GUJARAT TECHNOLOGICAL UNIVERSITY

DI -1 SEMESTER – OLD PAPER – W24 TO S25 – QUESTION BANK(English)

Subject Name & Code:

Mathematics-I- DI01000021

Unit 1- Determinant and Function

Repeated Questions:

1. **Find the value of the determinant:**

   ```
   | 1 3 1 |
   | 2 -1 0 |
   | 4 -2 5 |
   ```

   - **Appeared in:** W24 (Q.2(A)1, 03 marks)

2. **If $f(x) = \frac{x-1}{x+1}$ then prove that $f(x) \cdot f(-x) = 1$.**
   - **Appeared in:** W24 (Q.2(B)1, 04 marks), S25 (Q.2(B)3(ii), 04 marks)

3. **If $\log\left(\frac{x+y}{2}\right) = \frac{1}{2}(\log x + \log y)$ then prove that $x = y$.**
   - **Appeared in:** W24 (Q.2(B)2, 04 marks)

4. **Prove that:** $\log\left(\frac{x^p}{x^q}\right) + \log\left(\frac{x^q}{x^r}\right) + \log\left(\frac{x^r}{x^p}\right) = 0$.
   - **Appeared in:** S25 (Q.2(A)2, 03 marks)

Other Important Questions:

- **Find the value of the determinant:**

  ```
  | 1 2 3 |
  | 4 5 6 |
  | 7 8 9 |
  ```

  (S25 - Q.2(A)1, 03 marks)

- **If $f(x) = x^3 + 5$ then find $f(0)$, $f(1)$ and $f(-1)$.**
  (W24 - Q.2(A)2, 03 marks)

- **Solve:** $\log(x+3) + \log(x-3) = \log 27$.
  (W24 - Q.2(B)3, 04 marks)

- **Find the value of** $\tan(75^\circ)$.
  (S25 - Q.2(A)3, 03 marks)

- **Prove that:** $\frac{1}{\log_{12} 120} + \frac{1}{\log_2 120} + \frac{1}{\log_3 120} = 1$.
  (S25 - Q.2(B)1, 04 marks)

- **If $f(x) = \frac{1-x}{1+x}$ prove that: (i) $f(x) + f\left(\frac{1}{x}\right) = 0$ (ii) $f(x) \times f(-x) = 1$.** (S25 - Q.2(B)3(i), 04 marks)
- **MCQ: The value of $\log_3 1$ is _____.** (S25 - Q.1(1), 01 mark)
- **MCQ: If $f(x) = e^{x-1}$ then $f(1)$ = _____.** (S25 - Q.1(2), 01 mark)
- **MCQ: If $f(x) = x^3 - 7$ then $f(-2)$ = _____.** (S25 - Q.1(4), 01 mark)

Unit 2- Trigonometry

Repeated Questions:

1. **Prove that:** $\tan^{-1}\left(\frac{1}{2}\right)+\tan^{-1}\left(\frac{1}{3}\right)=\frac{\pi}{4}$.
   - **Appeared in:** W24 (Q.2(A)3, 03 marks), S25 (Q.3(A)2, 03 marks)

Other Important Questions:

