FIITJEE CBSE COMMON TEST

BATCHES : NEFY822A01, W822A01-A03, NETHW922A01

Applicable for class X

Phase Test – 2

MATHEMATICS

Time: 1:30 Hours **Max Marks: 41**

Instructions:

1. This paper consists of **17 *questions*** only
2. Attempt ***All*** questions.
3. Question No. **1 – 4** carries 1 mark each and **05 – 09** carries 2 marks, **10 – 14** carries 3 marks and **15 – 17** carries 4 marks each.
4. Use of Calculator is ***NOT PERMITTED***.

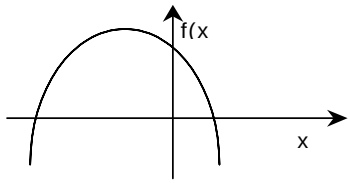
Name of the Candidate : .....

Enroll Number : .....

Date of Examination : .....

MCQ (4 × 1 = 4)

1. Consider the graph of $f(x) = ax^2 + bx + c$ in the adjacent figure. We can conclude that



(A) $c < 0$ (B) $a > 0$
(C) $b < 0$ (D) none of these

2. $\sec^2\theta - \tan^2\theta$ is equal to :
(A) 1 (B) 2 (C) 3 (D) 4

3. The value of $(\sin^2 7\frac{1}{2}^\circ + \cos^2 7\frac{1}{2}^\circ) - (\sin^2 30^\circ + \cos^2 30^\circ) + (\sin^2 7^\circ + \sin^2 83^\circ)$ is equal to :
(A) 3 (B) $3\frac{1}{2}$ (C) 2 (D) 1

4. If $\tan 15^\circ = 2 - \sqrt{3}$, then the value of $\cot^2 75^\circ$ is :
(A) $7+\sqrt{3}$ (B) $7-2\sqrt{3}$ (C) $7-4\sqrt{3}$ (D) $7+4\sqrt{3}$

MCQ (2 × 2 = 4)

5. Value of 'a' and 'b' respectively, if $f(x) = x+1$ is a factor of $g(x) = x^3+ax^2+bx+4$ and $g(1) = 7$.
(A) -1/2, 5/2 (B) 5/2,-1/2
(C) ½, 5/2 (D) -5/2, ½

6. If $x = p\sec\theta$ and $y = \theta\tan\theta$ then :
(A) $x^2 - y^2 = p^2q^2$ (B) $x^2q^2 - y^2p^2 = pq$ (C) $x^2q^2 - y^2p^2 = \frac{1}{p^2q^2}$ (D) $x^2q^2 - y^2p^2 = p^2q^2$

Short Answer type I (3 × 2 = 6)

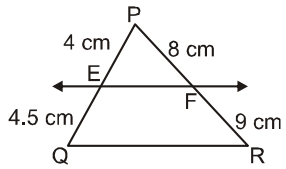
7. If $\cot\theta = \frac{7}{8}$, evaluate $\frac{(1-\cos\theta)(1+\cos\theta)}{(1-\sin\theta)(1+\sin\theta)}$.

8. If $13\tan\theta = 12$, then find the value of $\frac{2\sin\theta\cos\theta}{\cos^2\theta - \sin^2\theta}$

9. Find θ if $\sin 3\theta = \cos(\theta - 6)^\circ$, where 3θ and $(\theta - 6)^\circ$ are acute angles.

Short Answer type II (5 × 3 = 15)

10. E and F are points on the sides PQ and PR respectively of a ΔPQR. If PE = 4 cm, QE = 4.5 cm, PF = 8 cm and RF = 9 cm, prove EF || QR.



11. If $\sin\theta + \text{cosec}\,\theta = 2$ then find $\sin^n\theta + \text{cosec}^n\theta$.

12. A vertical stick 12m long casts a shadow 8 m long on the ground. At the same time a tower casts the shadow 40 m long on the ground. Find the height of the tower.

13. f(x) be a quadratic polynomial with f(2) = 10 and f(-2) = -2. Then find the coefficient of x in f(x).

14. H.C.F. of $(x^2 - kx + 6)(3x+4)$, $(9x^2+24x+16)(x-2)(x-p)$, (x-3) (6x+n) (x^2-4x+4) is (x -2) (x -3) (3x +4). Find value of k + p + n.

Long Answer type (3 × 4 = 12)

15. The string of a kite is 250m long it makes an angle of 60° with the horizontal. Find the height of the kite, assuming that there is no slackness in the string.

16. Find the angle of elevation of the sum (sun's altitude) when the length shadow of a vertical pole is equal to its height.

