3. Let S be the focus of the parabola $y^2 = 8x$ and let PQ be the common chord of the circle $x^2 + y^2 - 2x - 4y = 0$ and the given parabola. The area of the triangle PQS is *(2012)*

Solution: -

3. **(4)** We observe both parabola $y^2 = 8x$
and circle $x^2 + y^2 - 2x - 4y = 0$ pass through origin
$\therefore$ One end of common chord PQ is origin. Say P(0, 0)
Let Q be the point $(2t^2, 4t)$, then it will satisfy the equation of circle.

$\therefore \quad 4t^4 + 16t^2 - 4t^2 - 16t = 0$

$\Rightarrow \quad t^4 + 3t^2 - 4t = 0 \Rightarrow t(t^3 + 3t - 4) = 0$

$\Rightarrow \quad t(t-1)(t^2 + t - 4) = 0 \Rightarrow t = 0$ or 1

For $t = 0$, we get point P, therefore $t = 1$ gives point Q as (2, 4).
We also observe here that P(0, 0) and Q(2, 4) are end points of diameter of the given circle and focus of the parabola is the point S(2, 0).

$\therefore$ Area of $\Delta PQS = \frac{1}{2} \times PS \times QS = \frac{1}{2} \times 2 \times 4 = 4$ sq. units