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Class: X
Subject: Math's
Topic: Trigonometry
No. of Questions: 20

Q.1 If $\sin x = (a^2 - b^2)/(a^2 + b^2)$, find $\tan x$.

Sol: $\sin x = (a^2 - b^2)/(a^2 + b^2) = P/H$
$H^2 = P^2 + B^2$
$(a^2 + b^2) = (a^2 - b^2) + B^2$
$a^4 + b^4 + 2a^2b^2 = a^4 + b^4 - 2a^2b^2 + B^2$
$B = 2ab$
$\tan x = P/B = (a^2 - b^2)/2ab$

Q.2 If $\text{cosec } x = 2$, find the value of $1/\tan x + \sin x/(1 + \cos x)$

Sol: $\text{cosec } x = H/P = 2$
$H^2 = B^2 + P^2$
$4 = B^2 + 1$
$4 - 1 = B^2$
$B = \sqrt{3}$
$\tan x = P/B = 1/\sqrt{3}$
$\sin x = P/H = 1/2$
$\cos x = B/H = \sqrt{3}/2$
$1/\tan x + \sin x/(1 + \cos x) = 2$

Q.3 In ΔABC, right angled at C, if $\tan A = 1/\sqrt{3}$, find the value of $\sin A \cos B + \cos A \sin B$.
(CBSE-2008)

Sol: $\tan A = 1/\sqrt{3} = P/B$
$P^2 + B^2 = H^2$
$1 + (\sqrt{3})^2 = H^2$
$\sin A = 1/2$, $\cos A = \sqrt{3}/2$, $\cos B = 1/2$, $\sin B = \sqrt{3}/2$
$\sin A \cos B + \cos A \sin B = 1$

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Q.4 If sin B=1/2, find the value of 3 cos B – 4 $\cos^2$ B

Sol: sin B=1/2 = P/H
$H^2 = P^2 + B^2$
$4= 1 + B^2$
B= $\sqrt{3}$
cos B= $\sqrt{3}$ /2= B/H
3 cos B – 4 $\cos^2$B= 0

Q.5 If sin x= 4/5, find the value of $\frac{4\tan x - 5\cos x}{\sec x + 4\cot x}$

Sol: sin x = 4/5
$H^2= P^2 + B^2$
$25= 16 + B^2$
B=3
cos x=B/H= 3/5, tan x= P/B= 4/3, cot x=B/P=3/4, sec x= H/B=5/3
$\frac{4\tan x - 5\cos x}{\sec x + 4\cot x}$ = 1/2

Q.6 Given 16 cot A=12, find the value of $\frac{\sin A + \cos A}{\sin A - \cos A}$

Sol: $\frac{\sin A + \cos A}{\sin A - \cos A}$
Dividing the numerator and denominator by sin A,
= $\frac{1 + \cot A}{1 - \cot A}$
Now, 16 cot A=12
cot A= 12/16= 3/4
$\frac{\sin A + \cos A}{\sin A - \cos A}$ = 7

Q.7 If tan x= 12/13, evaluate (2sinx cos x)/ ($\cos^2$x – $\sin^2$x)

Sol: tan x= 12/13
(2sinx cos x)/ ($\cos^2$x – $\sin^2$x)
Dividing the numerator and denominator by $\cos^2$x
= 2tanx/(1 – $\tan^2$x)= 24/13 * 169/25= 312/25

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Q.8 Find the value of $2(\cos^2 45^0 + \tan^2 60^0) - 6(\sin^2 45^0 - \tan^2 30^0)$

Sol: $\cos 45^0 = 1/\sqrt{2}$, $\tan 60^0 = \sqrt{3}$, $\sin 45^0 = 1/\sqrt{2}$, $\tan 30^0 = 1/\sqrt{3}$

$2(\cos^2 45^0 + \tan^2 60^0) - 6(\sin^2 45^0 - \tan^2 30^0) = 2[(1/\sqrt{2})^2 + (\sqrt{3})^2] - 6[(1/\sqrt{2})^2 - (1/\sqrt{3})^2]$

$=6$

Q.9 Find the value of x in $\tan 3x = \sin 45^0 \cos 45^0 + \sin 30^0$

Sol: $\tan 3x = \sin 45^0 \cos 45^0 + \sin 30^0$

$\tan 3x = 1/\sqrt{2} * 1/\sqrt{2} + 1/2 = 1$

$\tan 3x = \tan 45^0$

$3x = 45^0$

$x = 15^0$

Q.10 Find the acute angle x. when $(\cos x - \sin x)/(\cos x + \sin x) = (1 - \sqrt{3})/(1 + \sqrt{3})$

Sol: $(\cos x - \sin x)/(\cos x + \sin x) = (1 - \sqrt{3})/(1 + \sqrt{3})$

Dividing LHS by cos x

$(1 - \tan x)/(1 + \tan x) = 1 - \sqrt{3})/(1 + \sqrt{3})$

$\tan x = \sqrt{3}$

$x = 60^0$

Q.11 If $\sin(A + B) = 1$ and $\cos(A - B) = \sqrt{3}/2$, $0^0 < A+B \leq 90^0$, A>B then find A and B.

