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Important Long Questions Mathematics from Past Papers for Inter Part-II

Chapter#01 (Functions and Limits)

1. Evaluate $\lim_{x\to 0}\frac{a^x-1}{x} = \log_e a$
2. Evaluate $\lim_{\theta\to 0}\frac{1-\cos p\theta}{1-\cos q\theta}$
3. Evaluate $\lim_{x\to 0}\frac{secx-\cos x}{x}$
4. Discuss the continuity of $f(x)$ at $x=c$: $f(x)=\begin{Bmatrix} 3x-1 \ if \ x<1 \\ 4 \ if \ x=1 \\ 2x \ if \ x>1 \end{Bmatrix}, \ c=1$
5. Find the values of m and n, so the given function f is continues at $x=3$. $f(x)=\begin{Bmatrix} mx-1 \ if \ x<3 \\ n \ if \ x=3 \\ -2x+9 \ if \ x>3 \end{Bmatrix}$,
6. If $f(x)=\begin{Bmatrix} \frac{\sqrt{2x+5}-\sqrt{x+7}}{x-2}, & x\neq 2 \\ k & ,x=2 \end{Bmatrix}$ find value of k so that f is continues at $x=2$

Chapter#02 (Differentiation)

1. Differentiate w.r.t 'x' $\frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}+\sqrt{1-x}}$
2. Differentiate w.r.t 'x' $\frac{x\sqrt{a+x}}{\sqrt{a-x}}$
3. If $y=\sqrt{x}-\frac{1}{\sqrt{x}}$, show that $2x\frac{dy}{dx}+y=2\sqrt{x}$
4. Prove that $y\frac{dy}{dx}+x=0$ if $x=\frac{1-t^2}{1+t^2}, \ y=\frac{2t}{1+t^2}$
5. If $x=a\cos^3\theta, \ y=b\sin^3\theta$, show that $a\frac{dy}{dx}+btan\theta=0$
6. Show that $\frac{dy}{dx}=\frac{y}{x}$ if $\frac{y}{x}=\tan^{-1}\frac{x}{y}$
7. If $x=\sin\theta, \ y=sinm\theta$, show that $(1-x^2)y_2-xy_1+m^2y=0$
8. If $y=e^x sinx$, show that $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+2y=0$
9. If $y=(\cos^{-1}x)^2$, prove that $(1-x^2)y_2-xy_1-2=0$
10. Show that $\cos(x+h)=cosx-hsinx-\frac{h^2}{2!}cosx+\frac{h^3}{3!}sinx+\cdots$ and evaluate $cos61^o$
11. Show that $2^{x+h}=2^x\left\{1+(ln2)h+\frac{(ln2)^2h^2}{2!}+\frac{(ln2)^3h^3}{3!}+\cdots\right\}$
12. Find the maximum and minimum value of the equation occurring in the interval $[0,2\pi]$.
    $f(x)=sinx+cosx$
13. Shoe that $y=\frac{lnx}{x}$ has maximum value at $x=e$
14. Show that $y=x^x$ has minimum value at $x=\frac{1}{e}$

Ch#03 (Integration)

1. Evaluate the indefinite integral $\int\sqrt{4-5x^2}\,dx$
2. Evaluate $\int\frac{dx}{(1+x^2)^{\frac{3}{2}}}$
3. Evaluate $\int\frac{dx}{\sqrt{7-6x-x^2}}$
4. Evaluate $\int e^{2x}cos3x\,dx$
5. Solve $\int e^x\left(\frac{1+sinx}{1+cosx}\right)dx$
6. Evaluate $\int\frac{2x}{1-sinx}dx$

7. Evaluate the indefinite integral $\int \sqrt{x^2 - a^2}\, dx$
8. Evaluate $\int ln\left(x + \sqrt{x^2 + 1}\right)dx$
9. Evaluate $\int \frac{\sqrt{2}}{sinx + cosx} dx$
10. Evaluate $\int x \sin^{-1} x\, dx$
11. Evaluate $\int_{\pi/6}^{\pi/2} \frac{cosx}{sinx(2+sinx)} dx$
12. Find the area between the x-axis and curve $y = \sqrt{2ax - x^2}$, where $a > 0$
13. Evaluate $\int_0^{\pi/4} cos^4 t\, dt$
14. Evaluate $\int_{\frac{1}{2}}^{\frac{\sqrt{3}}{2}} \frac{\sin^{-1} x}{\sqrt{1-x^2}} dx$

Chapter#04 (Introduction to Analytic Geometry)

1. Find the lines represented by $9x^2 + 24xy + 16y^2 = 0$ and also find measure of the angle between them.
2. Find equation of line through intersection of lines $x - y - 4 = 0, 7x + y + 20$ and parallel to the line $6x + y - 14 = 0$
3. Find h such that the points $A(h, 1), B(2,7), C(-6, -7)$ are the vertices of right triangle with right angle at vertex A.
4. Find equation of two parallel lines perpendicular to $2x - y + 3 = 0$ such that the product of x-intercept and y-intercept is 3.
5. Find the distance between the given parallel lines. Sketch the lines. Also find an equation of the parallel lines lying midway between them. $3x - 4y + 3 = 0;\ \ 3x - 47 + 7 = 0$

Chapter#05 (Linear Inequalities and Linear Programming)

1. Graph the feasible region of the linear inequalities and find corner points.
$$2x + 3y \le 18;\ \ x + 3y \le 10;\ x + 4y \le 12$$
2. Minimize $z = 3x + y$; subject to the constraints $3x + 5y \ge 15;\ \ x + 3y \ge 9;\ \ x, y \ge 0$
3. Maximize $f(x, y) = x + 3y$ subject to the constraints $2x + 5y \le 30;\ \ 5x + 4y \le 20;\ \ x \ge 0, y \ge 0$
4. Maximize $f(x, y) = 2x + 5y$ subject to the constraints $2y - x \le 8;\ \ x - y \le 4;\ \ x \ge 0, y \ge 0$
5. Graph the feasible region of the linear inequalities and find corner points.
$$x + y \le 5;\ -2x + y \le 2;\ x \ge 0, y \ge 0$$

Chapter#07 (Vectors)

1. Prove that the angle in a semi-circle is a right angle.
2. Use vector method to show that $\sin(\alpha - \beta) = sin\alpha cos\beta - cos\alpha sin\beta$
3. Find a unit vector perpendicular to the plane containing $\underline{a}$ and $\underline{b}$. also fin the sine of angle between them.
$$\underline{a} = 2\underline{i} - 6\underline{j} - 3\underline{k};\ \ \underline{b} = 4\underline{i} + 3\underline{j} - \underline{k}$$
4. Prove that the line segment joining the mid points of two sides of a triangle is parallel to third side and half as long.
5. Prove that the line segment joining the mid points of the sides of a quadrilateral taken in order form a parallelogram.
6. Prove that the perpendicular bisector of the sides of a triangle are concurrent.
7. Prove that the altitudes of a triangle are concurrent.
8. Prove that $\cos(\alpha + \beta) = cos\alpha cos\beta - sin\alpha sin\beta$
9. Prove that in any triangle ΔABC.
$$(i)\ b = ccosA + acosC\ ;\ \ (ii)\ \ c = acosB + bcosA$$
$$(iii)\ b^2 = c^2 + a^2 - 2cacosB\ \ ;(iv)\ c^2 = a^2 + b^2 - 2abcosC$$