

SCAVENGER HUNT



AREA OF A TRIANGLE USING SINE

Area = $\frac{1}{2}ab \sin C$: Which Two Sides?

Three sides, one angle · obtuse angles too · the cards check the answers

FREE

ANSWER

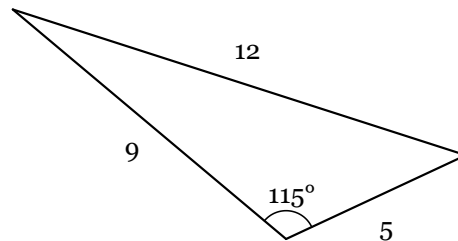
112.2

A triangle drawn to scale.

Find the area.

Round to the nearest tenth.

Put a finger on the arc. Which two sides meet at that corner?



R

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1. **Tape the 16 cards around the room**, in any order. Each card has a large letter in its bottom left corner. Start each group at a *different* one of these eight cards: *R J B F M K N G*.
2. **Say this once:** “Set your calculator to degrees. Sin 30 must show 0.5. Each card shows three sides. Use only the two sides that meet at the arc. Round the area to the nearest tenth, like 17.3. Then walk to the card with that answer at the top.”
3. **Each group writes one line per card.** Eight right answers bring the group back to its first card.

16 cards	pages 3–10, one copy. There are two cards on each sheet. Cut the whole stack once.
Record sheet	page 11, one per student. It shows the formula on a labeled triangle.
Answers	pages 12–13, for you only. Do not put them up in the room.

Every card shows a triangle drawn to scale, turned a different way, with all three sides labeled and one angle marked. The area is $\frac{1}{2} \times a \times b \times \sin C$, where a and b are the two sides that meet at the marked angle C . The third side is not used. On three of the eight ring cards the marked angle is more than 90° . The student does nothing extra there: the calculator gives $\sin 115^\circ$ directly, and it is the same number as $\sin 65^\circ$.

Eight of the sixteen cards make the ring. A group reaches the other eight only by a wrong answer, but all the cards look the same. There are two mistakes. In the first, the student uses the side across from the marked angle, which does not touch it. In the second, the student leaves out the $\frac{1}{2}$ and gets twice the area. Each of these lands on a card off the ring. That card sends the group back to the card it got wrong.

The check is the length of the group’s list. A clean run is **eight lines**. Each wrong answer adds two. Every card has a line in italics under its question. It tells a group that arrived by a wrong answer what to check. A group that arrived by a right answer skips it. Guessing does not work: no single rule, such as always using the two largest numbers, gets more than six of the cards. If a group keeps coming back to the same cards, ask: “*Put a finger on the arc. Which two sides meet there? Is your area less than half of those two sides multiplied together?*”



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ANSWER

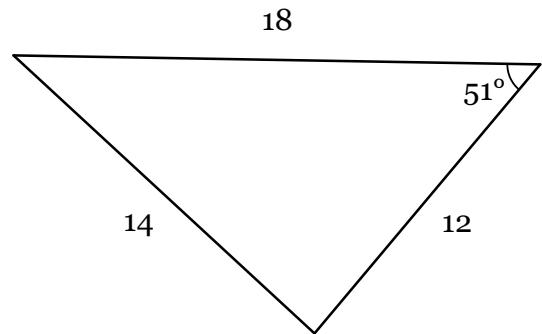
104.6

A triangle drawn to scale.

Find the area.

Round to the nearest tenth.

Check the formula on the strip. Every part of it belongs in your work.



A

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ANSWER

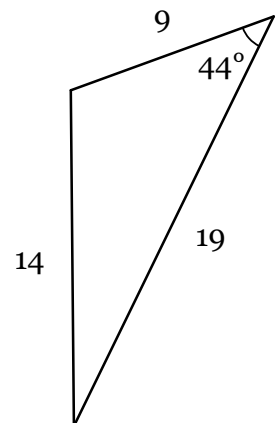
98.3

A triangle drawn to scale.

Find the area.

Round to the nearest tenth.

The side across from the arc does not touch the angle. Leave it out.



