Hi everyone,

The real learning in mathematics happens when you actively engage with a problem, explore different methods, and work through challenges. Therefore, we strongly encourage you to use this solution key responsibly.

Please attempt all the problems on your own first, giving them your best and most honest effort. These solutions are to help you get unstuck on a problem after you have already tried your best.

Your effort and dedication are the true keys to success.

Date of Exam: 3rd August 2025

Syllabus: Inequality, Modulus and Trigonometric Ratios & Identities

Sub: Mathematics **CT-02 MHT CET Solution** Prof. Chetan Sir

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101. If $x + |x| = 2x$ then x?

(1) $[10, \infty)$ (2) $[0, \infty)$ (3) $(0, \infty)$ (4) $(-\infty, 0)$

Solution:

The given equation is $x + |x| = 2x$.
This simplifies to $|x| = x$.
By definition, the absolute value of x is equal to x itself if and only if x is non-negative.
Therefore, the condition is $x \geq 0$.
In interval notation, this is $[0, \infty)$.

The correct option is **(2)**.

102. If $\tan A = \frac{1}{2}$ and $\tan B = \frac{1}{3}$ where A and B are acute angles, then the value of $A + B$ is:

(1) $\frac{\pi}{6}$ (2) π (3) 0 (4) $\frac{\pi}{4}$

Solution:

We use the tangent addition formula: $\tan(A+B) = \dfrac{\tan A + \tan B}{1 - \tan A \tan B}$.

$$\tan(A+B) = \frac{\frac{1}{2} + \frac{1}{3}}{1 - \frac{1}{2} \cdot \frac{1}{3}} = \frac{\frac{3+2}{6}}{1 - \frac{1}{6}} = \frac{5/6}{5/6} = 1.$$

Since A and B are acute angles, $0 < A < \pi/2$ and $0 < B < \pi/2$.

Therefore, $0 < A + B < \pi$.

The value of $A + B$ in this range for which $\tan(A+B) = 1$ is $\dfrac{\pi}{4}$.

The correct option is **(4)**.

103. If $|x - 5| = 27$ then $x = ?$

(1) -32 (2) 22 (3) -32, 22 (4) 32,-22

Solution:

The equation $|x - 5| = 27$ leads to two possible cases:

Case 1: $x - 5 = 27 \implies x = 27 + 5 = 32.$

Case 2: $x - 5 = -27 \implies x = -27 + 5 = -22.$

The solutions are 32 and -22.

The correct option is **(4)**.

104. The value of $\frac{\cos(90^\circ+\theta)\sec(-\theta)\tan(180^\circ-\theta)}{\sec(360^\circ-\theta)\sin(180^\circ+\theta)\cot(90^\circ-\theta)}$ is:

(1) 1 (2) -1 (3) $\tan\theta$ (4) $\cot\theta$

Solution:

We simplify each trigonometric term using reduction formulas:

$\cos(90^\circ + \theta) = -\sin\theta$

$\sec(-\theta) = \sec\theta$

$\tan(180^\circ - \theta) = -\tan\theta$

$\sec(360^\circ - \theta) = \sec\theta$

$\sin(180^\circ + \theta) = -\sin\theta$

$\cot(90^\circ - \theta) = \tan\theta$

Substitute these into the expression:

$$\frac{(-\sin\theta)(\sec\theta)(-\tan\theta)}{(\sec\theta)(-\sin\theta)(\tan\theta)} = \frac{\sin\theta\sec\theta\tan\theta}{-\sin\theta\sec\theta\tan\theta} = -1.$$

The correct option is **(2)**.

105. If $|3x-5|=7$ then $x=?$

(1) $4, -2/3$ (2) -4, 2/3 (3) $4/3, 2$ (4) $-4/3, 2$

Solution:

The equation $|3x-5|=7$ leads to two possible cases:
Case 1: $3x-5=7 \implies 3x=12 \implies x=4.$
Case 2: $3x-5=-7 \implies 3x=-2 \implies x=-2/3.$
The solutions are 4 and -2/3.

The correct option is **(1)**.

106. If $\cos A = 4/5$ then the value of $\cos 3A$ is:

(1) $\frac{44}{125}$ (2) $-\frac{44}{125}$ (3) $\frac{117}{125}$ (4) $-\frac{117}{125}$

Solution:

We use the triple angle identity for cosine: $\cos 3A = 4\cos^3 A - 3\cos A$.
Given $\cos A = 4/5$.

$$\cos 3A = 4\left(\frac{4}{5}\right)^3 - 3\left(\frac{4}{5}\right).$$
$$= 4\left(\frac{64}{125}\right) - \frac{12}{5} = \frac{256}{125} - \frac{12\times 25}{5\times 25}.$$
$$= \frac{256}{125} - \frac{300}{125} = \frac{256-300}{125} = -\frac{44}{125}.$$

The correct option is **(2)**.

