1. Find $\dfrac{\partial w}{\partial \theta}$ if $w = e^x \sin y$ and $x = r\cos\theta$, $y = r\sin\theta$

2. If $x^3 + y^3 + z^3 - 5x^2y^2z^2 = 5$ find $\dfrac{\partial z}{\partial y}$

3. Let $w = xyz$, $x = \sin 2t$, $y = \cos 2t$, $z = e^{-t}$. Find $\dfrac{dw}{dt}$.

4. Find relative maximum, minimum and saddle points of
$$f(x,y) = x^3 - 3xy + y^3.$$

5. Use polar coordinate to prove: $\displaystyle\lim_{(x,y)\to(0,0)} \frac{x^3+y^3}{x^2+y^2} = 0$

6. Prove: If $F(x,y,z) = 0$ implicitly define a differentiable $z = z(x,y)$ then $\frac{\partial z}{\partial x} = -\frac{F_x}{F_z}$

7. Find the limits: $\displaystyle\lim_{(x,y)\to(0,0)} \frac{x+y}{x^2+y}$

8. Show: $\frac{\partial w}{\partial u} + \frac{\partial w}{\partial v} = 0$ for $w = f(x,y)$, $x = u - v$ and $y = v - u$

9. Show: If $w = f(x,y)$ and $x = r\cos\theta$, $y = r\sin\theta$ then $(\frac{\partial w}{\partial x})^2 + (\frac{\partial w}{\partial y})^2 = (\frac{\partial w}{\partial r})^2 + (\frac{1}{r^2})(\frac{\partial w}{\partial \theta})^2$

10. Find the area of the region inside $r = a(1+\sin\theta)$ and outside $r = a\sin\theta$

11. Evaluate the integral by changing the order of integration:
$$\int_0^1 \int_{\sqrt{y}}^1 e^{-x^3}\, dx\, dy$$

12. Use cylindrical corrdinate to find the mass of a solid Q of uniform density k, inside both $x^2 + y^2 + z^2 = a$ and $x^2 + (y - a/2)^2 = (a/2)^2$