

Trigonometric Equations

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Questions:

1) Solve the following equations:

a. $\sin x = \sin 30$

b. $\sin x = \frac{\sqrt{3}}{2}$

2) Solve the following equations:

a. $\sin 3x = \frac{\sqrt{2}}{2}$

b. $2\sin 2x = 1$

3) Solve the following equations:

a. $\sin(2x + 30) = \sin x$

b. $\sin 2x - \sin 4x = 0$

4) Solve the following equations:

a. $\sin 3x + \sin x = 0$

b. $-\sin(x - 30) = \sin(60 + x)$

5) Solve the following equations:

a. $\sin x = 0$

b. $\sin x = 1$

6) Solve the following equations:

a. $\cos x = \sin 30$

b. $\cos x = \frac{\sqrt{3}}{2}$

7) Solve the following equations:

a. $\cos 3x = \frac{\sqrt{2}}{2}$

b. $2\cos 2x = 1$

8) Solve the following equations:

a. $\cos(2x + 30) = \cos x$

b. $\cos 2x - \cos 4x = 0$

9) Solve the following equations:

a. $\cos 3x + \cos x = 0$

b. $-\cos(x - 30) = \cos(60 + x)$

10) Solve the following equations:

a. $\cos x = 0$

b. $\cos x = 1$

11) Solve the following equations:

a. $\sin 3x = \cos x$

b. $\sin(2x + 60) = -\cos x$

12) Solve the following equations:

a. $\sin^2 x = \frac{1}{4}$

b. $\cos^2 2x = \frac{3}{4}$

13) Solve the following equations:

a. $2\sin x \cos x = -\cos^2 x + \sin^2 x$

b. $\cos^4 x - \sin^4 x = 2\sin 2x \cos 2x$

14) Solve the following equations:

a. $\sin 3x = \frac{1}{2} \quad 0 < x < 180$

b. $\cos 3x = \frac{\sqrt{3}}{2} \quad -90 < x < 90$

15) Solve the following equations:

a. $\sin x + \cos x = 0 \quad 0 \leq x \leq 360$

b. $\sin^2 2x = \frac{1}{4} \quad 0 < x < 90$

16) Solve the following equations:

a. $\sin x + \sin 4x = 0 \quad 0 < x < 180$

b. $\sin x - \cos 3x = 0 \quad 0 < x < 270$

17) Solve the following equations:

a. $\tan x = \sqrt{3}$

b. $\tan 3x = 1$

18) Solve the following equations:

a. $\tan x = -\frac{1}{\sqrt{3}}$

b. $\frac{1}{\sqrt{3}} \tan 4x = 1 \quad -90 < x < 90$

19) Solve the following equations:

a. $\tan 5x = 2 + \sqrt{3}$

b. $\tan(-3x) = -\frac{3}{\sqrt{3}}$

20) Solve the following equations:

a. $\tan^2 4x = \frac{1}{3} \quad 0 < x < 180$

b. $\tan^2 3x = 4$

21) Solve the following equations:

a. $\tan(x-30) = \tan(3x)$

b. $\tan(5x+15) = \tan(95) \quad 0 < x < 90$

22) Solve the following equations:

a. $2\cos^2 x + 3\cos x - 2 = 0$

b. $2\sin^2 x + 3\sin x + 1 = 0$

23) Solve the following equations:

a. $4\cos^2 2x + 3\cos 2x = 1$

b. $12\sin^2 2x - 13\sin 2x + 3 = 0$

24) Solve the following equations:

a. $2\cos^2 4x + 3\cos 4x = -1$

b. $2\sqrt{3}\sin^2 3x + \sin 3x = 2\sqrt{3}$

25) Solve the following equations:

a. $\sqrt{2}\sin^2 x + \cos x = 0$

b. $-4\cos^2 x + 3\sin x + 3 = 0$

26) Solve the following equations:

a. $\cos 2x - 3\cos x + 2 = 0$

b. $6\sin^2 x + \cos 2x - 2\sin x = 2$

27) Solve the following equations:

a. $\sin^2 x + \sin^2 2x = 1$

b. $4\sin^4 x + 7\cos 2x = 1$

28) Solve the following equations:

a. $\tan^2 x - 4\tan x + 3 = 0$

b. $\sqrt{3}\tan^2 x - 4\tan x + \sqrt{3} = 0$

29) Solve the following equations:

a. $\tan^2 x + 3\cot^2 x = 4$

b. $9\cot^2 2x + 4\sin^2 2x = 6$

30) Solve the following equations:

a. $\cos x + \sin x \cos x = 0$

b. $\cos 2x - 2\sin x \cos 2x = 0$

31) Solve the following equations:

a. $\sqrt{2}\sin x - \sin 2x = 0$

b. $2\sin^3 x - \sin x = 0$

32) Solve the following equations:

a. $2\sin x + \sin 2x = 0$

b. $\cos^2 x - \sin x - 1 = 0$

33) Solve the following equations:

a. $2\sin x \cos x - \sin x - 2\cos x + 1 = 0$

b. $2\sin x \cos x + \cos x - 2\sin x - 1 = 0$

34) Solve the following equations:

a. $2\sin 2x - 2\sin x - 2\cos x + 1 = 0$, $0 < x < 90$

b. $\sin 2x + 2\sin x - 2\cos x - 2 = 0$, $0 < x < \pi$

35) Solve the following equations:

a. $\sin 8x + \sin 4x = \sin 10x + \sin 2x$

b. $\sin x + \sin 3x = \cos x + \cos 3x$

36) Solve the following equations:

a. $\sin 4x = \sin 2x - 2\sin x$

b. $\sin 5x + \sin 6x + \sin 7x = 0$

Final Answers:

1) a. $x_1 = 30^\circ + 360^\circ k$, $x_2 = 150^\circ + 360^\circ k$

b. $x_1 = 60^\circ + 360^\circ k$, $x_2 = 120^\circ + 360^\circ k$

2) a. $x_1 = 15^\circ + 120^\circ k$, $x_2 = 45^\circ + 120^\circ k$

b. $x_1 = 15^\circ + 180^\circ k$, $x_2 = 75^\circ + 180^\circ k$

3) a. $x_1 = -30^\circ + 360^\circ k$, $x_2 = 50^\circ + 120^\circ k$

b. $x_1 = 30^\circ + 60^\circ k$, $x_2 = 180^\circ k$

4) a. $x_1 = 90^\circ + 180^\circ k$, $x_2 = 90^\circ k$

b.

5) a. $x = 180^\circ k$

b. $x = 90^\circ + 360^\circ k$

6) a. $x_{1,2} = \pm 60^\circ + 360^\circ k$

b. $x_{1,2} = \pm 30^\circ + 360^\circ k$

7) a. $x_{1,2} = \pm 15^\circ + 120^\circ k$

b. $x_{1,2} = \pm 30^\circ + 180^\circ k$

8) a. $x_1 = -10^\circ + 120^\circ k$, $x_2 = -30^\circ + 360^\circ k$

b. $x_1 = -180^\circ k$, $x_2 = 60^\circ k$

9) a. $x_1 = -90^\circ + 180^\circ k$, $x_2 = 45^\circ + 90^\circ k$

b.

10) a. $x = 90^\circ + 180^\circ k$

b. $x = 360^\circ k$

11) a. $x_1 = 45^\circ + 180^\circ k$, $x_2 = 22\frac{1}{2}^\circ + 90^\circ k$

b. $x_1 = 70^\circ + 120^\circ k$, $x_2 = -150^\circ + 360^\circ k$

12) a. $x_1 = 30^\circ + 360^\circ k$, $x_2 = 150^\circ + 360^\circ k$, $x_3 = -30^\circ + 360^\circ k$, $x_4 = 210^\circ + 360^\circ k$

b. $x_{1,2} = \pm 15^\circ + 180^\circ k$, $x_{3,4} = \pm 75^\circ + 180^\circ k$