107. If $|2025x-2024| = -2026$ then $x=?$

(1) 2026 (2) 2024 (3) 2025 (4) None of these

Solution:

The expression $|2025x-2024|$ represents an absolute value.
By definition, the absolute value of any real number is always non-negative.
$|2025x-2024| \geq 0.$
The right-hand side of the equation is -2026, which is a negative number.
The equation sets a non-negative value equal to a negative value, which is impossible.
Therefore, there is no real solution for x.

The correct option is **(4)**.

108. If $\cos x = -\frac{4}{5}$ and $\frac{\pi}{2} < x < \pi$, then the value of $\sin(\frac{x}{2})$ is:

(1) $\frac{1}{\sqrt{5}}$ (2) $-\frac{1}{\sqrt{5}}$ (3) $\frac{1}{\sqrt{10}}$ (4) $\frac{3}{\sqrt{10}}$

Solution:

Given the quadrant for x: $\frac{\pi}{2} < x < \pi$ (Quadrant II).
For x/2, we divide the inequality by 2: $\frac{\pi}{4} < \frac{x}{2} < \frac{\pi}{2}$.
This means x/2 is in Quadrant I. In Q1, $\sin(x/2)$ is positive.

We use the half-angle identity $\sin^2\left(\frac{x}{2}\right) = \frac{1-\cos x}{2}$.
Given $\cos x = -4/5$.
$\sin^2\left(\frac{x}{2}\right) = \frac{1-(-4/5)}{2} = \frac{1+4/5}{2} = \frac{9/5}{2} = \frac{9}{10}$.
$\sin\left(\frac{x}{2}\right) = \pm\sqrt{\frac{9}{10}} = \pm\frac{3}{\sqrt{10}}$.
Since x/2 is in Quadrant I, we choose the positive value.
$\sin\left(\frac{x}{2}\right) = \frac{3}{\sqrt{10}}$.

The correct option is **(4)**.

109. Number of solution of the equation $x^2 - 5|x| + 6 = 0$

(1) 2 (2) 0 (3) 4 (4) None of these

Solution:

Let $y = |x|$. Then $x^2 = |x|^2 = y^2$. Also, $y \geq 0$.
The equation becomes a quadratic in y:
$y^2 - 5y + 6 = 0$.
$(y-2)(y-3) = 0$.
The solutions for y are $y = 2$ or $y = 3$.
Both solutions are non-negative, so they are valid.

Case 1: $|x| = 2 \implies x = 2$ or $x = -2$.
Case 2: $|x| = 3 \implies x = 3$ or $x = -3$.

The solutions are $\{-3, -2, 2, 3\}$. There are 4 solutions.

The correct option is **(3)**.

110. The value of $3\sin 20^\circ - 4\sin^3 20^\circ$ is:

(1) $\frac{\sqrt{3}}{2}$ (2) $\frac{1}{2}$ (3) 1 (4) $\sin 40^\circ$

Solution:

We use the triple angle identity for sine: $\sin 3\theta = 3\sin\theta - 4\sin^3\theta$.
The given expression is in this exact form, with $\theta = 20^\circ$.

$$3\sin 20^\circ - 4\sin^3 20^\circ = \sin(3\times 20^\circ).$$
$$= \sin(60^\circ).$$
$$= \frac{\sqrt{3}}{2}.$$

The correct option is **(1)**.

111. Number of solution of the equation $x^2 + |x| + 2 = 0$

(1) 0 (2) 1 (3) 2 (4) 4

Solution:

The given equation is $x^2 + |x| + 2 = 0$.
For any real number x, we know that $x^2 \geq 0$ and $|x| \geq 0$.
Therefore, the sum of the terms on the left-hand side is:
$x^2 + 3|x| + 2 \geq 0 + 0 + 2$.
$x^2 + |x| + 2 \geq 2$.
The expression on the left-hand side is always greater than or equal to 2.
It can never be equal to 0.
Therefore, there are no real solutions.

The correct option is **(1)**.

112. If $\tan(\frac{x}{2}) = \frac{2}{3}$, then the value of $\cos x$ is:

(1) $\frac{5}{13}$ (2) $-\frac{5}{13}$ (3) $\frac{12}{13}$ (4) $-\frac{12}{13}$

Solution:

We use the half-angle identity for cosine in terms of tangent:

$$\cos x = \frac{1-\tan^2(x/2)}{1+\tan^2(x/2)}.$$

Given $\tan(x/2) = 2/3$.

$$\cos x = \frac{1-(2/3)^2}{1+(2/3)^2} = \frac{1-4/9}{1+4/9}.$$
$$= \frac{5/9}{13/9} = \frac{5}{13}.$$

The correct option is **(1)**.

