Law of Sines Worksheet

Missing sides and angles · answers to one decimal place

Name _____ **Date** _____ **Score** _____ / 26

THE LAW OF SINES

In any triangle, each side is proportional to the sine of the angle opposite it:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Use it when you know **two angles and any side** (AAS or ASA), or **two sides and an angle opposite one of them** (SSA). If you know three sides, or two sides and the angle *between* them, the law of sines cannot start — use the law of cosines.

SECTION A Find a missing side

Use $\frac{a}{\sin A} = \frac{b}{\sin B}$. Give each answer to one decimal place.

1. $\angle A = 40°$, $\angle B = 65°$, $a = 12$. Find b.

Answer _____

2. $\angle A = 55°$, $\angle B = 38°$, $a = 20$. Find b.

Answer _____

3. $\angle A = 28°$, $\angle B = 95°$, $a = 9$. Find b.

Answer _____

4. $\angle A = 72°$, $\angle B = 43°$, $a = 15$. Find b.

Answer _____

5. $\angle A = 33°$, $\angle B = 110°$, $a = 7$. Find b.

Answer _____

6. $\angle A = 48°$, $\angle B = 60°$, $a = 25$. Find b.

Answer _____

SECTION B Find a missing angle

Rearrange to $\sin B = \frac{b \sin A}{a}$, then take the inverse sine. One decimal place.

7. $a = 10$, $b = 7$, $\angle A = 50°$. Find the acute $\angle B$.

Answer _____

8. $a = 14$, $b = 9$, $\angle A = 65°$. Find the acute $\angle B$.

Answer _____

9. $a = 22$, $b = 15$, $\angle A = 40°$. Find the acute $\angle B$.

Answer _____

10. $a = 18$, $b = 11$, $\angle A = 75°$. Find the acute $\angle B$.

Answer _____

11. $a = 30$, $b = 19$, $\angle A = 58°$. Find the acute $\angle B$.

Answer _____

12. $a = 25$, $b = 16$, $\angle A = 47°$. Find the acute $\angle B$.

Answer _____

Law of Sines Worksheet

The ambiguous case and triangle area

SECTION C The ambiguous case (SSA)

Two sides and a non-included angle may give two triangles, one, or none. State which, and why.

13 $a = 8$, $b = 12$, $\angle A = 35°$. How many triangles are possible?

Answer _____

14 $a = 15$, $b = 10$, $\angle A = 50°$. How many triangles are possible?

Answer _____

15 $a = 5$, $b = 14$, $\angle A = 40°$. How many triangles are possible?

Answer _____

16 $a = 11$, $b = 12$, $\angle A = 55°$. How many triangles are possible?

Answer _____

SECTION D Area of a triangle

When two sides and the angle between them are known, Area $= \frac{1}{2}ab\sin C$.

17 $a = 9$, $b = 12$, included $\angle C = 40°$. Find the area.

Answer _____

18 $a = 15$, $b = 8$, included $\angle C = 112°$. Find the area.

Answer _____

19 $a = 6$, $b = 6$, included $\angle C = 60°$. Find the area.

Answer _____

20 $a = 20$, $b = 14$, included $\angle C = 25°$. Find the area.

Answer _____

Law of Sines Worksheet

Applied problems · sketch the triangle first, then set up the ratio

SECTION E Apply it

Draw a quick sketch first, label what you know, then set up the ratio.

21 Two observers standing 500 m apart both sight a balloon. The angle at the first observer is 62° and at the second is 48°. How far is the balloon from the first observer?

Answer _____

22 A triangular plot has angles of 42° and 73°, with the side between them measuring 85 m. Find the length of the side opposite the 42° angle.

Answer _____

23 In triangle ABC, $\angle A = 38°$, $\angle B = 51°$ and $a = 24$ cm. Find the length of side c.

Answer _____

24 A ramp forms a triangle with angles of 27° and 118°. The side opposite the 27° angle is 4.2 m. Find the side opposite 118°.

