Problems of Trigonometry

1) We know that $\sin\alpha = \frac{9}{41}$ and $0° < \alpha < 90°$, calculate the trigonometric functions sin α, cos α, tan α, cosec α, sec α, and cot α:

2) We know that $\cos\alpha = \frac{-3}{5}$ and $180° < \alpha < 270°$, calculate the trigonometric functions sin α, cos α, tan α, cosec α, sec α, and cot α:

3) We know that $\tan\alpha = \frac{9}{40}$ and $180° < \alpha < 270°$, calculate the trigonometric functions sin α, cos α, tan α, cosec α, sec α, and cot α:

4) If $\cos 56° = 0.5592$ find out $\sin 112°$, $\cos 112°$ and $\cos 28°$.

5) We know that $\sin 59° = 0.8572$ and $\sin 23° = 0.3907$, calculate $\sin 82°$, $\sin 36°$ and $\cos 82°$.

6) Give a proof of the following trigonometric identities.

a) $\tan 2\alpha = \frac{\cos\alpha - \cos 3\alpha}{\sin 3\alpha - \sin\alpha}$

b) $1 + \tan x = \frac{\sin(45° + x)}{\cos 45° \cdot \cos x}$

c) $\frac{\sec x - \cos x}{\operatorname{cosec} x - \sin x} = \tan^3 x$

d) $\frac{\cos\alpha + \sin\alpha}{\cos\alpha - \sin\alpha} - \frac{\cos\alpha - \sin\alpha}{\cos\alpha + \sin\alpha} = 2\tan 2\alpha$

e) $\sin x + \cos x \cdot \cot x = \operatorname{cosec} x$

f) $\frac{\operatorname{cosec}\alpha}{1 + \operatorname{cosec}\alpha} - \frac{\operatorname{cosec}\alpha}{1 - \operatorname{cosec}\alpha} = 2\sec^2\alpha$

g) $\frac{1}{\sec^2\alpha} = \sin^2\alpha \cdot \cos^2\alpha + \cos^4\alpha$

h) $-\tan\alpha = \frac{\sin 3\alpha - \sin 5\alpha}{\cos 3\alpha + \cos 5\alpha}$

7) Solve the following equations. Give the x values within the interval $[0°, 360°)$.

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

b) $2\sin 2x + \cos^2 x = -\sin^2 x$

c) $2\sin x - \sqrt{3} = 0$

d) $\cos x\,(1 - \cos x) = \sin^2 x$

e) $\cos 2x + \sin^2 x = -\cos^2 x$

f) $\sin x\,(2 + \sin x) = -\cos^2 x$

g) $\cos 2x - \sin^2 x = \cos^2 x$

h) $2\sin 3x + 1 = 0$

8) Triangle ABC has angle $C = 74°$, sides $c = 80$ cm and $a = 60$ cm. If angle A is acute, find angles A and B and length of side b.

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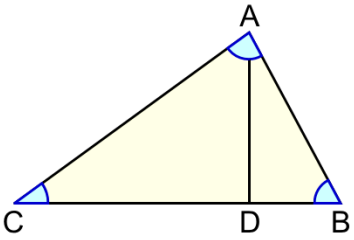
9) The triangle ABC has sides $b = 75$ cm, $a = 60$ cm and angle $C = 70°$. Calculate side c and angles B and A.

10) Triangle ABC has sides $b = 9$ cm, $a = 10$ cm and $c = 13$ cm. Find out all angles of the triangle.

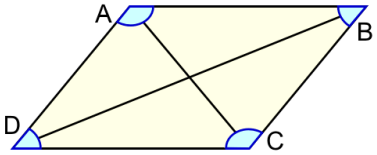
11) The triangle ABC shown below has an area of 1176 cm^2, its base BC is 84 cm length and angle $C = 25°$. Calculate:

a) Length of altitude AD.
b) Angle B.
c) Perimeter.



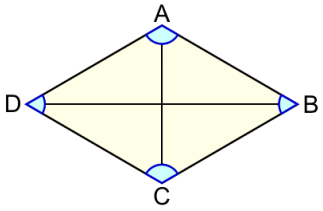
12) The rhomboid $ABCD$ shown below has side $AD = 5$ cm and diagonals $AC = 16$ cm and $BD = 19$ cm. Find out:

a) Angle D.
b) Perimeter.
c) Area.



13) The diagonals of the rhombus $ABCD$ are 27 cm and 33 cm length. Calculate:

a) Length of its side.
b) Angle D.
c) Area.



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Answers:

1) $\cos\alpha = \frac{40}{41}$ $\tan\alpha = \frac{9}{40}$ $\operatorname{cosec}\alpha = \frac{41}{9}$ $\sec\alpha = \frac{41}{40}$ $\cot\alpha = \frac{40}{9}$

2) $\sin\alpha = \frac{-4}{5}$ $\tan\alpha = \frac{4}{3}$ $\operatorname{cosec}\alpha = \frac{-5}{4}$ $\sec\alpha = \frac{-5}{3}$ $\cot\alpha = \frac{3}{4}$

3) $\sin\alpha = \frac{-9}{41}$ $\cos\alpha = \frac{-40}{41}$ $\operatorname{cosec}\alpha = \frac{-41}{9}$ $\sec\alpha = \frac{-41}{40}$ $\cot\alpha = \frac{40}{9}$

4) $\sin 112° = 0.9272$; $\cos 112° = -0.3746$; $\cos 28° = 0.8829$

5) $\sin 82° = 0.9903$; $\sin 36° = 0.5879$; $\cos 82° = 0.1391$

6) –

7)
a) 120°, 240°
b) 105°, 165°, 285°, 345°
c) 60°, 120°
d) 0°
e) 90°, 270°
f) 210°, 330°
g) 0°, 180°
h) 70°, 110°, 190°, 230°, 310°, 350°

8) $A = 46° 7' 57.58"$; $B = 59° 52' 2.42"$; $b = 71.978$ cm.

9) $c = 78.402$ cm; $B = 64° 1' 0.1"$; $A = 45° 58' 59.9"$.

10) $B = 43° 41' 27.22"$; $A = 50° 7' 53.97"$; $C = 86° 10' 38.81"$.

11) **a)** 28 cm; **b)** 49° 27' 11.67"; **c)** 187.1 cm.

12) **a)** 71° 49' 55.1"; **b)** 43.675 cm; **c)** 79.99 cm^2.

13) **a)** 21.319 cm; **b)** 78° 34' 43.73"; **c)** 445.5 cm^2.