113. Solution of the equation $|x-2| = x-2$

(1) $(-\infty, 2]$ (2) $(-\infty, \infty)$ (3) $[2, \infty)$ (4) $[-2, \infty)$

Solution:

The equation is of the form $|A| = A$.

Therefore, the condition is $x - 2 \geq 0$.
$x \geq 2$.
In interval notation, this is $[2, \infty)$.

The correct option is **(3)**.

114. If x is an acute angle, $\sqrt{1 + \sin x}$ is equal to:

(1) $\cos(\frac{x}{2}) - \sin(\frac{x}{2})$ (2) $\sin(\frac{x}{2}) - \cos(\frac{x}{2})$ (3) $\sin(\frac{x}{2}) + \cos(\frac{x}{2})$ (4) $\sin x + \cos x$

Solution:

We use the identities $1 = \sin^2(x/2) + \cos^2(x/2)$ and $\sin x = 2\sin(x/2)\cos(x/2)$.
$\sqrt{1 + \sin x} = \sqrt{(\sin^2(x/2) + \cos^2(x/2)) + 2\sin(x/2)\cos(x/2)}$.
$= \sqrt{(\sin(x/2) + \cos(x/2))^2}$.
$= |\sin(x/2) + \cos(x/2)|$.

Given that x is an acute angle, $0 < x < \pi/2$.
Then $0 < x/2 < \pi/4$.
In this interval, both $\sin(x/2)$ and $\cos(x/2)$ are positive.
Therefore, their sum is positive, and we can remove the absolute value.
$= \sin(x/2) + \cos(x/2)$.

The correct option is **(3)**.

115. Number of positive integral solution of the equation $|x + 3| = -x - 3$

(1) 0 (2) 2 (3) 4 (4) 3

Solution:

The equation is $|x + 3| = -(x + 3)$.
This is of the form $|A| = -A$, which holds true if and only if $A \leq 0$.
So, we must have $x + 3 \leq 0 \implies x \leq -3$.
The solution set is $(-\infty, -3]$.

The question asks for the number of *positive* integral solutions.
The solution set $(-\infty, -3]$ contains only negative numbers and -3.
There are no positive integers in this set.
Therefore, the number of positive integral solutions is 0.

The correct option is **(1)**.

116. The value of $\frac{\sin 2A}{1+\cos 2A}$ is equal to:

(1) cot A (2) tan A (3) sin A (4) cos A

Solution:

We use the double angle identities:
$\sin 2A = 2\sin A\cos A.$
$1 + \cos 2A = 2\cos^2 A.$

Substitute these into the expression:
$\frac{2\sin A\cos A}{2\cos^2 A}.$
Assuming $\cos A \neq 0,$ we can cancel $2\cos A$.
$= \frac{\sin A}{\cos A} = \tan A.$

The correct option is **(2)**.

117. Solution of the equation $|x^2 - x - 2| = 2 + x - x^2$

(1) $[1, 2]$ (2) $[-2, 1]$ (3) $[-1, 2]$ (4) $[-2, -1]$

Solution:

The equation is $|x^2 - x - 2| = -(x^2 - x - 2).$
This is of the form $|A| = -A,$ which holds true if and only if $A \leq 0.$
So, we must have $x^2 - x - 2 \leq 0.$
Factor the quadratic:
$(x - 2)(x + 1) \leq 0.$
The roots are -1 and 2. The expression is non-positive between the roots (inclusive).
The solution is $-1 \leq x \leq 2.$
In interval notation, this is $[-1, 2]$.

The correct option is **(3)**.

118. In a ΔABC, the value of $\sin 2A + \sin 2B + \sin 2C$ is:

(1) 2 sin A sin B sin C (2) 4 sin A sin B sin C (3) 2 cos A cos B cos C (4) 4 cos A cos B cos C

Solution:

Let $E = \sin 2A + \sin 2B + \sin 2C.$
Using the sum-to-product formula on the first two terms:
$E = 2\sin(A + B)\cos(A - B) + 2\sin C\cos C.$
Since $A + B + C = \pi, \sin(A + B) = \sin(\pi - C) = \sin C.$
$E = 2\sin C\cos(A - B) + 2\sin C\cos C.$
$E = 2\sin C(\cos(A - B) + \cos C).$
Also, $\cos C = \cos(\pi - (A + B)) = -\cos(A + B).$
$E = 2\sin C(\cos(A - B) - \cos(A + B)).$
Using the identity $\cos(A - B) - \cos(A + B) = 2\sin A\sin B :$

$$E = 2\sin C(2\sin A\sin B).$$
$$E = 4\sin A\sin B\sin C.$$

The correct option is **(2)**.

