ILLAWARRA TUTORING

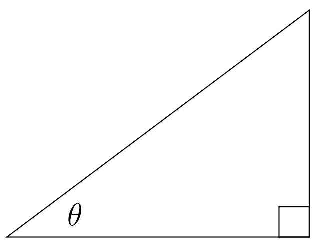
In this worksheet you will learn to define and use sin, cos, and tan ratios in right-angled triangles so that you can solve problems effectively.

Easy Questions

1. Write in plain text the definition of the sine ratio in a right-angled triangle.
2. Write in plain text the definition of the cosine ratio in a right-angled triangle.
3. Write in plain text the definition of the tangent ratio in a right-angled triangle.
4. In a right-angled triangle, state which side is opposite a given acute angle, which side is adjacent to the angle, and which is the hypotenuse.
5. Calculate $\sin 30°$, $\cos 30°$, and $\tan 30°$ using a standard 30-60-90 triangle.

Intermediate Questions

6. A right-angled triangle has an acute angle of $30°$ and a hypotenuse of length 20. Use the sine ratio to calculate the length of the side opposite the $30°$ angle.
7. Refer to the diagram below. Identify the opposite, adjacent, and hypotenuse sides with respect to the marked acute angle θ.



8. In a right-angled triangle, one of the acute angles measures $60°$, and the adjacent side to this angle is 5. Use the cosine ratio to determine the length of the hypotenuse.
9. In a right-angled triangle, one of the acute angles measures $45°$. Given that the side adjacent to this angle is 7, use the tangent ratio to calculate the length of the side opposite the angle.
10. In a right-angled triangle, the acute angle is $37°$ and the length of the side opposite this angle is 10. Use the sine ratio to compute the length of the hypotenuse.

11. A right-angled triangle has an acute angle of $53°$. The side adjacent to this angle has a length of 8. Use the cosine ratio to calculate the hypotenuse.

12. A right-angled triangle has an acute angle measuring $40°$. If the side opposite this angle is of length 6, use the sine ratio to find the length of the hypotenuse.

13. In a right-angled triangle, an acute angle measures $25°$. The length of the side adjacent to this angle is 9. Use the tangent ratio to find the length of the side opposite the angle.

14. In a right-angled triangle, the side opposite a given acute angle measures 4 and the hypotenuse measures 10. Calculate $\sin\theta$ for that angle.

15. In a right-angled triangle, the side adjacent to an acute angle is 6 and the hypotenuse is 10. Compute $\cos\theta$.

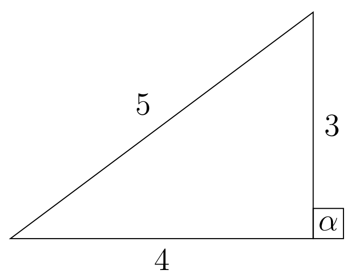
16. Determine $\tan\theta$ in a right-angled triangle where the side opposite the acute angle is 8 and the side adjacent is 6.

17. In a right-angled triangle, if $\sin\theta = 0.6$ and the hypotenuse is 15, use the sine ratio to compute the length of the side opposite θ.

18. In a right-angled triangle, given $\cos\theta = 0.8$ and the hypotenuse is 25, use the cosine ratio to calculate the length of the side adjacent to θ.

19. If in a right-angled triangle the tangent of an acute angle is 0.75 and the length of its adjacent side is 12, compute the length of the side opposite the angle using the tangent ratio.

20. Refer to the diagram below. For the marked acute angle α, calculate: (a) $\sin\alpha$, (b) $\cos\alpha$, and (c) $\tan\alpha$.
    The sides of the right-angled triangle are labelled as follows: the side opposite α is 3, the adjacent side is 4, and the hypotenuse is 5.



Hard Questions

21. Prove that for any acute angle θ in a right-angled triangle, $\sin^2\theta + \cos^2\theta = 1$. (Explain the relationship between the definitions of sine and cosine and the Pythagorean theorem.)

22. A flagpole is observed from a point on level ground such that the angle of elevation to the top of the flagpole is $50°$. If the distance from the point of observation to the base of the flagpole is 12, determine the height of the flagpole using the appropriate trigonometric ratio.

23. In a right-angled triangle, one of the acute angles measures $67°$. The side opposite this angle has a length of 9. Calculate the length of the side adjacent to $67°$ by first determining $\tan 67°$.

24. Prove that in a right-angled triangle $\tan\theta = \dfrac{\sin\theta}{\cos\theta}$ for any acute angle θ. (Provide a clear explanation based on the definitions.)

25. A ladder leans against a wall such that it reaches a window. If the base of the ladder is 3 metres from the wall and it makes an angle of $65°$ with the horizontal ground, use the cosine ratio to determine the length of the ladder. Then, verify your result by using the sine ratio to find the height reached on the wall.

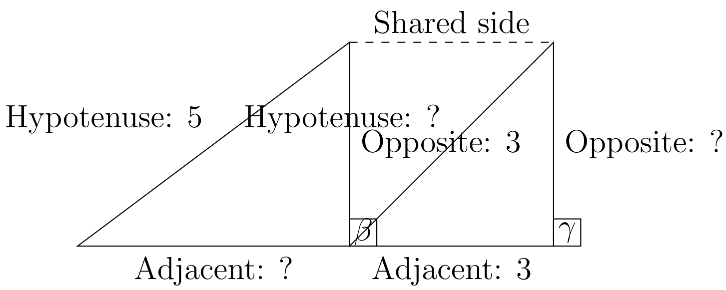
26. In a right-angled triangle, if $\sin\theta = \dfrac{3}{5}$, determine $\cos\theta$ and $\tan\theta$. (Hint: Use the Pythagorean identity to find $\cos\theta$.)

27. In a right-angled triangle, if $\cos\theta = \dfrac{4}{5}$, calculate $\sin\theta$, assuming θ is acute.

28. In a right-angled triangle, one acute angle θ has an opposite side of length 12 and a hypotenuse of length 15. First, calculate $\sin\theta$. Then use the cosine ratio to compute the length of the side adjacent to θ.

29. A ramp forms an angle of $12°$ with the level ground and has a length of 5 metres. Use the sine ratio to determine the vertical height that the ramp covers.

30. Refer to the composite diagram below which shows two right-angled triangles sharing a common side. The left triangle has an acute angle β with opposite side of length 4 and hypotenuse 5. The right triangle shares the vertical side of the left triangle and has an acute angle γ with an adjacent side of length 3.
(a) Calculate $\sin\beta$, $\cos\beta$, and $\tan\beta$.
(b) Using the shared vertical side (found from the left triangle), compute $\cos\gamma$.



(Note: You are only required to compute the requested ratios.)