Trigonometry

1. Find $\sin\alpha$, $\cos\alpha$ and $\tan\alpha$ in the following triangle:
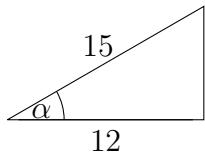
$$\cos\alpha = \frac{\text{adjacent}}{\text{hypotenuse}} =$$
$$\sin\alpha = \frac{\text{opposite}}{\text{hypotenuse}} =$$
$$\tan\alpha = \frac{\text{opposite}}{\text{adjacent}} =$$

4. Find $\sin\beta$, $\cos\beta$ and $\tan\beta$ in the following triangle:

$$\cos\beta =$$
$$\tan\beta =$$
$$\sin\beta =$$
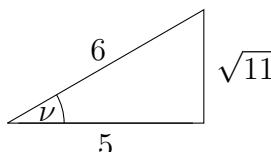
2. Find $\sin\nu$, $\cos\nu$ and $\tan\nu$ in the following triangle:

$$\sin\nu =$$
$$\tan\nu =$$
$$\cos\nu =$$

5. Find $\sin\alpha$, $\cos\alpha$ and $\tan\alpha$ in the following triangle:

$$\sin\alpha =$$
$$\tan\alpha =$$
$$\cos\alpha =$$
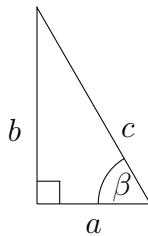
3. Find $\sin\nu$, $\cos\nu$ and $\tan\nu$ in the following triangle:

$$\sin\nu =$$
$$\tan\nu =$$
$$\cos\nu =$$
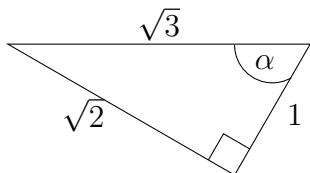
6. Find $\sin\alpha$, $\cos\alpha$ and $\tan\alpha$ in the following triangle:

$$\sin\alpha =$$
$$\tan\alpha =$$
$$\cos\alpha =$$
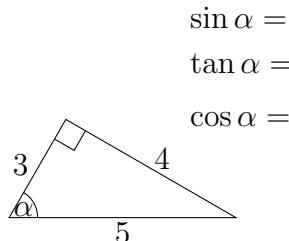
We define the following three additional trigonometric functions:

$$\sec\alpha = \frac{1}{\cos\alpha} = \frac{\text{hypotenuse}}{\text{adjacent}} \qquad \csc\alpha = \frac{1}{\sin\alpha} = \frac{\text{hypotenuse}}{\text{opposite}} \qquad \cot\alpha = \frac{1}{\tan\alpha} = \frac{\text{adjacent}}{\text{opposite}}$$

Example: Referring to exercise #1, $\sec\alpha = \dfrac{15}{9} = \dfrac{5}{3}$, $\csc\alpha = \dfrac{5}{4}$, and $\cot\alpha = \dfrac{4}{3}$.

7. Referring to exercise #2, find the values of the other three trigonometric functions.

8. Referring to exercise #3, find the values of the other three trigonometric functions.

9. Referring to exercise #4, find the values of the other three trigonometric functions.

10. Referring to exercise #5, find the values of the other three trigonometric functions.

11. Referring to exercise #6, find the values of the other three trigonometric functions.

Find the six trigonometric functions of the marked angles in the following triangles:

12.

13.

14.

15.
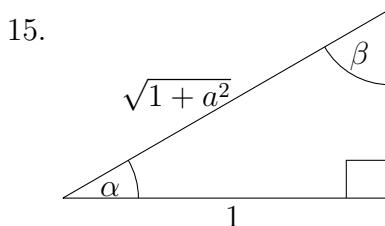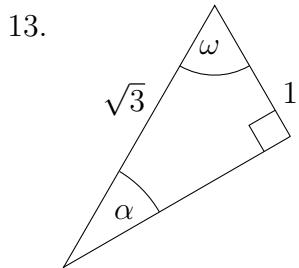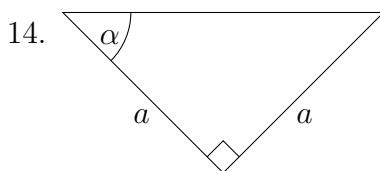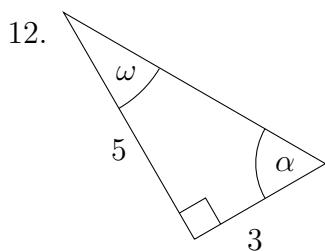
16. Suppose $\sin \beta = 15/17$. Find the values of $\csc \beta$, $\tan \beta$ and $\cos \beta$.