119. Solutions of the equation $|x-6|+|x-10|=4$

(1) $[-10, 6]$ (2) $[6, 10]$ (3) $[-6, 10]$ (4) None of these

Solution:

The equation is of the form $|x-a|+|x-b| = b-a,$ where $a = 6, b = 10$.
The expression $|x-a|+|x-b|$ represents the sum of the distances of x from a and b.
This sum is equal to the distance between a and b, which is $b-a,$ if and only if x lies on the segment be
So, the solution is $a \leq x \leq b$.
$6 \leq x \leq 10$.
The solution set is $[6, 10]$.

The correct option is **(2)**.

120. The value of $\frac{\cot A - \tan A}{\cot A + \tan A}$ is:

(1) sin 2A (2) cos 2A (3) tan 2A (4) sec 2A

Solution:

Convert all terms to sine and cosine.
$$\frac{\frac{\cos A}{\sin A} - \frac{\sin A}{\cos A}}{\frac{\cos A}{\sin A} + \frac{\sin A}{\cos A}} = \frac{\frac{\cos^2 A - \sin^2 A}{\sin A\cos A}}{\frac{\cos^2 A + \sin^2 A}{\sin A\cos A}}.$$
The denominators $\sin A\cos A$ cancel out.
$$= \frac{\cos^2 A - \sin^2 A}{\cos^2 A + \sin^2 A}.$$
Using the identities $\cos^2 A - \sin^2 A = \cos 2A$ and $\cos^2 A + \sin^2 A = 1:$
$$= \frac{\cos 2A}{1} = \cos 2A.$$

The correct option is **(2)**.

121. Solutions of the equation $|x-3|+|x-4|=|2x-7|$

(1) $(-\infty, 4) \cup [3, \infty)$ (2) $(-\infty, 4]$ (3) $(3, \infty)$ (4) $(-\infty, 3] \cup [4, \infty)$

Solution:

The equation is of the form $|A|+|B| = |A+B|$.
Let $A = x-3$ and $B = x-4$.
$A + B = (x-3) + (x-4) = 2x-7$.
The identity $|A|+|B| = |A+B|$ holds true if and only if A and B have the same sign, i.e., $A \cdot B \geq 0$.

So, we need to solve the inequality:
$(x-3)(x-4) \geq 0$.
The roots are 3 and 4. The expression is non-negative at or outside the roots.
The solution is $x \leq 3$ or $x \geq 4$.
In interval notation, this is $(-\infty, 3] \cup [4, \infty)$.

The correct option is **(4)**.

122. If $A+B+C=\pi$ then $\cos 2A + \cos 2B - \cos 2C$ is equal to :

(1) $1 - 4\sin A \sin B \cos C$
(2) $1 - 4\cos A \cos B \sin C$
(3) $1 - 2\sin A \sin B \cos C$
(4) $1 - 2\cos A \cos B \sin C$

Solution:

$$
\begin{aligned}
&E = (\cos 2A + \cos 2B) - \cos 2C. \\
&E = 2\cos(A+B)\cos(A-B) - (2\cos^2 C - 1). \\
&\text{Since } A+B = \pi - C, \cos(A+B) = -\cos C. \\
&E = -2\cos C\cos(A-B) - 2\cos^2 C + 1. \\
&E = 1 - 2\cos C(\cos(A-B) + \cos C). \\
&\text{Since } \cos C = -\cos(A+B): \\
&E = 1 - 2\cos C(\cos(A-B) - \cos(A+B)). \\
&\text{Using } \cos(A-B) - \cos(A+B) = 2\sin A\sin B: \\
&E = 1 - 2\cos C(2\sin A\sin B) = 1 - 4\sin A\sin B\cos C.
\end{aligned}
$$

The correct option is **(1)**.

123. Solution of the equation $|x+1| - |x-1| = 2$

(1) $(-\infty, 1)$
(2) $(1, \infty)$
(3) $[1, \infty)$
(4) $(-\infty, -1)$

Solution:

We solve by considering intervals based on the critical points $-1, 1$.
Case 1: $x \geq 1$. The equation is $(x+1) - (x-1) = 2 \implies 2 = 2$.
This is always true. So, all $x \geq 1$ are solutions.
Case 2: $-1 \leq x < 1$. The equation is $(x+1) - (-(x-1)) = 2 \implies 2x = 2 \implies x = 1$.
$x = 1$ is included in the solution from Case 1.
Case 3: $x < -1$. The equation is $-(x+1) - (-(x-1)) = 2 \implies -x-1+x-1 = 2 \implies -2 = 2$.
This is false. No solutions in this case.
The overall solution is $[1, \infty)$.

The correct option is **(3)**.

