MHT CET 2023 Question Paper Shift 2

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

- **A. ⅓**
- **B. 0**
- **C. 3**
- **D. 1**

Answer. A

Question 3. $\int \sin(\log x)\, dx$

- **A. $(x/2)[\sin(\log x) - \cos(\log x)]$**
- **B. $\cos(\log x) - x$**
- **C. $\int (x-1)e^x / (x+1)^3$**
- **D. $- \cos \log x$**

Answer. A

Question 4. The value of $\int (1 - \cos x).\mathrm{cosec}^2 dx$ 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 $\text{cosec}^2(x)$ is equal to $1 + \cot^2(x)$, where $\cot(x)$ is the cotangent of x.

$\int (1 - \cos x)\, \text{cosec}^2(x)\, dx = \int (1 - \cos x)(1 + \cot^2(x))\, dx$

Expanding the expression:

$= \int (1 - \cos x + \cot^2(x) - \cos x * \cot^2(x))\, dx$

Now, let's evaluate each term separately:

$\int (1 - \cos x)\, dx = x - \sin(x) + C_1$

$\int \cot^2(x)\, dx$ can be integrated by using the formula $\int \cot^2(x)\, dx = -x - \cot(x) + C_2$

$\int \cos x * \cot^2(x)\, dx$ 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:

$\int u * \cot^2(x)\, (-du/\sin(x)) = -\int u \cot^2(x)\, du = -\int \cot^2(x)\, du$

Using the formula mentioned earlier, we know that $\int \cot^2(x)\, dx = -x - \cot(x) + C_2$. Hence, the integral of $-\int \cot^2(x)\, du$ 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 5. 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 (-∞, 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 $(2, \infty)$:

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 $(2, \infty)$. 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 $(-\infty, 1) \cup (2, \infty)$, which corresponds to option B.

Question 6. 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 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. $\sqrt{5}/2$**
- **D. $2\sqrt{5}$**

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.