B

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ANSWER

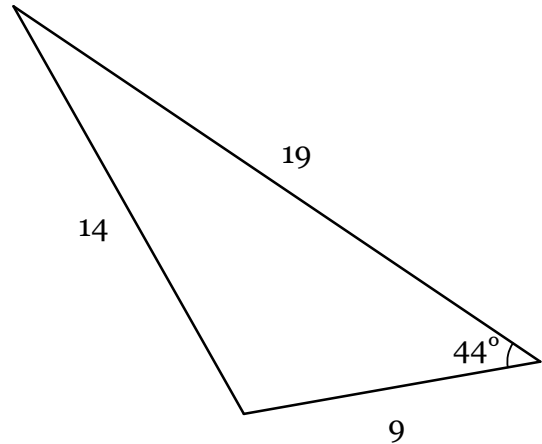
77.9

A triangle drawn to scale.

Find the area.

Round to the nearest tenth.

A triangle is half of a parallelogram. Keep the half in the formula.



C

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ANSWER

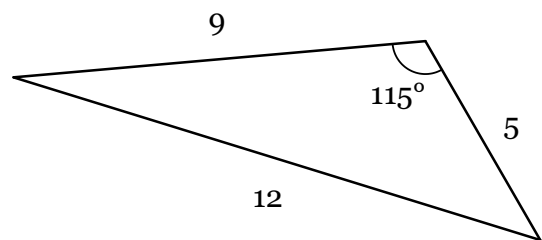
196.7

A triangle drawn to scale.

Find the area.

Round to the nearest tenth.

Compare: your area must be less than half of $a \times b$.



D

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ANSWER

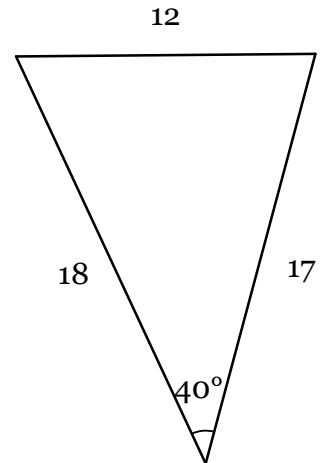
43.8

A triangle drawn to scale.

Find the area.

Round to the nearest tenth.

The sides that touch the arc are a and b. The third side is not.



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E

ANSWER

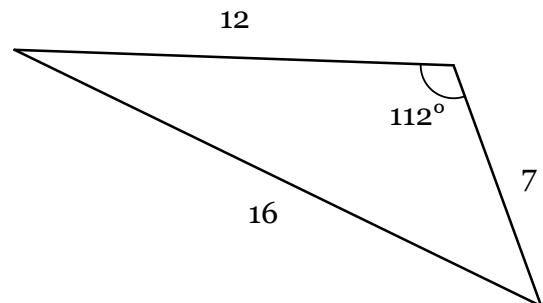
59.4

A triangle drawn to scale.

Find the area.

Round to the nearest tenth.

Write the half first, then the two sides, then the sine.



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F

ANSWER

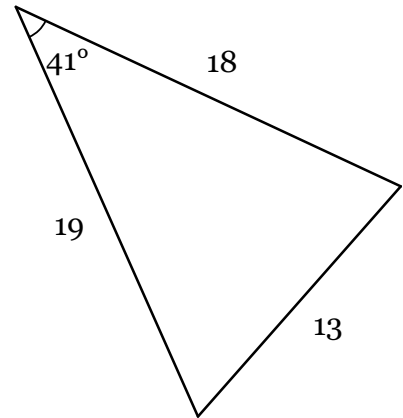
124.3

A triangle drawn to scale.

Find the area.

Round to the nearest tenth.

Half, side, side, sine. Count the four parts in your work.



G

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ANSWER

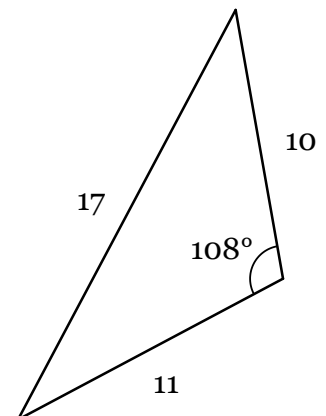
93.2

A triangle drawn to scale.

Find the area.

Round to the nearest tenth.

Two sides and the angle between them: that is all the formula takes.