124. The value of $\cos(\frac{\pi}{9})\cos(\frac{2\pi}{9})\cos(\frac{4\pi}{9})$ is :

(1) $\frac{1}{2}$
(2) $\frac{1}{4}$
(3) $\frac{1}{8}$
(4) $-\frac{1}{8}$

Solution:

Let $P = \cos(20^\circ)\cos(40^\circ)\cos(80^\circ)$.
This is of the form $\cos\theta\cos(2\theta)\cos(4\theta)$ with $\theta = 20^\circ$.
Using the identity $\cos\theta\cos(2\theta)\ldots\cos(2^{n-1}\theta) = \dfrac{\sin(2^n\theta)}{2^n\sin\theta}$.
$P = \dfrac{\sin(2^3 \cdot 20^\circ)}{2^3\sin 20^\circ} = \dfrac{\sin 160^\circ}{8\sin 20^\circ} = \dfrac{\sin(180-20)^\circ}{8\sin 20^\circ} = \dfrac{\sin 20^\circ}{8\sin 20^\circ} = \dfrac{1}{8}$.

The correct option is **(3)**.

125. Solution of the equation $|6-4x| = 1 - |2x+8|$

(1) ϕ (2) $[2,\infty)$ (3) $(-\infty,-2]$ (4) [-2,2]

Solution:

$|6-4x| + |2x+8| = 1$.
Critical points are $x = 6/4 = 3/2$ and $x = -4$.

Case 1: $x \geq 3/2$. $-(6-4x)+(2x+8) = 1 \implies 4x-6+2x+8 = 1 \implies 6x+2 = 1$ $\implies x = -1/6$. (Not in domain)
Case 2: $-4 \leq x < 3/2$. $(6-4x)+(2x+8) = 1 \implies -2x+14 = 1 \implies 2x = 13$ $\implies x = 6.5$. (Not in domain)
Case 3: $x < -4$. $(6-4x)-(2x+8) = 1 \implies 6-4x-2x-8 = 1 \implies -6x-2 = 1$ $\implies x = -1/2$. (Not in domain)
There is no solution. The solution set is ϕ.

The correct option is **(1)**.

126. The value of $\cos\frac{2\pi}{7} + \cos\frac{4\pi}{7} + \cos\frac{6\pi}{7}$ is:

(1) 1 (2) -1 (3) $\frac{1}{2}$ (4) $-\frac{1}{2}$

Solution:

Let $S = \cos\dfrac{2\pi}{7} + \cos\dfrac{4\pi}{7} + \cos\dfrac{6\pi}{7}$.
Multiply by $2\sin(\pi/7)$:
$2S\sin(\pi/7) = 2\sin(\pi/7)\cos(2\pi/7) + 2\sin(\pi/7)\cos(4\pi/7) + 2\sin(\pi/7)\cos(6\pi/7)$.
$= [\sin(3\pi/7) - \sin(\pi/7)] + [\sin(5\pi/7) - \sin(3\pi/7)] + [\sin(\pi) - \sin(5\pi/7)]$.
$= -\sin(\pi/7) + \sin(\pi) = -\sin(\pi/7)$.
$2S\sin(\pi/7) = -\sin(\pi/7) \implies S = -1/2$.

The correct option is **(4)**.

127. Solution of the equation $|x| - |x-2| = 2$

(1) $[2, \infty)$ (2) $(-\infty, -2]$ (3) $[-2, 2]$ (4) None of these

Solution:

Let $A = x, B = x - 2$. The equation is $|A| - |B| = 2$.
$A - B = x - (x - 2) = 2$.
The identity is $|A| - |B| = A - B$, which holds if $B \leq A$ and $B \geq 0$.
$|A| - |B| = |A - B|$ holds if $AB \geq 0$ and $|A| \geq |B|$.
Let's use cases. Critical points are 0, 2.
Case 1: $x \geq 2$. $x - (x - 2) = 2 \implies 2 = 2$. True. Solution is $[2, \infty)$.
Case 2: $0 \leq x < 2$. $x - (-(x - 2)) = 2 \implies 2x - 2 = 2 \implies 2x = 4$
$\implies x = 2$. (Not in interval, but is a boundary point)
Case 3: $x < 0$. $-x - (-(x - 2)) = 2 \implies -x + x - 2 = 2 \implies -2 = 2$. False.
The solution is $[2, \infty)$.

The correct option is **(1)**.

128. If $A + B + C = \frac{\pi}{2}$, then the value of $\tan A \tan B + \tan B \tan C + \tan C \tan A$ is:

(1) 0 (2) 1 (3) -1 (4) 1/2

Solution:

Given $A + B + C = \pi/2$.
$A + B = \pi/2 - C$.
$\tan(A + B) = \tan(\pi/2 - C) = \cot C$.
$\frac{\tan A + \tan B}{1 - \tan A \tan B} = \frac{1}{\tan C}$.
$\tan C(\tan A + \tan B) = 1 - \tan A \tan B$.
$\tan A \tan C + \tan B \tan C = 1 - \tan A \tan B$.
$\tan A \tan B + \tan B \tan C + \tan C \tan A = 1$.

