Engineering Mathematics I-(BAS-103)
Unit 3 Differential Calculus II
Tutorial 6

Que 1. If $x = r\cos\theta$, $y = r\sin\theta$ find $\frac{\partial(r,\theta)}{\partial(x,y)}$ **[2021-22]**

Que 2.(i) If u, v, w are the roots of equation $(\lambda - x)^3 + (\lambda - y)^3 + (\lambda - z)^3 = 0$, cubic in λ ,find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$. **[2021-22]**

(ii) If u, v, w are the roots of equation $(x - a)^3 + (x - b)^3 + (x - c)^3 = 0$, cubic in x ,find $\frac{\partial(u,v,w)}{\partial(a,b,c)}$. **[2018-19], [2015-16]**

Que 3. If $x = e^v \sec u$, $y = e^v \tan u$ then evaluate $\frac{\partial(x,y)}{\partial(u,v)}$. **[2020-21]**

Que 4. $If\ \ u^3 + v + w = x + y^2 + z^2$, $u + v^3 + w = x^2 + y + z^2, u + v + w^3 = x^2 + y^2 + z$ then show that $\frac{\partial(u,v,w)}{\partial(x,y,z)} = \frac{1-4(xy+yz+zx)+16xyz}{2-3(u^2+v^2+w^2)+27\,u^2v^2w^2}$ **[2020-21]**

Que 5. If u $= x(1 - y), v = xy$, find the value of $\frac{\partial(u,v)}{\partial(x,y)}$ **[2019-20]**

Que 6. $If\ u^3 + v^3 + w^3 = x + y + z$, $u^2 + v^2 + w^2 = x^3 + y^3 + z^3$ $u + v + w = x^2 + y^2 + z^2$ then show that $\frac{\partial(u,v,w)}{\partial(x,y,z)} = \frac{(x-y)(y-z)(z-x)}{(u-v)(v-w)(w-u)}$ **[2019-20]**

Que 7. $If\ u^3 + v^3 = x + y$, $u^2 + v^2 = x^3 + y^3$ then show that $\frac{\partial(u,v)}{\partial(x,y)} = \frac{y^2-x^2}{2uv(u-v)}$ **[2023-24]**

Que 8. If $u_1 = \frac{x_2x_3}{x_1}$, $u_2 = \frac{x_3x_1}{x_2}, u_3 = \frac{x_1x_2}{x_3}$ then find $\frac{\partial(u_1,u_2,u_3)}{\partial(x_1,x_2,x_3)}$. **[2017-18]**

Que 9. If x$= v^2 + w^2, y = u^2 + w^2, z = v^2 + u^2$, then show that $\frac{\partial(u,v,w)}{\partial(x,y,z)} \cdot \frac{\partial(x,y,z)}{\partial(u,v,w)} = 1$ **[2016-17]**

Que 10 Find the jacobian of the function $y_1 = (x_1 + x_2)(x_2 - x_3), y_2 = (x_1 - x_2)(x_2 + x_3)$ and $y_3 = x_2(x_1 - x_3)$. Hence show that functions are not independent. Find the relation between them. **[2022-23]**

Que 11. Find the relation between u, v, w for the values $u = x + 2y + z$, $v = x - 2y + 3z$, $w = 2xy - zx + 4yz - 2z^2$ **[2016-17]**

Que 12. If $x + y + z = u, y + z = uv, z = uvw$ find $\frac{\partial(x,y,z)}{\partial(u,v,w)}$. **[2015-16]**

Que 13. An error of 2% is made in measuring length and breadth then find the percentage error in the area of rectangle. **[2021-22]**

Que 14. Calculate the error in R ,if $E = RI$ and the possible error in E and I are 30% and 20% respectively. **[2018-19] , [2023-24]**

Que 15. What error in log of a number will be produced by an error of 1% of the number? **[2017-18]**

Que 16. A balloon is in the form of right circular cylinder of radius 1.5 and length 4 m is surmounted by hemispherical ends. If radius is increased by .01m and length by .05m. Find the percentage change in volume of balloon. **[2017-18]**

Que 17. Find the percentage error in measuring the volume of a rectangular box when error of 1% is made in measuring the each side. **[2016-17]**, **[2022-23]**

Que 18. If $pv^2 = k$ the relative error in p and v are .05 and .025 respectively. Show that error in k is 10%. **[2015-16]**

Answers

1. $\frac{1}{r}$

2. $(\boldsymbol{i})\ \ -2\frac{(x-y)(y-z)(z-x)}{(u-v)(v-w)(w-u)}$ $\quad (\boldsymbol{ii}) - 2\frac{(a-b)(b-c)(c-a)}{(u-v)(v-w)(w-u)}$

3. $-e^{2v}\sec u$

5. x

7. $\frac{1}{r}$

8. 4

10. $y_1 + y_2 - 2y_3 = 0$

11. $u^2 - v^2 = 4w$

12. $u^2 v$

13. 4%
14. 10%
15. 0.04343
16. 2.389%
17.3%