13) a. $x = 67\frac{1}{2}^\circ + 90^\circ k$

b. $x_1 = 45^\circ - 180^\circ k$, $x_2 = 15^\circ + 60^\circ k$

14) a. $x = 10, 50, 130, 170$

b. $x = \pm 10$

15) a. $x = 135, 315$

b. $x = 15, 75$

- 16) a. $x = 60, 72, 144$ b. $x = 22\frac{1}{2}, 112\frac{1}{2}, 202\frac{1}{4}$
- 17) a. $x = 60^\circ + 180^\circ k$ b. $x = 15^\circ + 60^\circ k$
- 18) a. $x = -30^\circ + 180^\circ k$ b. $x = -75, -30, 15, 60$
- 19) a. $x = 15^\circ + 36^\circ k$ b. $x = 20^\circ + 60^\circ k$
- 20) a. $x_1 = 7\frac{1}{2}^\circ + 45k (k = 0, 1, 2, 3), x_2 = -7\frac{1}{2}^\circ + 45^\circ k (k = 1, 2, 3, 4)$
 b. $x_{1,2} = \pm 21.145^\circ + 60^\circ k$
- 21) a. $x = -15^\circ + 90^\circ k$ b. $x = 16, 52, 88$
- 22) a. $x_{1,2} = \pm 60^\circ + 360^\circ k$
 b. $x_1 = -30^\circ + 360^\circ k, x_2 = 210^\circ + 360^\circ k, x_3 = -90^\circ + 360^\circ k$
- 23) a. $x_{1,2} = \pm 37.76^\circ + 180^\circ k, x_3 = 90^\circ + 180^\circ k$
 b. $x_1 = 24.3^\circ + 180^\circ k, x_2 = 65.7^\circ + 180^\circ k, x_3 = 9.74^\circ + 180^\circ k, x_4 = 80.26^\circ + 180^\circ k$
- 24) a. $x_{1,2} = \pm 30^\circ + 90^\circ k, x_3 = 45^\circ + 90^\circ k$ b. $x_1 = 20^\circ + 120^\circ k, x_2 = 40^\circ + 120^\circ k$
- 25) a. $x_{1,2} = \pm 135^\circ + 360^\circ k$
 b. $x_1 = 14.5^\circ + 360^\circ k, x_2 = 165.5^\circ + 360^\circ k, x_3 = -90^\circ + 360^\circ k$
- 26) a. $x_1 = 360^\circ k, x_{2,3} = \pm 60^\circ + 360^\circ k$
 b. $x_1 = 54^\circ + 360^\circ k, x_2 = 126^\circ + 360^\circ k, x_3 = -18^\circ + 360^\circ k, x_4 = 198^\circ + 360^\circ k$
- 27) a. $x = 90^\circ + 360^\circ k$
 b. $x_1 = 45^\circ + 360^\circ k, x_2 = 135^\circ + 360^\circ k, x_3 = -45^\circ + 360^\circ k, x_4 = 225^\circ + 360^\circ k$
- 28) a. $x_1 = 71.565^\circ + 180^\circ k, x_2 = 45^\circ + 180^\circ k$ b. $x_1 = 60^\circ + 180^\circ k, x_2 = 30^\circ + 180^\circ k$
- 29) a. $x_{1,2} = \pm 60^\circ + 180^\circ k, x_{3,4} = \pm 45^\circ + 180^\circ k$
 b. $x_1 = 30^\circ + 180^\circ k, x_2 = 60^\circ + 180^\circ k, x_3 = -30^\circ + 180^\circ k, x_4 = 120^\circ + 180^\circ k$
- 30) a. $x_{1,2} = \pm 90^\circ + 360^\circ k$ b. $x_{1,2} = \pm 45^\circ + 180^\circ k$
- 31) a. $x_1 = 180^\circ k, x_{2,3} = \pm 45^\circ + 360^\circ k$
 b. $x_1 = 180^\circ k, x_2 = 45^\circ + 360^\circ k, x_3 = 135^\circ + 360^\circ k, x_4 = -45^\circ + 360^\circ k, x_5 = 225^\circ + 360^\circ k$
- 32) a. $x = 180^\circ k$ b. $x_1 = 180^\circ k, x_2 = -90^\circ + 360^\circ k$
- 33) a. $x_1 = 90^\circ + 360^\circ k, x_{2,3} = \pm 60^\circ + 360^\circ k$
 b. $x_1 = 360^\circ k, x_2 = -30^\circ + 360^\circ k, x_3 = 210^\circ + 360^\circ k$
- 34) a. $x = 30, 60$ b. $x = 90$
- 35) a. $x = 30^\circ k$ b. $x_1 = 90^\circ + 360^\circ k, x_2 = 22\frac{1}{2}^\circ + 360^\circ k$
- 36) a. $x_1 = 180^\circ k, x_2 = 60^\circ + 120^\circ k$ b. $x_1 = 30^\circ k, x_{2,3} = \pm 120^\circ + 360^\circ k$