The correct option is **(2)**.

129. Solution of the inequation $|x - 4| \leq 4$

(1) $[-8, 8]$ (2) $[0, 8]$ (3) $(-\infty, 8]$ (4) None of these

Solution:

The inequality $|A| \leq B$ (for B¿0) is equivalent to $-B \leq A \leq B$.
$-4 \leq x - 4 \leq 4$.
Add 4 to all parts of the inequality:
$-4 + 4 \leq x \leq 4 + 4$.
$0 \leq x \leq 8$.
The solution set is $[0, 8]$.

The correct option is **(2)**.

130. If $\tan\theta = 3$, then $\sin 2\theta$ is equal to:

(1) $\frac{3}{5}$ (2) $\frac{4}{5}$ (3) $\frac{3}{10}$ (4) $\frac{1}{5}$

Solution:

$$\text{We use the identity } \sin 2\theta = \frac{2\tan\theta}{1+\tan^2\theta}.$$
$$\sin 2\theta = \frac{2(3)}{1+(3)^2} = \frac{6}{1+9} = \frac{6}{10} = \frac{3}{5}.$$

The correct option is **(1)**.

131. If $|x-4| \geq 6$ then $x \in$

(1) $(-\infty,-2]\cup[10,\infty)$ (2) $(-\infty,2)\cup(10,\infty)$ (3) $(-\infty,-2]\cup[10,\infty)$ (4) $(-\infty,2]\cup[-10,\infty)$

Solution:

The inequality $|A| \geq B$ (for B>0) is equivalent to $A \geq B$ or $A \leq -B$.
Case 1: $x-4 \geq 6 \implies x \geq 10$.
Case 2: $x-4 \leq -6 \implies x \leq -2$.
The solution is the union of these two cases: $(-\infty,-2]\cup[10,\infty)$.

The correct option is **(3)**.

132. The value of $\cos(20°)\cos(40°)\cos(80°)$ is:

(1) $\frac{1}{2}$ (2) $\frac{1}{4}$ (3) $\frac{1}{8}$ (4) $\frac{1}{16}$

Solution:

Let $P = \cos(20°)\cos(40°)\cos(80°)$.
Using the identity $\cos\theta\cos(60°-\theta)\cos(60°+\theta) = \frac{1}{4}\cos 3\theta$.
This is not directly applicable. Use $\cos\theta\cos 2\theta\cos 4\theta...$ instead.
$$P = \frac{\sin(2^3\cdot 20°)}{2^3\sin 20°} = \frac{\sin 160°}{8\sin 20°} = \frac{\sin(180-20)°}{8\sin 20°} = \frac{1}{8}.$$

The correct option is **(3)**.

133. If $|2x-5| > 5$ then $x \in$

(1) $(-\infty,0)\cup(5,\infty)$ (2) $(-\infty,0)$ (3) $(5,\infty)$ (4) None of these

Solution:

The inequality $|A| > B$ (for B¿0) is equivalent to $A > B$ or $A < -B$.
Case 1: $2x-5 > 5 \implies 2x > 10 \implies x > 5$.
Case 2: $2x-5 < -5 \implies 2x < 0 \implies x < 0$.
The solution is the union of these two cases: $(-\infty,0)\cup(5,\infty)$.

The correct option is **(1)**.

134. The maximum value of $\sin x + \cos x$ is:

(1) 1 (2) 2 (3) $\sqrt{2}$ (4) $\frac{1}{\sqrt{2}}$

Solution:

For an expression of the form $a \sin x + b \cos x$, the maximum value is $\sqrt{a^2 + b^2}$.
Here, $a = 1$ and $b = 1$.
Maximum value $= \sqrt{1^2 + 1^2} = \sqrt{2}$.

The correct option is **(3)**.

135. If $|-3x + 7| \leq 5$ then $x \in$

(1) $[\frac{3}{2}, 4]$ (2) $[\frac{2}{3}, 5]$ (3) $[\frac{2}{3}, 4]$ (4) $[\frac{2}{3}, \frac{3}{2}]$

Solution:

$|-3x + 7| = |-(3x - 7)| = |3x - 7|$.
$|3x - 7| \leq 5$.
$-5 \leq 3x - 7 \leq 5$.
$-5 + 7 \leq 3x \leq 5 + 7$.
$2 \leq 3x \leq 12$.
$\frac{2}{3} \leq x \leq 4$.
The solution set is $[2/3, 4]$.

The correct option is **(3)**.