17. Suppose $\cos \theta = 3/7$. Find the values of $\sin \theta$, $\tan \theta$ and $\csc \theta$.

18. Suppose $\tan \nu = 12/6$. Find the values of $\sin \nu$, $\cos \nu$ and $\cot \nu$.

19. Suppose $\csc \alpha = 2$. Find the values of $\sin \alpha$, $\cos \alpha$ and $\cot \alpha$.

20. Suppose $\sec \alpha = 1/a$. Find the values of $\sin \alpha$, $\tan \alpha$ and $\cos \alpha$ in terms of a.

In the right-angled triangles below, find the values of the unknowns:

21.

22.

23.

24.
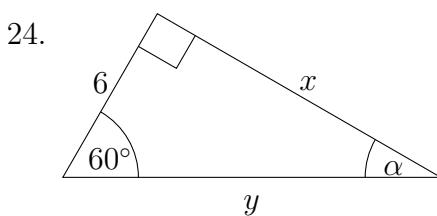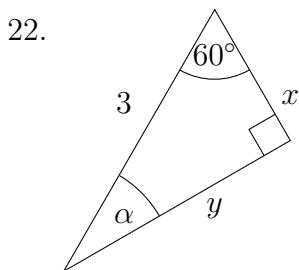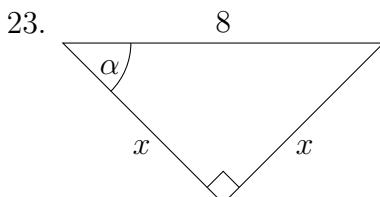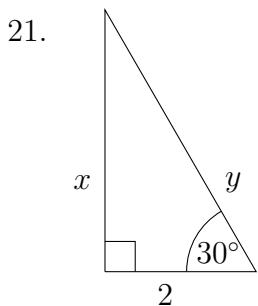
Evaluate:

25. $\sin 30° + \cos 30°$

27. $\csc 30° - \cos 45° + \cot 60°$

26. $\sin 30° - \cos 60°$

28. $\tan 30° \cdot \cot 30°$

Find the acute angle θ, given the value of one of the trigonometric functions:

29. $\sin \theta = \dfrac{1}{\sqrt{2}}$

33. $\cot \theta = \sqrt{3}$

37. $\csc \theta = \sqrt{2}$

41. $\csc \theta = 2$

30. $\cos \theta = \dfrac{\sqrt{2}}{2}$

34. $\cot \theta = 1$

38. $\sec \theta = \dfrac{2\sqrt{3}}{3}$

42. $\tan \theta = \sqrt{3}$

31. $\cos \theta = \dfrac{\sqrt{3}}{2}$

35. $\tan \theta = 1$

39. $\sin \theta = \dfrac{\sqrt{3}}{2}$

43. $\sec \theta = \sqrt{2}$

32. $\sec \theta = 2$

36. $\tan \theta = \dfrac{\sqrt{3}}{3}$

40. $\cos \theta = \dfrac{1}{2}$

44. $\sin \theta = \dfrac{1}{2}$

Answers:

1. $\cos \alpha = 4/5$
   $\sin \alpha = 3/5$
   $\tan \alpha = 3/4$

6. $\sin \alpha = 4/5$
   $\tan \alpha = 4/3$
   $\cos \alpha = 3/5$

11. $\cot \alpha = 3/4$
    $\sec \alpha = 5/3$
    $\csc \alpha = 5/4$

2. $\sin \nu = \sqrt{11}/6$
   $\tan \nu = \sqrt{11}/5$
   $\cos \nu = 5/6$

7. $\cot \nu = 5\sqrt{11}/11$
   $\csc \nu = 6\sqrt{11}/11$
   $\sec \nu = 6/5$

12. $\sin \alpha = 5\sqrt{34}/34$
    $\cos \alpha = 3\sqrt{34}/34$
    $\tan \alpha = 5/3$
    $\cot \alpha = 3/5$
    $\csc \alpha = \sqrt{34}/5$
    $\sec \alpha = \sqrt{34}/3$