H

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ANSWER

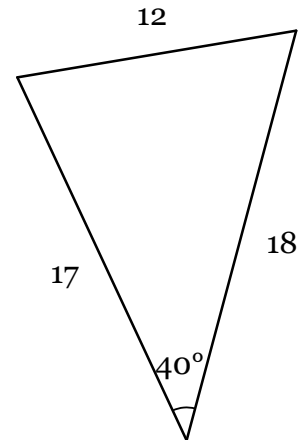
20.4

A triangle drawn to scale.

Find the area.

Round to the nearest tenth.

Half of a times b is the most the area can be. Check your answer.



J

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ANSWER

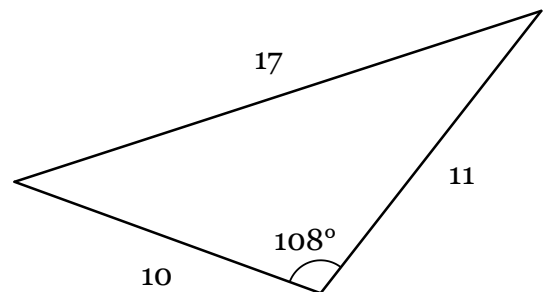
83.9

A triangle drawn to scale.

Find the area.

Round to the nearest tenth.

Is your area less than half of the product of the two sides?



K

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ANSWER

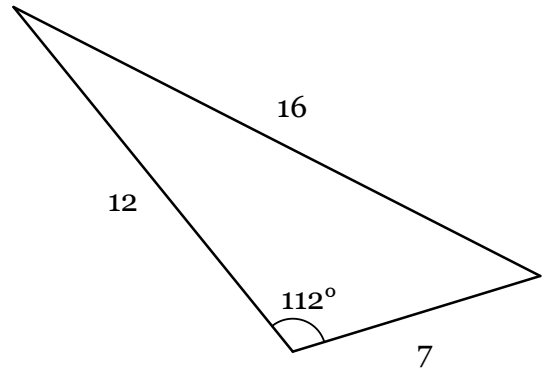
65.3

A triangle drawn to scale.

Find the area.

Round to the nearest tenth.

Each number sits next to its own side. Which two touch the arc?



L

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ANSWER

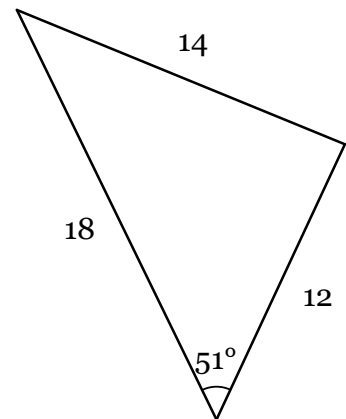
38.9

A triangle drawn to scale.

Find the area.

Round to the nearest tenth.

Three sides are given, and only two go into the formula. Which two?



M

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ANSWER

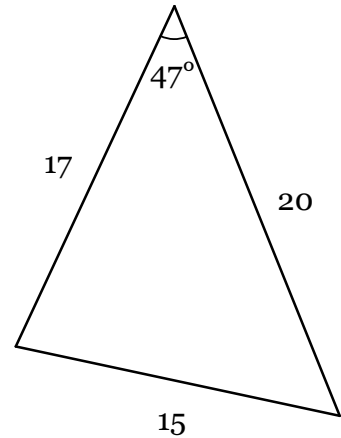
52.3

A triangle drawn to scale.

Find the area.

Round to the nearest tenth.

Trace the two sides from the arc with a pencil. Use those numbers.



N

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ANSWER

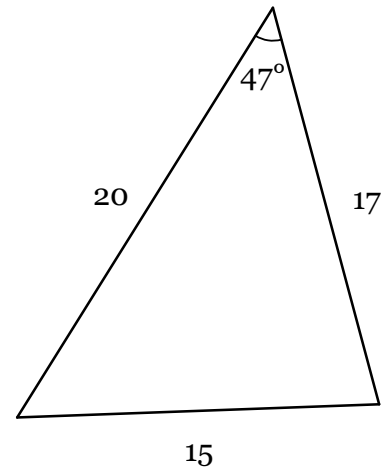
224.4

A triangle drawn to scale.

Find the area.

Round to the nearest tenth.

Estimate first: half of a times b. Is your area less than that?