136. Which of the following is not a possible value?

(1) $\tan \theta = 100$ (2) $\cos \theta = \frac{2\alpha}{1+\alpha^2}$ for $\alpha \in \mathbb{R}$ (3) $\sec \theta = 0.5$ (4) $\sin \theta = -\frac{1}{2}$

Solution:

(1) The range of $\tan \theta$ is $(-\infty, \infty)$.100 is a possible value.
(2) The range of $\frac{2\alpha}{1 + \alpha^2}$ is $[-1, 1]$, which is the same as the range of $\cos \theta$.Possible.
(3) The range of $\sec \theta$ is $(-\infty, -1] \cup [1, \infty)$.0.5 is not in this range. Not possible.
(4) The range of $\sin \theta$ is $[-1, 1]$. $-1/2$ is a possible value.

The correct option is **(3)**.

137. If $|2 + \frac{5}{x}| > 1$ then complete solution is

(1) $(-\infty,-5)\cup(\frac{-5}{3},0)\cup(0,\infty)$ (2) $(-\infty,-5)\cup(0,\infty)$
(3) ... (4) ...

Solution:

We have $|(2x+5)/x|>1,$ with $x\neq 0$.
Case 1:$(2x+5)/x>1 \implies (2x+5-x)/x>0 \implies (x+5)/x>0 \implies x\in(-\infty,-5)\cup(0,\infty)$.
Case 2:$(2x+5)/x<-1 \implies (2x+5+x)/x<0 \implies (3x+5)/x<0 \implies x\in(-5/3,0)$.
The union is $(-\infty,-5)\cup(-5/3,0)\cup(0,\infty)$.

The correct option is **(1)**.

138. The maximum value of the function $y=\frac{1}{5\cos x-12\sin x+15}$ is:

(1) 1/2 (2) 1/28 (3) 1/13 (4) 2

Solution:

To maximize y, we must minimize the denominator D.
$D=5\cos x-12\sin x+15$.
The range of $5\cos x-12\sin x$ is $[-\sqrt{5^2+(-12)^2},\sqrt{5^2+(-12)^2}]=[-13,13]$.
$D_{min}=-13+15=2$.
$y_{max}=1/D_{min}=1/2$.

The correct option is **(1)**.

139. If $|2x-6|\leq 12$ then

(1) [-3,9] (2) [3,9] (3) [3,16] (4) [-3,16]

Solution:

$$-12\leq 2x-6\leq 12.$$
$$-6\leq 2x\leq 18.$$
$$-3\leq x\leq 9.$$
Solution is $[-3,9]$.

The correct option is **(1)**.

140. In a ΔABC, if $\tan A=1$ and $\tan B=2$, then $\tan C$ is:

(1) 1 (2) 2 (3) 3 (4) -3

Solution:

In a triangle, $A+B+C=\pi \implies \tan(A+B)=\tan(\pi-C)=-\tan C$.
$$\frac{\tan A+\tan B}{1-\tan A\tan B}=-\tan C.$$

$$\frac{1+2}{1-1(2)} = -\tan C.$$
$$\frac{3}{-1} = -3 = -\tan C \implies \tan C = 3.$$

The correct option is **(3)**.

141. If $|\frac{3x+3}{5}| \leq 3$ then x

(1) [-6,4] (2) [-4,6] (3) [6,4] (4) None of these

Solution:

$$-3 \leq \frac{3x+3}{5} \leq 3.$$
$$-15 \leq 3x+3 \leq 15.$$
$$-18 \leq 3x \leq 12.$$
$$-6 \leq x \leq 4.$$
$$\text{Solution is } [-6, 4].$$

The correct option is **(1)**.

142. The value of $\sin 50° - \sin 70° + \sin 10°$ is:

(1) 1 (2) 0 (3) 1/2 (4) 2

Solution:

$$E = (\sin 50° + \sin 10°) - \sin 70°.$$
$$= 2\sin\frac{60}{2}\cos\frac{40}{2} - \sin 70° = 2\sin 30° \cos 20° - \sin 70°.$$
$$= 2(1/2)\cos 20° - \sin 70° = \cos 20° - \cos 20° = 0.$$

The correct option is **(2)**.

143. If $|\frac{x-4}{x+2}| \leq 1$ then $x \in$

(1) $(-\infty, -1)$ (2) $[1, \infty)$ (3) $(1, \infty)$ (4) None of these

Solution:

$$|x-4| \leq |x+2|, \text{ with } x \neq -2.$$
$$(x-4)^2 \leq (x+2)^2 \implies x^2 - 8x + 16 \leq x^2 + 4x + 4.$$
$$12 \leq 12x \implies 1 \leq x.$$
$$\text{Solution is } [1, \infty).$$

The correct option is **(2)**.

