ANSWER KEY

SECTION A	
Q.NO.	**ANSWERS**
1	**B**
2	**C**
3	**A**
4	**D**
5	**D**
6	**C**
7	**C**
8	**D**
9	**C**
10	**B**
11	**D**
12	**A**
13	**C**
14	**B**
	SECTION B
15	**Sn = 17885**
16	K=4 Or X=1,Y=2
17	$\frac{p^2-1}{p^2+1}$ $= \frac{(\sec\theta+\tan\theta)^2-1}{(\sec\theta+\tan\theta)^2+1}$ $\frac{\sec^2\theta+\tan^2\theta+2\sec\theta\tan\theta-1}{\sec^2\theta+\tan^2\theta+2\sec\theta\tan\theta+1}$ $= \frac{(\sec^2\theta-1)+\tan^2\theta+2\sec\theta\tan\theta}{\sec^2\theta+(\tan^2\theta+1)+2\sec\theta\tan\theta}$ $= \frac{\tan^2\theta+\tan^2\theta+2\sec\theta\tan\theta}{\sec^2\theta+\sec^2\theta+2\sec\theta\tan\theta}$ $= \frac{2\tan^2\theta+2\sec\theta\tan\theta}{2\sec^2\theta+2\sec\theta\tan\theta}$ $= \frac{2\tan\theta(\tan\theta+\sec\theta)}{2\sec\theta(\sec\theta+\tan\theta)}$ $= \frac{2\tan\theta}{2\sec\theta}$ $= \tan\theta\times\cos\theta$ $= \frac{\sin\theta}{\cos\theta}\times\cos\theta$ $= \sin\theta$
	SECTION C

18	$$\text{LHS} = \frac{\tan\theta}{1-\frac{1}{\tan\theta}} + \frac{\cot\theta}{1-\tan\theta}$$ $$= \frac{\tan^2\theta}{\tan\theta - 1} + \frac{\cot\theta}{1-\tan\theta}$$ $$= \frac{1}{1-\tan\theta}\left[\frac{1}{\tan\theta} - \tan^2\theta\right]$$ $$= \frac{1}{1-\tan\theta}\left[\frac{1-\tan^3\theta}{\tan\theta}\right]$$ $$= \frac{1}{1-\tan\theta}\,\frac{(1-\tan\theta)(1+\tan\theta+\tan^2\theta)}{\tan\theta}$$ $\left[\text{Since, } a^3 - b^3 = (a-b)(a^2+ab+b^2)\right]$ $$= \frac{1+\tan\theta+\tan^2\theta}{\tan\theta}$$ $$= \frac{1}{\tan\theta} + \frac{\tan\theta}{\tan\theta} + \frac{\tan^2\theta}{\tan\theta}$$ $= 1 + \tan\theta + \cot\theta$ Or $x = r\sin A\cos C \Rightarrow x^2 = r^2\sin^2 A\cos^2 C$ $y = r\sin A\sin C \Rightarrow y^2 = r^2\sin^2 A\sin^2 C$ $z = r\cos A \Rightarrow r^2\cos^2 A$ To Prove:- $x^2 + y^2 + z^2 = r^2$ Proof:- Taking L.H.S.- $x^2 + y^2 + z^2$ $= r^2\sin^2 A\cos^2 C + r^2\sin^2 A\sin^2 C + r^2\cos^2 A$ $= r^2\sin^2 A(\cos^2 C + \sin^2 C) + r^2\cos^2 A$ $= r^2\sin^2 A + r^2\cos^2 A$ $= r^2(\sin^2 A + \cos^2 A)$ $= r^2$ = R.H.S. Hence proved
19	

20	$$\frac{1}{a+b+x} = \frac{1}{a} + \frac{1}{b} + \frac{1}{x}$$ or, $$\frac{1}{a+b+x} - \frac{1}{x} = \frac{1}{a} + \frac{1}{b}$$ or, $$\frac{\cancel{x}-a-b-\cancel{x}}{x(a+b+x)} = \frac{a+b}{ab}$$ or, $$\frac{-\cancel{(a+b)}}{xa+bx+x^2} = \frac{\cancel{(a+b)}}{ab}$$ or, $-ab = x^2+bx+ax$ or, $x^2+bx+ax+ab=0$ or, $x(x+b)+a(x+b)=0$ or, $(x+b)(x+a)=0$ either, $\boxed{x=-a}$ or, $\boxed{x=-b}$ Ans
20	Answer: Here, $\frac{AD}{DB} = \frac{AE}{EC}$ [Given] ⇒ DE ‖ BC [By converse of Basic Proportionality Theorem] Now, ∠D = ∠B [Corresponding angle] ∠E = ∠C But ∠D = ∠E [Given] Hence ∠B = ∠C ∴ AB = AC [Sides opp. to equal angles of a Δ are equal] ∴ ΔBAC is an isosceles Δ.
21	Lengths of Δ drawn from an external pt to a circle are equal. ⇒ AQ=AR, BQ=BP, CP=CR$ Perimeter of ΔABC = AB + BC + CA = AB + (BP + PC) + (AR − CR) = (AB + BQ) + PC + (AQ − PC) = AQ + AQ = 2AQ AQ = $\frac{1}{2}$(perimeter of ΔABC).
	Section D
22	**I)** **41+2n** **II)** $\frac{135n}{2}+\frac{5n^2}{2}$ **III)** $7\ minutes$
23	**i)** **6m** **ii)** **2m**

iii) 8m

SECTION E

24

28,19

Or

Son 4 year

Father 32 year

25

Let AB be the surface of the lake and let C be a point of observation such that AC = h metres Let D be the position of the cloud and D be its reflection in the lake Then BD = BD