P

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ANSWER

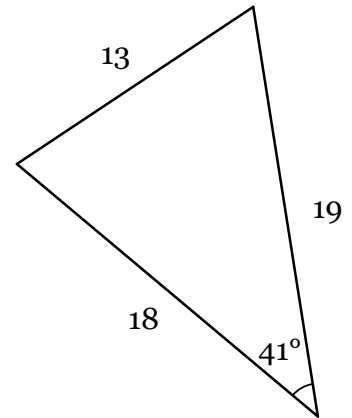
27.2

A triangle drawn to scale.

Find the area.

Round to the nearest tenth.

Find the corner with the arc. Its two sides go into the formula.



Q

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ANSWER

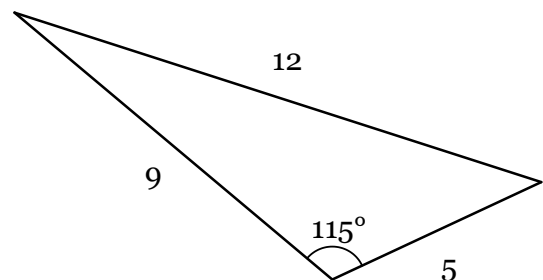
112.2

A triangle drawn to scale.

Find the area.

Round to the nearest tenth.

Put a finger on the arc. Which two sides meet at that corner?



R

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Scavenger Hunt — where I went

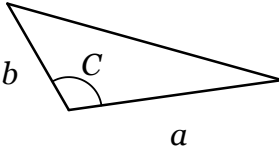
Area of a triangle with sine

Name _____

Period _____

Date _____

For each card, write the two sides that meet at the arc, then the angle, then the area. **Round the area once, at the end, to the nearest tenth, like 17.3.** Then find the card with your answer at the top. A clean run is eight lines. Each card has a line in italics under its question. **If you are on a card because you went wrong, its line says what to check. If you were right, skip it.**



Area = $\frac{1}{2} \times a \times b \times \sin C$. *C* is the angle between the sides *a* and *b*: the corner where the two sides meet.

Calculator in degree mode: sin 30 must show 0.5. Keep every digit. Round the area once, at the end, to the nearest tenth.

The area is always less than $\frac{1}{2} \times a \times b$. An angle over 90° works the same way: $\sin 120^\circ = \sin 60^\circ$.

Card letter	The two sides that meet at the arc	The angle	Area, in square units
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Why is the angle between the two sides always happy?

Every number stands for a letter. Write the letter for each answer in the box above its number. Read the boxes you filled, left to right. **If they do not spell the answer, one of your answers is wrong.**

20.4 = I 27.2 = U 38.9 = N 43.8 = D 52.3 = C 59.4 = L 65.3 = I 77.9 = D 83.9 = U 93.2 = C 98.3 = D 104.6 = L
 112.2 = E 124.3 = D 196.7 = E 224.4 = N

20.4	27.2	38.9	43.8	52.3	59.4	65.3	77.9	83.9	93.2	98.3	104.6	112.2	124.3	196.7	224.4



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Scavenger Hunt — answers

For the teacher

The ring in order, with the answer found on each card. A group may begin anywhere on it. Wherever it begins, eight right answers bring it back to that card.

R (20.4) → J (98.3) → B (59.4) → F (38.9) → M (83.9) → K (52.3) → N (124.3) → G (112.2) → R

Why is the angle between the two sides always happy? The answer is *INCLUDED!* It is read along the boxes of the record sheet, which run from the smallest number to the largest. Every sine below is the calculator's value in degree mode, to four places. The area is rounded only at the end.