3. $\sin \nu = 1/2$
   $\tan \nu = \sqrt{3}/3$
   $\cos \nu = \sqrt{3}/2$

8. $\cot \nu = \sqrt{3}$
   $\csc \nu = 2$
   $\sec \nu = 2\sqrt{3}/3$

$\sin \omega = 3\sqrt{34}/34$
$\cos \omega = 5\sqrt{34}/34$
$\tan \omega = 3/5$
$\cot \omega = 5/3$
$\csc \omega = \sqrt{34}/3$
$\sec \omega = \sqrt{34}/5$

4. $\sin \beta = b/c$
   $\tan \beta = b/a$
   $\cos \beta = a/c$

9. $\cot \beta = a/b$
   $\csc \beta = c/b$
   $\sec \beta = c/a$

5. $\sin \alpha = \sqrt{6}/3$
   $\tan \alpha = \sqrt{2}$
   $\cos \alpha = \sqrt{3}/3$

10. $\cot \alpha = \sqrt{2}/2$
    $\sec \alpha = \sqrt{3}$
    $\csc \alpha = \sqrt{6}/2$

13. $\sin \alpha = \sqrt{3}/3$
    $\cos \alpha = \sqrt{6}/3$
    $\tan \alpha = \sqrt{2}/2$

$$\cot \alpha = \sqrt{2}$$
$$\csc \alpha = \sqrt{3}$$
$$\sec \alpha = \sqrt{6}/2$$

$$\sin \omega = \sqrt{6}/3$$
$$\cos \omega = \sqrt{3}/3$$
$$\tan \omega = \sqrt{2}$$
$$\cot \omega = \sqrt{2}/2$$
$$\sec \omega = \sqrt{6}/2$$
$$\csc \omega = \sqrt{3}$$

14. $\sin \alpha = \sqrt{2}/2$
$$\cos \alpha = \sqrt{2}/2$$
$$\tan \alpha = 1$$
$$\cot \alpha = 1$$
$$\csc \alpha = \sqrt{2}$$
$$\sec \alpha = \sqrt{2}$$

15. $\sin \alpha = a\sqrt{1+a^2}/(1+a^2)$
$$\cos \alpha = \sqrt{1+a^2}/(1+a^2)$$
$$\tan \alpha = a$$
$$\cot \alpha = 1/a$$
$$\csc \alpha = \sqrt{1+a^2}/a$$
$$\sec \alpha = \sqrt{1+a^2}$$

$$\sin \beta = \sqrt{1+a^2}/(1+a^2)$$
$$\cos \beta = a\sqrt{1+a^2}/(1+a^2)$$
$$\tan \beta = 1/a$$
$$\cot \beta = a$$
$$\csc \beta = \sqrt{1+a^2}$$
$$\sec \beta = \sqrt{1+a^2}/a$$

16. $\csc \beta = 17/15$

$\tan \beta = 15/8$
$\cos \alpha = 8/17$

17. $\sin \theta = 2\sqrt{10}/7$
$$\csc \theta = 2\sqrt{10}/3$$
$$\sec \theta = 7\sqrt{10}/20$$

18. $\sin \nu = 2\sqrt{5}/5$
$$\cos \nu = \sqrt{5}/5$$
$$\cot \nu = 1/2$$

19. $\sin \alpha = 1/2$
$$\cos \alpha = \sqrt{3}/2$$
$$\cot \alpha = \sqrt{3}$$

20. $\sin \alpha = \sqrt{1-a^2}$
$$\tan \alpha = \sqrt{1-a^2}/a$$
$$\cos \alpha = a$$

21. $x = 2\sqrt{3}/3,\ y = 4\sqrt{3}/3$

22. $x = 3/2,\ y = 3\sqrt{3}/3,$
$\alpha = 30°$

23. $x = 4\sqrt{2},$
$\alpha = 45°$

24. $x = 6\sqrt{3},\ y = 12,$
$\alpha = 30°$

25. $\frac{1+\sqrt{3}}{2}$

26. 0

27. $\frac{12-3\sqrt{2}+2\sqrt{3}}{6}$

28. 1

29. $\theta = 45°$

30. $\theta = 45°$

31. $\theta = 30°$

32. $\theta = 60°$

33. $\theta = 30°$

34. $\theta = 45°$

35. $\theta = 45°$

36. $\theta = 30°$

37. $\theta = 45°$

38. $\theta = 30°$

39. $\theta = 60°$

40. $\theta = 60°$

41. $\theta = 30°$

42. $\theta = 60°$

43. $\theta = 45°$

44. $\theta = 30°$