Answer _____

Law of Sines Worksheet

Reasoning · answer in your own words

SECTION F Explain your reasoning

A sentence or two each.

25 Why can two sides and a non-included angle describe two different triangles, while two angles and a side never can?

Answer _____

26 You know all three sides of a triangle but no angles. Can the law of sines start you off? What would you use instead?

Answer _____

THE MISTAKE TO AVOID

Your calculator's $\sin^{-1}$ only ever returns an angle between 0° and 90° for a positive sine. In the SSA case the obtuse partner $180^\circ - B$ may also be valid, so always check whether it leaves a positive third angle before ruling it out.

Answer Key

Every value recomputed from the triangle at build time.

SECTION A

1. $b = \dfrac{12 \sin 65^\circ}{\sin 40^\circ} = 16.9$
2. $b = \dfrac{20 \sin 38^\circ}{\sin 55^\circ} = 15$
3. $b = \dfrac{9 \sin 95^\circ}{\sin 28^\circ} = 19.1$
4. $b = \dfrac{15 \sin 43^\circ}{\sin 72^\circ} = 10.8$
5. $b = \dfrac{7 \sin 110^\circ}{\sin 33^\circ} = 12.1$
6. $b = \dfrac{25 \sin 60^\circ}{\sin 48^\circ} = 29.1$

SECTION B

7. $\sin B = \dfrac{7 \sin 50^\circ}{10}$, so $\angle B = 32.4^\circ$
8. $\sin B = \dfrac{9 \sin 65^\circ}{14}$, so $\angle B = 35.6^\circ$
9. $\sin B = \dfrac{15 \sin 40^\circ}{22}$, so $\angle B = 26^\circ$
10. $\sin B = \dfrac{11 \sin 75^\circ}{18}$, so $\angle B = 36.2^\circ$
11. $\sin B = \dfrac{19 \sin 58^\circ}{30}$, so $\angle B = 32.5^\circ$
12. $\sin B = \dfrac{16 \sin 47^\circ}{25}$, so $\angle B = 27.9^\circ$

Answer Key

Every value recomputed from the triangle at build time.

SECTION C

13. $\sin B = 0.860$ gives $B = 59.4^\circ$ or 120.6°, and both leave a positive third angle — **two triangles**.

14. $a \geq b$, so the shorter side is opposite the known angle and only the acute solution fits — **one triangle**.

15. $\sin B = \dfrac{14 \sin 40^\circ}{5} = 1.800 > 1$, which is impossible — **no triangle**.

16. $\sin B = 0.894$ gives $B = 63.3^\circ$ or 116.7°, and both leave a positive third angle — **two triangles**.

SECTION D

17. Area $= \frac{1}{2}(9)(12)\sin 40^\circ = 34.7$ square units

18. Area $= \frac{1}{2}(15)(8)\sin 112^\circ = 55.6$ square units

19. Area $= \frac{1}{2}(6)(6)\sin 60^\circ = 15.6$ square units

20. Area $= \frac{1}{2}(20)(14)\sin 25^\circ = 59.2$ square units

Answer Key

Every value recomputed from the triangle at build time.

SECTION E

21. $\dfrac{500 \sin 48^\circ}{\sin 70^\circ} = 395.4$ m

22. $\dfrac{85 \sin 42^\circ}{\sin 65^\circ} = 62.8$ m

23. $\dfrac{24 \sin 91^\circ}{\sin 38^\circ} = 39$ cm

24. $\dfrac{4.2 \sin 118^\circ}{\sin 27^\circ} = 8.2$ m

SECTION F

25. Taking the inverse sine gives an acute angle, but $\sin\theta = \sin(180^\circ - \theta)$, so an obtuse angle has the same sine. If both leave a positive third angle, both triangles exist. With two angles the third is fixed by the 180° sum, so the shape is determined.

26. No — every law of sines ratio needs an angle and the side opposite it, and here no angle is known. Use the law of cosines, $c^2 = a^2 + b^2 - 2ab\cos C$, rearranged for $\cos C$, to get the first angle; then the law of sines finishes the triangle.