Card	What the card shows	Answer, and why	The common wrong answer on this card, and why	Letter of its top
1 R	Sides 5, 9 and 12. The 115° arc is at the corner where 5 and 9 meet.	20.4. The 115° angle is between the sides 5 and 9, so the area is $\frac{1}{2} \times 5 \times 9 \times \sin 115^\circ = \frac{1}{2} \times 5 \times 9 \times 0.9063 = 20.4$ square units.	27.2. The 12 is used in place of the 9: $\frac{1}{2} \times 5 \times 12 \times \sin 115^\circ = 27.2$. The side 12 is across from the marked angle and does not touch it.	E
2 J	Sides 17, 18 and 12. The 40° arc is at the corner where 17 and 18 meet.	98.3. The 40° angle is between the sides 17 and 18, so the area is $\frac{1}{2} \times 17 \times 18 \times \sin 40^\circ = \frac{1}{2} \times 17 \times 18 \times 0.6428 = 98.3$ square units.	196.7. The 1/2 is left out: $17 \times 18 \times \sin 40^\circ = 196.7$, twice the area. It is more than $\frac{1}{2} \times 17 \times 18$, so it cannot be right.	I
3 B	Sides 9, 19 and 14. The 44° arc is at the corner where 9 and 19 meet.	59.4. The 44° angle is between the sides 9 and 19, so the area is $\frac{1}{2} \times 9 \times 19 \times \sin 44^\circ = \frac{1}{2} \times 9 \times 19 \times 0.6947 = 59.4$ square units.	43.8. The 14 is used in place of the 19: $\frac{1}{2} \times 9 \times 14 \times \sin 44^\circ = 43.8$. The side 14 is across from the marked angle and does not touch it.	D
4 F	Sides 7, 12 and 16. The 112° arc is at the corner where 7 and 12 meet.	38.9. The 112° angle is between the sides 7 and 12, so the area is $\frac{1}{2} \times 7 \times 12 \times \sin 112^\circ = \frac{1}{2} \times 7 \times 12 \times 0.9272 = 38.9$ square units.	77.9. The 1/2 is left out: $7 \times 12 \times \sin 112^\circ = 77.9$, twice the area. It is more than $\frac{1}{2} \times 7 \times 12$, so it cannot be right.	L
5 M	Sides 12, 18 and 14. The 51° arc is at the corner where 12 and 18 meet.	83.9. The 51° angle is between the sides 12 and 18, so the area is $\frac{1}{2} \times 12 \times 18 \times \sin 51^\circ = \frac{1}{2} \times 12 \times 18 \times 0.7771 = 83.9$ square units.	65.3. The 14 is used in place of the 18: $\frac{1}{2} \times 12 \times 14 \times \sin 51^\circ = 65.3$. The side 14 is across from the marked angle and does not touch it.	N
6 K	Sides 10, 11 and 17. The 108° arc is at the corner where 10 and 11 meet.	52.3. The 108° angle is between the sides 10 and 11, so the area is $\frac{1}{2} \times 10 \times 11 \times \sin 108^\circ = \frac{1}{2} \times 10 \times 11 \times 0.9511 = 52.3$ square units.	104.6. The 1/2 is left out: $10 \times 11 \times \sin 108^\circ = 104.6$, twice the area. It is more than $\frac{1}{2} \times 10 \times 11$, so it cannot be right.	U
7 N	Sides 17, 20 and 15. The 47° arc is at the corner where 17 and 20 meet.	124.3. The 47° angle is between the sides 17 and 20, so the area is $\frac{1}{2} \times 17 \times 20 \times \sin 47^\circ = \frac{1}{2} \times 17 \times 20 \times 0.7314 = 124.3$ square units.	93.2. The 15 is used in place of the 20: $\frac{1}{2} \times 17 \times 15 \times \sin 47^\circ = 93.2$. The side 15 is across from the marked angle and does not touch it.	C
8 G	Sides 18, 19 and 13. The 41° arc is at the corner where 18 and 19 meet.	112.2. The 41° angle is between the sides 18 and 19, so the area is $\frac{1}{2} \times 18 \times 19 \times \sin 41^\circ = \frac{1}{2} \times 18 \times 19 \times 0.6561 = 112.2$ square units.	224.4. The 1/2 is left out: $18 \times 19 \times \sin 41^\circ = 224.4$, twice the area. It is more than $\frac{1}{2} \times 18 \times 19$, so it cannot be right.	D

Scavenger Hunt — the cards off the ring

For the teacher

A group reaches these eight cards only by a wrong answer. The number at the top of each one is the wrong answer from one ring card. Its right answer is the number at the top of that ring card, so the group goes to the card it got wrong and tries it again. If the group makes the same mistake here, it goes to another card off the ring. So a second wrong answer never moves a group forward.

