MHT CET 2023 Question Paper with Answers and Solution May 11 Shift 2 (Memory-based)

Question 1. The value of ∫ (1 - cosx).cosec^{2}dx is?

Answer. cos(x) + sin(x) + cot(cos(x)) + C

Solution. To evaluate the integral ∫ (1 - cosx) cosec^2(x) dx, we can simplify the integrand using trigonometric identities.

Recall that cosec^2(x) is equal to 1 + cot^2(x), where cot(x) is the cotangent of x.

∫ (1 - cosx) cosec^2(x) dx = ∫ (1 - cosx) (1 + cot^2(x)) dx

Expanding the expression:

= ∫ (1 - cosx + cot^2(x) - cosx * cot^2(x)) dx

Now, let's evaluate each term separately:

∫ (1 - cosx) dx = x - sin(x) + C_1

∫ cot^2(x) dx can be integrated by using the formula ∫ cot^2(x) dx = -x - cot(x) + C_2

∫ cosx * cot^2(x) dx can be integrated by substitution. Let's denote cos(x) as u:

u = cos(x) du = -sin(x) dx

Replacing dx and cos(x) with du and u, respectively, we have:

∫ u * cot^2(x) (-du/sin(x)) = -∫ u cot^2(x) du = -∫ cot^2(x) du

Using the formula mentioned earlier, we know that ∫ cot^2(x) dx = -x - cot(x)
+ C_2. Hence, the integral of -∫ cot^2(x) du will be -(-u - cot(u) + C_2) = u + cot(u) - C_2.

Putting it all together, the integral becomes:

x - sin(x) + C_1 + (-x - cot(x) + C_2) + (cos(x) + cot(cos(x)) -

C_2) Simplifying:

= x - x + cos(x) + sin(x) + cot(cos(x)) + C_1 - C_2

The final result is cos(x) + sin(x) + cot(cos(x)) + C, where C = C_1 - C_2 is the constant of integration.

Question 2. The function of f(x)= $2x^3$-$9x^2$+ 12x+29 is monotonically increasing in the interval

A. (-∞, 1)

B. (-∞, 1) U (2,∞)

C. (-∞,-∞)

D. (2,∞)

Answer. B

Solution. To determine whether the function f(x) = 2x^3 - 9x^2 + 12x + 29 is monotonically increasing in an interval, we need to analyze the first derivative of the function, which is given by:

$f'(x) = 6x^2 - 18x + 12$

To find the critical points of the function (where the derivative is equal to zero), we need to solve the equation $f'(x) = 0$:

$6x^2 - 18x + 12 = 0$

Dividing both sides by 6, we get:

$x^2 - 3x + 2 = 0$

Factoring the left-hand side, we get:

$(x - 1)(x - 2) = 0$

So the critical points are $x = 1$ and $x = 2$.

Now we need to analyze the sign of the derivative in the different

intervals: Interval $(-\infty, 1)$:

For $x < 1$, we can choose $x = 0$ as a test point. Plugging this into the derivative, we get:

$f'(0) = 6(0)^2 - 18(0) + 12 = 12$

Since $f'(0) > 0$, the derivative is positive in the interval $(-\infty, 1)$. This means that the function is monotonically increasing in this interval.

Interval $(1, 2)$:

For $1 < x < 2$, we can choose $x = 1.5$ as a test point. Plugging this into the derivative, we get:

$f'(1.5) = 6(1.5)^2 - 18(1.5) + 12 = -3$

Since f'(1.5) < 0, the derivative is negative in the interval (1, 2). This means that the function is not monotonically increasing in this interval.

Interval (2, ∞):

For x > 2, we can choose x = 3 as a test point. Plugging this into the derivative, we get:

f'(3) = 6(3)^2 - 18(3) + 12 = 30

Since f'(3) > 0, the derivative is positive in the interval (2, ∞). This means that the function is monotonically increasing in this interval.

Therefore, the function f(x) = 2x^3 - 9x^2 + 12x + 29 is monotonically increasing in the interval (-∞, 1) U (2, ∞), which corresponds to option B.

Question 3. The equation of the tangent to the curve y = $\sqrt{(9-2x^2)}$, at the point where the ordinates and abscissa are equal, is?

Answer. y > 0

Question 4. For all real x, the minimum value of function f(x)=1-x+x^2/1-x+x

A. 1/3

B. 0

C. 3

D. 1

Answer. 1/3

Question 5. The minimum value of function $(1 - x + x^2) / (1 + x + x^2)$

A. ⅓
B. 0
C. 3
D. 1

Answer. A

Question 6. ∫ sin(log x) dx

A. (x/2)[sin(logx) - cos(logx)]

B. cos(logx) - x
C. $\int (x-1)e^x / (x+1)^3$
D. - cos logx

Answer. A

Question 7. If the line (x - 1)/2 = (y+1)/3 = (z-2) /4 = �� meets the plane, x+2y+3z = 15 at a point P, then the distance of P from the origin is?

A. 7/2

B. 9/2

C. √5/2

D. 2√5

Answer. B

Question 8. If cosx + cosy - cos(x+y) = 3/2 then,

A. x+y = 0

B. x = 2y

C. x =y

D. 2x =y

Answer.

C

Question 9. If the vertices of a triangle are (-2,3) , (6,-1) and (4,3), then the co-ordinates of the circumcentre of the triangle are? A. (1,1)

B. (-1,-1)

C. (-1,1)

D. (1,-1)

Answer. D

Question 10. If cos-1√p + cos-1√(1-p) + cos-1√(1-a) = 3��/4, then q is? A. 1/2

B. 1/√2

C. 1

D. 1/3

Answer. A

Question 11. In △ABC b=√3, c=1 angle A = 30, then largest angle?

Answer. 120

Question 12. If the area of the parallelogram with a and b as two adjacent sites 16 sq, units, then the area of the Parallelogram having 3a+2b and a+3b as two adjacent sides in sq.units is
A. 96

B. 112

C. 144

D. 128

Answer. B

Question 13. dy/dx + y/x = sinn
Answer. xy+cosy-sinx=c

Question 14. x=5/1-21,value of $x^3+x^2-x^1 22$
Answer. $x^2-2x+1= -4$

Question 15. Equation of tangent to the curve $y = \sqrt{(9-2x^2)}$ where x=y.