Sol: : $\sin(A + B) = 1$

$\sin(A + B) = \sin 45^0$

$\cos(A - B) = \sqrt{3}/2$

$\cos(A - B) = \cos 30^0$

$A + B = 90^0$

$A - B = 45^0$

Add both the above equations

$2A = 120^0$

$A = 60^0$

$60^0 + B = 90^0$

$B = 30^0$

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Q.12 If x is an acute angle and sin x= cos x, find the value of $2\tan^2x + \sin^2x - 1$

Sol: $2\tan^2x + \sin^2x - 1$
sin x= cos x (given)
sin x/cos x= cos x/ cos x
$2\tan^2x + \sin^2x - 1 = 2 + 1/2 - 1 = 3/2$

Q.13 Given that sin (A+B)= sin A cos b + cos A sin B, find the value of $\sin 75^0$.

Sol: $75^0 = 45^0 + 30^0$
$\sin(30^0 + 45^0) = \sin 30^0 \cos 45^0 + \cos 30^0 \sin 45^0$
$\sin 75^0 = 1/2 * 1/\sqrt{2} + \sqrt{3}/2 * 1/\sqrt{2} = (\sqrt{3} + 1)/2\sqrt{2}$

Q.14 If each of α, β and γ is appositive acute angle such that $\sin(\alpha + \beta + \gamma)=1/2$, $\cos(\beta + \gamma - \alpha)= 1/2$ and $\tan(\gamma + \alpha - \beta)=1$, find the values of α, β and γ.

Sol: $\sin(\alpha + \beta + \gamma)=1/2$
$\sin(\alpha + \beta + \gamma)=\sin 30^0$
$\alpha + \beta + \gamma= 30^0$
$\cos(\beta + \gamma - \alpha)= 1/2$
$\cos(\beta + \gamma - \alpha)= \cos 60^0$
$\beta + \gamma - \alpha= 60^0$
$\tan(\gamma + \alpha - \beta)=1$
$\tan(\gamma + \alpha - \beta)=\tan 45^0$
$\gamma + \alpha - \beta=45^0$
add the 3 equations
$2\beta= 90^0$ and $2\alpha=75^0$
$\beta=45^0$ and $\alpha=37.5^0$
$\gamma= 52.5^0$

Q.15 Evaluate $\cos(40^0 - x) - \sin(50^0 + x) + (\cos^240^0 + \cos^250^0)/(\sin^240^0 + \sin^250^0)$ (CBSE-2002)

Sol: $\cos(40^0 - x) - \sin(50^0 + x) + (\cos^240^0 + \cos^250^0)/(\sin^240^0 + \sin^250^0)$
$\cos(40^0 - x) - \sin(90-(40^0 - x)) + [\cos^240^0 + \cos^2(90^0 - 40^0)]/[\sin^240^0 + \sin^2(90^0 - 40^0)]$
$\cos(40^0 - x) - \cos(40^0 - x) + (\cos^240^0 + \sin^240^0)/(\sin^240^0 + \cos^240^0)$
$= 0 + 1 = 1$

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Q.16 Evaluate $\cot 12^0 \cot 38^0 \cot 52^0 \cot 60^0 \cot 78^0$

(CBSE-2001)

Sol: $\cot 12^0 \cot 38^0 \cot 52^0 \cot 60^0 \cot 78^0$
$= (\cot 12^0 \cot 78^0)(\cot 38^0 \cot 52^0)(\cot 60^0)$
$= (\cot 12^0 \tan 12^0)(\cot 38^0 \tan 38^0)(\cot 60^0)$
$= 1 * 1/\sqrt{3} = 1/\sqrt{3}$

Q.17 Evaluate $\tan 1^0 \tan 2^0 \tan 3^0 \ldots\ldots \tan 89^0$.

Sol: $\tan 1^0 \tan 2^0 \tan 3^0 \ldots\ldots \tan 89^0$
$= \tan(90^0 - 89^0) \tan(90^0 - 88^0) \ldots\ldots \tan 88^0 \tan 89^0$
$= \cot 89^0 \cot 88^0 \ldots\ldots \tan 88^0 \tan 89^0$.
$= (\cot 89^0 \tan 89^0) \ldots\ldots (\cot 44^0 \tan 44^0) \tan 45^0$
$= 1 * 1 * 1 * 1 \ldots\ldots * 1 = 1$

Q.18 If $\sec 4A = \operatorname{cosec}(A - 20^0)$, where 4A is an acute angle, find the value of A.

(CBSE-2008)

Sol: $\sec 4A = \operatorname{cosec}(A - 20^0)$
$= \sec[90^0 - (A - 20^0)]$
$4A = 110^0 - A$
$5A = 110^0$
$A = 22^0$.

Q.19 Evaluate $\cot^2 x - 1/\sin^2 x$

Sol: $\cot^2 x - 1/\sin^2 x = \cot^2 x - \operatorname{cosec}^2 x = -1$

Q.20 $(1 + \tan^2 x)(1 + \sin x)(1 - \sin x)$, find the value.

Sol: $(1 + \tan^2 x)(1 + \sin x)(1 - \sin x)$
$= (1 + \tan^2 x)(1 - \sin^2 x) = \sec^2 x * \cos^2 x = 1$