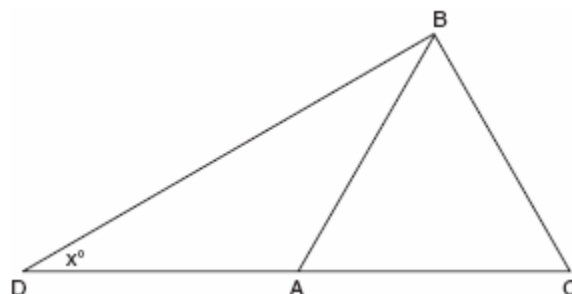
9. 069930a, P.I. G.G.31

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 $m\angle CBD$?



10. 080221a, P.I. G.G.31

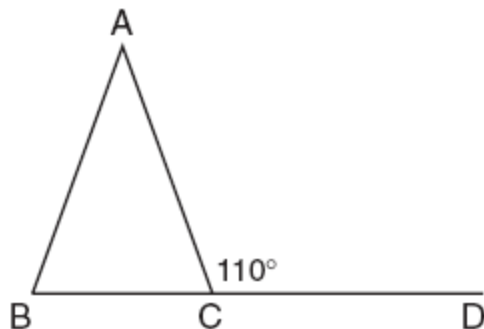
In the accompanying diagram of $\triangle BCD$, $\triangle ABC$ is an equilateral triangle and $AD = AB$. What is the value of x , in degrees?



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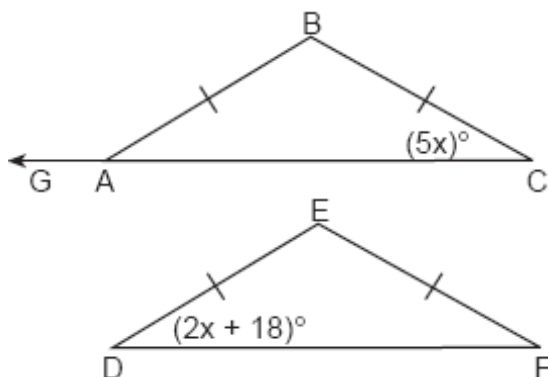
11. 080734a, P.I. G.G.31

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



12. 060838a, P.I. G.G.31

In the accompanying diagram, isosceles $\triangle ABC \cong$ isosceles $\triangle DEF$, $m\angle C = 5x$, and $m\angle D = 2x + 18$. Find $m\angle B$ and $m\angle BAG$.



13. 010223a, P.I. G.G.31

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

14. 060733a, P.I. G.G.31

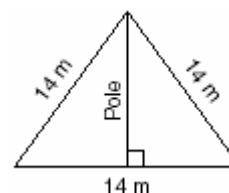
The perimeter of an isosceles triangle is 71 centimeters. The measure of one of the sides is 22 centimeters. What are all the possible measures of the other two sides?

15. 080829b, P.I. G.G.31

A parcel of land is in the shape of an isosceles triangle. The base has a length of 673 feet and the two equal legs meet at an angle of 43° . Find, to the nearest square foot, the area of the parcel of land.

16. 080504b, P.I. G.G.31

The accompanying diagram shows two cables of equal length supporting a pole. Both cables are 14 meters long, and they are anchored to points in the ground that are 14 meters apart.



What is the exact height of the pole, in meters?

- [A] $7\sqrt{3}$ [B] 7 [C] 14 [D] $7\sqrt{2}$

17. 089920a, P.I. G.G.31

What is the perimeter of an equilateral triangle whose height is $2\sqrt{3}$?

- [A] $6\sqrt{3}$ [B] 6 [C] $12\sqrt{3}$ [D] 12

18. 080914b, P.I. G.G.31

What is the length of the altitude of an equilateral triangle whose side has a length of 8?

- [A] $4\sqrt{3}$ [B] 32 [C] 4 [D] $4\sqrt{2}$

19. 080613b, P.I. G.G.31

If the perimeter of an equilateral triangle is 18, the length of the altitude of this triangle is

- [A] $3\sqrt{3}$ [B] $6\sqrt{3}$ [C] 3 [D] 6

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[1] C _____

[2] A _____

[3] B _____

[4] D _____

[5] A _____

[6] B _____

[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

[7] obviously incorrect procedure.

[3] The student draws an obtuse triangle and all sides and all angles are correctly calculated, such as by using 120° , 30° , and 30° 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° , 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

[8] incorrect procedure.

[3] 135 and appropriate work is shown.

[2] The two correct angles of 65° and 70° are found, but their sum is not identified as the answer to the question.

or [2] 65° or 70° and an appropriate sum is found.

[1] Either the 65° or the 70° 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.

[9]

[2] 30, and appropriate work is shown or an appropriate explanation is given.

[1] Angles of the equilateral triangle are shown to be 60° , 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

[10] incorrect procedure.

[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° , 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

[11] incorrect procedure.

- [4] $m\angle B = 120$ and $m\angle BAG = 150$, and appropriate work is shown.
 [3] Appropriate work is shown, but one computational error is made.
 or [3] Appropriate work is shown, but only $m\angle B$ or $m\angle BAG$ is found.
 or [3] Appropriate work is shown, and the correct answers 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] Appropriate work is shown to find $x=6$, but no further correct work is shown.
 [1] $5x=2x+18$ is written, but no further correct work is shown.
 or [1] $m\angle B = 120$ and $m\angle BAG = 150$, but no work is shown.
 [0] $m\angle B = 120$ or $m\angle BAG = 150$, 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 obviously incorrect procedure.
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- [12]

- [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° is shown, but it is solved appropriately, such as $4x + 20 = 180$; or an incorrect equation set equal to 360° 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.
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- [13]

- [2] 22, 27 and 24.5, 24.5, or 22, 27, and 24.5, and appropriate work is shown, such as a labeled 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] Appropriate work is shown, but only one of the two possible sets of numbers is found.
 or [1] 22, 27 and 24.5, 24.5, or 22, 27, and 24.5, 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.
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- [14]
- [4] 287,457, and appropriate work is shown, such as using trigonometry and the area formula or the Law of Sines and the area formula.
 [3] Appropriate work is shown, but one computational or rounding error is made.
 [2] Appropriate work is shown, but two or more computational or rounding errors are made.
 or [2] Appropriate work is shown, but one conceptual error is made, such as using an incorrect trigonometric function.
 [1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
 or [1] The length of the altitude or the length of a leg is found correctly, but no further correct work is shown.
 or [1] Correct, substitutions are made into the Law of Sines, but no further correct work is shown.
 or [1] 287,457, 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.
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- [15]

- [16] A _____
 [17] D _____
 [18] A _____

[19] A