17. If $\sin\theta = \frac{a^2 - b^2}{a^2 + b^2}$, then find cosec θ + cot θ.

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SOLUTIONS

1. Ans. C
$b < 0$ (vertex lies in 2nd quadrant and $a < 0$)

2. Ans. A
$\sec^2\theta - \tan^2\theta = 1$.

3. $\sin 83° = \cos 7°$
$\therefore$ the given expression is $1 - 1 + 1 = 1$.

4. $\cot^2 75° = (2-\sqrt{3})^2 = 7 - 4\sqrt{3}$

5. $f(-1) = 0 \Rightarrow a - b + 3 = 0$
Also $g(1) = 7 \Rightarrow a + b = 2 \Rightarrow a = \frac{-1}{2}, b = \frac{5}{2}$

6. $\frac{x}{p} = \sec\theta$ and $\frac{y}{q} = \tan\theta$ so $\frac{x^2}{p^2} - \frac{y^2}{q^2} = 1$.

7. $\frac{(1-\cos\theta)(1+\cos\theta)}{(1-\sin\theta)(1+\sin\theta)} = \frac{1-\cos^2\theta}{1-\sin^2\theta} = \tan^2\theta$
$= \frac{64}{49}$

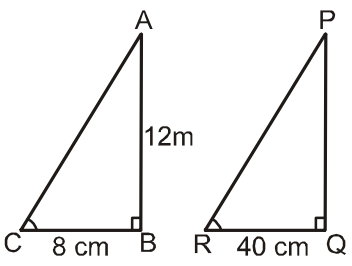
8. Given : $13\tan\theta = 12$
Now given expression is, $\frac{2\sin\theta\cdot\cos\theta}{\cos^2\theta - \sin^2\theta}$
Dividing numerator and denominator by $\cos^2\theta$.
Given expression is $= \frac{312}{25}$

9. $\sin 3\theta = \cos(\theta - 6)°$
where $(\theta - 6)°$ is an acute angle so $3\theta + (\theta - 6)° = 90°$
$\therefore \quad \theta = \frac{96}{4} = 24°$

10. $\frac{PE}{EQ} = \frac{4}{4.5} = \frac{8}{9}, \frac{PF}{RF} = \frac{8}{9} \therefore \frac{PE}{EQ} = \frac{PF}{RF}$
$\therefore$ EF || QR

11. $\sin\theta + \text{cosec}\,\theta = 2$ so $\sin\theta = 1$
$\sin^n\theta + \text{cosec}^n\theta = 2$

12. If figure, AB represents the stick and BC is its shadow.
Therefore AB = 12 m and BC = 8 m.
Again PQ is tower and QR is its shadow. Therefore QR = 40 m
Now, $\Delta ABC \sim \Delta PQR$
$\therefore \quad \frac{PQ}{QR} =$
$\frac{AB}{BC} \Rightarrow \frac{PQ}{40} = \frac{12}{8} \Rightarrow PQ = 60\,m$



13. Ans. 3

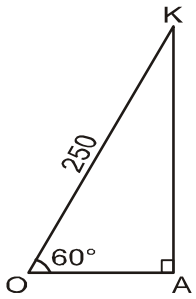
Sol. Let $f(x) = ax^2 + bx + c \Rightarrow 4a + 2b + c = 10$ and $4a - 2b + c = -2$

$\Rightarrow b = 3$

14. Ans. 16

Sol. k = 5, p = 3, n = 8

15.



Let K be the position of the kit at a height h above the ground OA.
The length of the string = OK = 250 m such that

$\angle KOA = 60°$

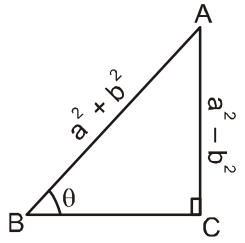
In ΔKOA, we have

$\Rightarrow \quad \frac{KA}{KO} = \sin 60°$

$\Rightarrow \quad KA = 250 \times \frac{\sqrt{3}}{2} = 125\sqrt{3}\,m$

16. The angle of elevation of the sun = 45°.

17.



$\sin\theta = \frac{a^2 - b^2}{a^2 + b^2}$ Since $\sin\theta = \frac{\text{perpendicular}}{\text{base}}$

$\therefore \frac{AC}{AB} = \frac{a^2 - b^2}{a^2 + b^2}$

Now in ΔABC,

$\angle B = \theta$ and $\angle C = 90°$

$(a^2 + b^2)^2 = BC^2 + (a^2 - b^2)^2$

$\therefore$ BC = 2ab

$\text{cosec}\,\theta = \frac{a^2 + b^2}{a^2 - b^2}$, $\cot\theta = \frac{BC}{AC} = \frac{2ab}{a^2 - b^2}$

$\text{cosec}\,\theta + \cot\theta = \frac{a^2 + b^2}{a^2 - b^2} + \frac{2ab}{a^2 - b^2} = \frac{a + b}{a - b}$

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