ILLAWARRA TUTORING

In this worksheet you will learn how to apply the cosine rule to find unknown sides or angles in triangles where the sine rule is not applicable.

Easy Questions

1. Write down the cosine rule for a triangle with sides a, b, c and with A being the angle opposite side a.
2. A triangle has sides $b = 4$ and $c = 5$, with the included angle $A = 60°$. Use the cosine rule to find the value of a.
3. In a triangle with sides $a = 7$, $b = 8$, and $c = 9$, use the cosine rule to find the measure of angle A (the angle opposite side a).
4. Explain briefly why the cosine rule is used rather than the sine rule when solving for unknown parts in a triangle.
5. In a triangle, if $b = 6$, $c = 10$, and the included angle $A = 90°$, use the cosine rule to calculate a.

Intermediate Questions

6. A triangle has sides $b = 7$, $c = 9$, and an included angle $A = 70°$. Find side a using the cosine rule.
7. In triangle ABC, if $b = 10$, $c = 6$, and the angle $A = 45°$, determine side a.
8. In triangle ABC, the sides are $a = 8$, $b = 9$, and $c = 10$. Calculate angle B (opposite side b) using the cosine rule.
9. Draw triangle ABC with $AB = 8$, $BC = 10$, and $AC = 14$. Label the triangle and, using the cosine rule, find the measure of angle B.
10. In a triangle with $b = 12$, $c = 15$, and angle $A = 80°$, use the cosine rule to find side a to 1 decimal place.
11. Show how to rearrange the cosine rule to solve for $\cos A$. Then, outline the steps required to find angle A.
12. In triangle ABC, let $b = 13$, $c = 20$, and the included angle $A = 120°$. Use the cosine rule to determine side a.

13. Given a triangle with sides $a = 11$, $b = 13$, and $c = 19$, calculate the measure of angle A (opposite side a) and comment on its nature (acute, right, or obtuse).

14. A surveyor stands at point B and observes two landmarks at points A and C. The distance between the landmarks is 15 km, and the angles of sight from B are such that the angle at B is $100°$. If the distance from B to A is 12 km, use the cosine rule to find the distance from B to C.

15. In triangle ABC, if $b = 9$, $c = 11$, and angle $A = 30°$, determine side a.

16. In triangle ABC, with $b = 8$, $c = 12$, and the angle $A = 65°$, calculate side a using the cosine rule.

17. A triangle has sides $a = 9$, $b = 10$, and $c = 7$. Use the cosine rule to determine the measure of angle C (opposite side c).

18. In triangle ABC, sides b and c are 5.5 and 7.3 respectively, with the included angle $A = 55°$. Find side a accurate to 2 decimal places.

19. In triangle ABC, given $b = 14$, $c = 18$, and angle $A = 110°$, compute side a.

20. A triangular plot of land has two sides measuring 25 m and 30 m. The angle between these sides is $95°$. Determine the length of the third side using the cosine rule.

Hard Questions

21. Consider triangle ABC. Drop a perpendicular from vertex A to side BC. Using the Pythagorean theorem in the resulting right-angled triangles, outline a derivation of the cosine rule.

22. In triangle ABC, side $a = 8$, side $b = 6$, and angle $C = 40°$. First, use the cosine rule to find side c, then determine one of the unknown angles.

23. A triangle has sides $a = 16$, $b = 22$, and an unknown side c. If angle C (opposite side c) is $75°$, use the cosine rule to calculate side c.

24. In triangle ABC, the sides are given as follows: $a = 2x+1$, $b = x+5$, and $c = 3x-2$. If the angle A (opposite side a) is $120°$, use the cosine rule to find the value of x and hence determine the lengths of the sides.

25. Draw triangle ABC with $AB = 13$, $BC = 17$, and $AC = 20$. Label the triangle clearly and use the cosine rule to compute angle C.

26. In triangle ABC, the sides are given by $a = \sqrt{50}$, $b = \sqrt{72}$, and $c = \sqrt{98}$. Use the cosine rule to find the measure of angle A (opposite side a).

27. A boat sails from point A to point B, a distance of 18 km. Then it sails from B to point C, a distance of 22 km, with the angle between these paths being $130°$. Use the cosine rule to compute the direct distance from A to C.

28. In triangle ABC, if $b = 24$, $c = 30$, and the angle $A = 105°$, determine side a. Explain why the resulting triangle must be obtuse.

29. Prove that in any triangle if $a^2 > b^2 + c^2$, then angle A is obtuse, using the cosine rule.

30. In triangle ABC, sides $a = 21$, $b = 28$, and $c = 35$. Using the cosine rule, determine the measure of angle C. Provide your answer to the nearest degree.