144. The value of $\tan(22.5°)$ is:

(1) $\sqrt{2}+1$ (2) $1-\sqrt{2}$ (3) $\sqrt{2}-1$ (4) $\sqrt{3}+1$

Solution:

$$\tan(2\theta) = \frac{2\tan\theta}{1-\tan^2\theta}. \text{ Let } \theta = 22.5°, 2\theta = 45°.$$
$$\tan 45° = 1 = \frac{2\tan(22.5)}{1-\tan^2(22.5)}.$$
$$\text{Let } t = \tan(22.5). \quad 1 = \frac{2t}{1-t^2} \implies t^2+2t-1=0.$$
$$t = \frac{-2 \pm \sqrt{4-4(-1)}}{2} = \frac{-2 \pm \sqrt{8}}{2} = -1 \pm \sqrt{2}.$$
$$\text{Since } 22.5° \text{ is in Q1, tan is positive. So, } t = \sqrt{2}-1.$$

The correct option is **(3)**.

145. If $|x^2-7| \leq 9$ then x

(1) [-4,4] (2) [4,4] (3) [-9, 4] (4) [-9,9]

Solution:

$$-9 \leq x^2 - 7 \leq 9.$$
$$-2 \leq x^2 \leq 16.$$
$$\text{The inequality } -2 \leq x^2 \text{ is always true since } x^2 \geq 0.$$
$$\text{We only need to solve } x^2 \leq 16.$$
$$-4 \leq x \leq 4.$$
$$\text{Solution is } [-4,4].$$

The correct option is **(1)**.

146. The range of the function $f(x) = \cos^2 x - 6\cos x + 12$ is:

(1) [7, 19] (2) [6, 18] (3) [7, 18] (4) [6, 19]

Solution:

Let $y = \cos x$. Range of y is $[-1,1]$.
$f(y) = y^2 - 6y + 12$.
Complete the square: $(y-3)^2 - 9 + 12 = (y-3)^2 + 3$.
The vertex of the parabola is at $y = 3$, which is outside the interval $[-1,1]$.
Since the parabola opens upwards, the max/min values will occur at the endpoints of $[-1,1]$.
$f(-1) = (-1-3)^2 + 3 = 16 + 3 = 19$.
$f(1) = (1-3)^2 + 3 = 4 + 3 = 7$.
The range is $[7,19]$.

The correct option is **(1)**.

147. If $|x^2 + x - 6| < 6$ then $x \in$

(1) [-4,3] (2) (-4,3) (3) (-3,4) (4) [-3,4]

Solution:

$-6 < x^2 + x - 6 < 6.$

Part 1: $x^2 + x - 6 > -6 \implies x^2 + x > 0 \implies x(x+1) > 0 \implies x \in (-\infty, -1) \cup (0, \infty).$

Part 2: $x^2 + x - 6 < 6 \implies x^2 + x - 12 < 0 \implies (x+4)(x-3) < 0 \implies x \in (-4, 3).$

Intersection of both parts: $((-4, -1) \cup (0, 3)).$

The solution is $(-4, -1) \cup (0, 3)$.

148. The value of $\tan 20° \tan 30° \tan 40° \tan 80°$ is:

(1) 1 (2) $\sqrt{3}$ (3) $\frac{1}{\sqrt{3}}$ (4) 3

Solution:

$$E = \tan 30°(\tan 20° \tan 40° \tan 80°).$$
$$\tan 20° \tan(60-20)° \tan(60+20)° = \tan(3 \times 20)° = \tan 60° = \sqrt{3}.$$
$$E = \tan 30° \cdot \tan 60° = \frac{1}{\sqrt{3}} \cdot \sqrt{3} = 1.$$

The correct option is **(1)**.

149. If $||x-2|-3| \leq 0$ then product of roots is

(1) 5 (2) -5 (3) 6 (4) -6

Solution:

The absolute value of an expression is always non-negative.

So, $||x-2|-3| \geq 0$.

The only way $||x-2|-3| \leq 0$ can be true is if $||x-2|-3| = 0$.

$|x-2| - 3 = 0 \implies |x-2| = 3.$

$x - 2 = 3 \implies x = 5.$

$x - 2 = -3 \implies x = -1.$

The roots are 5 and -1. Product of roots $= 5 \times (-1) = -5$.

The correct option is **(2)**.

150. The value of $\frac{\sin 7x - \sin 5x}{\cos 7x + \cos 5x}$ is equal to:

(1) tan x (2) cot x (3) tan 6x (4) cot 6x

Solution:

Using sum-to-product formulas:

$$\sin C - \sin D = 2\cos\frac{C+D}{2}\sin\frac{C-D}{2}.$$
$$\cos C + \cos D = 2\cos\frac{C+D}{2}\cos\frac{C-D}{2}.$$
$$\frac{2\cos\frac{7x+5x}{2}\sin\frac{7x-5x}{2}}{2\cos\frac{7x+5x}{2}\cos\frac{7x-5x}{2}} = \frac{2\cos 6x\sin x}{2\cos 6x\cos x}.$$
$$= \frac{\sin x}{\cos x} = \tan x.$$

The correct option is **(1)**.