In Δ DCE

$\tan\alpha = \frac{DE}{CE} \Rightarrow CE = \frac{H}{\tan\alpha}$............(i)

In Δ CED'

$\Rightarrow CE = \frac{h+H+h}{\tan\beta} \Rightarrow CE = \frac{2h+H}{\tan\beta}$............(ii)

From (i) & (ii)

$\Rightarrow \frac{H}{\tan\alpha} = \frac{2h+H}{\tan\beta} \Rightarrow H\tan\beta = 2h\tan\alpha + H\tan\alpha$

$H\tan\beta - H\tan\alpha = 2h\tan\alpha \Rightarrow H(\tan\beta - \tan\alpha) = 2h\tan\alpha$

$\Rightarrow H = \frac{2h\tan\alpha}{\tan\beta - \tan\alpha}$........(iii)

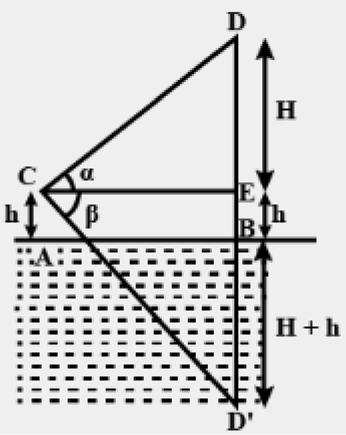
In Δ DCE $\sin\alpha = \frac{DE}{CD} \Rightarrow CD = \frac{DE}{\sin\alpha} \Rightarrow\Rightarrow CD = \frac{H}{\sin\alpha}$

Substituting the value of H from (iii)

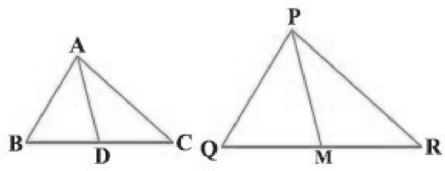
$CD = \frac{2h\tan\alpha}{(\tan\beta - \tan\alpha)\sin\alpha} \Rightarrow CD = \frac{2h\frac{\sin\alpha}{\cos\alpha}}{(\tan\beta - \tan\alpha)\sin\alpha}$

$CD = \frac{2h\sec\alpha}{\tan\beta - \tan\alpha}$

Hence the distance of the cloud from the point of observation is $\frac{2h\sec\alpha}{\tan\beta - \tan\alpha}$



26



SOLUTION

Since AD and PM are medians of $\triangle ABC$ and $\triangle PQR$,

$\therefore BD = \frac{1}{2}BC$ and $QM = \frac{1}{2}QR \ldots\ldots\ldots(1)$

Given that,

$\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AD}{PM} \ldots\ldots\ldots(2)$

$\therefore$ From (1) and (2),

$\frac{AB}{PQ} = \frac{BD}{QM} = \frac{AD}{PM} \ldots\ldots\ldots\ldots(3)$

In $\triangle ABD$ and $\triangle PQM$

$\frac{AB}{PQ} = \frac{BD}{QM} = \frac{AD}{PM}$

$\therefore$ By SSS criterian of proportionality $\triangle ABD \sim \triangle PQM$

$\therefore \angle B = \angle Q$ (Corresponding Sides of Similar Triangles) $\ldots\ldots\ldots\ldots(4)$

In $\triangle ABC$ and $\triangle PQR$

$\frac{AB}{PQ} = \frac{BC}{QR}$ (From 2)

$\angle B = \angle Q$ (From 4)

$\therefore$ By SAS criterian of proportionality $\triangle ABC \sim \triangle PQR$

Or

Let a be the first term and d be the common difference of the given A.P. Then, m times m^{th} term = n^{th} term

$\Rightarrow ma_m = na_n$

$\Rightarrow m\{a + (m - 1) d\} = n \{a + (n - 1) d\}$

$\Rightarrow m\{a + (m - 1) d\} - n\{a + (n - 1) d\} = 0$

$\Rightarrow a(m - n) + \{m (m - 1) - n(n - 1)\} d = 0$

$\Rightarrow a(m - n) + (m - n) (m + n - 1) d = 0$

$\Rightarrow (m - n) \{a + (m + n - 1) d\} = 0$

$\Rightarrow a + (m + n - 1) d = 0$

$\Rightarrow a_{m+n} = 0$