Card	What the card shows	Answer, and why	The common wrong answer on this card, and why	Letter of its top
Q	Sides 18, 19 and 13. The 41° arc is at the corner where 18 and 19 meet.	112.2. The 41° angle is between the sides 18 and 19, so the area is $\frac{1}{2} \times 18 \times 19 \times \sin 41^\circ = \frac{1}{2} \times 18 \times 19 \times 0.6561 = 112.2$ square units.	224.4. The $\frac{1}{2}$ is left out: $18 \times 19 \times \sin 41^\circ = 224.4$, twice the area. It is more than $\frac{1}{2} \times 18 \times 19$, so it cannot be right.	U
D	Sides 5, 9 and 12. The 115° arc is at the corner where 5 and 9 meet.	20.4. The 115° angle is between the sides 5 and 9, so the area is $\frac{1}{2} \times 5 \times 9 \times \sin 115^\circ = \frac{1}{2} \times 5 \times 9 \times 0.9063 = 20.4$ square units.	27.2. The 12 is used in place of the 9: $\frac{1}{2} \times 5 \times 12 \times \sin 115^\circ = 27.2$. The side 12 is across from the marked angle and does not touch it.	E
E	Sides 17, 18 and 12. The 40° arc is at the corner where 17 and 18 meet.	98.3. The 40° angle is between the sides 17 and 18, so the area is $\frac{1}{2} \times 17 \times 18 \times \sin 40^\circ = \frac{1}{2} \times 17 \times 18 \times 0.6428 = 98.3$ square units.	196.7. The $\frac{1}{2}$ is left out: $17 \times 18 \times \sin 40^\circ = 196.7$, twice the area. It is more than $\frac{1}{2} \times 17 \times 18$, so it cannot be right.	D
C	Sides 9, 19 and 14. The 44° arc is at the corner where 9 and 19 meet.	59.4. The 44° angle is between the sides 9 and 19, so the area is $\frac{1}{2} \times 9 \times 19 \times \sin 44^\circ = \frac{1}{2} \times 9 \times 19 \times 0.6947 = 59.4$ square units.	43.8. The 14 is used in place of the 19: $\frac{1}{2} \times 9 \times 14 \times \sin 44^\circ = 43.8$. The side 14 is across from the marked angle and does not touch it.	D
L	Sides 7, 12 and 16. The 112° arc is at the corner where 7 and 12 meet.	38.9. The 112° angle is between the sides 7 and 12, so the area is $\frac{1}{2} \times 7 \times 12 \times \sin 112^\circ = \frac{1}{2} \times 7 \times 12 \times 0.9272 = 38.9$ square units.	77.9. The $\frac{1}{2}$ is left out: $7 \times 12 \times \sin 112^\circ = 77.9$, twice the area. It is more than $\frac{1}{2} \times 7 \times 12$, so it cannot be right.	I
A	Sides 12, 18 and 14. The 51° arc is at the corner where 12 and 18 meet.	83.9. The 51° angle is between the sides 12 and 18, so the area is $\frac{1}{2} \times 12 \times 18 \times \sin 51^\circ = \frac{1}{2} \times 12 \times 18 \times 0.7771 = 83.9$ square units.	65.3. The 14 is used in place of the 18: $\frac{1}{2} \times 12 \times 14 \times \sin 51^\circ = 65.3$. The side 14 is across from the marked angle and does not touch it.	L
H	Sides 10, 11 and 17. The 108° arc is at the corner where 10 and 11 meet.	52.3. The 108° angle is between the sides 10 and 11, so the area is $\frac{1}{2} \times 10 \times 11 \times \sin 108^\circ = \frac{1}{2} \times 10 \times 11 \times 0.9511 = 52.3$ square units.	104.6. The $\frac{1}{2}$ is left out: $10 \times 11 \times \sin 108^\circ = 104.6$, twice the area. It is more than $\frac{1}{2} \times 10 \times 11$, so it cannot be right.	C
P	Sides 17, 20 and 15. The 47° arc is at the corner where 17 and 20 meet.	124.3. The 47° angle is between the sides 17 and 20, so the area is $\frac{1}{2} \times 17 \times 20 \times \sin 47^\circ = \frac{1}{2} \times 17 \times 20 \times 0.7314 = 124.3$ square units.	93.2. The 15 is used in place of the 20: $\frac{1}{2} \times 17 \times 15 \times \sin 47^\circ = 93.2$. The side 15 is across from the marked angle and does not touch it.	N

Other mistakes lead to no card. A group might use the side across from the angle and also leave out the $\frac{1}{2}$, use a calculator in radian mode, round the sine to two places before multiplying, or, for an angle over 90° , take the sine of the angle minus 90° . Its answer is then not the number at the top of any card.