- **Prove that:**
  $\frac{\sin(\pi+\theta)\cdot\operatorname{cosec}(\pi-\theta)\cdot\tan(\pi/2+\theta)}{\sec(\pi/2-\theta)\cdot\cos(-\theta)\cdot\cot(2\pi-\theta)}=-1$
  (W24 - Q.3(A)1, 03 marks)
- **Prove that:** $\frac{\cos 10^\circ+\sin 10^\circ}{\cos 10^\circ-\sin 10^\circ}=\tan 55^\circ$.
  (W24 - Q.3(A)2, 03 marks)
- **Prove that:** $\frac{\sin(x-y)}{\cos x\cos y}+\frac{\sin(y-z)}{\cos y\cos z}+\frac{\sin(z-x)}{\cos z\cos x}=0$.
  (W24 - Q.3(B)1, 04 marks)
- **Draw the graph of** $y=\cos x; 0\le x\le\pi$.
  (W24 - Q.3(B)2, 04 marks)
- **Prove that:**
  $\frac{\sin(180^\circ-x)}{\cos(90^\circ+x)}+\frac{\operatorname{cosec}(180^\circ-x)}{\sec(90^\circ+x)}+\frac{\tan(180^\circ+x)}{\cot(90^\circ+x)}=-3$
  (S25 - Q.3(A)1, 03 marks)
- **Prove that:** $\tan(70^\circ)=\frac{\cos(25^\circ)+\sin(25^\circ)}{\cos(25^\circ)-\sin(25^\circ)}$.
  (S25 - Q.3(A)4, 03 marks)
- **MCQ:** $\sin\frac{\pi}{2}+\cos\frac{\pi}{2}=$ _____. (W24 - Q.1(5), 01 mark)
- **MCQ:** $\tan^{-1}(1)=$ _____. (W24 - Q.1(6), 01 mark)
- **MCQ:** $\frac{2\pi}{3}$ **radian =** _____ **degree.** (W24 - Q.1(7), 01 mark)
- **MCQ: Principal period of** $\cos x$ **is** _____. (S25 - Q.1(6), 01 mark)
- **MCQ:** $\sin^{-1}x+\cos^{-1}x=$ _____. (S25 - Q.1(7), 01 mark)
- **MCQ:** $150^\circ=$ _____ **radian.** (S25 - Q.1(6), 01 mark)

Unit 3- Vectors

Repeated Questions:

- *(No exact repetition was found for long-answer questions, but the concepts of scalar/dot product and vector/cross product are heavily repeated.)*

Other Important Questions:

- **Find unit vector perpendicular to $\vec{a} = \hat{i} - \hat{j} + 3\hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} + 2\hat{k}$.**
  (W24 - Q.4(A)1, 03 marks)
- **Forces (1, 2, 1) and (2, -1, 3) act on a particle and the particle moves from a point (2, 3, 1) to (4, 6, 2). Find the work done.**
  (W24 - Q.4(A)2, 03 marks)
- **Show that the angle between $\vec{a} = \hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} + 2\hat{k}$ is $\sin^{-1}\left(\frac{\sqrt{26}}{27}\right)$.**
  (W24 - Q.4(B)1, 04 marks)
- **If $\vec{a} = (1, 1, 1), \vec{b} = (2, 0, 1)$ and $\vec{c} = (-2, 1, 0)$ then find $\vec{a} \cdot (\vec{b} \times \vec{c})$.**
  (W24 - Q.4(B)2, 04 marks)
- **If $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}, \vec{b} = 4\hat{i} + 0\hat{j} + 0\hat{k}$ and $\vec{c} = 2\hat{i} + 0\hat{j} + \hat{k}$ find $|2\vec{a} + 3\vec{b} - 5\vec{c}|$.**
  (S25 - Q.3(A)5, 03 marks)
- **If the vectors $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{b} = 2\hat{i} + m\hat{j} - 4\hat{k}$ are perpendicular, find m.**
  (S25 - Q.3(A)6, 03 marks)
- **Find the direction cosines and direction angles of the vector $\vec{a} = 5\hat{i} - 12\hat{k}$.**
  (S25 - Q.3(A)7, 03 marks)
- **Show that the lines $2x - 3y + 5 = 0$ and $8x - 12y - 3 = 0$ are parallel lines.**
  (W24 - Q.4(A)3, 03 marks)
- **MCQ:** $\hat{i} \cdot \hat{j} =$ _____. (W24 - Q.1(8), 01 mark)
- **MCQ:** $|\hat{i} + \hat{j} + \hat{k}| =$ _____. (W24 - Q.1(9), 01 mark)
- **MCQ:** $(1, 0, 0) \times (1, 0, 0) =$ _____. (S25 - Q.1(8), 01 mark)
- **MCQ: If $\vec{a} = 4\hat{i} - 3\hat{j}$ then $|\vec{a}| =$** _____. (S25 - Q.1(9), 01 mark)

Unit 4- Coordinate Geometry

Repeated Questions:

- *(No exact repetition was found for long-answer questions, but finding the equation of a line and circle are core, repeated concepts.)*

Other Important Questions:

- **Find the equation of the line passing through the points (1, 2) and (-3, 1).**
  (W24 - Q.3(B)3, 04 marks)
- **Find the equation of the line passing through the point (2, -3) and having slope 4.**
  (W24 - Q.5(B)1, 04 marks)
- **For what value of m, the lines $7x + y - 1 = 0$ and $3x - my + 2 = 0$ are perpendicular to each other.**
  (W24 - Q.5(B)2, 04 marks)
- **Find the centre and radius of the circle $x^2 + y^2 + 4x + 4y - 8x - 12y - 3 = 0$.**
  (W24 - Q.5(B)3, 04 marks)
- **Find the equation of the line whose X-intercept is 3 and Y-intercept is 2.**
  (S25 - Q.3(A)3, 03 marks)
- **Find the equation of the circle having center at (2, -3) and radius 3.**
  (S25 - Q.3(A)8, 03 marks)
- **Find the equation of the line passing through points (1, 2) and (2, 1).**
  (S25 - Q.5(B)1, 04 marks)
- **Find the equation of the line that passes through (-3, 2) and is parallel to the line $x - 2y + 1 = 0$.**
  (S25 - Q.5(B)2, 04 marks)
- **Find the center and radius of the circle: $x^2 + y^2 + 6x - 4y - 3 = 0$.**
  (S25 - Q.5(B)3, 04 marks)
- **MCQ: Slope of the line $2x + y - 3 = 0$ is _____.** (W24 - Q.1(10), 01 mark)
- **MCQ: Radius of the circle $x^2 + y^2 = 81$ is _____.** (W24 - Q.1(11), 01 mark)
- **MCQ: If a line makes an angle of 45° with the positive x-axis then the slope of the line is _____.** (S25 - Q.1(10), 01 mark)
- **MCQ: Radius of the circle $x^2 + y^2 = 4$ is _____.** (S25 - Q.1(11), 01 mark)

Unit 5- Limit

Repeated Questions:

1. **Evaluate:** $\lim_{\theta \to 0} \frac{\sin 4\theta}{\theta}$.
   - **Appeared in:** W24 (Q.4(B)3, 04 marks), S25 (Q.1(13), 01 mark as MCQ)

Other Important Questions:

- **Evaluate:** $\lim_{x \to 9} \frac{x^2-81}{x-9}$.
  (W24 - Q.5(A)1, 03 marks)
- **Evaluate:** $\lim_{x \to \infty} \left(1 + \frac{3}{x}\right)^x$.
  (W24 - Q.5(A)2, 03 marks)
- **Evaluate:** $\lim_{x \to 1} \frac{x^2-1}{x^2+x-2}$.
  (W24 - Q.5(A)3, 03 marks)
- **Evaluate:** $\lim_{x \to 0} \frac{2^x-5^x}{x}$.
  (S25 - Q.4(A)3, 03 marks)
- **Evaluate:** $\lim_{x \to 0} \left(1 + \frac{3x}{7}\right)^{\frac{1}{x}}$.
  (S25 - Q.5(A)1, 03 marks)
- **Evaluate:** $\lim_{x \to 3} \frac{x^2-5x+6}{x^2-9}$.
  (S25 - Q.5(A)2, 03 marks)
- **Evaluate:** $\lim_{x \to 0} \frac{\sqrt{4+x}-2}{x}$.
  (S25 - Q.5(A)4, 03 marks)

- **MCQ:** $\lim_{n \to \infty} \frac{1}{n} =$ _____. (W24 - Q.1(13), 01 mark)
- **MCQ:** $\lim_{x \to 1}(x^2 + x + 1) =$ _____. (W24 - Q.1(13), 01 mark)
- **MCQ:** $\lim_{\theta \to 0} \frac{\tan \theta}{\theta} =$ _____. (W24 - Q.1(14), 01 mark)
- **MCQ:** $\lim_{x \to 0} \frac{e^x-1}{x} =$ _____. (S25 - Q.1(12), 01 mark)
- **MCQ:** $\lim_{n \to \infty} \frac{5n+4}{4n+5} =$ _____. (S25 - Q.1(14), 01 mark)

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